

Testimony of Dr. Jasmin Ansar, Economics Professor, Mills College, Oakland.

Coal is a very dirty fuel.

Coal is one of the dirtiest fuels on the planet. Coal pollution contributes to four out of five of the leading causes of mortality in the USA: heart disease, cancer, stroke, and chronic lower respiratory diseases. Pollution damage occurs at every stage of the coal life cycle: mining, transportation, washing, burning and disposal. In addition to causing air pollution, coal is a major contributor to global warming as its combustion leads to significant releases of carbon dioxide.

A seminal research paper published in 2011 estimated the pollution damages of every industry in the US and came to the conclusion that the most damaging industries were coal fired power plants and solid waste combustion and incineration.¹ In the case of coal, the cost-benefit ratio was 5 to 1, indicating \$5 of environmental damage costs (harm to health, agriculture, depreciation of materials and ecosystem harm) for every \$1 of value produced by coal. This is a misallocation of resources that occurs because pollution damages are external costs not priced in the market.

Local impacts of transporting coal – Public health and safety risks.

The proposed transformation of nearly fifty percent (or up to 100%) of the bulk terminal at the Oakland Army base to a port for exporting coal from Utah to Asia will have significant health impacts for local residents who live near the railway tracks and port. Coal is typically transported in trains with one hundred rail cars. During the journey, these trains lose part of their load as 'dust,' which results in ambient particulate matter and nitrous oxides pollution that is harmful to human health. A 1993 study on a West Virginia rail line estimated loss of coal dust of around a pound of coal per mile per car.² Twenty-one

¹ *Environmental Accounting for Pollution in the US Economy*, Muller, N. Z., Mendelsohn, R., and Nordhaus, W., *American Economic Review*, August 2011

² Simpson Weather Associates 1993. Norfolk southern rail emission study: consulting report prepared for Norfolk Southern Corporation. Charlottesville, VA

trains per week from Utah to Oakland would generate about 1,260,000 pounds of coal dust each week, blowing along the path of the train tracks.

Local communities in West Oakland and vicinity, already burdened with air pollution from the Port, trucks, and many freeways, will be exposed to even more air pollution from coal dust and NOx emissions. These toxic particulate matters are linked to numerous health problems such as decreased lung capacity, increased childhood bronchitis, asthma, pneumonia, emphysema and heart disease. West Oakland already has pollution concentrations that are higher (two to three times) than anywhere else in the Bay area. It is not fair to burden further those communities that are already bearing so much of local pollution costs. The World Health Organization (WHO) cites coal dust that leads to high ambient particulate matter concentrations, along with silica and asbestos as the main cause of occupational lung diseases. Coal from Utah is also especially high in silica, posing yet another worker safety danger for those who would handle the coal in Oakland or on the railroad.

Another danger from the transportation and storage of coal to the Army Base is the real possibility of spontaneous combustion leading to serious fires³. These fires are a well-documented consequence of coal stockpiled in storage and raise serious public safety concerns given the urban population concentrations along the train tracks.

Is there an economic case for investing in this project?

The coal industry is in economic decline, serving a shrinking market. U.S. demand for coal demand has decreased sharply due to: the supply of cheap shale oil and gas, the economic viability of renewables, numerous energy efficiency efforts, and tougher environmental regulations.

The coal industry has turned to export markets to recover revenues and profits. Yet, these markets are shrinking due to a glut of global coal supplies, pollution concerns and the recent emergence of a much more competitive liquefied natural gas (LNG) buyer's market. LNG prices have more than halved recently and are likely to continue to remain low as they are linked to the price of oil whose price continues to fall. In addition planned increases in global liquefaction capacity (up to a third) will lead to persistent low prices for LNG. Another nail in the

³ Coal's Spontaneous Combustion Problem, Sightline Daily, April 11, 2012, <http://daily.sightline.org/2012/04/11/coals-spontaneous-combustion-problem/>.

coffin has been the appreciation of the US dollar which has hurt the competitiveness of US coal exports.

Research firm SNL Energy says that over three dozen coal operations have been forced into bankruptcy in the last three years. U.S. coal company shares have lost over 80% of their market value since 2011.

These fundamental economic realities demonstrate the downside-risks and liabilities associated with investing in coal.

The economic question for the Oakland City Council is this: does investing in a port terminal dedicated to exporting coal make good financial use of public land and resources?

The investment of millions of dollars in building a port terminal with the specific and sole capability to export millions of tons of coal is a poor investment choice. It would tie up investment funds in a project-specific venture that is highly likely to become stranded. It is unlikely to succeed and may well end up a financial albatross.

It is instructive to learn the lessons from the Port of Los Angeles, which built a "world-class" coal export facility in the early 90s. The facility closed just six years after opening due to unfavorable market conditions. The city of LA had to write off \$19 million of capital investment and forfeit \$94 million in expected revenues.⁴ In addition, during the short operational period, the terminal experienced two fires as coal dust accumulated on ship-loading equipment.

Despite promises to the contrary, the investment would create few jobs. Facilities like these are typically automated with little direct labor. A recent economic study,⁵ which evaluated the labor requirements of shipping cargo, found that a bulk commodity such as coal only generated 0.09 jobs per 1000 metric tons as compared to 0.57 jobs for containerized cargo and 4.2 jobs for "break bulk" cargo, such as machines or goods shipped on pallets that require more handling.

⁴ Patrick McGreevy, "L.A. Weighs Costly Exit from Coal Terminal", Los Angeles Times, June 14, 2003

⁵ Martin Associates, "The 2007 Economic Impact Study of the Port of Seattle," February 10, 2009

Key Takeaways.

- Coal is a very dirty fuel that pollutes the air and emits large amounts of carbon dioxide a key global warming pollutant. This pollution endangers the health and safety of humans and the ecosystem.
- The economic prospects for coal are dismal. Cheaper supplies of alternatives are expanding and this combined with pollution concerns are resulting in an ever-shrinking market. Exports, viewed as the main engine of growth for coal, are depressed – leading one article⁶ to suggest...*'investors should be running as fast as they can from any coal stock in nearly every global market'*. Market valuations of coal companies, which are a signal of the market's view of future profitability, have dropped over 80% in the last few years.
- This project would expend funds on specialized equipment and terminals that could be used productively for alternative uses. Air, land, and water pollution is inevitable and costly to clean up, and the costs of the pollution would be borne by poor, pollution-burdened communities. Finally, when the facilities fail, the financial repercussions will constrain future economic opportunities for the city.

⁶ Wolf Street, "Coal is Dying, not just in the US. Look What's happening in China", ISA intel, April 4, 2015

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L.A. Weighs Costly Exit From Coal Terminal

June 14, 2003 | Patrick McGreevy | Times Staff Writer

Los Angeles officials are preparing to pull out of a 10-year-old partnership in a coal export terminal, which would mean writing off a \$19-million investment by the city and forfeiting nearly \$94 million in projected revenue from the venture.

The Port of Los Angeles, a city agency, could face much steeper losses if the Los Angeles Export Terminal Inc. declares bankruptcy, as officials say will probably occur without a new agreement.

But the plan to terminate the city's investment and transfer some of its harbor area property to one of the partners has sparked a battle at City Hall.

City Councilwoman Janice Hahn, who represents the harbor area, prefers that the city seek bidders who could put the 117 acres in question to other, more environmentally friendly uses than transferring coal and petroleum coke.

"This was a bad deal from the beginning," Hahn said. "It was a loser every single year. We ought to take our losses, write it off and look for a better opportunity."

A City Council committee has voted 3 to 2 to endorse the deal, which heads to the full council for action Tuesday.

The Harbor Department invested in the terminal facility in 1993, seeking a way to help private investors establish a major export business on surplus city land at Pier 300 on Terminal Island.

In exchange for providing the 117 acres and \$19 million in capital, the city agency received a 13% interest in the Los Angeles Export Terminal, whose 29 partners are foreign and U.S. corporations involved in the coal and export business.

The terminal was completed in 1997 to transfer coal from rail cars to ships for export.

It is capable of handling 3 million tons of coal and 2 million tons of petroleum coke annually.

However, Harbor Department General Manager Larry Keller said a slump in the coal export market has prevented the terminal from ever generating cash above operating expenses.

The facility has been hurt by the emergence of China as a major coal exporter, a strong U.S. coal demand, disruptions in U.S. coal supplies and a decline in export prices for coal in the Pacific Rim from \$40 per metric ton to \$30, with some spot prices as low as \$23, Keller said.

The terminal "has determined that it cannot compete economically at these prices and sees no demand for the U.S. to export coal in the foreseeable future," Keller said in a report to the City Council.

Because of the slump, the terminal has stopped handling coal and owes the Harbor Department more than \$11 million in back rent for the land.

Under the proposed deal, Los Angeles Export Terminal Inc. would be replaced by a partner, Oxbow Carbon and Mineral Inc., and the city would give up its \$19 million in equity in the terminal. Other partners would walk away from \$230 million they have spent on the facility, according to Brad Goldstein, a spokesman for Oxbow.

The proposal calls for 81 acres devoted to coal storage to be deleted from terminal holdings and to revert to city use after Oxbow contributes \$500,000 of the \$1.5 million it will cost the city to clean up the site.

Oxbow would maintain use of 36 acres for 12 1/2 years to operate a petroleum coke export facility, and would clean up the site before transferring it back to the city.

Oxbow also would pay the city the \$11 million owed in back rent, but the minimum annual payment to the city in future years would be cut from \$11 million to about \$3 million, for a loss of \$93.6 million in future revenue during the next 12 years.

Councilwoman Hahn says much of the money could be recovered by renting the land to other tenants, but Harbor Department officials said they are uncertain how soon that could be done and what it would yield.

Hahn said the city would be better off seeking open bids from firms to shut down all coal and coke operations in five years and converting the property into a cleaner operation.

"I know my residents in Wilmington would like to see that facility go away," she said. "It's an ugly facility."

The dispute over the best way for the city to get out of a sour investment has divided Los Angeles political leaders, resulted in multiple charges of conflict of interest and put an army of lobbyists to work attempting to influence the outcome.

"Every lobbyist I have ever heard of is in this chamber," Councilwoman Ruth Galanter said during a recent hearing on the proposal.

"I would like to know where, if [the terminal] is on the verge of bankruptcy, they got the money to hire all these lobbyists," Galanter said.

The lobbyists, who include former harbor-area City Councilman Rudy Svorinich Jr., have been hired by other private corporations that have or want to have a financial stake in the terminal.

The debate is complicated further by the fact that even though the terminal is facing severe financial problems and is partly owned by the city, records show it has made 25 political contributions totaling more than \$10,000 to city officials and candidates including Mayor James K. Hahn and his sister, Councilwoman Hahn.

Councilwoman Hahn agreed there was a problem with the city investing in a tenant of the port.

"I think the whole thing is inappropriate," she said. "I think it was a conflict of interest from the beginning. I don't think the port and the city should be an investor in a tenant on port property. Is there any other tenant allowed to default on their rent for a year?"

Councilmen Bernard Parks and Nick Pacheco have joined Hahn in opposing the proposed deal with Oxbow, which has been recommended by the terminal board.

Council members Galanter, Hal Bernson and Ed Reyes voted for the deal in committee, arguing the city could lose much more if the terminal goes into bankruptcy.

Killing the deal, Bernson said, would mean the city would not get the back rent and cleanup funds promised by Oxbow, and the land could be tied up in Bankruptcy Court and unusable for years to come.

Oxbow officials see other motives behind the opposition to the deal.

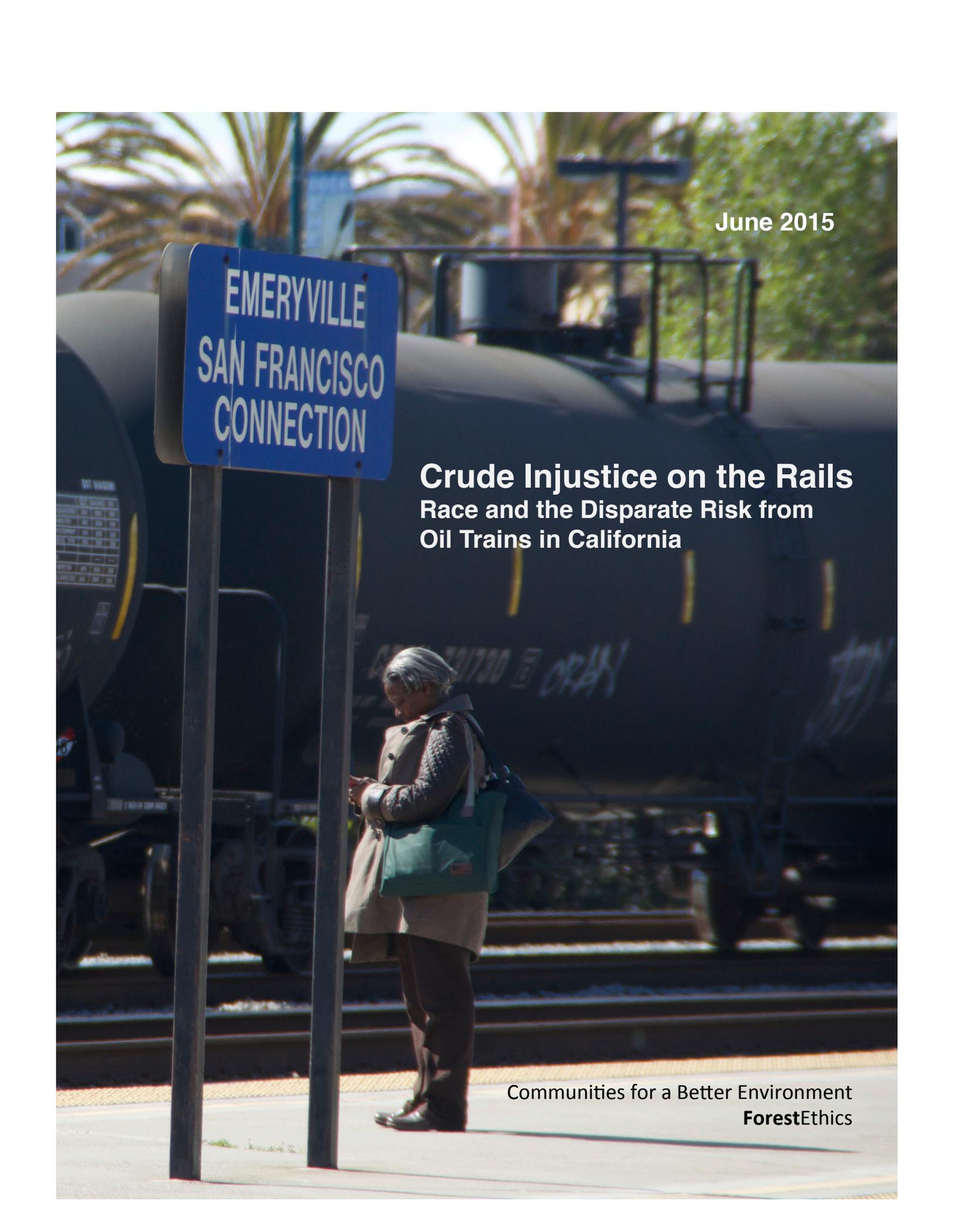
John Fairbanks, who is Councilwoman Hahn's political pollster, and Svorinich, a Hahn political supporter, have been hired by Metropolitan Stevedore Co., which would like to take over the terminal under a Hahn plan that would phase out its operation in five years.

Oxbow spokesman Goldstein said Metropolitan's real goal is to shut down the Los Angeles terminal so it no longer is competition for a terminal Metropolitan operates in Long Beach.

"There is a conflict here. Hahn is not acting in the interest of her constituents or the taxpayers of L.A.," Goldstein said. "She is doing a favor for her political consultant, Fairbanks, which will cost the taxpayers millions."

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**Crude Injustice on the Rails
Race and the Disparate Risk from
Oil Trains in California**

Communities for a Better Environment
ForestEthics



Lac Megantic, Quebec, July 6, 2013, the day of the fatal oil train derailment. Photo: Sûreté du Québec
http://commons.wikimedia.org/wiki/File:Lac_megantic_burning.jpg#/media/File:Lac_megantic_burning.jpg

Crude Injustice on the Rails

Race and the Disparate Risk from Oil Trains in California

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INTRODUCTION

The principles of environmental justice say that access to clean air, water and soil, and to a healthy, safe, livable community, are intrinsic human rights.

ForestEthics and Communities for a Better Environment (CBE) evaluated oil train routes and US Census data to investigate disparities in the hazards that Californians face from oil trains. This data is presented in maps showing the oil train blast zone, environmental justice census block groups, and racial profile of the ten largest cities in California with current and probable oil train routes, and four urban core areas where CBE works for environmental justice.

We conclude that oil trains contribute to environmental racism in California. Californians of color are more likely to live in the oil train blast zone, the dangerous one-mile evacuation zone in the case of an oil train derailment and fire.

Sixty percent of Californians live in environmental justice communities.¹ Yet 80 percent of the 5.5 million Californians with homes in the blast zone live in environmental justice communities. Nine out of ten of California’s largest cities on oil train routes have an even higher rate of discriminatory impact than the state average. In these cities, 82–100 percent of people living in the blast zone are in environmental justice communities.

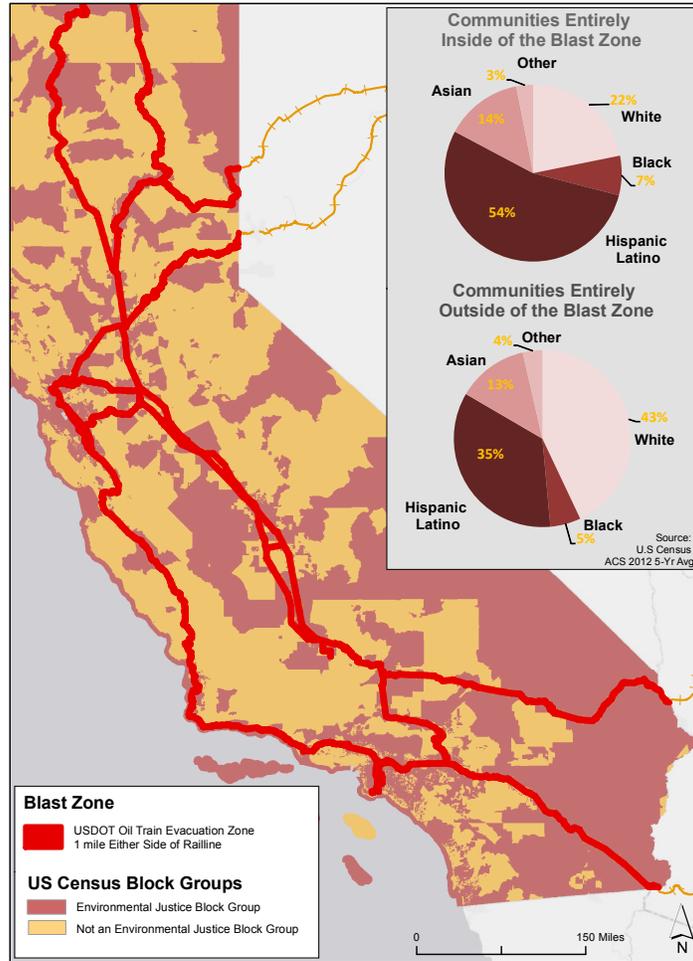
Percentage of people in the oil train blast zone that live in environmental justice communities in the ten largest California cities on oil train routes:

Los Angeles	82%	San José	91%
Fresno	85%	Sacramento	89%
Long Beach	85%	Oakland	92%
Bakersfield	77%	Stockton	94%
Fremont	100%	San Bernardino	100%

We document a racial component of this injustice statewide, in cities and in communities. People of color comprise a greater percentage of populations in the blast zone than outside the blast zone statewide, within each major California city on oil train routes except for Sacramento, and within each environmental justice community—except for the City of Huntington Park, where the comparison is not applicable. The exception to the pattern is Sacramento where the blast zone crosses the State Capital and its local urban renewal. The situation in Huntington Park also describes deep racial injustice, because nearly all residents are people of color *and* in the blast zone.

¹ Environmental Justice Communities, in this analysis, are census block groups that meet one or more of three criteria: more than 25% of residents are people of color (non-white); median household income is less than 65% of statewide median household income; more than 25% of households are linguistically isolated (no English speaker older than 14).

Environmental Justice and Race Inside of the California Blast Zone



People of color* as a percentage of populations inside *versus* outside of the oil train blast zone in California, by political jurisdiction:

	Inside the blast zone	Outside the blast zone		Inside the blast zone	Outside the blast zone
Los Angeles	90%	69%	San José	76%	70%
Fresno	74%	66%	Sacramento	61%	65%
Long Beach	88%	63%	Stockton	85%	66%
Bakersfield	78%	64%	Oakland	91%	64%
San Bernardino	88%	78%	Richmond	89%	70%
Modesto	58%	49%	Wilmington	97%	95%
Fremont	73%	71%	Huntington Park	99%	NA
California	78%	57%			

*Latino/Hispanic, Black, Asian, and other non-white Census categories; *see* pages 4, and 7–20 for detail.

RECOMMENDED ACTION

Federal, state, and local officials must consider environmental justice in oil train safety protections and the review of any proposed infrastructure projects that will permit or expand oil train traffic.

Federal, state and local officials must take immediate action to address the flawed and discriminatory safety protections and permits that allow oil trains to exacerbate already-serious cumulative health and safety hazards in our most vulnerable communities. There is great urgency because every oil train brings with it the potential for catastrophe and a guarantee of air pollution exposure leading to chronic risks.

Based on the severe potential environmental health, safety, and climate impacts of oil trains in California, the lack of necessity for trains to deliver the oil refined for fuels used here, and the environmental injustice and racism documented in this report, ForestEthics and Communities for a Better Environment (CBE) recommend the following actions.

- **A moratorium on oil imports into California by train and an immediate halt to permitting of proposed projects that would enable new or expanded use of oil trains in the state.**
- **Immediate action to root out systemic and institutional environmental discrimination and racism. Actions to investigate and correct the oil train-related public disclosure, public participation, monitoring, standard setting, and permitting actions that contribute to the environmental and racial injustice observed in California’s oil train blast zone, including but not limited to the following:**
 - **The California Attorney General should open an investigation and inquiry, with state and local agencies, regarding oil train infrastructure permitting.**
 - **The US EPA Office of Civil Rights should enforce federal statutes prohibiting racial discrimination in the protection of people from oil trains.**
 - **The US Department of Justice Division of Civil Rights should enforce federal statutes prohibiting racial discrimination, to protect all people from oil trains.**
- **Public support of CBE and ForestEthics to protect our health, safety, and climate, and win on environmental justice. Join our local efforts to stop oil trains and prevent oil train projects, and join us to collaborate together across California’s communities in the blast zone.**

MAPPING ENVIRONMENTAL INJUSTICE IN THE BLAST ZONE



Fireball from the derailment of a crude oil train outside Casselton, ND. Photo: US PHMSA

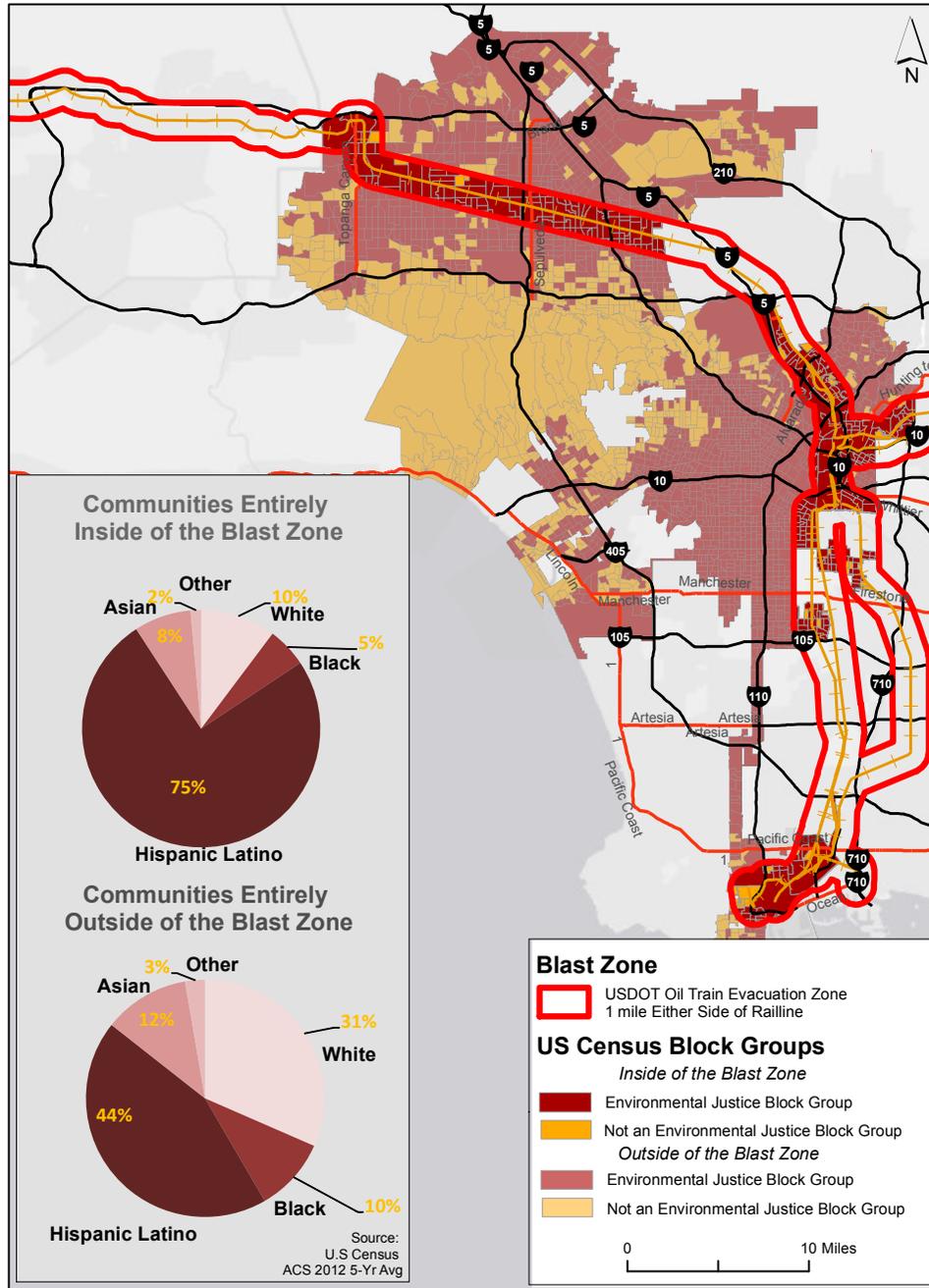
Interpreting the blast zone maps:

- The **blast zone** shown is the one-mile evacuation area that the US Department of Transportation recommends in the case of an oil train derailment, spill and fire. While one-mile is a guideline for initial response to a multi-car accident with fire, the toxic cloud from the December 2013 Casselton, ND, oil train disaster (above) required a five-mile evacuation zone downwind.
- **Environmental justice communities** as defined in this analysis are based on a method from the State of Massachusetts, and are census block groups that meet one or more of three criteria: (1) greater than 25 percent of residents are people of color (non-white); (2) median household income is less than 65 percent of statewide median household income; (3) linguistically isolated households (no English speaker older than 14) are more than 25 percent of households.
- **Race** is broken out in charts for each area mapped.
- The estimates shown in these maps and charts were calculated from US Census [block group](#)² data. Data and methods are detailed at the end of this report.
- ForestEthics [calculates](#)³ that 25 million Americans and 5.5 million Californians live in the blast zone. ForestEthics built the blast zone map tool using train routing information from the rail industry, current and proposed rail terminals, expert reporting, and eyewitness accounts. [Blast-zone.org](#) allows anyone to search addresses in the US and Canada and see if they are in the blast zone.

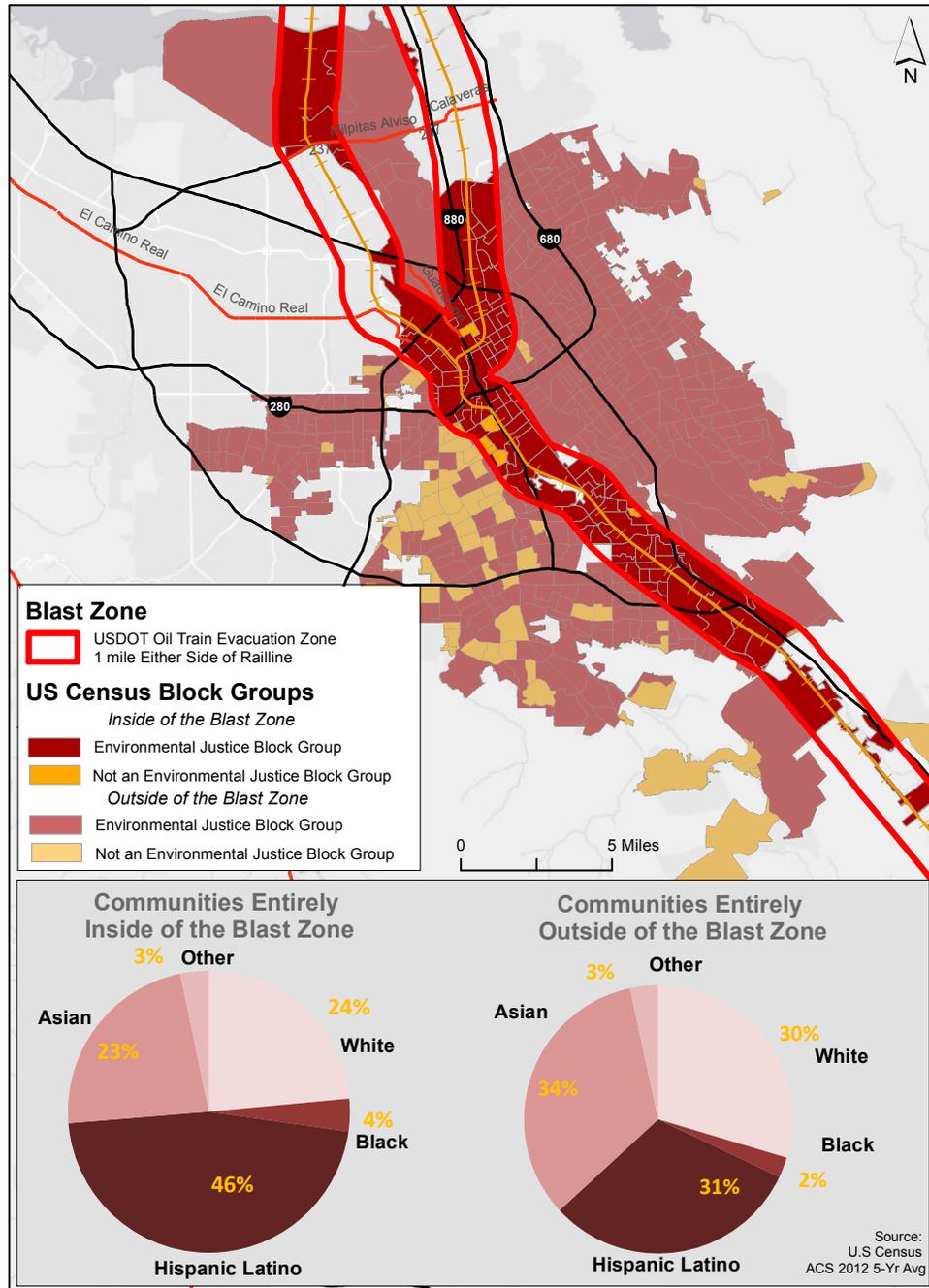
² https://www.census.gov/geo/reference/gtc/gtc_bg.html

³ <http://tinyurl.com/orzncca>

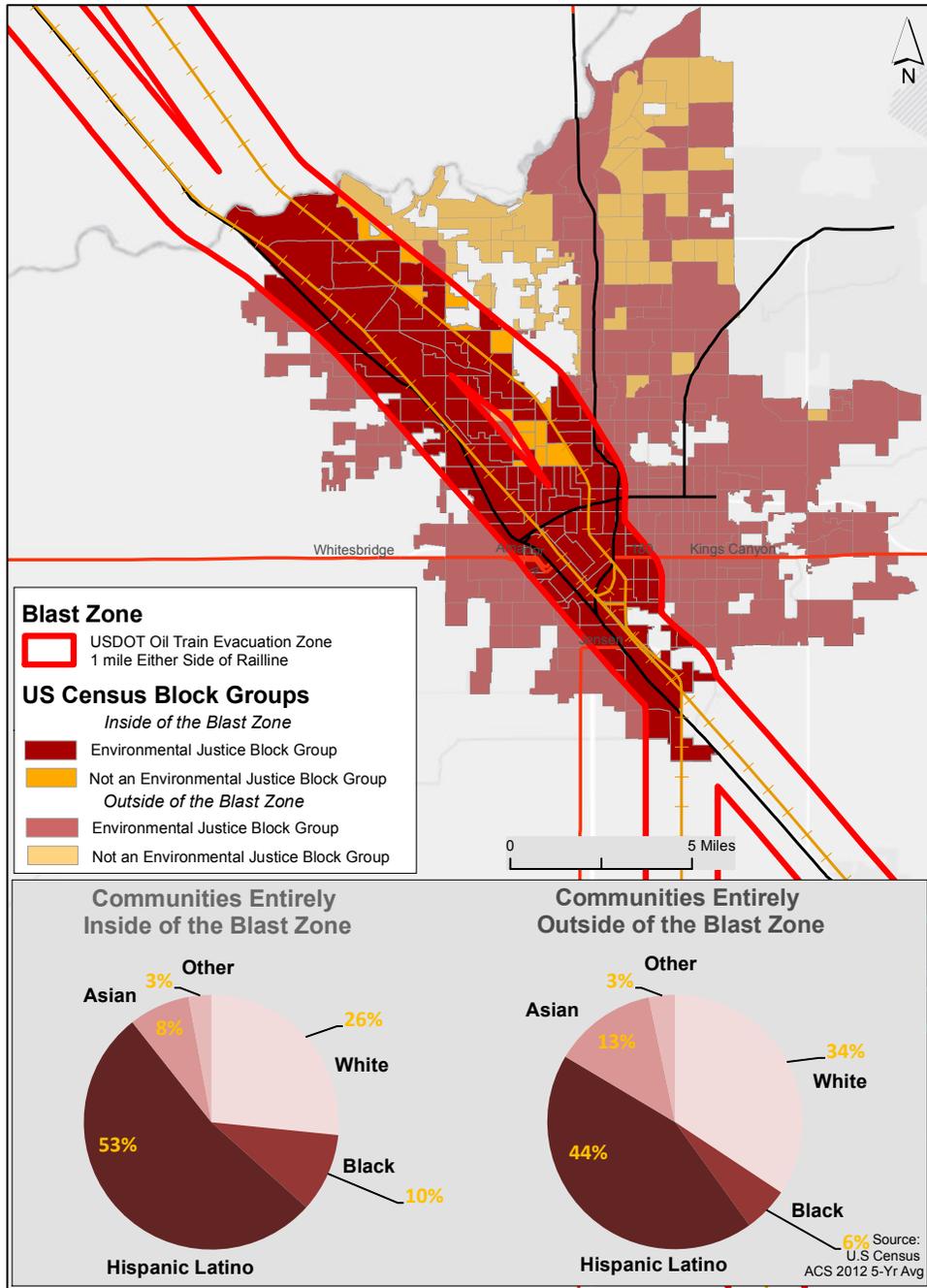
Environmental Justice and Race Inside of the Los Angeles, CA Blast Zone



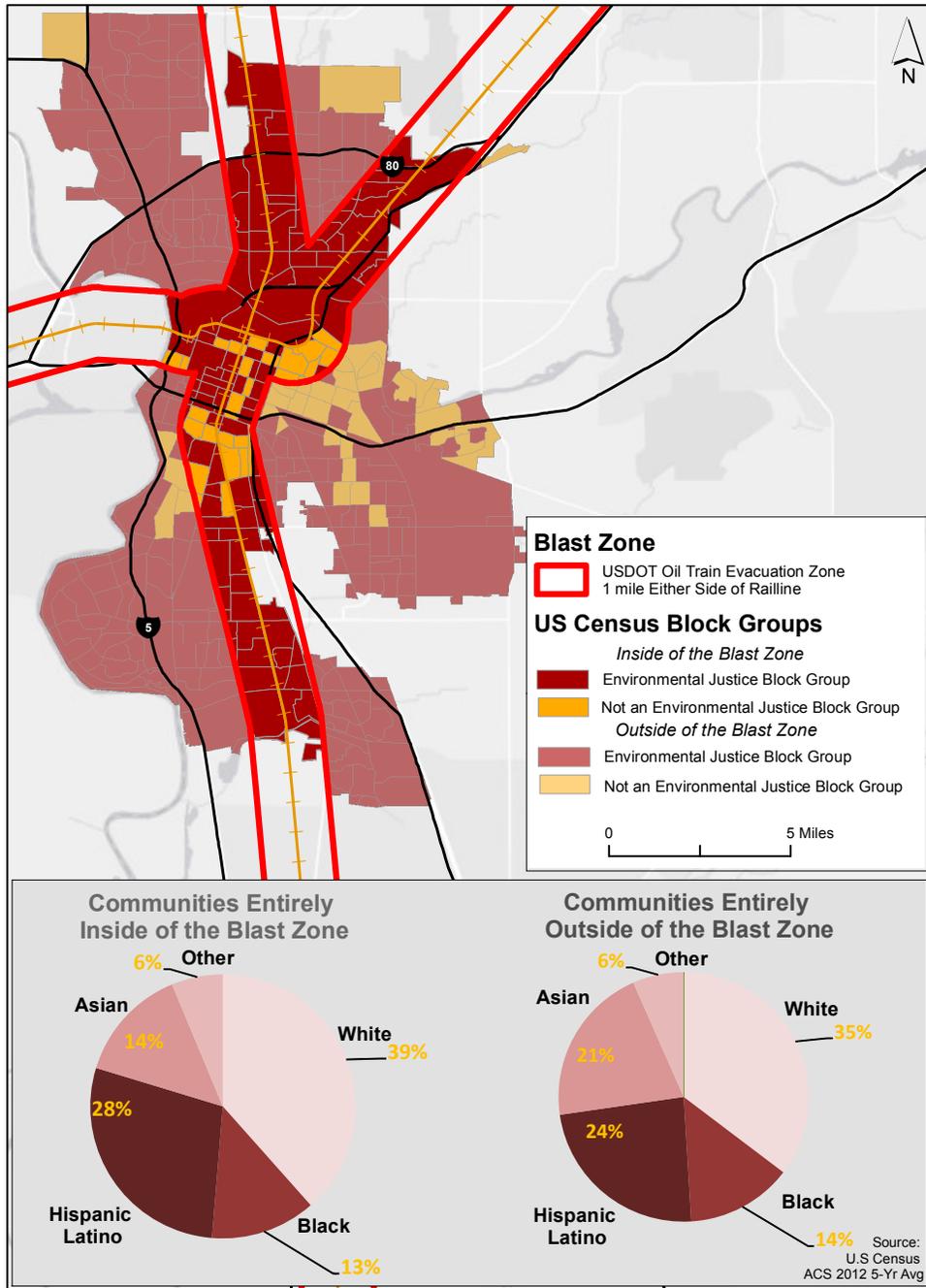
Environmental Justice and Race Inside of the San Jose, CA Blast Zone



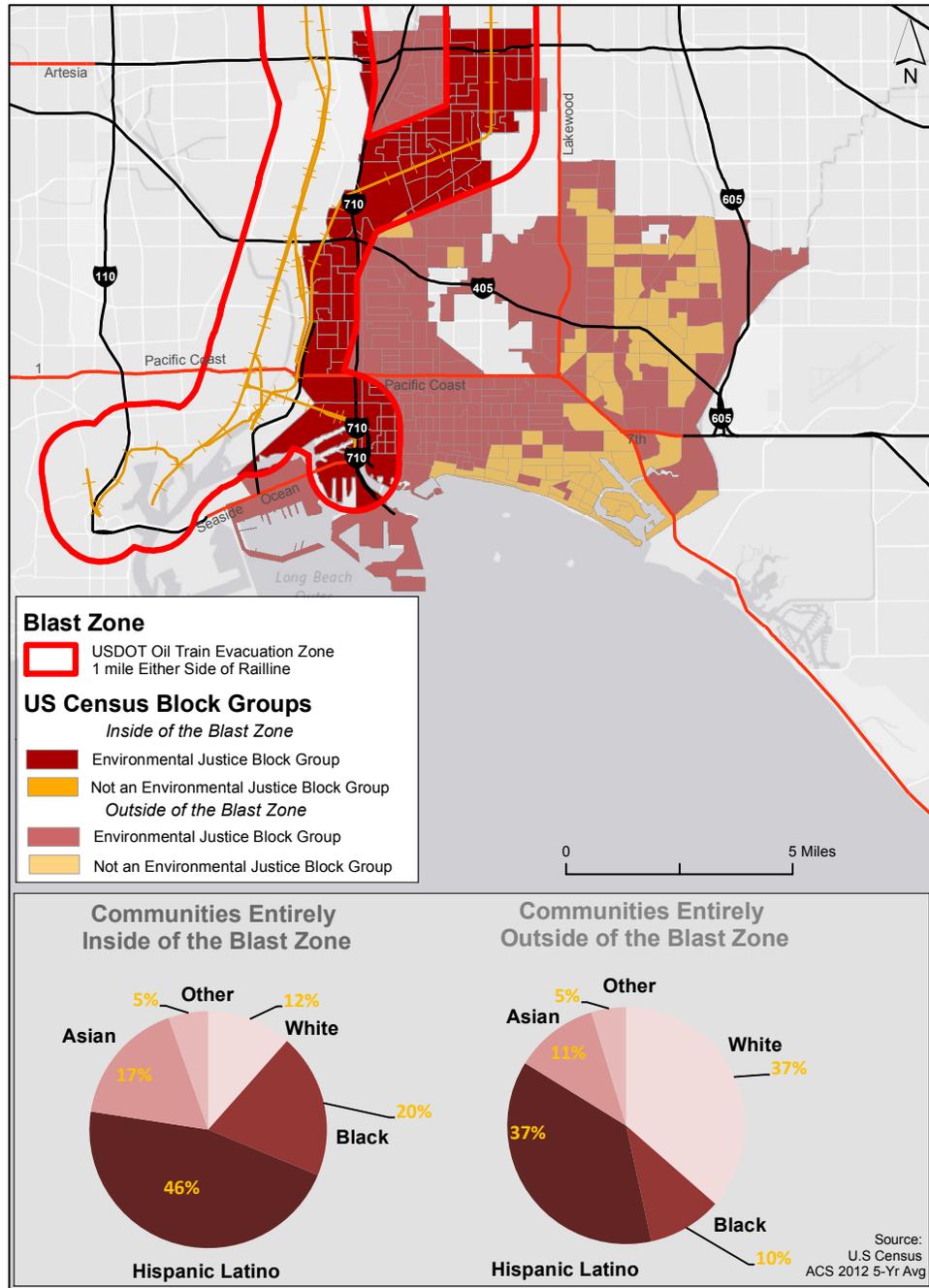
Environmental Justice and Race Inside of the Fresno, CA Blast Zone



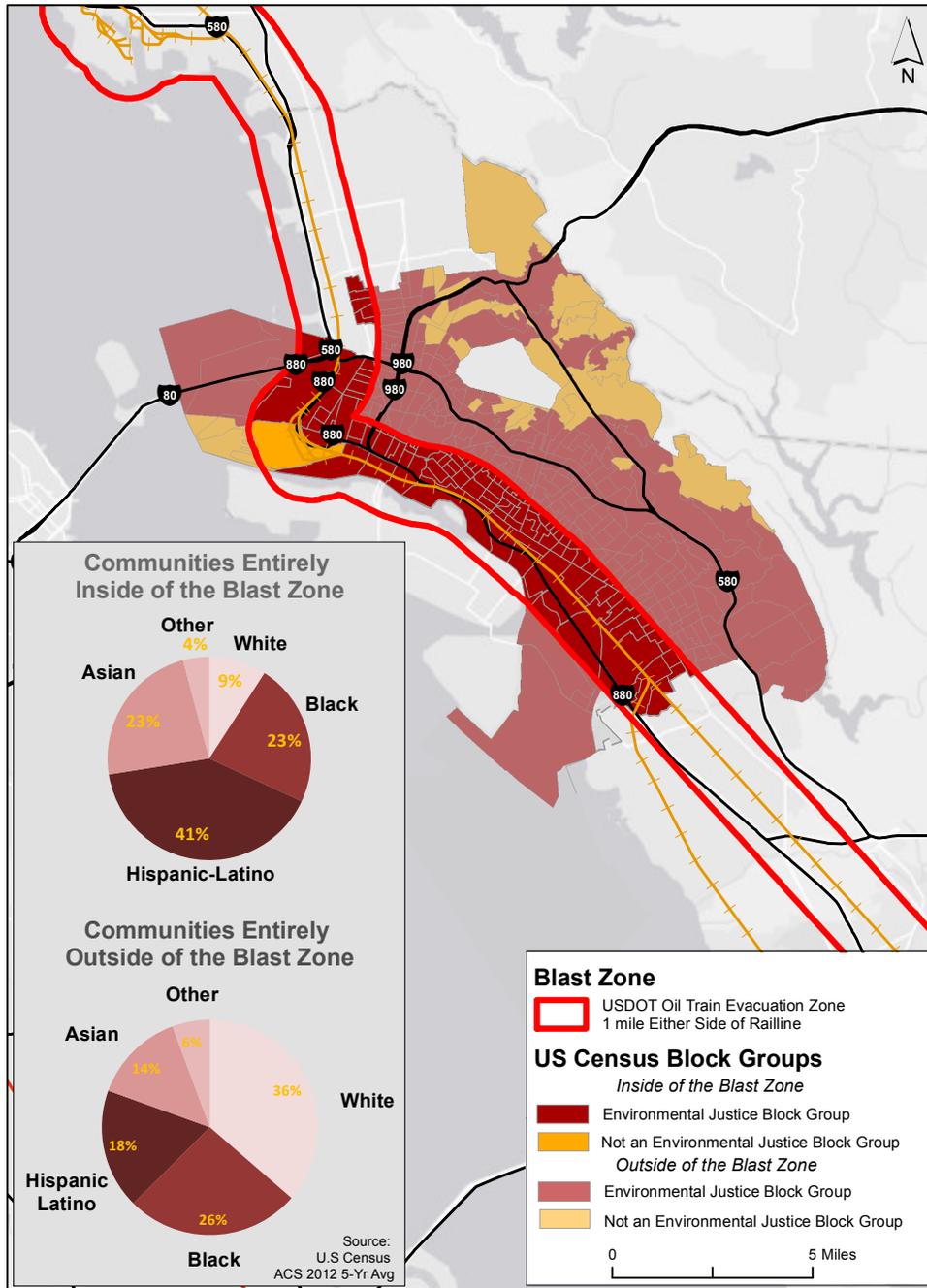
Environmental Justice and Race Inside of the Sacramento, CA Blast Zone



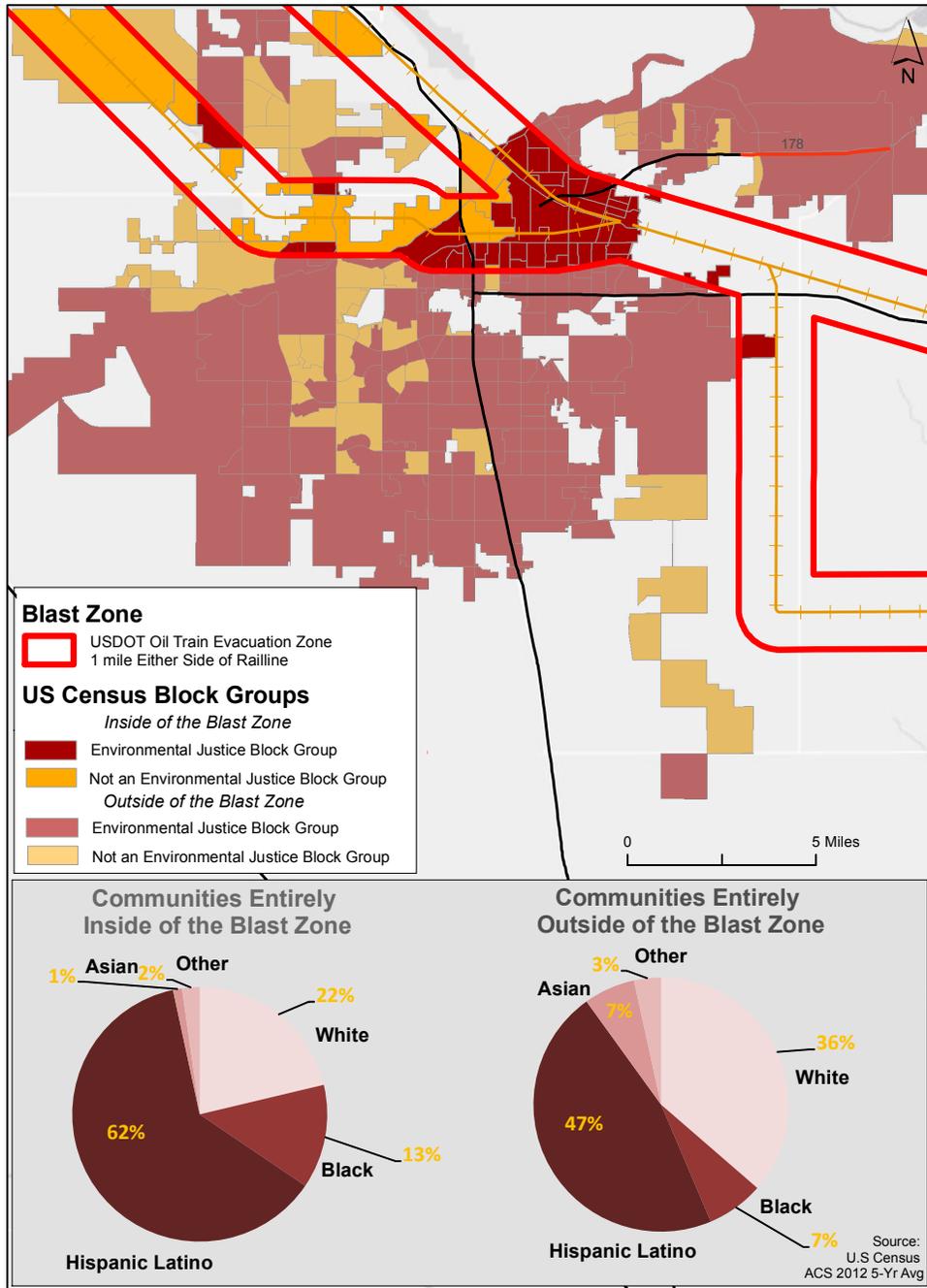
Environmental Justice and Race Inside of the Long Beach, CA Blast Zone



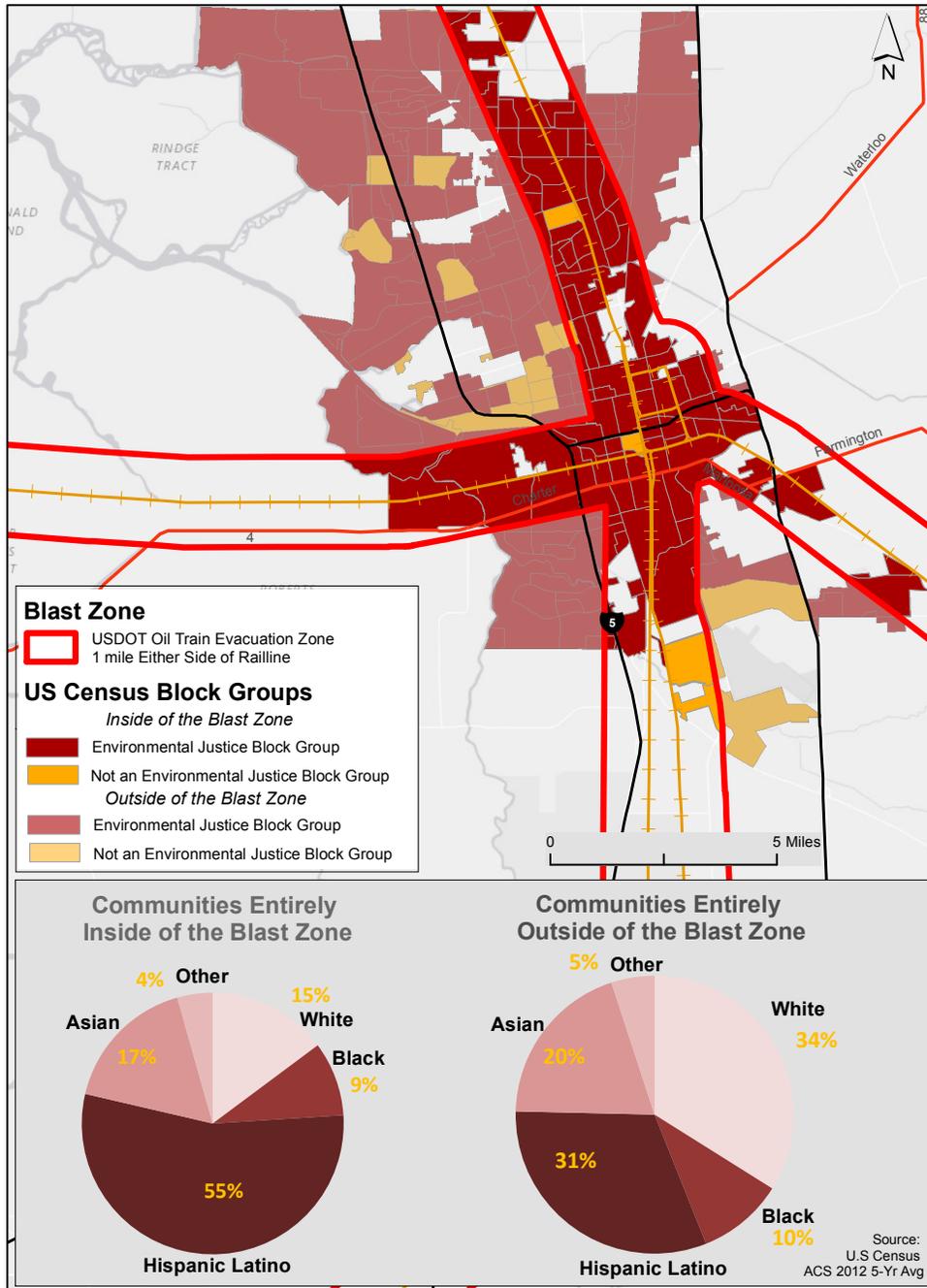
Environmental Justice and Race inside of the Oakland, CA Blast Zone



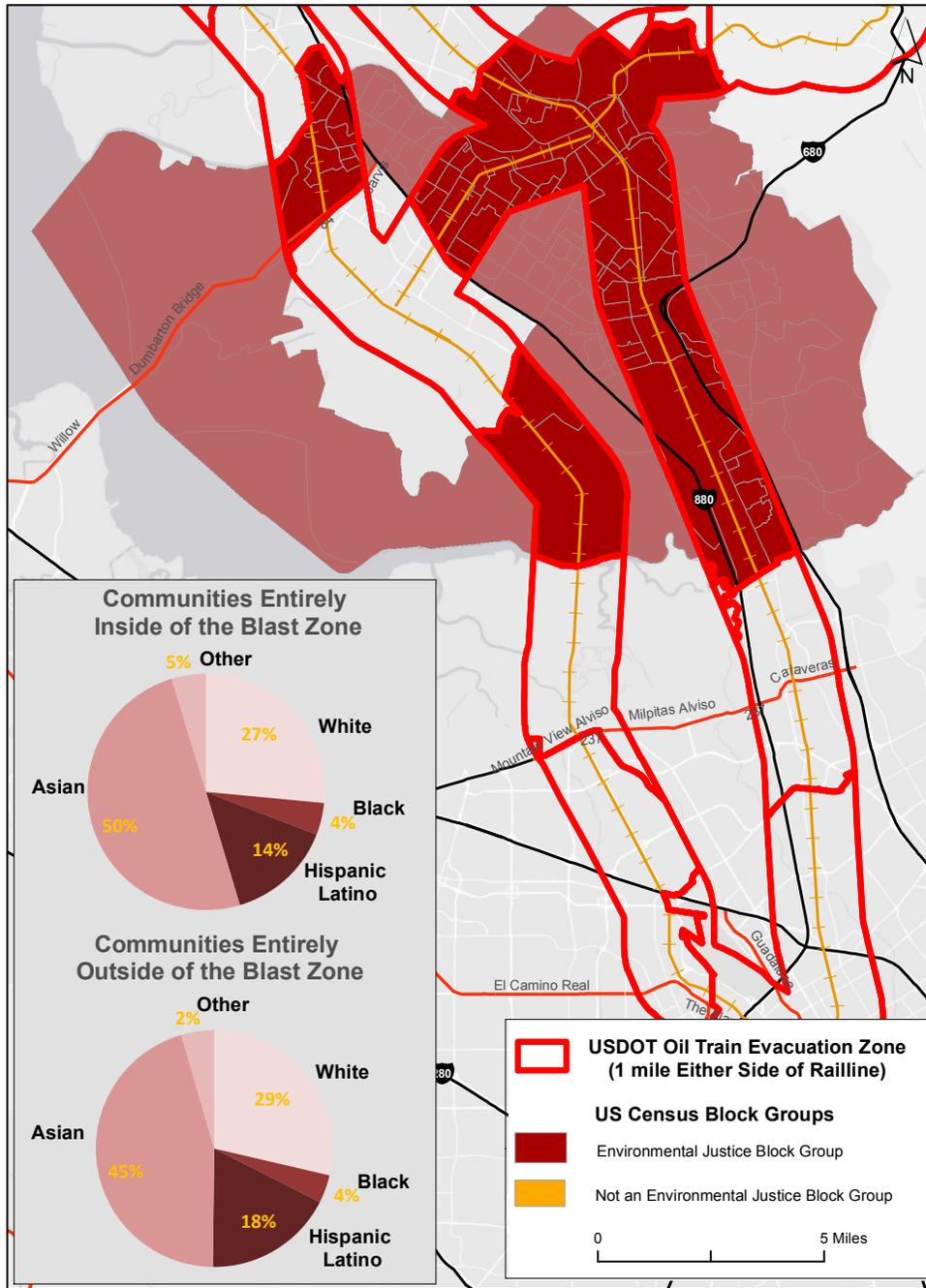
Environmental Justice and Race Inside of the Bakersfield, CA Blast Zone



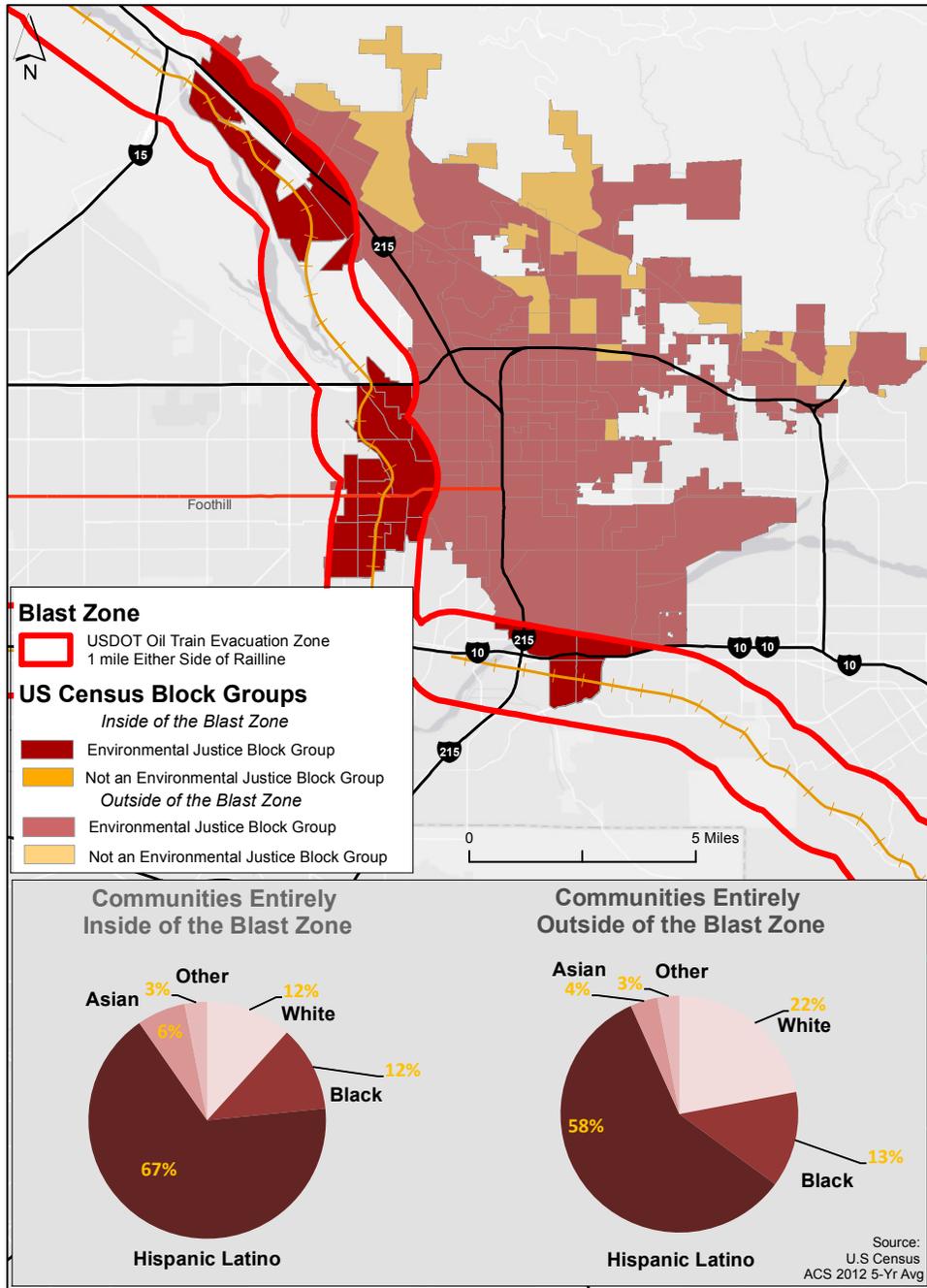
Environmental Justice and Race Inside of the Stockton, CA Blast Zone



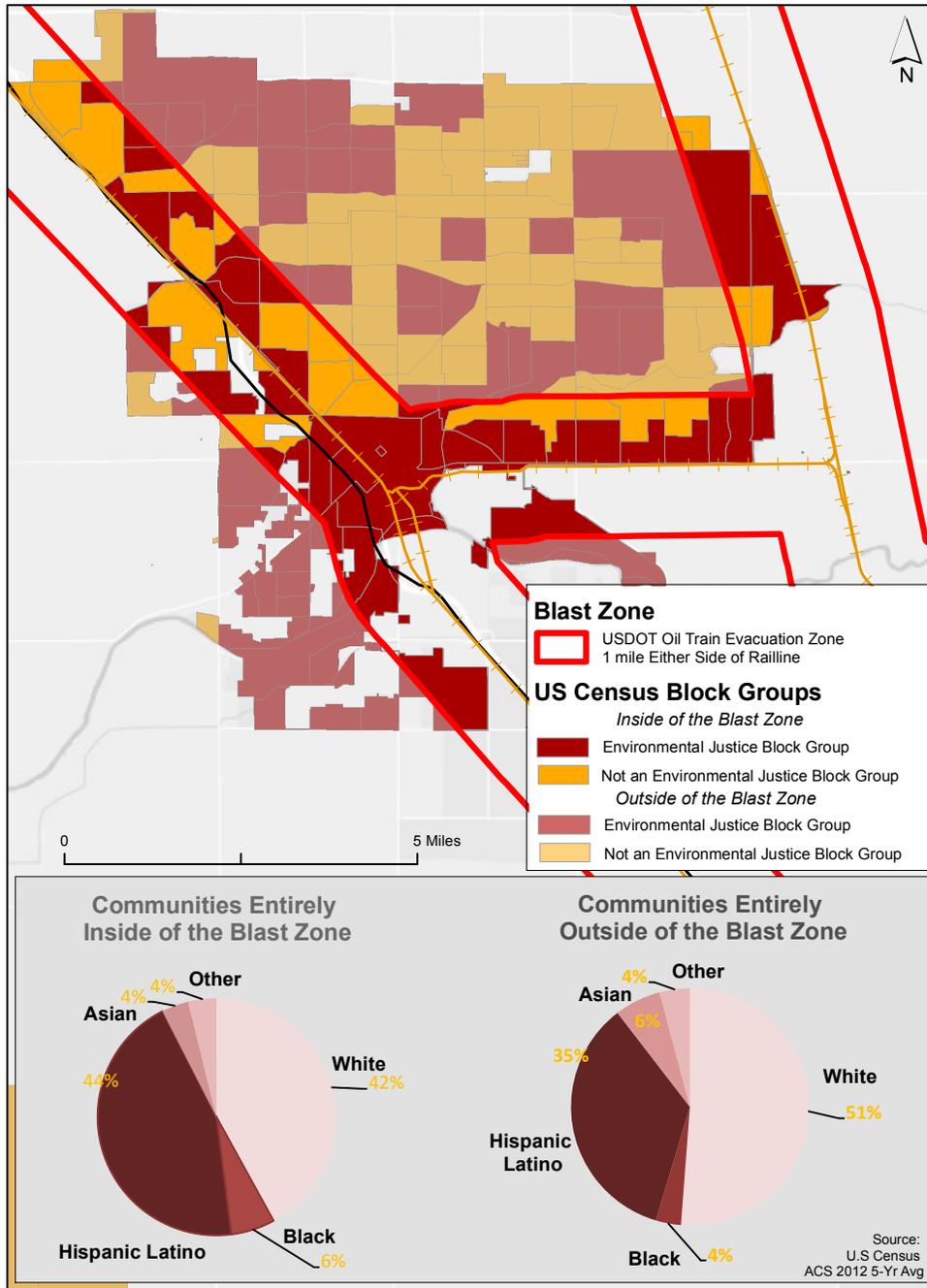
Environmental Justice and Race Inside of the Fremont, CA Blast Zone



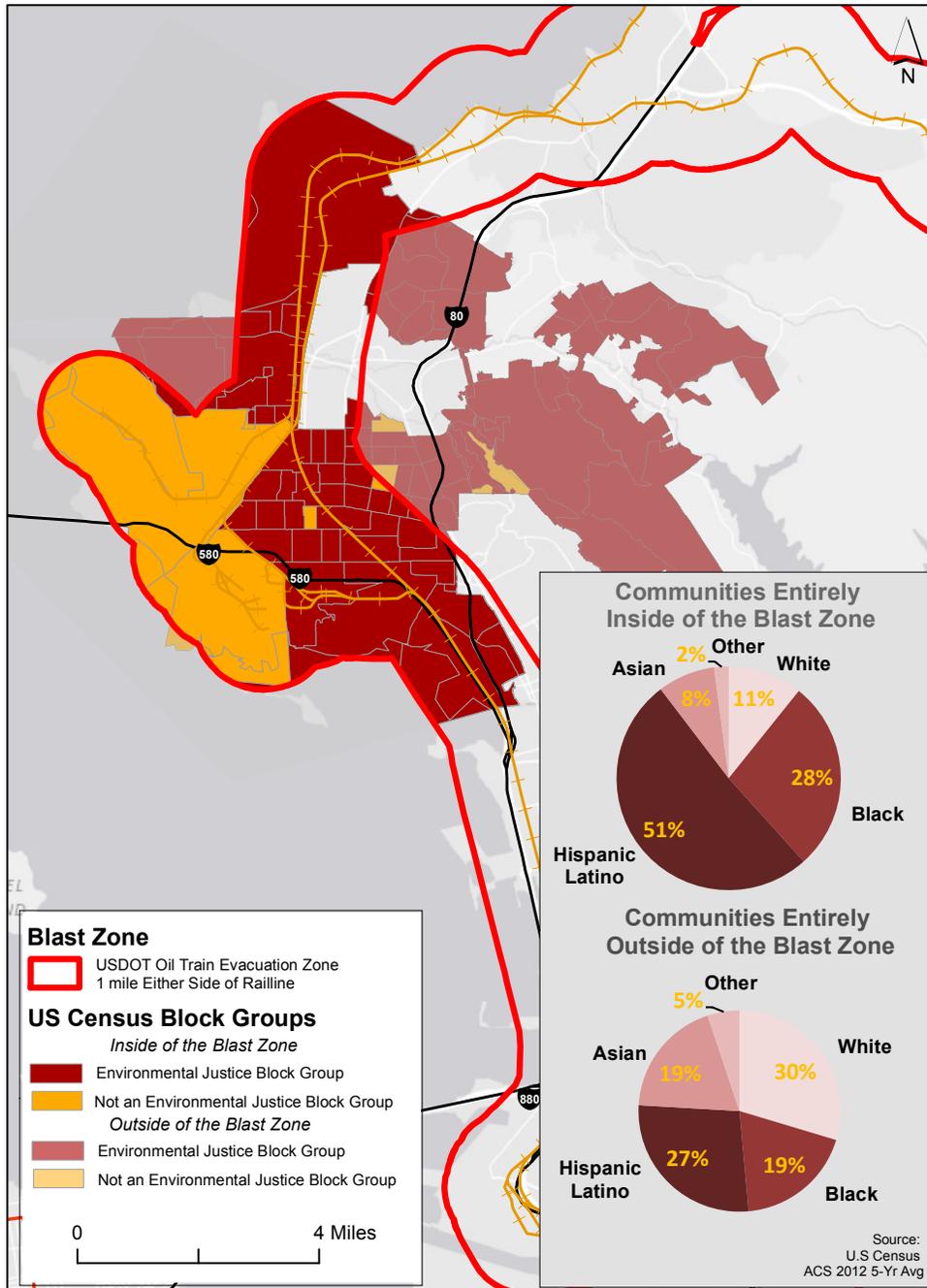
Environmental Justice and Race Inside of the San Bernardino, CA Blast Zone



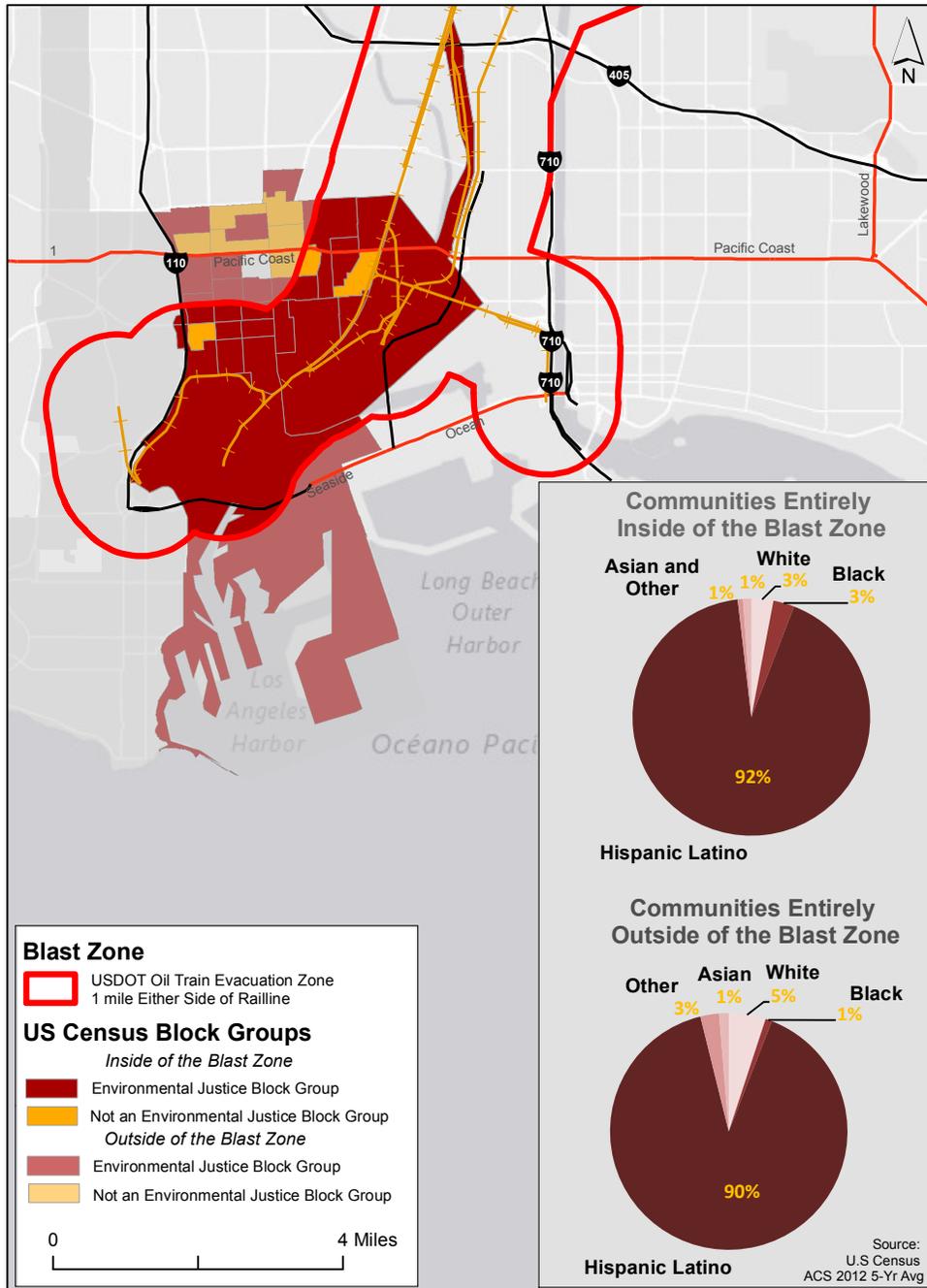
Environmental Justice and Race Inside of the Modesto, CA Blast Zone



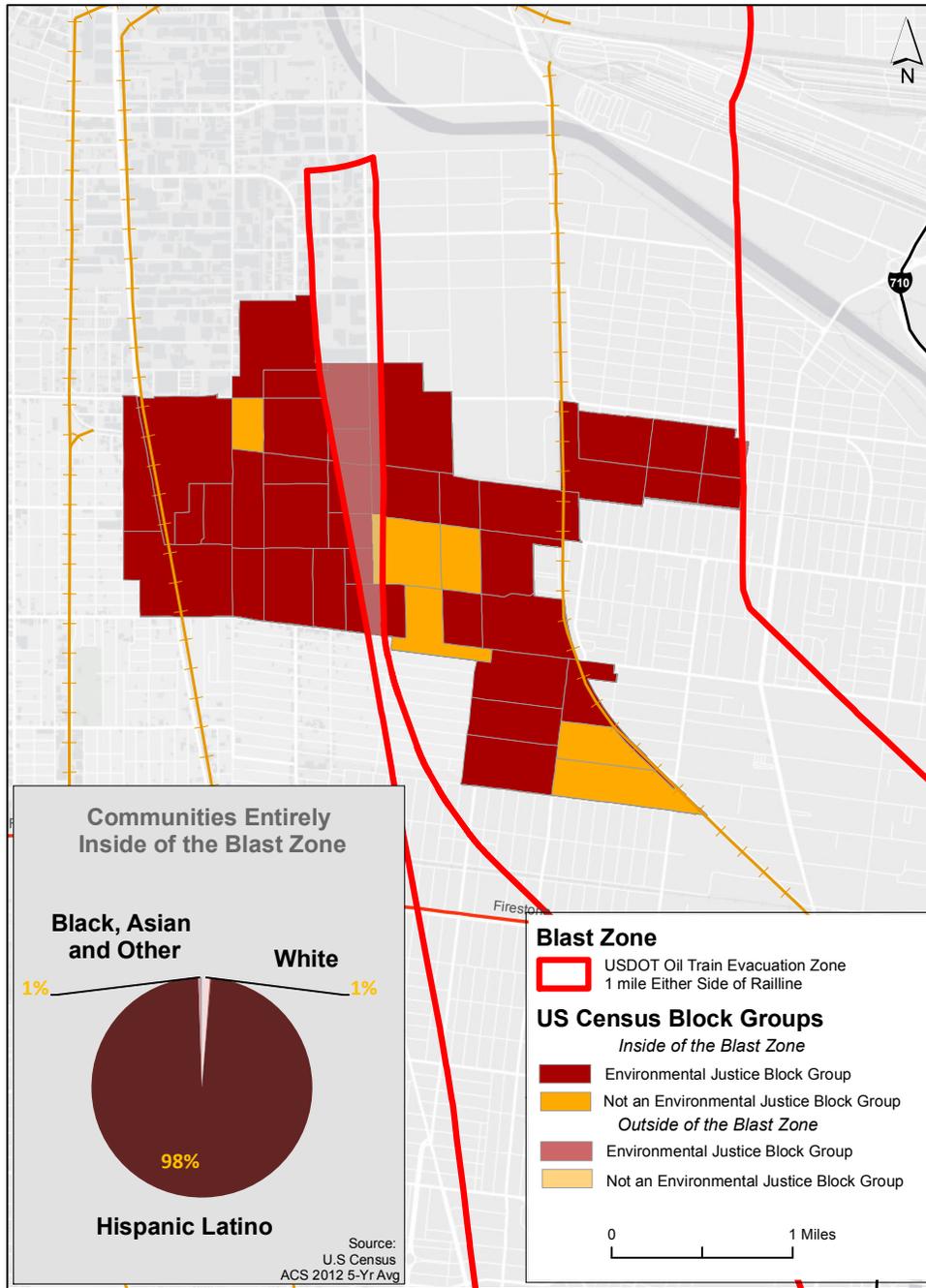
Environmental Justice and Race Inside of the Richmond, CA Blast Zone



Environmental Justice and Race Inside of the Los Angeles-Wilmington, CA Blast Zone



Environmental Justice and Race Inside of the Los Angeles -- Huntington Park, CA Blast Zone



BACKGROUND: EXTREME OIL ON THE RAILS

The oil and rail industries are moving to turn California's railways into deadly crude oil superhighways.

Government officials cited by [Reuters](#)⁴ on April 7, 2015, reported oil industry plans to increase oil moving by train from about one percent of California imports in 2014 to 25 percent. Based on proposed California oil train infrastructure expansion projects cited in the table on page 26, the oil industry could bring up to 660,000–900,000 barrels per day (which would be 40–50 percent of refinery inputs statewide) of crude oil by rail. That would mean nine or more oil trains, each carrying 70,000 barrels—about three million gallons in each train—of explosive crude oil on California rails every day.

The increase in oil train traffic nationally over the past seven years has been rapid and poorly regulated. In 2008 the oil industry moved 9,500 carloads of crude oil. In 2014 approximately 500,000 carloads of crude moved on US tracks. In 2013, more crude oil spilled from trains than in the previous 30 years combined. According to the California Energy Commission oil imports by rail into California grew from 45,491 barrels in [2009](#)⁵ to 6.3 million barrels in [2013](#).⁶

In the first five months of 2015 five major oil train disasters resulted in spills and fires that burned for days, forcing evacuations, polluting waterways, and putting rail workers and emergency responders at risk. These incidents, in West Virginia, Illinois, North Dakota, and two in Ontario, were all in rural, relatively unpopulated areas. However, each of these trains passed through heavily populated areas before derailling and exploding. Each would have passed through many more cities and towns, and over critical water supplies, before reaching its final destination.

Our railways are not designed to carry hazardous materials. Railways connect population centers and our cities grew around rail lines. Moving oil by train means that hazardous oil train routes now cross through eight of the state's ten largest cities and through the downtowns of many smaller cities and towns. Increased oil train traffic is a threat to all Californians but brings greatest risk to environmental justice communities that already live with elevated health and safety risk from industrial spills, fires and explosions, as well as, chronic, daily air and water pollution.

Fueling the Fires of Injustice

Low-income communities of color that are threatened by oil trains already are forced to carry heavy environmental burdens. For example, the California Office of Environmental Health Hazard Assessment [estimates](#)⁷ the relative environmental health of communities based on indicators of cumulative health hazard: pollutant exposures, environmental effects, population vulnerability, and socio-economic vulnerability. A comparison of these state estimates with the state's Rail Risk & Response [map](#)⁸ reveals that:

⁴ <http://af.reuters.com/article/commoditiesNews/idAFL2N0X425Y20150407>

⁵ http://www.energyalmanac.ca.gov/petroleum/statistics/2009_crude_by_rail.html

⁶ http://www.energyalmanac.ca.gov/petroleum/statistics/2013_crude_by_rail.html

⁷ <http://oehha.ca.gov/ej/ces2.html>

⁸ <http://california.maps.arcgis.com/home/gallery.html>

- Communities near oil train routes in Wilmington, Huntington Park, Oakland, Richmond and North Richmond already face disparate impacts, often facing a total environmental health hazard that is in the highest (worst) 20 percent among all communities statewide.
- Communities near oil train routes and oil refineries in Carson, Paramount, Torrance, Wilmington, Bakersfield, Martinez, Richmond and North Richmond face an environmental health hazard in the highest (worst) 20 percent statewide.
- Urban core communities near oil train routes in the Sacramento, Oakland, San José, Stockton, Modesto, Fresno, Bakersfield, Los Angeles, and San Bernardino–Riverside areas also score in the highest (worst) 20 percent for environmental health hazard statewide.

Disparities in environmental health exist now. Further increasing oil train traffic would make this environmental injustice even more severe. In Huntington Park, Wilmington, Fremont, and Richmond, ***most of the population*** faces the potential for direct impacts of an oil train derailment, explosion and fire, as most people living in each area live in the blast zone.

State and Federal Officials Ignore Race and Environmental Justice

Authorities are required by state and federal law to consider the disparate impacts on environmental justice communities in their review of projects that would expand oil train traffic in California. Oil trains disproportionately threaten the health and safety of environmental justice communities. Yet, federal, state and local authorities have systematically failed to consider environmental justice, disproportionate impacts, and cumulative health impacts that result from discrimination in safety regulations or reviews of oil train projects.

On May 4, 2015, the US Department of Transportation released new regulations for trains hauling liquid hazardous materials, including crude oil. These rules include new tank standards, but long phase-out of hazardous cars, inadequate speed limits, deficient tanker shells, and secrecy leave communities at risk of catastrophe.⁹ These rules allow unnecessary harm and will not protect public health and the environment. They also fail to consider the disproportionate impacts on environmental justice communities residing in the blast zone.

The Obama Administration failed to address two critical areas of federal law requiring that impacts on environmental justice communities and communities of color be addressed in federal rulemaking and funding decisions. The 1994 Executive Order, which remains in effect, requires that federal agencies and state agencies that take federal funds consider environmental justice in decisions about health and public safety. Likewise, Title VI of the 1964 Civil Rights Act prevents federal funds from being used to encourage racial discrimination. Yet the Department of Transportation and other federal rail safety agencies have developed new oil train rules that fail to consider disparate risk from oil trains to environmental justice communities.

[California law](#) also prohibits such discrimination, and further, requires that agencies and other regulatory bodies consider environmental justice and the cumulative impacts on health and safety when considering a project to “avoid over-concentrating these uses in proximity to schools or residential dwellings.”

⁹ <http://earthjustice.org/news/press/2015/obama-administration-leaves-explosive-oil-trains-on-the-rails-for-years>

Explosion and Pollution: The Acute and Chronic Threat from Oil Trains

The fatal derailment, Bakken crude spill and fire in Lac-Mégantic, Quebec, on July 6, 2013 was a wakeup call to the severe threat from oil trains carrying toxic, explosive crude oil. At least 47 people lost their lives and an entire downtown was incinerated in a fire that lasted for days. Both North Dakota Bakken and Canadian tar sands crude oil have been involved in many rail explosions and spills, despite earlier claims that tar sands crude was expected to be safer than Bakken during transport.

Much of the crude oil carried by train in California is tar sands from Canada, with that proportion anticipated to increase in the future. Tar sands are an asphalt-like substance mined from rock that requires the addition of light petroleum diluent so that it can be loaded into tank cars. Once mixed with diluent the resulting mixture, called diluted bitumen or “dilbit,” is not only toxic but also highly corrosive, flammable and explosive,¹⁰ and bitumen oil spills sink in waterbodies, causing chronic pollution.

Chronic Pollution, Cumulative Health Impacts, and Disruption

Even without derailment, spill, and fire, oil trains create hazardous air pollution from diesel exhaust and emit volatile pollutants. This air pollution is dangerous to anyone, but especially hazardous in communities that already suffer a significantly higher burden of airborne toxics and accompanying respiratory disease.

The antiquated tank cars currently used to move crude oil leak. They were not designed to carry volatile chemicals or contain chemicals at high pressure. The unpressurized DOT 111 and CPC 1232 tank cars currently permitted to carry crude under federal rules vent carcinogens and other toxic gases into the atmosphere.

In a process called shrinkage, one oil company calculated a loss of one percent of volume from oil tank cars on a journey from North Dakota to the Gulf Coast from off gassing through pressure relief valves and anticipated leakage. At this rate a 100 car, three-million-gallon train, may lose as much as 30,000 gallons of volatile, cancer-causing chemicals as it rolls down the tracks past homes and schools on the way to coastal refineries. New federal requirements announced in April 2015 will do nothing to improve containment of volatile air pollutants.

In an October 2014 environmental review for a Phillips 66 refinery oil train unloading project, San Luis Obispo County [admits](#)¹¹ that the proposed project will create “significant and unavoidable” levels of air pollution, including toxic sulfur dioxide and cancer-causing chemicals. This project’s air pollution would impact communities near that refinery and along the rails in many California counties. The review cites increased health risks -- particularly for children and the elderly -- of cancer, heart disease, respiratory disease, and premature death.

¹⁰ [See Andrews, 2014. Congressional Research Service; www.hsdl.org/?view&did=751042.](#)

¹¹ http://www.slocounty.ca.gov/Assets/PL/Santa+Maria+Refinery+Rail+Project/Phillips+66+Company+Rail+Spur+Extension+Project+%28Oct+2014%29/Individual+EIR+Section/0_3_Executive+Summary.pdf

In 2012, The Whatcom Docs, a group of more than 180 physicians from Whatcom County, WA, [outlined](#)¹² their conclusions on the potential health impacts from increased coal train traffic based on research published in major medical journals. Their findings on the chronic health threat from coal trains are also directly relevant to anyone living along oil train routes, and in particular environmental justice communities where air emissions from industrial facilities, road traffic, and other sources are higher than average.

[Research](#)¹³ compiled by the Whatcom Docs establishes:

Diesel particulate matter from passing and idling trains, and increased road traffic due to delays at road crossings, is associated with:

- Impaired pulmonary development in adolescents;
- Increased cardiopulmonary mortality and all-cause mortality;
- Measurable pulmonary inflammation;
- Increased severity and frequency of asthma attacks, ER visits, and hospital admissions in children;
- Increased rates of myocardial infarction (heart attack) in adults;
- Increased risk of cancer.

Noise pollution exposure from train traffic causes:

- Cardiovascular disease, including increased blood pressure, arrhythmia, Stroke, and ischemic heart disease;
- Cognitive impairment in children;
- Sleep disturbance and resultant fatigue, hypertension, arrhythmia, and increased rate of accidents and injuries;
- Exacerbation of mental health disorders such as depression, stress and anxiety, and psychosis.

Frequent long trains at rail crossings will mean:

- Delayed emergency medical service response times;
- Increased accidents, traumatic injury and death.

Other medical authorities¹⁴ are sounding the alarm about the health hazards posed by oil trains as well.

¹²<http://www.coaltrainfacts.org/whatcom-docs-position-statement-and-appendices>

¹³ <http://www.coaltrainfacts.org/whatcom-docs-position-statement-and-appendices - appendixA>

¹⁴ <http://www.truth-out.org/news/item/31258-oil-trains-don-t-have-to-derail-or-explode-to-be-hazardous-doctors-warn>

Oil Trains Undermine California Climate Policy

Oil trains threaten California’s climate protection goals. The oil industry wants to move more tar sands crude from Alberta, Canada, to California—the largest oil refining center in Western North America. This would require switching California refineries over to fundamentally different crude that causes the most extreme extraction and refining impacts of any petroleum known, undermining California’s climate initiative.

The tar sands crude that trains could bring in increasing volumes emits more greenhouse gas per barrel. A study¹⁵ published in 2015 by the Carnegie Endowment for International Peace showed that a switch from conventional light crude to tar sands could increase total well-to-wheel carbon pollution by as much as 80 percent. A 2010 study¹⁶ published in *Environmental Science and Technology* by Greg Karras, Communities for a Better Environment (a co-author of this report), estimated that a switch from the average US refinery crude slate to tar sands could double or triple the average emission intensity of oil refining. If the oil industry is allowed to increase the importation of tar sands into the state, and that results in a full-blown switch to processing tar sands bitumen in California, refinery emissions alone could approach or exceed California’s year-2050 target for GHG emissions from all sources statewide.

¹⁵ <http://carnegieendowment.org/2015/03/11/know-your-oil-creating-global-oil-climate-index>

¹⁶ <http://pubs.acs.org/doi/abs/10.1021/es1019965>

ACTIVE OIL TRAIN PROPOSALS IN CALIFORNIA

Planned and recently permitted oil train projects in California as of June 2015.

Oil Train Project	Status as of June 2015
Bakersfield: Alon Location: 6451 Rosedale Hwy, Bakersfield Proposed capacity: 140,000 barrels/day	Construction delayed, ongoing challenge of secrecy in environmental permit review, uncertainty over crude price forecasts
Bakersfield: Plains All-American Location: South Lake Road, Taft Capacity: 140,000 barrels/day	Operating despite ongoing challenge of secrecy in environmental permit review
Benicia: Valero Location: 3400 East 2 nd Street, Benicia Proposed capacity: 70,000 barrels/day	Delayed since 2013 by public pressure, revised draft Environmental Impact Report (EIR) scheduled for release August 31, 2015
Pittsburg: WesPac Location: 690 West 10 th Street, Pittsburg Proposed capacity: 242,000 b/d rail+marine	Delayed since 2013 by public pressure and shifting proposals regarding the project's rail component, revised EIR expected in 2015
Richmond: Kinder Morgan Location: 303 S. Garrard Blvd., Richmond Capacity: 70,000 barrels/day	Operating despite ongoing challenge of permit that was issued in secret, actual oil throughput appears to vary with crude price
San Luis Obispo County: Phillips 66 Location: 2555 Willow Road, Arroyo Grande Proposed capacity: 52,000 barrels/day	Opposed by community, environment groups and 16 city and county governments, revised final EIR expected in summer or fall 2015
Stockton: TARGA Location: Port of Stockton Proposed capacity: 70,000 b/d rail+marine	Proposed, seeking permits
Whitewater, CA: Questar Location: Unknown Proposed capacity: 120,000 b/d	No permit application found yet; trains would feed a pipeline from near Palm Springs to Long Beach and Los Angeles Area refineries

Data from CBE and ForestEthics reviews of project documents. Additional new or secretly permitted (see Kinder Morgan above) proposals may be anticipated.

Oil Trains are Not Needed in California

The planned statewide oil infrastructure listed in the table above could enable 660,000–900,000 barrels of oil to roll through California on trains every day—enough to supply 40–50 percent of total statewide refinery crude inputs. Today, however, despite their exponential growth since 2009, oil train imports to California still supply less than two percent of the crude refined statewide.¹⁷ Meanwhile, Californians are steadily using less oil—statewide gasoline sales declined by 15 percent from 2006–2014¹⁸—and this trend is expected to continue as State climate policies move toward sustainable transportation. Oil trains are not necessary to supply the feedstock for the fuels used in California.

¹⁷ http://www.energyalmanac.ca.gov/petroleum/statistics/2014_crude_by_rail.html

¹⁸ <http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=C100050061&f=A>

DATA AND METHODS

Route selection and data

The Blast Zone map uses data from Oak Ridge National Laboratory’s publicly available [rail map data set](#)¹⁹, their railroad network. There are many more possible rail lines than shown on the map. A three-step process was used to identify the most likely routes oil trains will travel:

1. Base routes were identified in the article [All Oiled Up](#)²⁰ in the March 2014 issue of Trains Magazine. The article, by rail freight expert Fred Frailey, shows the most likely rail routes used for oil trains.
2. We compared estimates in the Frailey article with Oil Change International’s [map of known oil train offloading terminals](#).²¹ We then connected major routes to known terminals. Where multiple connecting routes are possible we preferentially chose the Category 1 rail line owned by the railroad operating the main trunk line. Where multiple routes were possible with no Category 1 line, we chose the most direct route.
3. After publication of the Blast Zone website we have used first person accounts and feedback from site users to add rail routes. Any individual providing a first person account was asked to verify that they had seen the appropriate 1267 HAZMAT placard, and verify that they were observing crude oil unit trains. Often, individuals responded with unsolicited photographs of trains and their placards. Of the more than 100 additions and revisions we have received, only about five percent indicated areas that incorrectly showed oil train routes.

A fourth step, comparing our results against State of California oil train route mapping, (*see* ‘Fueling the Fires of Injustice’ above) also served as an informal spot-check on this method.

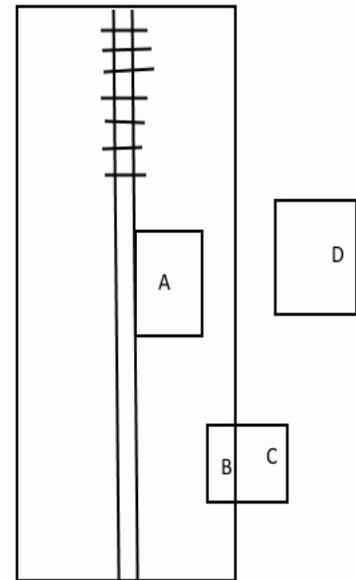
Calculating populations

In July 2014 ForestEthics calculated that 25 million Americans live in the blast zone. We believe this is a conservative estimate. Whether for California or for individual communities where we have created environmental justice or racial makeup screens, we used the same methodology to calculate a range of estimates and create a ‘best-estimate,’ as follows.

Populations were calculated using US Census data at the block group level. Using the one-mile evacuation or blast zone buffer, we calculated our best guess number as A + B below.

- A = Block groups wholly within Blast Zone
- B = Areal interpolated population estimate for fractions of blocks within the Blast Zone
- C = Areal interpolated population estimate for fractions of blocks outside the Blast Zone
- D = Block groups wholly outside of the Blast Zone

With higher concentrations of populations near tracks in major urban areas, as well as smaller rail towns, it is a fundamentally conservative assumption to use an areal interpolated estimate of population based on even distribution across the block group. Our use of areal interpolation in this case meant an assumption of even distribution such that if 30 percent of the area of the block group lies within the blast zone, we assumed that 30 percent of the population of that block group resides in the blast zone. To validate our methodology, we compared numbers to other data sources using the “places” GIS layer available through the US Census, and American Fact Finder (2011-2012). A spot check of 24 California cities showed that our estimates are consistently from 1 to 5 percent lower than population estimates in the American Fact Finder.



¹⁹ <http://www.cta.ornl.gov/transnet/RailRoads.html>

²⁰ <http://trn.trains.com/issues/2014/march-2014>

²¹ <http://priceofoil.org/rail-map/>

The most conservative and precise number would be to only use counts of A. Allowable methodologies for geographic analysis of these types of ranges include only A, our choice of A + B, and the high end methodology of all of A+B+C. We believe that the less precise, but potentially more accurate, choice of A+B is superior to using the much higher A+B+C number, or the lower number shown by A alone.

Identifying Environmental Justice Communities

We identified Environmental Justice (EJ) Block Groups (communities) using the 2008-2012 American Community Survey 5-yr average demographic and economic data (2012-ACS 5-Yr Avg). A method used by the State of Massachusetts was chosen as the screening tool for this analysis. This method uses three criteria to identify EJ communities: the impacts of race, income, and linguistic isolation. Any Block Group that meets at least one of the three EJ criteria is flagged as an EJ community:

- To evaluate race, we calculated percent minority population and flagged an EJ community for US Census Block Groups where percent minority is greater than 25% of the population.
- To evaluate income, we compared Median Household Income for each Block Group to the statewide Median Household Income. Where the Block Group Median Household Income is less than 65% of the State's Median Household Income, the Block Group is flagged as an EJ community.
- To evaluate linguistic isolation we identified the total number of households without English speakers older than 14-years old by Block Group. Where the number of households without English speakers older than 14-years old is greater than 25% of the Block Group, that Block Group is flagged as an EJ community.

Our mapping of EJ communities uses the 'A+B' counts method described above.

Identifying Racial Make up of Communities

To identify the racial make up of communities, the 2012-ACS 5-Yr Avg. B03002 Table for Hispanic or Latino Origin by Race was used. Within the U.S Census and the ACS, Hispanic and Latino origin information is not taken as a separate racial category, so a person can have Hispanic or Latino origin and be of multiple races, according to the Census. For our purpose of estimating population composition by race, anyone of Hispanic or Latino Origin from the ACS data was included in the Hispanic Latino community. The other racial communities were taken from the ACS data for the Non-Hispanic and Latino Origin population.

From the B03002 table, we estimated population counts for the categories Hispanic-Latino Origin, and from the Non-Hispanic Latino Origin population data we estimated White Alone, Blacks Alone, Asian Alone, American Indian Alone, Native Hawaiian-Pacific Islander Alone, Other races Alone, and Two or More Races. In our pie charts, American Indian, Native Hawaiian-Pacific Islander, Other races and Two or More Races are grouped together as 'other' (this was done for clarity of presentation only).

About the ½ mile (800m) and 1 mile (1,600m) "blast zone" buffers

As represented on various maps and the blast-zone.org website, the 800 meter and 1,600 meter oil train incident and fire evacuation zones are simplified versions of what in practice is a highly complex set of potential responses by first responders and other safety personnel. In practice, these evacuation and impact zones may be much smaller (a single tipped car with no puncture in Seattle led to no evacuation) and much larger (the Casselton, ND explosion and ensuing toxic cloud led to a five mile evacuation zone to the south and east of the incident in the dead of winter.)

Various agencies including the Department of Transportation's Pipeline and Hazardous Materials Safety Administration have issued initial response guidelines codified in the Emergency Response Guidebook. For an incident involving a single oil tank car (whether truck or train), the primary set of responses is codified under response protocol 128 for petroleum crude oil, or UN hazmat code 1267. That guideline recommends initial evacuation range of 800 meters for a single burning car.

The 800 meter zone of evacuation and impact could be the result of multiple scenarios: high volumes of tar sands crude spilled and the toxic inhalation hazard it represents, or per the PHMSA guide a single burning tank car that doesn't impinge on other cars. Likewise, the 1,600 meter zone of evacuation and impact is recommended for multiple burning cars, leading to risk of a boiling liquid expanding vapor explosion (BLEVE).

However, additional response protocols may be called for with crude oils with high levels of hydrogen sulfide, a deadly toxic inhalation hazard (TIH), or extremely high vapor pressures and high percentages of explosive gases

Crude Injustice on the Rails

during commonly experienced temperatures of transport, such as tar sands-derived (Canadian Heavy) oils, condensates, and Bakken shale oils.

The 800 meter and 1,600 meter evacuation and impact zones also fail to take into account geography. Incidents involving pour points into waterways, such as the 1999 Olympic pipeline disaster in Bellingham, WA, can result in a plume of toxic smoke more than two miles long.

Coverage limitation

We focused our limited resources on analysis of communities in California's major urban centers crossed by oil train routes. A strength of this choice is its focus on high-density populations where catastrophic and chronic hazards in the blast zone, if manifest, will harm the greatest number of people. A limitation is that detailed analysis for communities in low-density rural areas, smaller cities and towns is left to future work. Every community should have access to environmental justice information—and such future work might shed additional light on questions such as why, in California, Latinos appear to be disproportionately concentrated in the oil train blast zone.

Additional Data References:

2012 TIGER Line Polygon Feature Classes of Block Groups by State and County;

<ftp://ftp2.census.gov/geo/tiger/TIGER2012/BG/>

2012 TIGER Line Polygon Feature Classes of Places (Cities, Towns, Etc.) by State;

<ftp://ftp2.census.gov/geo/tiger/TIGER2012/PLACE/>

2008-2012 5-Year Average Selected Demographic and Economic Data from the American Community Survey (ACS); ftp://ftp.census.gov/geo/tiger/TIGER_DP/2012ACS

CTA North American Railroad Network Lines; <http://www-cta.ornl.gov/transnet/RailRoads.html>

Open Street Map Rail Data; <http://download.geofabrik.de/north-america.html>

All Oiled Up: A Special Report by Fred Frailey; <http://trn.trains.com/issues/2014/march-2014>

MassGIS Data - 2010 U.S. Census - Environmental Justice Populations;

<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/cen2010ej.html>

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Title: "Diesel Particulate Matter and Coal Dust from Trains in the Columbia River Gorge,
Washington State, USA"

Dear Dr. Jaffe,

We are pleased to inform you that your manuscript has been accepted for publication in Atmospheric Pollution Research. Your manuscript has been forwarded to our Publishing Office. You will be contacted soon by the Journal Publishing Staff regarding the page proofs for your manuscript.

Your page proofs will be prepared by our staff, and will be sent to you electronically. After you approve your page proofs, your manuscript will be published on the Web. Any change to the manuscript once it appears on the Web will need to be submitted to the journal office as additions or corrections.

If you have further questions about your paper, please contact the Journal's Publications staff directly at APRproof@atmospolres.com. Be sure to refer to the manuscript number. We have enjoyed working with you on this paper and look forward to receiving other contributions from you in the future.

Sincerely,

Tolga Elbir, Ph.D.
Editor-in-Chief

Atmospheric Pollution Research

Diesel Particulate Matter and Coal Dust from Trains in the Columbia River Gorge, Washington State, USA

--Manuscript Draft--

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Abstract:	<p>We examined the emissions of diesel particulate matter (DPM) and coal dust from trains in the Columbia River Gorge (CRG) in Washington State by measuring PM1, PM2.5, CO2, and black carbon (BC) during the summer of 2014. We also used video cameras to identify the train type and speed.</p> <p>During the two-month period, we identified 293 freight trains and 74 coal trains that gave a PM2.5 enhancement of more than 3.0 $\mu\text{g}/\text{m}^3$. We found an average PM2.5 enhancements of 8.8 and 16.7 $\mu\text{g}/\text{m}^3$, respectively, for freight and coal trains. For most freight trains (52%), and a smaller fraction of coal trains (11%), we found a good correlation between PM2.5 and CO2. Using this correlation, we calculated a mean DPM emission factor (EF) of 1.2 gm/kg fuel consumed, with an uncertainty of 20%. For four coal trains, the videos revealed large plumes of coal dust emanating from the uncovered coal cars. These trains also had the highest peak PM2.5 concentrations recorded during our study (53-232 $\mu\text{g}/\text{m}^3$). Trains with visible coal dust were observed for 5.4% of all coal trains, but 10.3% when the effective wind speed was greater than 90 km/h. We also found that nearly all coal trains emit coal dust based on (1) statistically higher PM2.5 enhancements from coal trains compared to freight trains; (2) the fact that most coal trains showed a weak correlation between PM2.5 and CO2,</p>

	<p>whereas most freight trains showed a strong relationship; (3) a statistically lower BC/PM2.5 enhancement ratio for coal trains compared to freight trains; and (4) a statistically lower PM1/PM2.5 enhancement ratio for coal trains compared to freight trains. Our results demonstrate that, on average, passage of a diesel powered open-top coal train result in nearly twice as much respirable PM2.5 compared to passage of a diesel-powered freight train.</p>
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4 **Diesel Particulate Matter and Coal Dust from Trains in the Columbia River Gorge,**
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33 **Abstract**
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33 **Keywords**

34 Diesel particulate matter, coal dust, air pollution from trains, air pollution from rail.
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41 **1. Introduction**

42 Rail locomotives powered by diesel fuel travel through the Columbia River Gorge
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44 National Scenic Area as well as many urban areas in Washington State. Evaluating the air
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46 quality impacts from rail traffic for people living near rail lines is hampered by a lack of data.
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48 Several plans that would expand coal shipments by rail through Washington and Oregon to
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50 coastal ports for export to Asia have been proposed. New export facilities have been proposed
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52 for Longview and Bellingham, Washington. One proposed port near Bellingham would have the
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54 capacity to ship up to 54 million metric tons of coal annually (WA DOE, 2013).
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4 The U.S. Department of Health and Human Services states that diesel particulate matter
5 (DPM) is “reasonably anticipated to be a human carcinogen” (U.S. DHHS, 2014). The World
6 Health Organization also categorizes DPM as “carcinogenic to humans” (WHO, 2012). In urban
7 areas, including Seattle, the most significant “air toxic” is DPM, contributing over 80% of the
8 cancer risk for air toxics (Keill and Maykut, 2003; PSCAA, 2005). DPM sources consist of rail
9 locomotives, ships and diesel trucks, both on road and off road. Average DPM concentrations for
10 the Seattle area are 1.4–1.9 $\mu\text{g}/\text{m}^3$, based on monitoring and a chemical mass balance model
11 (Keill and Maykut, 2003; Maykut et al., 2003). These DPM concentrations make up 15–20% of
12 the mass of total particulate matter with diameters less than 2.5 μm ($\text{PM}_{2.5}$).
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26 Emission standards for new and remanufactured locomotives, developed by the U.S.
27 Environmental Protection Agency (EPA) (40 CFR part 1033) have decreased steadily over the
28 past several decades. For diesel locomotives various standards apply based on the date of
29 manufacture: Tier 0, 1973–2001; Tier 1, 2002–2004; Tier 2, 2005–2010; Tier 3, 2011–2014; and
30 Tier 4, after 2015 (U.S. EPA, 2013). Tier 4 locomotives must comply with a PM_{10} standard of
31 0.03 g/bhp-hr, which is about 0.19 g of PM_{10} per kg of fuel consumed (U.S. EPA, 2009).
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41 Previous studies looked at rail yards as air pollutant sources. They determined that the
42 primary source of $\text{PM}_{2.5}$ at these sites was diesel fuel combustion. One study investigated the
43 impact of DPM emissions on $\text{PM}_{2.5}$ concentrations at an Atlanta area rail yard (Galvis et al.,
44 2013). Using measurements collected upwind and downwind of the rail yard, they found the
45 average “neighborhood” contribution to $\text{PM}_{2.5}$ was 1.7 $\mu\text{g}/\text{m}^3$. The emission factors (EFs) per kg
46 of diesel fuel burned were calculated to be 0.4–2.3 grams DPM. The EFs were not determined
47 from individual train measurements but were calculated using three different methods, each
48 based on differing assumptions. Two studies of a Roseville, California, rail yard also found
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4 significant enhancements in $PM_{2.5}$ from the yard. Using measurements from upwind and
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6 downwind, Cahill et al. (2011) found an average $PM_{2.5}$ enhancement of $4.6 \mu\text{g}/\text{m}^3$, and Campbell
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8 and Fujita (2006) found even larger contributions ($7.2\text{--}12.2 \mu\text{g}/\text{m}^3$). Cahill et al. (2011) also
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10 demonstrated that particles with diameters below $1 \mu\text{m}$ are the major contributor to $PM_{2.5}$ aerosol
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12 mass from diesel exhaust. Abbasi et al. (2013) studied concentrations in the interior of trains and
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14 close to rail lines and found significantly elevated $PM_{2.5}$ and PM_{10} concentrations, particularly in
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16 stations that were underground. Gehrig et al. (2007) looked at electric trains in Switzerland and
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18 examined the influence of dust from these trains on PM_{10} concentrations. Several studies
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20 investigated the EFs of on-road diesel trucks and buses (Jamriska et al., 2004; Zhu et al., 2005;
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22 Cheng et al., 2006; Park et al., 2011; Dallmann et al., 2012), but we have found no similar
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24 studies on diesel rail.
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31 Trains that carry coal in uncovered rail cars may also release coal dust, in addition to
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33 DPM, into the atmosphere. The BNSF railway requires that a surfactant be applied over the top
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35 of coal being transported by rail (see BNSF Railway, 2013). However, we are unaware of any
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37 studies reported in the scientific literature that evaluate the efficacy of this or the impact of coal
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39 dust on air quality. By examining the PM by train type, we can examine whether there is
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41 respirable coal dust ($PM_{2.5}$) as part of the emissions from coal trains. We will also examine the
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43 particle size distribution because combustion-related particles and coal dust, which is
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45 mechanically generated, are associated with particles of different sizes (Seinfeld, 1986).
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51 A substantial amount (44–60%) of the diesel engine $PM_{2.5}$ mass is black carbon (BC)
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53 (Bond et al., 2004; Kirchstetter and Novakov, 2007; Ramanathan and Carmichael, 2008).
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55 Because radiative forcing due to BC is the major light-absorbing species in atmospheric aerosol,
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57 it is significant both globally and regionally (Jacobson, 2001; Ramanathan and Carmichael,
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4 2008). In addition, because of BC's surface properties, it is possible for polyaromatic
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6 hydrocarbons (PAHs) and other semi-volatile compounds to be adsorbed and transported by BC
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8 (Dachs and Eisenreich, 2000). Health organizations are also taking a hard look at BC because of
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10 its contribution to the harmful effects caused by PM_{2.5}, including cardiopulmonary and
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12 respiratory disease (Jansen et al., 2005; Janssen et al., 2011; U.S. EPA, 2012).
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17 Because of the lack of information on PM_{2.5} concentrations and the exposure to humans
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19 from diesel trains, the debate over coal dust and the scarcity of information on diesel train EFs,
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21 we sought to measure these air quality effects by answering the following questions:
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- 24 1. What are the DPM emission factors for locomotives in Washington State and how do
25 these compare with published values?
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- 28 2. Do open-top coal-carrying trains emit respirable coal dust (PM_{2.5}) into the air? If so, can
29 we quantify the emissions?
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33 To address these questions we measured PM₁, PM_{2.5}, CO₂, black carbon and meteorology at a
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35 location in the Columbia River Gorge next to the rail line. Because we wanted to quantify DPM
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37 and coal dust exposure and quantify the EFs from each train, we collected measurements every
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39 10 seconds in order to identify the air quality impacts of individual trains. In a previous study,
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41 we measured a similar suite of parameters in 2013 at a site in Seattle, Washington, and (very
42
43 briefly) at a site in the Columbia River Gorge (Jaffe et al., 2014). In the previous study, we
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45 quantified DPM emission factors from diesel trains, evaluated the neighborhood scale exposure
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47 to PM_{2.5} from trains and found evidence that suggested emissions of coal dust, based on particle
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49 size. In the present analysis, we report new data taken in 2014 that more clearly identifies and
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51 quantifies the emissions of DPM and coal dust from coal-carrying trains.
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2. Experimental

Measurements were made at a site between the towns of Lyle and Dallesport, Washington, in the Columbia River Gorge (approximately 45.7°N, 121.2°W) between June 7–August 10, 2014. The instruments were housed in a weather-proof enclosure, located about 10 meters above and 20 meters northeast of the rail line. Two video cameras were used; one took video of the trains at a 90° angle to the rail line, and one viewed the trains arriving/departing to the northwest. The rail line travels along the north side of the Columbia River. There were no roads between our site and the river. Our measurement site was approximately 200 meters southwest of Washington Route 14, a state highway with light traffic. The measurement location used in 2014 was in the same general location, but about 300 meters away, from the site we used for our 2013 measurements (Jaffe et al., 2014). At this site the rail line is almost completely flat; there is a maximum grade of 1 meter per km in the next few km in either direction.

We used a DustTrak DRX Aerosol Monitor (Model #8533, TSI, Inc., Shoreview, MN) to measure size-segregated PM. The DustTrak reports 4 size fractions of PM mass concentrations: PM₁, PM_{2.5}, PM₁₀ and TSP. The instrument uses aerosol scattering to calculate its measurements. Therefore, its measurements are not the same as mass-based measurements (Wang et al., 2009). The DustTrak is calibrated against Arizona road dust (ISO 12103-1) by the manufacturer and so will not correctly reflect the mass concentration for other types of aerosol. This is specifically the case for diesel PM because of the particle size (Park et al., 2011). Obtaining accurate measurements with the DustTrak requires comparing its measurements with a mass-based measurement (Moosmuller et al., 2001). The DustTrak has been used to quickly measure several PM size fractions and determine EFs of individual vehicles in several previous studies (e.g., Park et al., 2011; Dallmann et al., 2012), but usually after using a mass-based method to calibrate the

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4 response factor (Jamriska et al., 2004; Zhu et al., 2005; Cheng et al., 2006; Jaffe et al 2013). In
5
6 our study, the DustTrak was calibrated against two mass-based measurements—a Tapered
7
8 Element Oscillating Microbalance (TEOM) and the EPA Federal Reference Method at a routine
9
10 air quality monitoring station in Seattle, Washington (details below).
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14 The DustTrak inlet was stainless steel tubing (4.8 mm i.d.) facing downward from a
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16 height of approximately 2 meters above ground level. The flow rate through the inlet was 3.0
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18 liters per minute. With these conditions, the flow was laminar. To estimate the particle sampling
19
20 efficiency, we used the methodology and program provided by von der Weiden et al. (2009). The
21
22 wind speeds during train sampling in the CRG varied between 1–11 meters per second (mps),
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24 with an average of 4.5 mps during the sampling period. For particles less than 2.5 μm
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26 aerodynamic diameter, we calculated greater than 90% particle transmissions at all wind speeds
27
28 up to 15 mps. For particles between 3–10 μm aerodynamic diameter, the inlet sampling
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30 efficiency would be much less than 1.0 and vary with wind speed (von der Weiden et al., 2009).
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32 For this reason, we used only the $\text{PM}_{2.5}$ and PM_1 data in this analysis.
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39 We measured CO_2 using a Licor-820 (Licor, Inc., Lincoln, NE) with a small vacuum
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41 pump for sampling. The inlet was a 4.8 mm i.d. stainless steel tube (38 mm long) connected to
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43 PFA tubing. We zeroed the instrument using CO_2 -free air and calibrated it with a 395 ppmv
44
45 standard from Airgas, Inc. We calibrated the instrument both before and after the deployment;
46
47 the instrument response varied by less than 1 ppmv between these calibrations. We used
48
49 DAQFactory on a PC to record data from the DustTrak, the Licor-820 (CO_2 , cell temperature
50
51 and pressure) and the meteorological station. We recorded 10-second averages for PM and CO_2
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53 data.
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4 To identify trains and quantify their speeds, we used two Night Owl cameras (Model
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6 CAM-MZ420-425M) that were equipped with infrared (IR) night vision. The cameras were
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8 motion activated and operated with iSpy open source camera security software. However, even
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10 with the IR capability of the cameras, we were unable to identify the type of trains at night. We
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12 considered using an auxiliary light to view the trains at night; however, this was rejected as the
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14 Columbia River Gorge is classified as a National Scenic Area, which limits lighting options.
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16 Only trains that could positively be identified as freight or coal were used in this analysis, so this
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22 excluded all trains passing our site in full darkness.

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24 BC was measured using an aethalometer (Magee Scientific model AE22). BC data were
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26 collected at one-minute time resolution at 370 nm and 880 nm. BC loading was determined using
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28 infrared attenuation data at 880 nm alone, because at 370 nm, other organic compounds may
29
30 contribute interference (Wang et al., 2011). The aethalometer determines raw BC concentration
31
32 (BC_0 , ng/m^3) from measured attenuation values (ATN , m^{-1}) via

$$33 \quad BC_0 = 10^9 \times ATN/\sigma \quad (1)$$

34
35 where σ is the calibrated cross-section ($16.6 m^2/g$ at 880 nm). As in our previous study (Jaffe et
36
37 al., 2014), we applied a correction to the BC_0 concentrations to account for diminishing
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39 transmission as a function of BC loading. Transmission (Tr) is calculated from each attenuation
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41 value:
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$$48 \quad Tr = e^{-ATN/100} \quad (2)$$

49
50 Following Kirchstetter and Novakov (2007), we calculated the corrected BC mass loading
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52 (BC_{corr} , ng/m^3) as:

$$53 \quad BC_{corr} = BC_0 / (0.88 \times Tr + 0.12) \quad (3)$$

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The DPM EFs are calculated for each passing train in units of DPM emitted per kg of diesel fuel burned using:

$$EF (PM_{2.5}) = \frac{\Delta PM_{2.5}}{\Delta CO_2} \times CF \times W_c \quad (4)$$

where the $\Delta PM_{2.5}/\Delta CO_2$ or “enhancement ratio” is calculated from the Reduced Major Axis (RMA) regression slopes of the 10-second CO_2 and $PM_{2.5}$ data for each passing train, in units of $\mu g/m^3$ per ppmv. CF is a conversion factor to convert CO_2 concentrations in ppm to $\mu g C/m^3$ units using the ideal gas law at 1 atm and $25^\circ C$ ($1 \text{ ppmv } CO_2 = 490.7 \text{ ugC/m}^3$). W_c is the mass fraction of carbon in diesel fuel (870 g C/kg fuel) (Lloyd's Register, 1995; Cooper, 2003), which yields overall units on the EF of g $PM_{2.5}/kg$ fuel consumed. Yanowitz et al. (2000) showed that over 95% of diesel fuel carbon is released as CO_2 .

Enhancement ratios ($\Delta PM_{2.5}/\Delta CO_2$ and $\Delta PM_1/\Delta PM_{2.5}$) were calculated from the 10-second data using the RMA regression method, which considers errors in both the x and y variables (Ayers, 2001; Cantrell, 2008). Absolute enhancements were calculated by subtracting out the PM, BC and CO_2 maximums during train passage from the background concentration measured prior to each train's passage. The RMA regression parameters were calculated for each train passage using a program written in Java utilizing Apache Commons Mathematics Library 3.3. The program first looked for a $PM_{2.5}$ enhancement of at least $3 \mu g/m^3$ over the median value from the past 17 minutes (100, 10-second data points). The accuracy of the Java program to calculate PM and CO_2 enhancements and the RMA regression parameters were manually verified for approximately 20% of the peaks. All times in this manuscript are given in Pacific Daylight Time (PDT).

3. Results

3.1 Calibration of the DustTrak

We compared the DustTrak PM_{2.5} concentrations with a TEOM and the filter-based Federal Reference Method (FRM) at a routine air quality monitoring site in Seattle, Washington (Beacon Hill), operated by the Puget Sound Clean Air Agency (PSCAA). Comparison data were obtained between April 30–May 20, 2014. TEOM data were continuous and reported on an hourly basis, the filter-based FRM measurements were for 24 hours and conducted every third day only. At this site, the TEOM is a Thermo Fisher Scientific Model 1400AB with 8500C Filter Dynamic Measurement System (FDMS) with the Very Sharp Cut Cyclone (VSCC™) modification (U.S. EPA, 2014). This configuration is designated by the EPA as a Federally Equivalent Method (FEM) for PM_{2.5}. The inlet and flow configuration used for the DustTrak at the Beacon Hill site were identical to the configuration used in the Columbia River Gorge.

We found a very good correlations between the TEOM PM_{2.5}, the FRM and the DustTrak's reported PM_{2.5}. Table 1 shows the regression parameters.

The 95% confidence interval in the slope for the DustTrak-TEOM comparison is +/- 4.5%, whereas it is +/- 32% for the DustTrak-FRM comparison due to the very small sample size. In both cases, the intercepts are insignificantly different from zero (95% confidence interval overlaps zero). Because of this, we corrected all of the DustTrak PM data using the TEOM slope of 0.5577. This slope is 22% greater than the one reported by Jamriska et al. (2004), who reported a slope of 0.458. It also is approximately 14% greater than our earlier DustTrak comparison at a different site, where we reported a slope of 0.491 (Jaffe et al., 2014). These differences may be attributable to different aerosol types at these sites. Given these differences, we estimated the uncertainty in the corrected DustTrak PM₁ and PM_{2.5} values to be ±20%.

3.2 Overview of observations on train emissions in the Columbia River Gorge

As each train passed our observation site, we may detect a peak in PM and CO₂, but this depended on the wind direction and wind speed. If the winds were from the north to northeast directions, our sensors recorded minor peaks only, or no peaks at all, in PM and CO₂. We found that small PM events had a lower correlation between the various parameters. For this reason, we screened out small peaks where the maximum $\Delta\text{PM}_{2.5}$ (enhancement above background) was $< 3 \mu\text{g}/\text{m}^3$. If a peak larger than this value was detected and the video confirmed a simultaneous train passage, then we included this peak in our analysis. We included only freight and coal-carrying trains, since these were the dominant types that we observed in the Columbia River Gorge. Trains that carried mixed loads (e.g., freight plus coal), sand or other unidentifiable or uncovered cargo were not included in this analysis. We also observed very few passenger trains during the daytime hours, in contrast to our previous study in Seattle (Jaffe et al., 2014).

During this study, we observed 367 events with $\Delta\text{PM}_{2.5} > 3 \mu\text{g}/\text{m}^3$ that were identified by the video cameras as either freight or coal. We refer to each train passage with a detectable PM peak and verified by the video as a “train event.” Table 2 shows a summary of the 367 train events, including number and average peak PM₁ and PM_{2.5} enhancement values (over background). The peak PM₁ and PM_{2.5} enhancements (10-second) from coal trains are about double the enhancements seen from freight trains. In addition, there are three extreme events with PM_{2.5} enhancements greater than $75 \mu\text{g}/\text{m}^3$ that were seen only for the coal trains. The differences between the peak PM enhancements for coal and freight trains are statistically significant ($P < .001$). The statistically significant difference remains even if these extreme events are excluded from the analysis. For all train events, there is an excellent relationship between the

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PM₁ and PM_{2.5} data, although the fraction of PM₁/PM_{2.5} varies by train type. This is discussed in section 3.5 below.

However, only some train events showed a good correlation between PM_{2.5} and CO₂. Figure 1 shows an example of a freight train that passed our site on July 10, 2014. In this case, the PM_{2.5} enhancement is 24 µg/m³, the CO₂ enhancement is 39 ppmv and the two are very well correlated, indicating that the dominant source of PM is diesel exhaust. Figure 2 shows an example of a coal-carrying train that passed by on July 18, 2014. For this example, the peak PM_{2.5} concentration is more than 6 times the peak shown previously for the freight train, while the CO₂ enhancement is much smaller. In addition, the CO₂ peaks occurred at the start and end of the train passage due to locomotives at the beginning and end of this train, which is typical of the very long coal trains. The height of the CO₂ peak shows no obvious relationship with train type and likely varies mainly with meteorology, which influences the degree to which the combustion exhaust gases reach the measurement site. For the coal train (Figure 2), the dominant source of PM is not diesel exhaust but coal dust. This was confirmed by the video (discussed below). It should be noted that DPM was probably present but is not apparent in the data due to the much larger coal dust peak. In this case, because the PM concentrations were not correlated to CO₂, we were not able to calculate a DPM emission factor. For this reason, we did not include train events in the DPM EF calculation if the PM_{2.5}-CO₂ R² is less than 0.5. We also excluded train events that had very small CO₂ enhancements ($\Delta\text{CO}_2 < 2$ ppmv), as these had erratic behavior.

3.3 DPM emission factors

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4 The $\Delta\text{PM}_{2.5}/\Delta\text{CO}_2$ was used to derive the DPM emission factors. The average
5
6 $\Delta\text{PM}_{2.5}/\Delta\text{CO}_2$ slope for all train events was found to be $6.56 \mu\text{g}/\text{m}^3$ per ppmv, but this included
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8 many trains with a very poor correlation between $\text{PM}_{2.5}$ and CO_2 . For the DPM emission factor
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10 calculation, we restricted our analysis to only those cases with an R^2 for the $\text{PM}_{2.5} - \text{CO}_2$
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12 relationship of 0.5 or greater and a CO_2 enhancement of at least 2 ppmv. Table 2 shows the
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14 number of each train type that was used for the DPM analysis and statistics on the $\text{PM}_{2.5} - \text{CO}_2$
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16 slope.
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21 The data in Table 2 show that while most freight trains were included in this analysis, the
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23 majority of coal trains were not included. This is due to the fact that most of the coal train events
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25 show a poor correlation between $\text{PM}_{2.5}$ and CO_2 (see Figure 2). One coal train that would
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27 otherwise have been included in the DPM calculation had a $\text{PM}_{2.5} - \text{CO}_2$ slope of 12.0, more than
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29 10x the mean value, and had visible coal dust in the video. Thus the large amount of $\text{PM}_{2.5}$ in this
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31 case cannot be attributed solely to DPM. This train event was not included in the DPM analysis.
32
33 With this exclusion, the mean and median slopes for freight and coal trains are rather similar.
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35 Using equation 4, we find that the mean and median DPM EFs from our study are 1.2 and 0.99
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37 g/kg fuel consumed, with an overall uncertainty of 20%. Our previous observations in the Pacific
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39 Northwest (Jaffe et al., 2014) found an average EF for diesel locomotives of 0.94 g/kg.
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45 Diesel EFs for locomotives have been previously reported from several measurement
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47 campaigns. Kean et al. (2000) reported locomotive emission factors of between 1.8–2.1 g/kg
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49 using the EPA “NONROAD” model. A 2009 report (U.S. EPA, 2009) estimated that average
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51 locomotives EFs are declining about 5% per year, with a 2014 value of 0.98 g/kg. A study by
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53 Sierra Research in 2004 (Sierra Research, 2004) forecast a much slower decrease in the EFs of
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55 diesel locomotives, compared to U.S. EPA (2009), and for 2014 projected 1.4 g/kg. Our average
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4 measured EF is consistent with those cited in the above literature for the 2014 time frame, within
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6 the respective uncertainties.
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10 11 **3.4 Black carbon**

12 We obtained simultaneous BC and PM_{2.5} data on 294 of the trains. Table 3 reports the
13
14 observed BC/PM_{2.5} and PM₁/PM_{2.5} enhancement ratios (discussed in section 3.5)
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18 These data show that, on average, 43% of the PM_{2.5} was BC for all trains. In our previous
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20 study using similar data from 2013 (Jaffe et al., 2014), we found that the BC/PM₁ fraction was
21
22 52%, with most of those observations on freight trains. Our new data in 2014 indicates a
23
24 significant difference ($P < .001$) in the average BC/PM_{2.5} fraction for freight (0.47) and coal trains
25
26 (0.29). Previous studies have found values that are similar to our freight train values for the
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28 BC/PM fraction. A study by Hildemann et al. (1991) found that 55% of diesel emissions were
29
30 BC, and Watson et al. (1994) reported 45%. An Atlanta study (Galvis et al., 2013) found that
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32 diesel trains had BC to PM_{2.5} ratios of 47–52%. The significant difference in the BC/PM_{2.5}
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34 between coal and freight trains, shown in Table 3, indicates a significant coal dust component in
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36 the PM from the coal trains.
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43 We assume that the coal dust has the same composition as the coal being shipped. This
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45 coal, from the Powder River Basin of Wyoming and Montana, has a relatively low carbon
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47 content compared to other coal types (ca 50% C), with the remainder of the mass made up of
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49 moisture and minerals, such as silicates, iron oxides and calcium oxide (NETL, 2012). While the
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51 low carbon content is partly responsible for the low BC/PM_{2.5} fraction, shown in Table 3, our
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53 data suggest that other factors may also be involved. This could include a change in the mass
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55 absorption cross section for coal dust, as compared to diesel exhaust, which might reflect the
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4 impact of the coal mineral content, the organic matter composition or the size distribution of the
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6 particles.
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10 11 **3.5 PM₁/PM_{2.5} fraction**

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13 The DustTrak calculates concentrations of PM in four size ranges, but due to the inlet
14 sampling efficiency (discussed in section 2) we considered only data for PM₁ and PM_{2.5}. Table 3
15
16 gives the statistical parameters on the PM₁/PM_{2.5} enhancement ratio. Coal trains showed a larger
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18 mass fraction of particles above 1 μm aerodynamic diameter, and this difference is statistically
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20 significant. This reflects the significant contribution of coal dust to the PM_{2.5} concentrations
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22 during the passage of the coal trains.
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31 **3.6 Influence of coal dust on PM_{2.5} concentrations**

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33 In four cases, the videos revealed visible coal dust from the open-top coal trains. These
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35 visible coal dust plumes were seen in the four train events with the highest peak PM_{2.5}
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37 concentrations (Table 4). We call these four train events with the highest PM_{2.5} and visible coal
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39 dust “super-dusters.” Two of the “super-duster” videos have been archived as part of the
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41 supplemental materials for this paper (8/7/2014 and 7/27/2014). Figure 3 shows still images
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43 obtained from the video before and after train passage for the “super duster” on 8/7/2014, along
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45 with the measured PM_{2.5} concentrations. We found that 4 out of 74 coal trains, or 5.4%, were
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47 classified as “super dusters” during our study.
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53 A number of factors could be important in explaining the coal dust emissions of PM_{2.5}
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55 from coal trains. These include quality of the surfactant application or factors that may disturb
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57 the coal/surfactant surface, such as high train speeds, exposure to high winds or rough handling
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4 during transport. While we have no information on upstream conditions, our data do allow us to
5 examine the influence that train and local wind speed may have played on dust emissions. To do
6 this, we calculated train speeds for each coal train from the videos. We also calculated the vector
7 component of the winds in the direction opposite to the trains' travel. The sum of train speed plus
8 vector wind speed represents the true wind speed across the open-top coal trains. We refer to this
9 as the effective wind speed. During our study, the average train speed was 71.3 km/h and the
10 average vector wind speed was 14.9 km/h.
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21 Figure 4 shows the effective wind speed versus peak $PM_{2.5}$ for each coal train event. The
22 four "super dusters" are shown as large red squares. While no simple relationship emerges from
23 this analysis, the data do suggest that "super dusters" are more likely to occur when the effective
24 wind speed is greater than 80–90 km/h. Above 90 km/h, the fraction of "super dusters" is 10.3%
25 (3 out of 29 trains), compared to 5.4% at all wind speeds. Thus we can view wind speed as one
26 factor that increases the risk of high-level coal dust exposure. However, the fact that many coal
27 trains with effective wind speeds greater than 90 km/h are not "super dusters" indicates that other
28 factors, such as quality of the surfactant applied to the coal surface, must also be important.
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43 4. Conclusions

44 We measured PM_1 , $PM_{2.5}$, BC and CO_2 during 367 train passages (train events) in the
45 Columbia River Gorge. From the data, we calculated a DPM EF average of 1.2 g/kg fuel
46 consumed ($\pm 20\%$) on 163 of those train events that show a good correlation between $PM_{2.5}$ and
47 CO_2 (mostly freight trains). Our data indicate that nearly all open-top coal trains release coal
48 dust, which contributes to enhanced $PM_{2.5}$ in the Columbia River Gorge. In four train events, that
49 we call "super-dusters," the coal dust emissions led to visible dust plumes and the highest $PM_{2.5}$
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4 concentrations observed in our study. But nearly all coal trains generate some degree of coal dust
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6 (PM_{2.5}) based on the following evidence:
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- 9 1. Statistically higher peak PM_{2.5} concentrations during passage of coal trains compared to
10 freight trains. The peak PM_{2.5} enhancements during a coal train passage are nearly
11 double, on average, compared to the value during a freight train passage (Table 2);
12
13
- 14 2. The fact that most freight trains (52%) show a good correlation between PM_{2.5} and CO₂,
15 whereas very few coal trains (15%) show this relationship (Table 2);
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17
- 18 3. The BC/PM_{2.5} enhancement ratio is statistically higher for freight trains compared to coal
19 trains (Table 3);
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- 22 4. The PM₁/PM_{2.5} enhancement ratio is statistically higher during passage of freight trains
23 compared to coal trains (Table 3).
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31 These four results demonstrate statistically significant differences between freight and coal
32 trains, even if the four super-dusters are excluded from the statistical analysis.
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35 Because our focus was on air quality, we measured the respirable size fractions of PM.
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37 Thus it is not possible to relate our observations to any data on bulk loss of coal during transport,
38 since most of this loss will occur as much larger size particles. Because most coal train events
39 show a poor correlation between PM_{2.5} and CO₂, it is not possible to rigorously derive a fuel-
40 based emission factor for the coal dust. Nonetheless, our data provide some guidance to anyone
41 wishing to calculate total PM_{2.5} emissions from the railway sector. Since the peak PM_{2.5} values
42 for coal trains are nearly double those for freight trains, it is reasonable to conclude that the total
43 PM_{2.5} emissions from coal trains are approximately double those of freight trains. This would
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4 Though all coal trains appear to generate some degree of dust, the “super-dusters”
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6 generate visible plumes and the highest concentrations of PM_{2.5}. “Super-dusters” represent 5.4%
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8 of all coal trains but 10.3% when the effective wind speed is greater than 90 km/h. This indicates
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10 that wind is one factor contributing to the coal dust emissions, but it is not the only explanatory
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12 factor.
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Figure captions

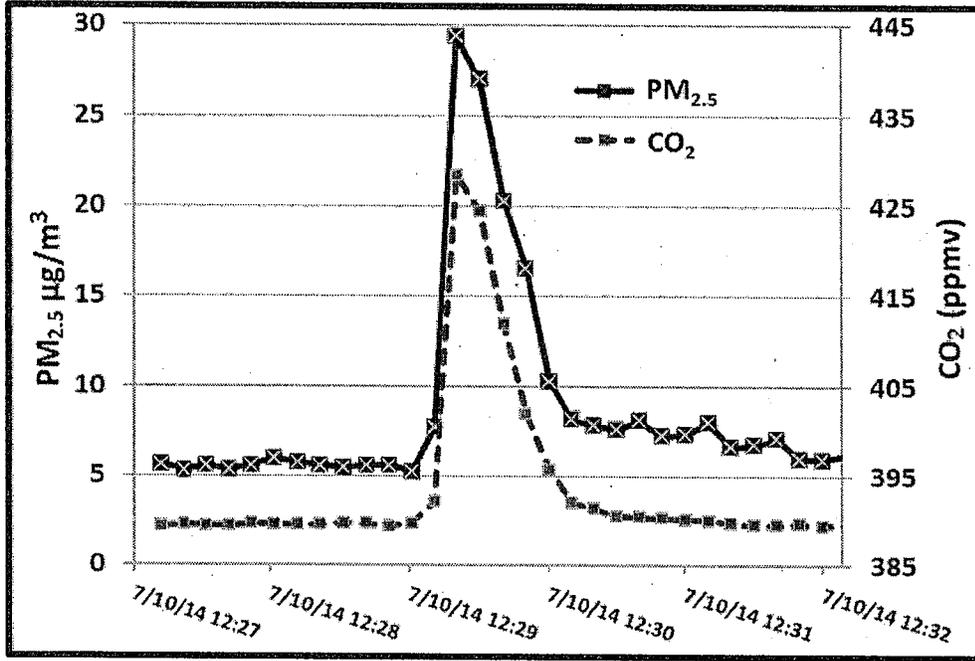
Figure 1. $PM_{2.5}$ and CO_2 during passage of a freight train on 7/10/2014 at 12:29 PDT. The two values show a good correlation with an R^2 of 0.98 and a slope of $0.61 \mu\text{g}/\text{m}^3$ per ppmv.

Figure 2. $PM_{2.5}$ and CO_2 during passage of a coal train on 7/18/2014 at 4:56 PDT. The two parameters show no correlation during this time period. The train was observed to have locomotives in the front and rear, giving rise to the CO_2 peaks at the beginning and end of this time period.

Figure 3. Images captured from the video camera before and after coal train passage on 8/7/2014 at 17:28 PDT. The full video of this train passage is archived as part of the supplemental materials for this paper. The camera looks to the west, downriver in the Columbia River Gorge. The coal train is visible in the right image and was moving from left to right.

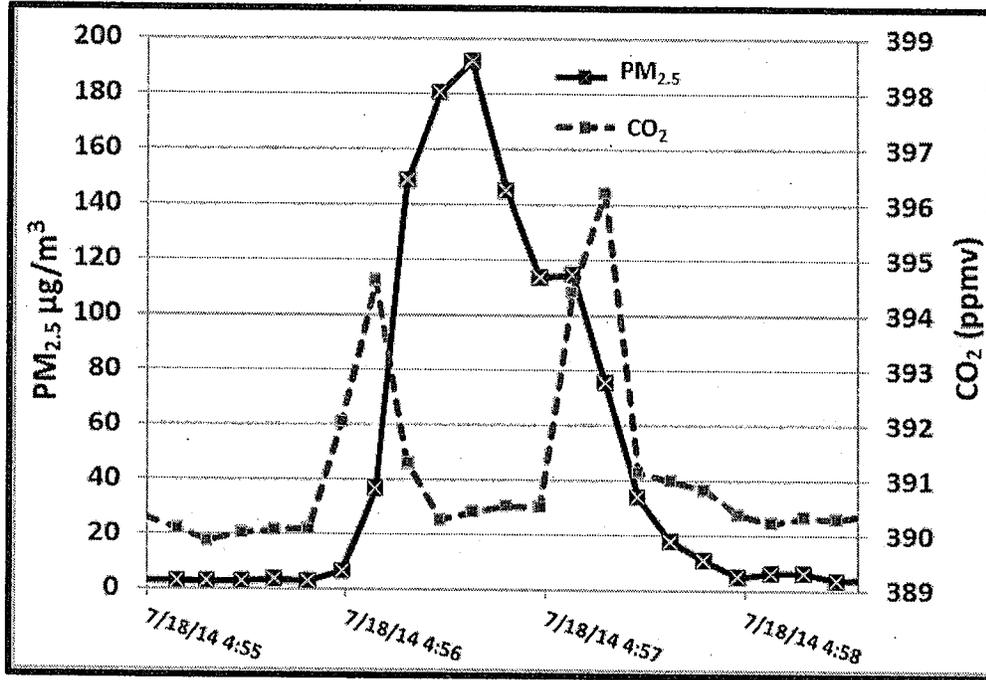
Figure 4. Peak $PM_{2.5}$ enhancement for each coal train passage versus effective wind speed over the top of the train. The effective wind speed is calculated as the train speed plus the vector component of the wind at 180° to the train's movement. The four "super dusters" are shown as large red squares.

Figure 1



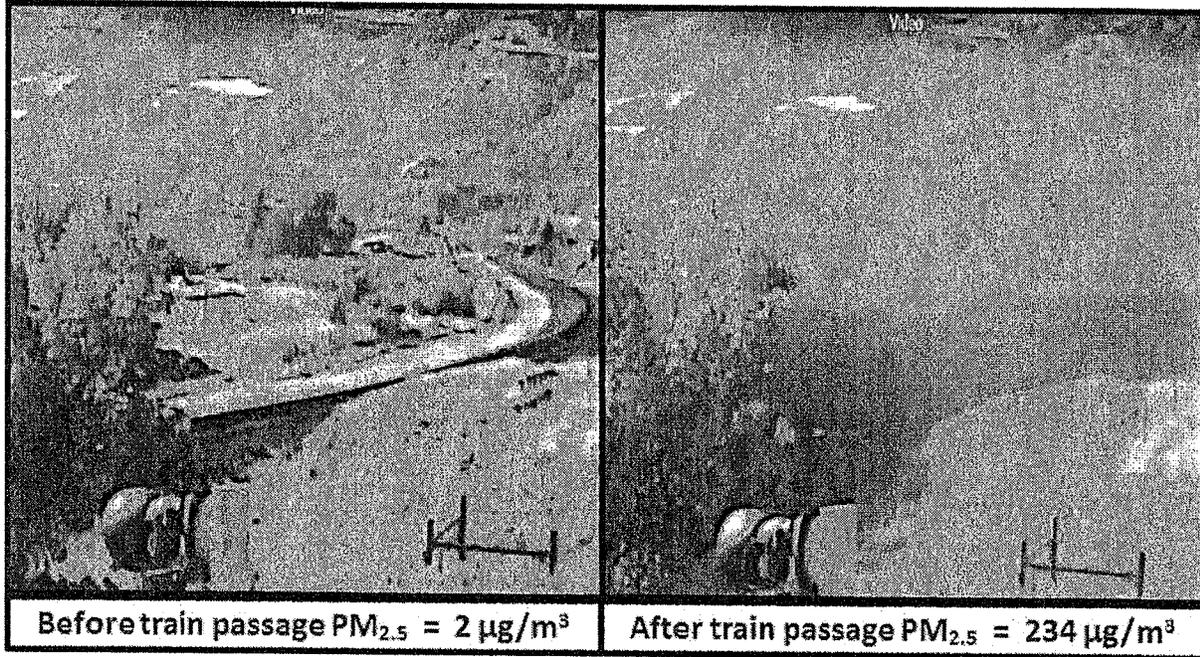
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Figure 2



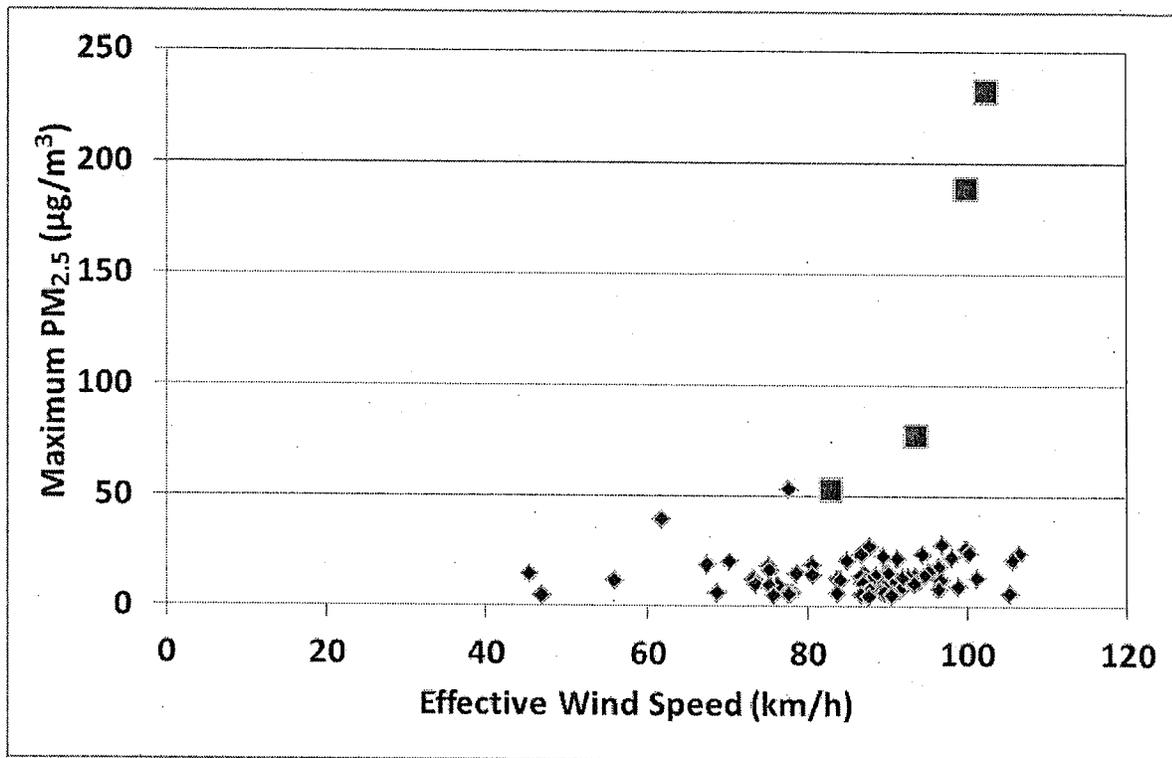
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Figure 3



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Figure 4



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Tables

Table 1. Regression parameters for the comparisons between the DustTrak data, the TEOM data and the FRM method at the PSCAA site at Beacon Hill, Seattle, Washington.

Comparison equation (using Reduced Major Axis regression)	R ²	N
TEOM PM _{2.5} (μg/m ³) = DustTrak x 0.5577 – 0.6977	0.74	485 (hourly averages)
FRM PM _{2.5} = DustTrak x 0.5524 – 0.8433	0.92	7 (24-hour samples)
FRM PM _{2.5} = TEOM x 1.05 – 0.4326	0.96	7 (24-hour samples)

Table 2. PM and CO₂ data for freight and coal trains. Slopes for $\Delta\text{PM}_{2.5}/\Delta\text{CO}_2$ relationship is reported only for those train events with $R^2 > 0.5$ and $\Delta\text{CO}_2 > 2$ ppmv.^a

	Freight	Coal	All trains
Number	293	74	367
Average peak ΔPM_1 ($\mu\text{g}/\text{m}^3$)	11.0	19.7	12.5
Average peak $\Delta\text{PM}_{2.5}$ ($\mu\text{g}/\text{m}^3$)	10.7	20.9	13.0
Maximum $\Delta\text{PM}_{2.5}$ ($\mu\text{g}/\text{m}^3$)	57.2	232.3	232.3
Number with $\text{PM}_{2.5} - \text{CO}_2 R^2 > 0.5$ and $\Delta\text{CO}_2 > 2$ ppm	152 (52%)	11 (15%)	163 (44%)
Mean/median $\Delta\text{PM}_{2.5}/\Delta\text{CO}_2$ slope ($\mu\text{g}/\text{m}^3/\text{ppmv}$)	0.70/0.56	0.71/0.56	0.70/0.56
Max/Min slope	3.88/0.10	1.64/0.20	3.88/0.10

^aIn addition to the criteria given in the text above, we excluded one additional case with visible coal dust and an extremely high $\text{PM}_{2.5} - \text{CO}_2$ slope (12.0).

Table 3. BC/PM_{2.5} and PM₁/PM_{2.5} enhancement ratios for freight and coal trains.

	Freight	Coal	All trains
N (for BC/PM _{2.5} analysis)	233	61	294
Mean/median BC/PM _{2.5} (unitless)	0.47/0.40	0.29/0.20	0.43/0.35/0.27
Standard deviation on BC/PM _{2.5}	0.27	0.23	0.27
N (for PM ₁ /PM _{2.5} analysis)	293	74	367
Mean/median PM ₁ /PM _{2.5} (unitless)	0.93/0.93	0.96/0.96	0.96/0.96
Standard deviation on PM ₁ /PM _{2.5}	0.03	0.03	0.03

Table 4. The four train events with the highest peak PM_{2.5} concentrations. In each case, a coal train with a visible coal dust plume was confirmed in the video recording.

Date/time (PDT)	Peak PM _{2.5} conc. $\mu\text{g}/\text{m}^3$	Peak BC $\mu\text{g}/\text{m}^3$	BC/PM _{2.5} ratio
8/7/14 17:28	232.3	53.5	0.23
7/18/14 4:57	188.8	88.9	0.47
7/20/14 14:07	77.6	8.86	0.11
7/27/14 21:16	53.1	9.13	0.17

Comments of Dr. Bart Ostro. Former Chief of the Air Pollution Epidemiology Section, California Environmental Protection Agency (retired). Dr. Ostro was responsible for helping to develop the air pollution standards for fine particles (PM2.5) for California, the U.S. EPA and the World Health Organization and is the author of over 100 peer reviewed publications on the health effects of air pollution and heat waves.

RE: Comments on: Oakland Bulk and Oversized Terminal Air Quality & Human Health and Safety Assessment of Potential Coal Dust Emissions, prepared for: California Capital and Investment Group, HDR Engineering, September 2015

1. Page 5 the consultants state there will be little erosion of coal. However, their citation refers to field testing of dust from coal piles **NOT** from moving trains which will likely produce a distinctly different level of emissions. In addition, the erosion potential will be impacted at the West Oakland location due to the winds that are often experienced there. For example, wind analysis from the Bay Area Air Quality Management District shows that 100% of the winds in the summertime, when people spend the greatest amount of time outdoors, are from the West. This means that dust from the rail operations, including the train hauling itself, will blow directly into Oakland residential areas, particularly West Oakland. In the winter time, still about 70% of the time, the wind is from the West. In addition, the data indicate that many days have wind speed above 10 mph. (Eric Fujita and Campbell, West Oakland Monitoring Report, DRI, 2010). Furthermore, actual empirical evidence of fine particle concentrations at the delivery site (**NOT** at the mines where the contractors state is the only place that will be impacted by erosion) shows **significant increase in concentrations due to coal trains**. This issue is discussed in point 5d below.

2. Page 5. CCIG consultants state: “moving rail cars would emit negligible quantities of coal dust in the Oakland area because of load profiling and topping measures.” To support this statement they refer to the lack of erosion (again suggesting incorrectly that all erosion will occur near the mines), discussed above, and to tests that shows an 85% reduction in coal dust from the control strategies undertaken. Several points here: (1) The 85% reduction is based on field tests and trials conducted by BNSF and Union Pacific in limited circumstances. It is not based on real world practices or data; (2) the surface sprays used to cover the coal tend to degrade over time

and for the new marine terminal at the former Oakland Army Base ~~port~~—we are talking about a 800 mile trip from Utah. In the Powder River coal transport to the West Coast, the train company needed to add an additional surface spray facility along the route from Montana. It is not clear if an added facility is planned in this case and it is not mentioned in the consultant report ; (3) there is no mandate for this control and compliance, especially over time, is questionable; and (4) even after an 85% reduction, there would still be significant increases in fine particulate air pollution for Oakland residents. Representatives from BNSF indicated that there would be an average erosion of 1.6 lbs of coal dust per car per mile. Using simple assumptions, a daily train of 115 cars for a year, for the 12 miles that the train would pass through Oakland would relate to a deposition of

1.6 lbs/car-mile* 365 days * 115 cars *12 miles *ton/2000 lbs = 400 tons a year of coal dust deposited in Oakland

and 100 tons a year in West Oakland. Even with 85% control, if it actually occurs, this would still leave 60 tons of coal dust a year in Oakland and approximately 15 tons per year in West Oakland. **Hardly a “negligible” amount.**

3. Page 6. The consultants add, almost as an aside, that the trains will also be covered. However, there is no detail on this and to our knowledge no existing practice where this is currently employed, and certainly no regulatory mandate for it. Again, **compliance is an issue** since this would add costs to the train operation and is currently not ~~an~~ actively used. We contacted two companies that are now developing prototypes of covered cars. They have only been tested on a limited basis and are still engaged in development. It is unclear when, if ever, these would be available commercially.

4. Page 11. The CCIG consultants make a statement in section IV that the transport operations will not harm public health. They state that “Coal and coal dust in itself is not specifically regulated or defined as a hazardous material by USEPA.” While this is true, the coal dust is a fine particulate and is subject to federal and state outdoor air pollution standards which is discussed below.

Comment [ljf1]: It's not the Port of Oakland but former Oakland Army Base where the marine terminal will be build.

5a. **WHY are fine particles important?** Airborne fine particles (often called PM2.5 ~~since~~ are particles that are 2.5 microns or less in diameter. By contrast, a human hair is approximately 70 microns). PM2.5 from coal dust are important since they can be inhaled in the deep lung. Studies from epidemiologists and cardiologists have demonstrated in peer reviewed journals that there is a **clear causal relationship between both very short (a day or multiple days) and longer-term (several months to years) exposure to PM 2.5 and a wide range of adverse health outcomes** (Brook et al 2010). Studies from around the world and from California demonstrate that PM2.5 is associated with respiratory symptoms, school and work loss, asthma exacerbation, emergency room visits, non-fatal heart attacks, adverse birth outcomes (premature births, low birth weight), hospital admissions, and **death from cardiovascular disease**. The populations at greatest particular risk (though other groups are susceptible) include children, asthmatics and older individuals with pre-existing cardiovascular or respiratory disease. In California, these peer reviewed studies showing some of these health effects include those by Ostro et al. 2006, 2009; Malig and Ostro (2009), Green et al. (2009) and Malig et al. (2013).

5b. PM2.5 has been determined by The World Health Organization (WHO) to have the greatest worldwide impacts of any environmental exposure with an **estimated 3 million deaths per year**. (Lim et al, 2012). ARB estimates for California range from 10 to 30 thousand per year depending on the assumptions in the analysis and the air standard used.

5c. While specific outdoor air standards have been established for PM2.5, institutions including California EPA, USEPA and WHO, have specified **there is no clear cut safe level** for these effects. This means that every exposure adds to the likelihood of an adverse health outcome. Thus, even in areas where the standard is being attained, additional exposure to coal dust is likely to impact health, especially in a susceptible population.

5d. In **one of the few actual studies** conducted on this issue, scientists at the University of Washington examined the contribution to PM2.5 from coal versus freight trains, close to the destination site (i.e., **NOT close to the mines**) (Jaffe et al., 2014; 2015). In their peer reviewed publication, they reported that the average peak in near-by concentrations of PM2.5 of coal trains were twice that of freight, specifically 21 versus 11 micrograms per cubic meter. In addition, they reported several events with concentrations greater than 75 micrograms with concentrations

Comment [ljf2]: Do you mean exposure to PM2.5?

up to 230 micrograms. **Thus, one would logically expect very high peaks of PM2.5 from coal dust, at concentrations that could cause health effects.**

6. Page 11, Section A. The CCIG consultants report the results of a coal dust study conducted by the Surface Transportation Board (STB) regarding a proposed rail line in Montana (also known as the Tongue River Rail Project). Based on a modeling exercise they report that incremental concentrations of airborne coal dust from train cars are expected to be below the standards set in the NAAQS and the Montana Ambient Air Quality Standards (Montana AAQS) to protect human health. I believe they wish the reader to infer that therefore, the proposed project in Oakland will also not impact public health. However, there are **major differences** between these two sites. Based on the latest available information, the two major towns in rural Montana, Colstrip and Ashland that are impacted by the railroad have populations of 2200 and 400, respectively. There is obviously very little urban residential activity to produce pollution in this area such as traffic, restaurant cooking, and biomass burning. In fact, based on a letter from the governor of Montana, the annual average concentrations of fine particles in Rosebud and Powder River Counties, the two counties immediately impacted by the railroad are 5.5 and 6.7 micrograms per cubic meter (the latter is the standard method for measuring fine particles concentrations). (Letter from Steve Bullock, Governor to Shaun McGrath, Regional Administrator, USEPA, "Montana 2012 Revised Annual PM2.5 NAAQS Initial Designation, Dec 2, 2013). This is a very low concentration, but not unexpected for this very rural area. In addition, the STB report says nothing about impacted communities at the final delivery point.

Comment [ljf3]: What is NAAQS?

In contrast, obviously Oakland is part of a major metropolitan area with multiple sources of fine particulate pollution. Air pollution measurements have been taken in West Oakland by the Desert Research Institute, a firm known internationally for its work on measuring exposures. Their analysis indicates that, based on sampling conducted at several residential sites in the West Oakland community, the annual averages of PM2.5 were above 11 micrograms per cubic meter (Fujita and Campbell, West Oakland Monitoring Report to the BAAQMD, DRI, 2010. Another monitoring study showed concentrations in West Oakland of 15 to 40 micrograms per cubic meter (Bui et al. Ground Level Monitoring of Particulate Matter in West Oakland). **Thus, the current levels of PM2.5 in West Oakland are roughly twice that of the Montana train site**

used by the consultants. As such, the expected contribution of coal dust would most likely put them in **violation of both the state and federal averages** of 12 micrograms per cubic meter. In addition, as explained earlier, there is a possibility that they would exceed the 24-hour standard for PM2.5. It is also important to note that West Oakland is heavily impacted by diesel particles, which are very small particles. Several studies have shown that these particles (which are similar to the coal dust particles) are up to 10 times more toxic than generic PM2.5 (Ostro et al., 2014).

Conclusion Based on the above information, coupled with the lack of a recognized safe level for exposure to PM2.5, it is naive and reckless to state that the public health will not be impacted by the coal-bearing trains. Further it is inappropriate to use the study in Montana to infer the consequences of coal transport in the Oakland corridor. Finally, comments from the Environmental Impact Statement for the Montana project suggest that only 30 percent of shippers comply with the rule to properly spray and control dust. [↗](#) (Online Public Meeting for the Draft EIS for the Proposed Tongue River Railroad, June 17, 2015). Based on all available information, empirical data from Washington state, and a common sense approach to the issue, it is very likely that the proposed coal trains would significantly impact the health of residents of West Oakland and Oakland, in general.

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My name is Laura Wisland and I am a senior energy analyst with the Union of Concerned Scientists, a science-based organization working on policies to build a healthier planet and safer world. Our west-coast office is located in downtown Oakland, but I am also here as an Oakland resident.

UCS believes that building a new export terminal in Oakland to ship coal that would be burned in other countries stands in direct contrast to the efforts that this state and this city have made to reduce criteria air pollutants and greenhouse gas emissions that cause serious public health concerns and global climate change.

Making it possible to burn this quantity of coal abroad not only contradicts the spirit of where this city and this state are headed on climate change, but will have tangible, negative impacts on the City of Oakland and its residents.

California's efforts to reduce coal-fired electricity

Carbon emissions from burning coal are one of the leading causes of global warming, accounting for over ~~and burning coal accounts for~~ 40% of the world's carbon emissions.¹

California's leadership to phase-out coal started as far back as 2006, with the passage of Senate Bill 1368, a law that prohibits California utilities from making long-term commitments to buy coal-fired electricity.

As a result of SB 1368 and other supporting policies, California's consumption of coal-fired electricity dramatically dropped- from more than 10 percent in 2005 to less than 5 percent in 2014.² In addition, there is almost no coal burned in California anymore. The 5 percent we still receive comes from legacy coal contracts that utilities have had since before passage of SB 1368. Therefore, when these contracts expire in the 2017-2025 timeframe, California will use a negligible amount of coal to meet its electricity needs.

In addition, the expiration of these coal contracts and inability to renew them has hastened the retirement of utility-owned coal assets, which means that

¹ Center for Climate and Energy Solutions. Available at: <http://www.c2es.org/energy/source/coal>

² California Energy Commission, California Electrical Energy Generation Total Production, by Resource Type (Gigawatt Hours), available online at: http://energy Almanac.ca.gov/electricity/electricity_generation.html

this law has reduced the amount of coal burned by these facilities for Californians, as well as for other western electricity consumers.³

Oakland's efforts to reduce GHGs

The City of Oakland *itself* has made important commitments to address climate change. In fact, the resolution that the City Council adopted in 2009 to approve preliminary planning targets for the development of an energy and action climate plan says:

"...the City of Oakland is committed to providing leadership on energy and climate issues as part of becoming a model sustainable city; and

"...tremendous collective action will be necessary in the near term on a global scale to reduce greenhouse gas emissions to safe levels, and a variety of opportunities exist in Oakland to provide leadership on reducing GHG emissions..."⁴

The Energy and Climate Action Plan, which was adopted by this Council in 2012, commits the City to reducing greenhouse gas emissions associated with Oakland 36 percent below 2005 levels by 2020.

On page 4, the plan states "We will take action, joining cities around the globe to provide the leadership needed to answer this challenge."⁵

Clearly, the city recognizes the value of reducing emissions in its backyard, *and* the value of providing leadership to other cities around the world to do the same.

But what message would send if Oakland, on one hand, spends money and resources to reduce emissions at home, but on the other, makes it possible for countries across the Pacific to potentially increase their reliance on one of the leading contributors to global climate change?

Low sulfur coal is still dirty

Supporters of this project have attempted to downplay what would be Oakland's role in increasing worldwide air pollution and global climate change

³ See http://www.energy.ca.gov/renewables/tracking_progress/documents/current_expected_energy_from_coal.pdf

⁴ See <http://clerkwebsvr1.oaklandnet.com/attachments/22728.pdf#page=1&zoom=auto,-264,7864>

⁵ See <http://www2.oaklandnet.com/oakca1/groups/pwa/documents/report/oak039056.pdf>

by pointing out that the coal Oakland would ship from its facility is low in sulfur, and therefore relatively clean.

Clean coal is a myth. It's true that some coal, like the coal likely to be shipped from Oakland, would have a lower sulfur content than some other sources of coal. But no matter the sulfur content, all coal emits greenhouse gas emissions and other toxic air pollutants like particulate matter, nitrogen oxides that form smog, and other contaminants such as mercury. Burning lower sulfur coal will not shield communities from being exposed to emissions containing these other toxic compounds.

In addition, burning lower sulfur coal will not materially help reduce coal's contribution to climate change. According to the Energy Information Administration, burning sub-bituminous coal releases slightly less carbon per million BTU⁶, but because sub-bituminous coal has a lower BTU content than other sources of coal, you have to burn more of it to achieve the same energy output, which could very well result in higher overall emissions.

The proposed coal export facility would export approximately 10 million tons of coal annually. Burning this much coal to generate electricity amounts to at least 26 million tons of carbon dioxide annually and would consume approximately 10 billion gallons of water.⁷ This is roughly equivalent to the carbon and water footprint of seven average sized coal plants.

Supporters have also made the argument that if Oakland facilitates the burning of more low sulfur coal, this would actually reduce pollution and greenhouse gas emissions by supplanting even dirtier sources of electricity.

This argument assumes that other countries, which are currently dealing with serious public health effects of burning coal, are not going to take greater measures to improve air quality and enact policies to encourage the transition towards much cleaner sources of electricity generation. More and more, these countries have greater access to cleaner options like renewables and natural gas that are increasingly cost competitive with conventional coal-fired electricity.

⁶ See http://www.eia.gov/coal/production/quarterly/co2_article/co2.html

⁷ Assumes an average coal plant with generation capacity of 500 MW, burning roughly 1.4 million tons of coal per year. Source: http://www.ucsusa.org/clean_energy/coalvswind/brief_coal.html#bf-toc-7

This argument also assumes that the international community will fail to reach a global commitment to reduce global warming emissions, which would no doubt make it much more expensive for countries in the future to continue relying on so much coal to meet their power needs.

Burning coal across the Pacific impacts local health and safety

So, setting aside how dissonant it would be for the state to make great strides to reduce climate pollution while Oakland takes a step in the opposite direction, let's look at what burning this coal actually means for the health and safety of Oakland, even if this coal is not burned in our backyard.

Several studies published in peer-reviewed journals document the evidence of ozone pollution on the west coast that can be traced back to East Asia.⁸ As we know, because California has some of the highest ozone rates in the country, a substance which causes respiratory stress, exacerbates asthma, and is linked to cardiovascular harm like heart disease, heart attacks, and strokes. There is also documented evidence that mercury released in Asia is found on the west coast.⁹

In addition, Oakland must consider the impacts of burning this coal on global climate change and how it will impact the health and safety of the Bay Area and Oakland residents.

First, there is the increased risk of extreme heat events:

- Average temperatures in Alameda County are expected to rise between 3.3 and 5.6 degrees Fahrenheit in the next half century, and the number of extreme heat days in the state is expected to rise from 4 to between 21 and 24.¹⁰ According to the California Energy Commission, mortality linked to extreme heat may increase two to three times during an extreme heat event.¹¹

⁸ See 2a. Zhang, Lin, et al. "Intercontinental source attribution of ozone pollution at western US sites using an adjoint method." *Geophysical Research Letters* 36.11 (2009).; Zhang, Lin, et al. "Transpacific transport of ozone pollution and the effect of recent Asian emission increases on air quality in North America: an integrated analysis using satellite, aircraft, ozonesonde, and surface observations." *Atmospheric Chemistry and Physics*. (2008).

⁹ Jaffe D, Prestbo E, Swartzendruber P, Weiss-Penzias P, Kato S, Takami A, Hatakeyama S, Kajii Y. Export of atmospheric mercury from Asia. *Atmospheric Environment* 2005;39(17):3029-3038.

¹⁰ See <http://cal-adapt.org/tools/factsheet/>

¹¹ Second California Climate Change Assessment. 2010. Estimating the mortality effect of the July 2006 California Heat Wave. 2009. Online at <http://www.energy.ca.gov/2009publications/CEC-500-2009-036/CEC-500-2009-036-F.PDF>

- Those most susceptible to public health risks related to extreme heat are those who are already ill, the poor, the elderly, and those without access to air conditioning (particularly people working outdoors) or medical treatment.⁴ With large populations of low-income individuals, Oakland will be particularly at risk to these events.¹²

Then, there are safety concerns associated with sea level rise:

- The Pacific Institute estimates that between roughly 3 and 5 thousand Oakland residents live in an area that is at a direct risk of a 100 year flood with projected sea-level rise.¹³ The impacts to property value and access to vital infrastructure and services could be significant.
- Major critical infrastructure—airports, roads and rail, water and wastewater treatment facilities, and power and telecommunications utilities, for example—are located within flood-prone areas and will require billions of dollars of protection investment to ensure the safety and livelihood of our communities.¹⁴
- In addition, there are major concerns that the encroaching seawater caused by sea level rise in the Bay area could threaten local sources of groundwater that Alameda County residents depend upon for drinking water.

And finally, there are water shortage concerns associated with climate change. We need look no further than the current historic drought the state is in for evidence of this.

In an informational hearing convened by the State Senate this May, which took place at Oakland City Hall, it was reported that:

- “Though an overall reduction in rain amounts is expected with climate change, rainfall events will likely be more extreme, overwhelming sewage and water treatment facilities and resulting in further decreases in water quality.”¹⁵

¹² Social Vulnerability to Climate Change in California. 2012. Online at http://www2.pacinst.org/reports/climate_vulnerability_ca/maps/

¹³ <http://pacinst.org/wp-content/uploads/sites/21/2014/04/community-based-climate-planning-Oakland.pdf>

¹⁴ http://senv.senate.ca.gov/sites/senv.senate.ca.gov/files/background_paper_final.pdf

¹⁵ See http://senv.senate.ca.gov/sites/senv.senate.ca.gov/files/background_paper_final.pdf

The state and the city have already made serious commitments to address climate change and air quality in an effort to improve the quality of life for their residents, and set an example for the rest of the world to follow.

The decision for Oakland to allow enough coal to be shipped through its port to fuel the equivalent of seven coal-fired power plants in other parts of the world would significantly undermine these efforts and put Oakland residents at further risk from exposure to air pollutants that will travel across the Pacific, as well as the contributions that burning this coal will make to global climate change, an impact that knows no political boundaries.

Countries across the globe must face the reality that in order to avoid the worst consequences of climate change, we must make decisions to not extract and burn every ton of fossil fuels that are currently in the ground. Oakland's role in this scenario is front and center with its decision of whether or not to export coal, a fossil fuel that the state has already closed the door on.

UCS strongly believes that given coal's contribution to air pollution and climate change, and the impacts that will be felt locally and globally, Oakland should not approve a coal export terminal at its port.

Thank you,

Laura Wisland

July 30, 2015

The Honorable Libby Schaaf,
Mayor, City of Oakland
Members, Oakland City Council
1 Frank H. Ogawa Plaza
Oakland, CA 94612

Dear Mayor Schaaf and City Council Members:

On behalf of the Union of Concerned Scientists (UCS), I'd like to thank you for helping to ensure that a possible coal export facility will get full public vetting at a public hearing proposed by (City Councilmember) Kalb on September 21st, 2015. UCS believes there are compelling reasons related to climate change, public health and safety, and the environment of the city and region sufficient to reject a coal export facility.

A coal export terminal would be counter to the City's own policies to reduce the risks of climate change, and seriously harm Oakland's stature as a leader on climate action. Oakland's Energy and Climate Action Plan (ECAP), which includes a goal to reduce the city's greenhouse gas emissions by 36 percent below 2005 levels by 2020, is a significant and laudable commitment of effort and resources to help reduce the threat of global warming. Yet a coal terminal would significantly undermine and render useless at least a portion of that effort by enabling the use of coal in power plants outside of California. It is well-known that coal is one of the primary sources of carbon pollution that is causing global warming.

In addition, there are significant public health and safety uncertainties related to transporting coal through densely populated areas adjacent to the rail corridor, including areas that are predominately low-income communities of color. Scientific research points to potential public health hazards of coal and coal dust. To cite but one example, the Multnomah County Health Department in Oregon published a health evaluation assessment of the human effects of proposed rail transport of coal through the county, and found multiple potential threats to public health and safety, including inhalation of particulate matter, collisions, derailment, and fires. These hazards could result in heart and lung problems, cancers, childhood growth and development problems, and safety related injuries and death. The study also highlighted the lack of information about the hazards of coal dust from train transport:

“There are significant gaps in the scientific literature regarding how much coal dust is shed by trains carrying coal, how far coal dust travels from rail lines, and the health effects of inhaling this environmental coal dust. The lack of scientific information limits the ability of this analysis to quantify the number of people potentially affected or the severity of the effects. “

Given the evidence that coal dust and other hazards related to coal transport could jeopardize public health and safety, and the uncertainty surrounding the extent of such hazards or what measures could safely avoid or mitigate the impacts of coal transport, the most prudent and responsible course is to not allow Oakland residents to be exposed to such risks in the first place.

Coal transport also presents the City with potentially costly as well as toxic environmental problems, primarily (though not exclusively) from coal dust. Surfactants sprayed onto coal loads can reduce but do not eliminate coal dust spilling from moving trains. Once the coal arrives at a terminal, coal loads need to be managed to prevent migrating dust. One media report on the Westshore coal terminal near Vancouver, BC found that operators needed expensive upgrades and a large quantity of water to keep coal sufficiently dampened to control the dust. The report did not say whether or how the port managed runoff from the water treatment, nor how effective the measures were, though it cited anecdotal reports from citizens complaining of black dust that nearby communities may be finding coal dust on surfaces regardless of attempts at control.

Given the well-documented impact of burning coal to exacerbating climate change as well as the potential health and environmental hazards of transporting coal by rail and temporarily storing it in terminals, UCS believes that the best course of action would be to prevent a coal terminal from being developed in Oakland. Communities in Oregon and Washington have worked hard to prevent coal terminals for similar reasons, and so far these efforts have succeeded. Oakland residents as well as residents near the rail transport corridor throughout Northern California should not be subjected to the hazards and uncertainty of coal transport by rail, nor should facilities in the City enable the use of one of the worst contributors to global warming.

Sincerely,

Adrienne Alvord

Director, California and Western States

Union of Concerned Scientists

500 12th Street, Suite 340

Oakland, CA 94607

City of Oakland

Energy and Climate Action Plan

December 4, 2012



Acknowledgements

The Oakland Energy and Climate Action Plan was adopted by City Council on December 4, 2012.

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The purpose of the Oakland Energy and Climate Action Plan (ECAP) is to identify and prioritize actions the City can take to reduce energy consumption and greenhouse gas (GHG) emissions associated with Oakland. The ECAP will assist the City of Oakland in continuing its legacy of leadership on energy, climate and sustainability issues, and provide a roadmap for the Oakland community to achieve broad community goals related to reducing GHG emissions.

A technical appendix is also available through the City’s website at www.sustainableoakland.com providing additional information on Oakland’s GHG emission sources and the role of recommended strategies and actions in meeting Oakland’s GHG reduction goal.

Executive Summary

The Oakland Energy and Climate Action Plan (ECAP) was adopted by City Council on December 4, 2012. Its purpose is to identify and prioritize actions the City can take to reduce energy consumption and greenhouse gas (GHG) emissions associated with Oakland. This plan establishes GHG reduction actions, as well as frameworks for coordinating implementation and monitoring and reporting on progress. The ECAP will assist the City of Oakland in continuing its legacy of leadership on energy, climate and sustainability issues.

In July 2009, the Oakland City Council approved a preliminary GHG reduction target for the year 2020 of 36% below 2005 levels. This planning target was developed based on recent publications of the world's leading climate scientists. The primary sources of Oakland's GHG emissions are:

- Transportation & Land Use
- Building Energy Use
- Material Consumption & Waste

The ECAP outlines a ten year plan including more than 150 actions that will enable Oakland to achieve a 36% reduction in GHG emissions with respect to each of these GHG sources. Oakland can accomplish this goal by 2020 through:

- 20% reduction in vehicle miles traveled annually as residents, workers and visitors meet daily needs by walking, bicycling, and using transit
- 24 million gallons of oil saved annually due to less driving and more fuel efficient vehicles on local roads
- 32% decrease in electricity consumption through renewable generation, conservation and energy efficiency
- 14% decrease in natural gas consumption through building retrofits, solar hot water projects and conservation
- 62 million kWh and 2.7 million therms annually of new renewable energy used to meet local needs
- 375,000 tons of waste diverted away from local landfills through waste reduction, reuse, recycling, and composting

The ECAP also recommends a Three Year Priority Implementation Plan - a prioritized subset of actions recommended for implementation in the next three years. These priority actions will capitalize on near term opportunities and lay the groundwork for long term progress. Some of the recommended priority actions can be implemented with existing and anticipated resources. Others will require the identification of new, in some cases significant, resources to move forward. Implementation responsibility, status and resource needs are outlined for each recommended priority action.

Achieving Oakland's GHG reduction goals will require an unprecedented collaborative effort. The ECAP outlines the role that recent State policies are expected to play in reducing GHG emissions, and provides a vision for the role of additional community leadership. The ECAP also recommends steps the City can take to help Oakland adapt to the impacts of climate change and increase community resilience.

Implementing the actions identified in the ECAP has the potential to create a variety of community benefits, including energy cost savings, local green economic development and job creation, reduced local air pollution, improved public health, and other quality of life enhancements throughout Oakland.

Progress in reducing citywide GHG emissions will be reported annually. The ECAP will be updated every three years to review progress, identify new priority actions and maintain momentum.



Chapter 1 – Background

The Importance of Addressing Energy and Climate Issues

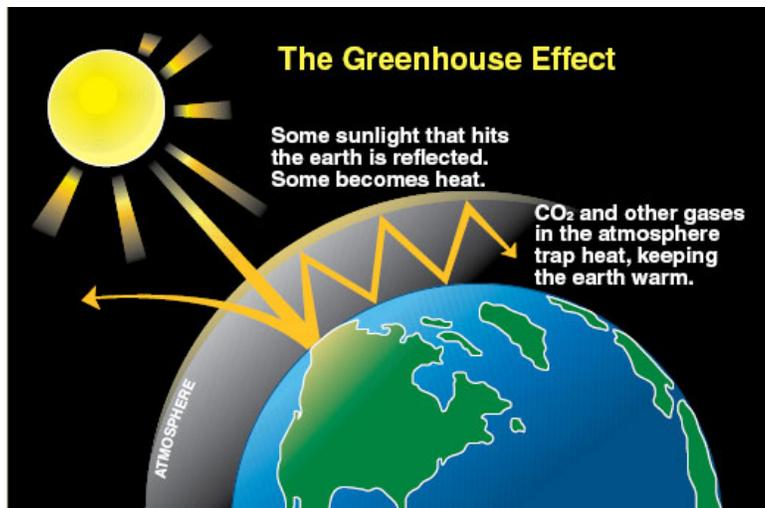
Solving the challenge of climate change is critical to preserving and improving quality of life in Oakland.

A scientific near-consensus has emerged regarding the dangers of increasing concentrations of greenhouse gas (GHG) emissions in the Earth's atmosphere, and the significant role that human activity is playing in increasing those concentrations.

Climate change is projected to impose significant ecological, health, economic and quality of life risks on Oakland and other communities.

Projected local impacts of climate change include rising Bay and delta waters, increased vulnerability to flood events, decreased potable water supply due to shrinking Sierra snowpack, increased fire danger, more extreme heat events and public health impacts, added stress on infrastructure, higher prices for food and fuels, and other ecological and quality of life impacts. Current dependence on fossil fuels not only creates GHG emissions, but imposes other risks associated with energy security, environmental impacts (e.g., recent Gulf oil spill), and vulnerability to energy price volatility. These risks are magnified for economically disadvantaged communities.

Reducing greenhouse gas emissions, in Oakland and elsewhere, can help to avoid and/or lessen the severity of these impacts. Tremendous collective action will be necessary on a global scale to reduce GHG emissions to safer levels.



Transforming the threat of climate change into an opportunity for Oakland

Many actions that could be taken locally to reduce energy use and GHG emissions hold the potential to create a range of economic, health and other quality-of-life benefits in Oakland. Actions described in this plan have the potential to attract new green businesses, create hundreds of new local green jobs, and help neighborhoods thrive. By reducing fuel consumption, we can also reduce fossil fuel dependence and local air pollutants, and help to improve public health.



The City of Oakland is dedicated to doing its part to reduce GHG emissions and the threat of climate change. We recognize that many of the sources of GHG emissions can be reduced through local action. We also recognize the need to take local steps to better adapt to the impacts of climate change and improve the resiliency of our community.

We will take action, joining cities around the globe to provide the leadership needed to answer this challenge. In doing so, we are not just working to alleviate the threat of climate change, we are working to create a better Oakland, and a better world, for residents, businesses, and all members of our community.



Oakland's Legacy of Climate Leadership

Oakland has been ranked among the ten greenest cities in America several times in the last five years. Recent accomplishments include:

Constructed dozens of green buildings

Launched the Oakland Green Jobs Corps

Performed energy retrofits at over 100 of the City's largest municipal facilities

Adopted a green building ordinance for civic buildings

Installed nearly 100 miles of new bikeways and over 3,000 bike parking spaces

An aerial photograph of a city, likely New York City, showing a dense urban area with numerous skyscrapers and buildings. A large, green park area is visible in the center, surrounded by water. The image is overlaid with four text boxes highlighting various urban development and sustainability achievements.

Installed 6 megawatts of local solar energy systems

Achieved leading rates of waste diversion and recycling

Implemented food scraps composting program

Increased emphasis on dense, transit-oriented, mixed-use development featuring green buildings and alternative transportation options

The Next Phase of Local Climate Action

Building on Oakland’s legacy of climate protection progress, the next phase of action on energy and climate issues must consist of efforts in two major areas: Mitigation and Adaptation. The primary focus of this draft ECAP is on Mitigation – reducing energy use and GHG emissions. Recommendations are also included for moving forward with Adaptation strategies. It is important to make progress in these two areas simultaneously.

Mitigation

Mitigation refers to actions that reduce the creation of greenhouse gas emissions. These include strategies to reduce transportation fuels used to move people and goods around, reducing natural gas used to heat our homes, reducing electricity use used to light and power our buildings, and reducing consumption of material goods and disposal of materials into landfills. Reducing GHG emissions in collaboration with other communities around the world can help us to avoid, or at least lessen, some of the projected impacts of climate change.

Figure 1. Areas Targeted for GHG Reductions



Adaptation

Adaptation refers to activities that can help our community adapt to the impacts of climate change. Projected local climate impacts include sea level rise, reduced water availability from shrinking snowpack, and increased occurrence of extreme heat events and wildfires. Some impacts, such as minor sea level rise, are already starting to be observed – the result of decades of fossil fuel combustion and other activities such as deforestation. Adaptation strategies may include imposing land use restrictions in vulnerable low-lying areas, upgrading storm and sewer infrastructure, and practicing water conservation. Adaptation strategies are further discussed in later chapters.

Figure 2. Sea Level Rise Vulnerability is One of Many Projected Local Climate Impacts



Source: Pacific Institute

Oakland's Greenhouse Gas Emissions

Oakland's citywide carbon footprint can be measured in multiple ways. Each perspective illuminates opportunities to reduce greenhouse gas emissions through local action. Transportation & Land Use, Building Energy Use, and Material Consumption & Waste are the three largest sources of GHG emissions associated with Oakland.

Figure 3 illustrates a "sector-based" perspective of GHG emissions over which the City government has a relatively high degree of influence. These sources include emissions occurring within Oakland's boundaries, as well as external emissions from citywide electricity consumption and waste sent to landfill. From this perspective, building energy use and fuel used for transportation are both major sources of GHG emissions.

Figure 4 provides a "demand-based" perspective that reveals a different story. National average data illustrates that material consumption and waste – including energy used to manufacture and transport goods, energy consumed in their use, and methane generated when some materials are discarded in landfills – accounts for the majority of GHG emissions.ⁱ This perspective highlights the potential to reduce GHG emissions through waste reduction and recycling.

Transportation & Land Use, Building Energy Use, and Material Consumption & Waste are each significant sources of GHG emissions, and all can be addressed through local action.

For the purposes of the ECAP, these categories of GHG emission sources have been defined to include the following issues:

- **Transportation & Land Use:** integrated planning; transit-oriented development; bike/pedestrian issues; parking; vehicles/fuels; Port of Oakland operations; urban forestry; and the City fleet.
- **Building Energy Use:** new construction; building operations; retrofits of existing buildings; water use / conservation; renewable energy; product efficiency; City facilities; and streetlights.
- **Material Consumption & Waste:** waste reduction; recycling; composting; reuse and repair; rehabilitation and renovation; landfill waste; purchasing; producer responsibility; and local urban agriculture.

Additional information about GHG emission sources associated with Oakland is provided in the ECAP Appendix. To download the ECAP Appendix, visit the City's website at www.sustainableoakland.com.

Figure 3. Sector-Based View of Oakland GHG Emissions

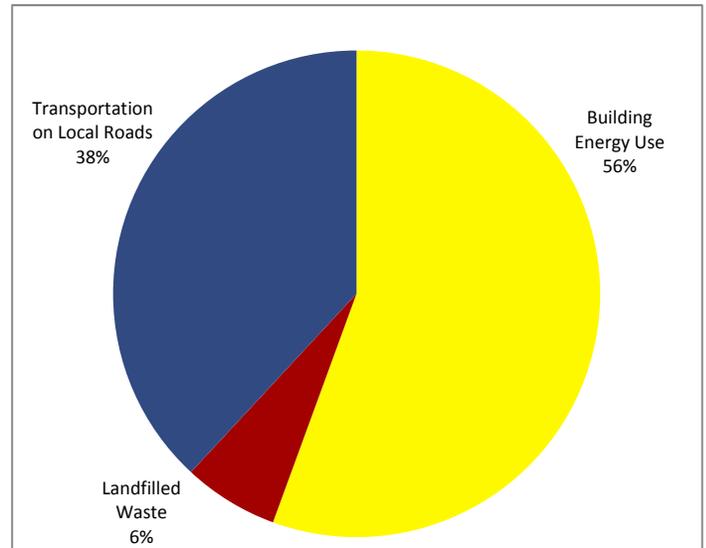
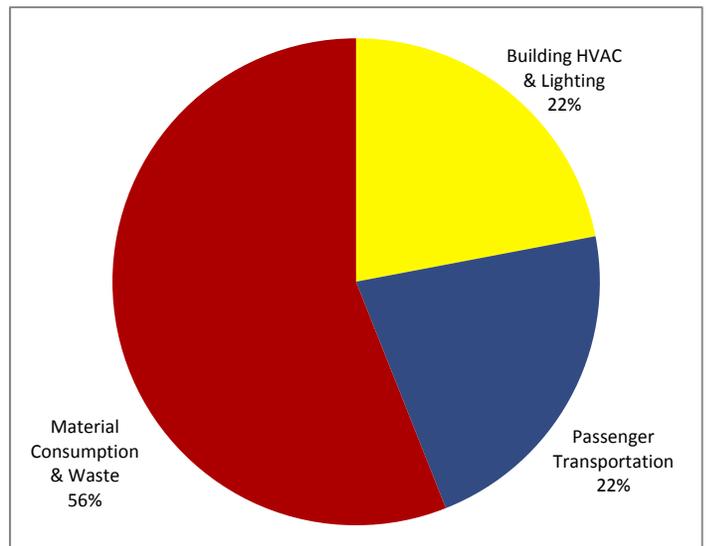


Figure 4. Demand-Based View of U.S. GHG Emissions



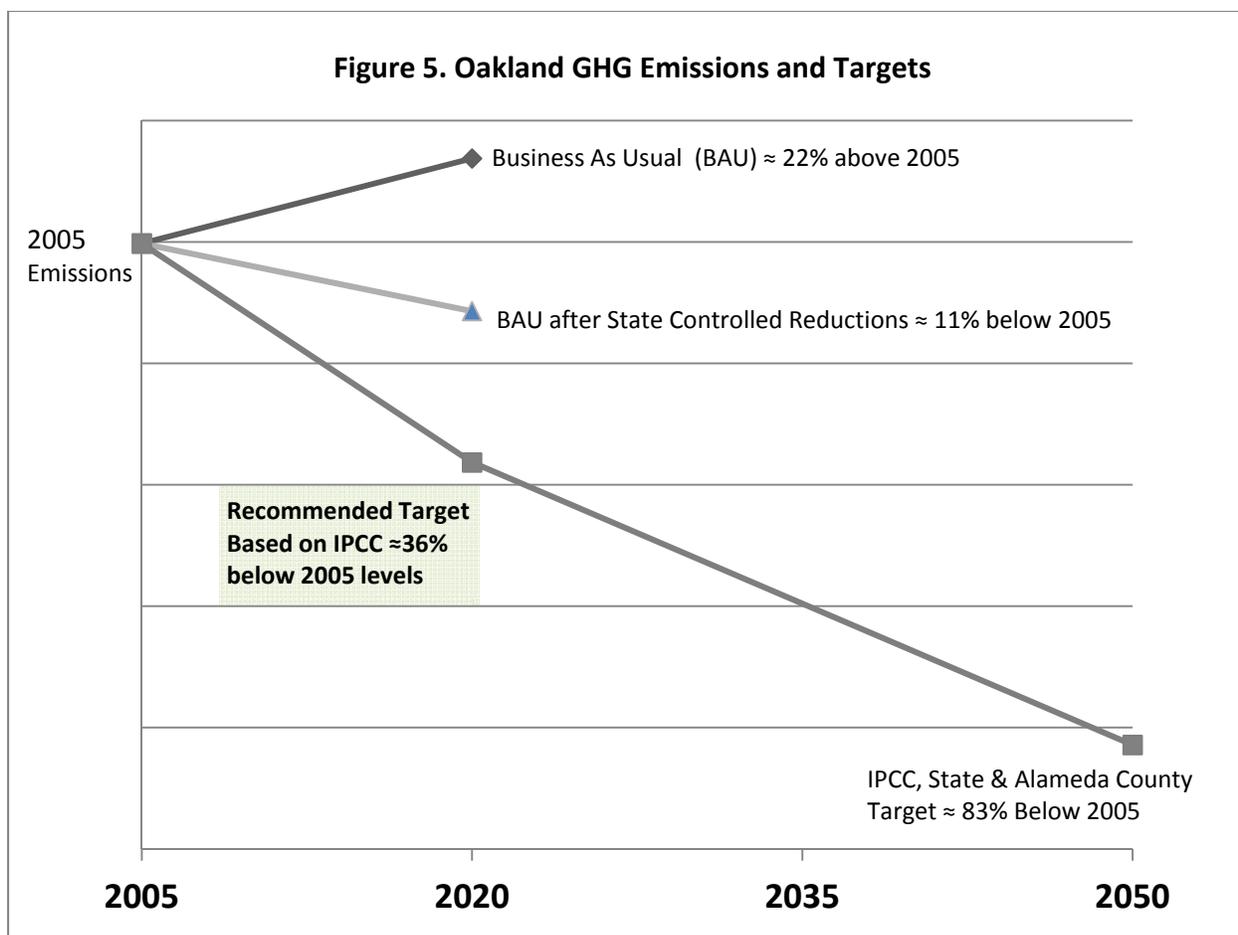
Oakland's 2020 GHG Reduction Goal

In July 2009, the Oakland City Council approved a preliminary planning GHG emissions reduction target for the year 2020 at 36% below 2005 levels, on a path toward reducing GHG emissions by more than 80% below 2005 levels by 2050.

This planning target was developed based on recent publications of the Intergovernmental Panel on Climate Change (IPCC), widely recognized as the world's leading body of climate scientists. According to a recent IPCC reportⁱⁱ, achieving this level of GHG reductions throughout the industrial world will help to produce a level of climate stabilization that would avoid the worst future climate impact scenarios.ⁱⁱⁱ Additional background on this GHG reduction target is provided in the ECAP Appendix.

36%
reduction

Oakland has an opportunity to demonstrate leadership by striving to achieve this level of GHG emissions reductions, reinforcing our commitment to local climate action.



Chapter 2 – Implementation and Reporting

Implementing the Plan

City Departments that are responsible for each priority action will provide regular status updates to the Environmental Services Division. Annual reports will be presented to the City Council. These reports will be publicly available.

ECAP implementation will involve an inter-agency staff team to provide staff-level coordination. This team will discuss progress and challenges in ECAP implementation. Team members will continue relationships with key external partners (e.g., PG&E, EBMUD, StopWaste.Org) to foster coordination and collaboration.



Updating and Evolving the Plan

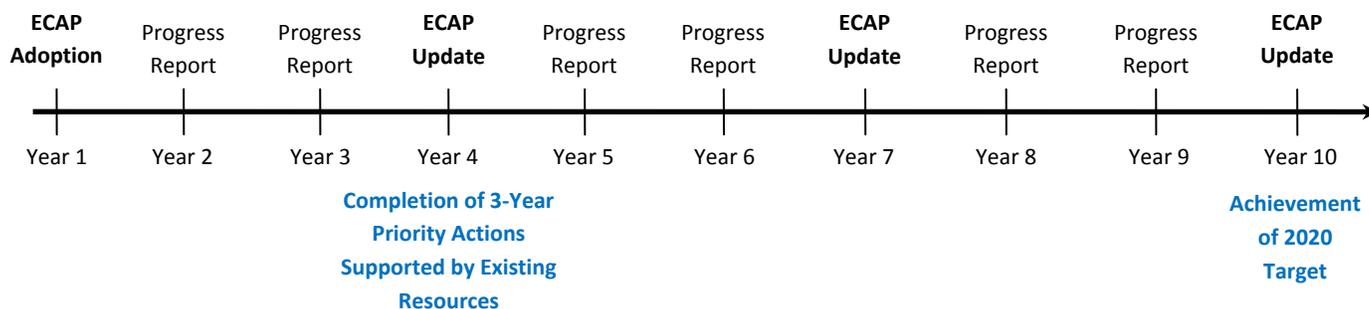
Annual updates on the status of ECAP implementation will be presented to City Council. The ECAP will be updated every three years, including updates to Oakland GHG inventories.

The City will benefit from monitoring the implementation of priority actions during the next three years (2010-2013), and will have the opportunity to learn from these observations to improve plans going forward. Successful programs may be continued and expanded, while unsuccessful actions can be dropped or reconfigured. Other unforeseen changes (e.g., technological advancements, energy price changes, economic growth rates, updated climate models, funding availability) will be considered in future updates to this plan. Future updates will also be informed by consideration of how social equity issues are impacted by ECAP implementation, both with respect to adaptation and mitigation.

The City will provide ongoing opportunities for the public to receive information on the City’s progress in implementing ECAP actions, and to provide input as the implementation process proceeds. These will include three community climate forums annually as described in the Community Engagement section of Chapter 4.

Timeline for Plan Implementation

The City will report on progress and update the ECAP according to the timeline below.



Priority Actions Supported by Existing Resources

A number of actions in the ECAP can be accomplished with existing resources, or with the aid of anticipated external support (e.g., grants). The Priority Actions Supported by Existing Resources below will move forward with existing or anticipated resources, and will be implemented during the next three years (2010-2013). Some of these actions are in progress. Table 1 provides a summary of when the City anticipates beginning work on each action and which department/ division is responsible for implementation.

Table 1. Priority Actions Supported by Existing Resources

Priority Action	Anticipated Implementation Start	Responsible Department / Division
PA 1. Identify and Adopt Priority Development Areas	Underway	Transportation Services, Strategic Planning, Redevelopment
PA 2. Launch and Develop a Funding Plan for the Downtown Shuttle	Underway	Transportation Services, Economic Development
PA 3. Advance Bus Rapid Transit in Oakland	Underway	Transportation Services, Infrastructure Planning & Programs
PA 4. Participate in Quarterly SB 375 Discussions	Underway	Transportation Services, Strategic Planning, Housing and Community Development
PA 5. Call for Port of Oakland GHG Reduction Targets and Plans	Underway	Elected Officials
PA 6. Call for Climate Action by Port Tenants	Underway	Elected Officials
PA 7. Adopt a Green Building Ordinance for Private Development	Completed Fall 2010	Planning, Building Services
PA 8. Offer Property-Based Energy Financing	TBD	Environmental Services, Planning, Building Services
PA 9. Launch a Downtown Commercial Retrofit Program	Underway	Economic Development, Environmental Services
PA 10. Encourage Participation in Local Energy Efficiency Programs	Underway	Environmental Services
PA 11. Launch a Residential Green Retrofit Program	Underway	Environmental Services, Planning, Housing & Community Development
PA 12. Conduct a Multi-Family Affordable Housing Retrofit Pilot	Underway	Housing and Community Development
PA 13. Expand Weatherization Program Delivery	Underway	Housing and Community Development
PA 14. Launch the Weatherization and Energy Retrofit Loan Program	Underway	Housing and Community Development
PA 15. Create an Oakland-Specific Water-Efficient Landscaping Ordinance	TBD	Strategic Planning
PA 16. Implement Advanced Operating Procedures for City Facilities	Winter 2011/12	Department of Facilities & Environment
PA 17. Improve Energy Performance of New City Facilities	Underway	Environmental Services

PA 18. Retrofit City Facilities to Improve Energy Performance	Underway	Environmental Services, Building Services
PA 19. Restructure Solid Waste Management System	Underway	Environmental Services
PA 20. Refine Implementation of C&D Recycling Ordinance	Underway	Building Services and Permit Center
PA 21. Promote Waste Reduction at Community Events	Underway	Environmental Services
PA 22. Develop Regulations Enabling Urban Food Production	TBD	Strategic Planning, Economic Development
PA 23. Encourage Land Owners to Lease Space for Food Production	TBD	Strategic Planning
PA 24. Provide Additional Information on Energy and Climate Issues Through Existing City Channels	Winter 2010/11	Environmental Services
PA 25. Expand Outreach on Energy and Climate Issues Through Partnerships with Local Organizations	Winter 2010/11	Environmental Services
PA 26. Convene Community Climate Forums	Summer 2011	Environmental Services
PA 27. Report on Energy and GHG Reduction Progress	Winter 2011/12	Environmental Services
PA 28. Support Local Green Jobs Programs	Underway	Mayor's Office, Redevelopment Agency
PA 29. Participate in Regional Climate Adaptation Discussions	Underway	Strategic Planning, Economic Development, Engineering

Priority Actions Requiring New Resources

Putting Oakland on a steady path of progress toward achieving a 36% reduction in GHG emissions by 2020 will require the implementation of additional actions during the next three years, beyond those described above for which existing resources are available. The Priority Actions Requiring New Resources identified in Table 2 below will move forward if new resources can be found. See page 40 for more information on these proposed actions.



Table 2. Priority Actions Requiring New Resources

PA 30. Develop a Comprehensive Transportation Policy Plan
PA 31. Improve Transportation & Land Planning Integration in Every Planning Effort
PA 32. Create and Adopt a Transportation Impact Fee to Support Implementation
PA 33. Update Local CEQA Standards to Reduce Emphasis on Congestion Impacts
PA 34. Accelerate Completion of Bicycle and Pedestrian Plans
PA 35. Establish Alternative Mechanisms for Meeting Parking Requirements
PA 36. Conduct a Citywide Dynamic Parking Pricing Study
PA 37. Plan for Electric Vehicle Infrastructure
PA 38. Develop an Urban Forestry Master Plan
PA 39. Accelerate City Fleet Vehicle Replacement

PA 40. Subsidize Transit and Transportation Alternatives for City Employees
PA 41. Discontinue Subsidizing Parking for City Employees
PA 42. Engage Largest Electricity Consumers in Energy Retrofits
PA 43. Market Energy Retrofit Opportunities to All Oakland Businesses
PA 44. Create a Renter-Occupied Residential Energy Retrofit Program
PA 45. Adopt and Implement a Residential Energy Conservation Ordinance
PA 46. Consider Energy Benchmarking Requirements for Commercial Buildings
PA 47. Encourage the Creation of On-Bill Financing for Energy Retrofits
PA 48. Seek Resources to Support Energy Programs
PA 49. Encourage Citywide Energy Conservation and Efficient Product Purchasing
PA 50. Facilitate Community Solar Programs
PA 51. Encourage PG&E to Offer Green Power Options
PA 52. Monitor Community Choice Energy
PA 53. Enforce Mandatory Recycling
PA 54. Conduct Residential Social Marketing Campaigns and Business Outreach
PA 55. Study Options for Advancing Next-Level Waste Reduction
PA 56. Develop an Oakland Climate Action Model Practices Campaign
PA 57. Community Climate Action Guide
PA 58. Support Local Climate Workshops
PA 59. Study Potential Local Climate Impacts
PA 60. Communicate Climate Impacts to the Community
PA 61. Identify and Act on Opportunities to Improve Resilience in City Plans and Policies

Cost of Priority Actions Requiring New Resources

The ECAP includes budget estimates for resources the City would need to implement the 32 Priority Actions Requiring New Resources identified in Table 2. The average annual cost to the City associated with implementing all 32 of these actions is projected to be approximately 21 additional staff FTE (2.5 of which can be funded with identified external funds), and an additional \$9 million per year for related expenses. It is outside the scope of the ECAP to include a total budget for other actions proposed for implementation through 2020. It is important that the City identify long-term dedicated funding streams to support energy and climate action.



Implementation of climate actions, whether imposed by Federal, State or local law, or from voluntary community action at a level commensurate with achieving Oakland’s 36% GHG reduction target, may result in potential reductions in revenues to the City associated with decreased energy and fuel consumption (e.g., Utility Consumption Tax, Alameda County Transportation Improvement Authority [Measure B-ACTIA], State Gas Tax). Conversely, an influx of new revenues may result from the creation of new green business activities (e.g., business tax and sales tax revenue associated with energy retrofit work performed, green business attraction, local job creation associated with implementation activities). It is beyond the scope of the ECAP to estimate net costs and benefits associated with achievement of the 36% GHG reduction target.

Cost to Oakland Community and Stakeholders

In addition to resources required by the City to support implementation, achieving the 36% GHG reduction target will require complementary action throughout the community in many areas. For example, the City may develop and offer programs assisting property owners in improving energy efficiency of their buildings. In most cases, those property owners would require additional resources to implement the upgrades. In another example, the City would require resources to participate in the development of a Public Transit Master Plan for Oakland. AC Transit would also require significant additional resources to increase the frequency of its service and provide amenities needed to foster significant increases in ridership.

It is beyond the scope of the ECAP to project total implementation costs that might be borne by the greater Oakland community in the course of taking primarily voluntary action at the level necessary to achieve a citywide GHG reduction of 36%. However, these costs would clearly be significant. For example, it is estimated that performing voluntary energy upgrades to 30% of Oakland's residential properties would cost on the order of \$400 million. Much of this work has the potential to create significant cost savings for property owners and/or tenants, and some households could experience a net positive cash flow. However, identifying resources to support initial implementation costs is a significant barrier to implementation. ECAP actions (e.g., working with partners to expand financing options) are identified to help overcome such barriers, but cannot fully remove the need for resources.

Potential Funding Opportunities

Through a variety of partnerships, Oakland has been successful in receiving resources to support new energy and climate programs. These programs include support for residential energy retrofits and expanded weatherization services, downtown commercial energy retrofits, and the launch of a new downtown free shuttle.

Opportunities to seek funds are available. Assuming that capacity to seek funds exists, Oakland will continue to be competitive. Examples of funding sources the City should continue to explore include:

- State and Federal energy grants
- Air District & CA Air Resources Board grants
- Foundation support
- Emerald Cities Collaborative support
- Federal appropriations
- HUD Sustainable Communities planning grants
- EPA Climate Showcase Communities grants
- State and Federal transportation funds
- MTC directed regional transportation dollars
- Additional ARRA funding opportunities
- Regional gas tax/green investment fee
- Surcharges on GHG intensive energy use
- Parking rates
- Landfill disposal fees
- Federal tax credits
- EPA Clean Water Revolving Loan Fund
- Reformulated Gasoline Settlement Fund
- Development impact fees
- Permit fees
- Tax increment financing

Considerations of Job Quality and Economic Development in Implementation

Climate action by the City and complementary action by the Oakland community have the potential to foster significant green job creation and green economic development in Oakland. The City encourages the expansion of local green job training programs to help provide the workforce needed to achieve these goals. The City also encourages private employers to ensure that these are high quality, living wage jobs offering green career pathways for local residents. The City will continue to support these objectives by applying existing living wage, local hire and prevailing wage policies to its programs and projects.

Tracking and Reporting on Progress

The City will report on the status of priority actions and key performance metrics on an annual basis beginning one year after ECAP adoption. In addition to annual reports to City Council, reporting will be delivered through a variety of dissemination methods to various interest groups and stakeholders. Multiple actions identified in the Community Engagement section of Chapter 5 will serve as additional vehicles for reporting on implementation progress.

Oakland's success in reducing energy use and GHG emissions will be measured using the following, primarily citywide annual metrics. While not an exhaustive list, these metrics will enable evaluation of Oakland's progress as implemented actions reduce GHG emissions while creating a healthier, more equitable, and more economically vibrant Oakland.

Key Performance Metrics

- Vehicle miles traveled in Oakland
- Residential electricity consumption
- Residential natural gas consumption
- Commercial/industrial electricity consumption
- Commercial/industrial natural gas consumption
- Tons of waste sent to landfill

Secondary Performance Metrics

Transportation and Land Use

- Gallons of petroleum fuel consumed
- Percent of mode share represented by each form of transportation
- Miles of identified bikeways
- Number of bicycle parking spots
- Percent of Oakland residents living within ½ mile of major bike lane
- Total number of transit passenger miles traveled
- Total number of bus service hours
- Total miles of bus lines
- Average bus travel time for representative routes
- Revenue generated by transportation impact fees
- Funding allocated to transit projects (all sources)
- Average installed parking of new development
- City fleet fuel consumption

Building Energy Use

- Number of low-income residential units served by weatherization assistance programs
- Number of homes participating in residential retrofit programs
- Number of properties utilizing property-assessed energy financing
- Number of commercial and industrial buildings participating in energy rebate programs
- Percent of electricity from RPS-compliant renewable energy sources
- Percent of electricity from carbon-neutral sources
- Amount of energy (kWh and therms) generated from local renewable sources
- Amount of energy (kWh and therms) consumed by City operations
- Amount of electricity (kWh) generated at City facilities

Material Consumption and Waste Reduction

- Tons of waste landfilled
- Tons of material recycled by City franchisees or contractors
- Tons of organic material composted by City franchisees or contractors
- Amount of construction and demolition (C&D) debris diverted from landfills
- Amount of solid waste generated by City operations

Community Leadership

- Number of individuals pledging to take and/or reporting climate actions



Chapter 3. A Collaborative Approach

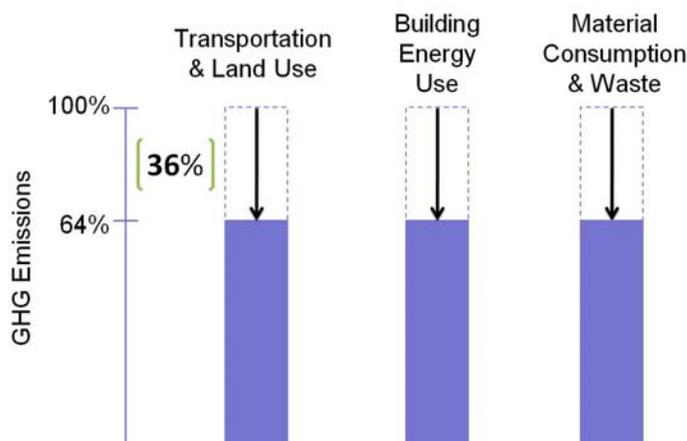
Achieving Oakland's 2020 GHG Reduction Goal

Achieving a 36% reduction in citywide GHG emissions by 2020 will require a collaborative effort between government, business, and residents. This effort will require unprecedented action to address all three of the major sources of GHG emissions:

- Transportation & Land Use
- Building Energy Use
- Material Consumption & Waste

For the purpose of developing the draft ECAP, Oakland's 36% GHG reduction goal is applied to each of these three categories of GHG emission sources. This level of GHG reduction can be accomplished by 2020 by achieving the following targets:

Figure 6. Applying the 36% GHG Reduction Goal in Each Emissions Source Category



20% reduction in vehicle miles traveled annually as residents, workers and visitors meet daily needs through transit, walking, and bicycling

24 million gallons of gasoline and diesel saved annually on local roads due to less driving and more fuel efficient vehicles

32% reduction in annual electricity consumption through conservation and energy efficiency in homes and businesses

14% reduction in annual natural gas consumption through retrofits to Oakland's homes and commercial buildings and aggressive conservation

62 million kWh and 2.7 million therms of renewable energy production annually from local solar panels and other renewable energy technologies

375,000 tons of waste diverted annually away from local landfills through waste reduction, reuse, recycling, and composting



Role of Federal, State, Regional Partners

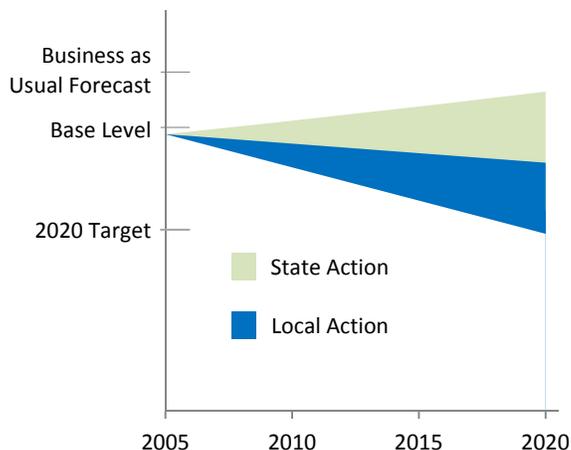
The ECAP is intended to complement actions taken by federal, state and regional governments to address the threat of climate change.

The Federal government has begun to take an increasing interest in solving the challenge of climate change. President Obama issued an executive order in 2009 calling for GHG reductions in Federal government operations.^{iv} The U.S. Environmental Protection Agency has also begun to take steps to recognize GHG emissions as an environmental problem.

In California, recent climate policies adopted at the State level (e.g., AB 32, SB 375) aim to reduce statewide GHG emissions to 1990 levels by 2020.^v Executive Order S-3-05 issued by Governor Schwarzenegger calls for statewide GHG reductions of 80% below 1990 levels by 2050.^{vi}

In December 2008, the California Air Resources Board (CARB) adopted the Climate Change Scoping Plan, outlining a variety of State-driven strategies to help achieve these statewide goals.^{vii} Complementary and supplemental local actions will be needed to help reach these goals. Among the strategies contained in the CARB Scoping Plan are: vehicle fuel efficiency and low carbon fuel standards; energy efficiency standards for buildings; aggressive renewable portfolio standards for electricity generation; hybrid vehicle support; high speed rail; industrial sector energy efficiency measures; growing sustainable forests; and recycling and waste measures. While some of these strategies may not affect Oakland, most will have some impact in Oakland and are considered in the context of developing local GHG reduction targets and plans to meet the targets.

Figure 7. A Collaborative Partnership to Achieve Oakland's GHG Reduction Goals

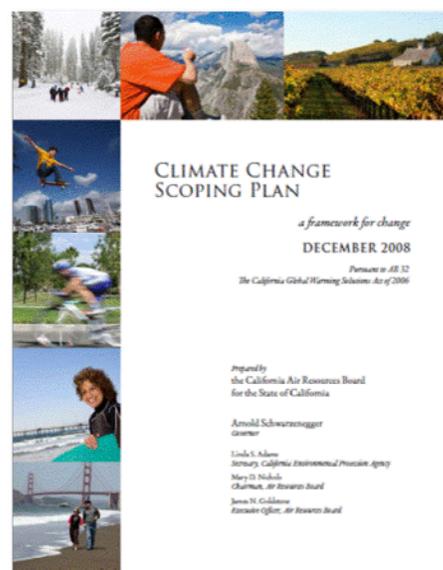


State policies are projected to result in significant progress toward Oakland's 2020 GHG reduction goal.

Some of the State-driven strategies, such as requiring the sale of more fuel-efficient vehicles and lower carbon fuels, are projected to reduce GHG emissions in Oakland without imposing new burdens on local government. Other State strategies outline goals for reducing GHG emissions that will only be met if action is taken by local governments and communities.

For the purpose of quantifying GHG emissions and needed reductions, projections of Oakland's 2020 GHG emissions have been adjusted based on projected changes in population, economic activity and vehicle miles traveled.^{viii} These projections also assume implementation of State-driven strategies that will not require additional local government action. Achievement of other State-defined goals requiring local action is not assumed without the implementation of actions recommended in this draft ECAP.

The role of regional partners in achieving Oakland's future GHG reduction goals is very significant. Regional partners such as the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) are working to reduce emissions through development of regional housing allocations for Bay Area cities, transportation plans, and priority development areas. Several strategies that hold promise would require new regional action by a regional body or the collective action of all the cities and counties (see page 81 for examples).



Role of City Government and Local Action

The primary purpose of the ECAP is to identify and prioritize actions the City can take to reduce energy consumption and GHG emissions associated with Oakland. The ECAP also tells the story of action the Oakland community would need to take in partnership with the City to achieve a 36% reduction in GHG emissions.

The City of Oakland can provide leadership and leverage, and can play an important role in helping to reduce citywide energy use and GHG emissions. The City can enact new policies; develop new plans, programs and projects; and help to educate and motivate additional community progress.

For example, land use and transportation plans developed by the City can help to orient new development around transportation networks that reduce dependence on automobiles and associated GHG emissions. Examples of relevant City planning documents include: the General Plan Land Use and Transportation Element and Housing Element; the Zoning Code; and the Bicycle and Pedestrian Master Plans.

City policies and programs can help to reduce energy use associated with residential and commercial buildings as well. For example, the City's proposed Green Building Ordinance for Private Development would help to ensure that new residential and commercial buildings and rehabilitations of existing buildings are designed to achieve high levels of energy efficiency and green performance.

The City has significant influence over GHG emissions associated with materials and waste through its solid waste management programs. The City's garbage franchise agreement and recycling service contracts define the type, frequency and cost of garbage, recycling and compost collection services, and can be tailored to keep more materials out of landfills.

The City also has an important role to play in educating and motivating all members of the Oakland community to join in the effort to reduce energy use and GHG emissions. The City can encourage voluntary action, promote model local practices, provide opportunities for new ideas from the community to further strengthen local efforts, and track and report on Oakland's progress in reducing energy use and GHG emissions.

Achieving a 36% reduction in GHG emissions will require unprecedented leadership by the City and all members of the Oakland community

Leadership from local businesses, non-profit organizations, civic groups and others will be essential to achieving Oakland's 36% GHG reduction target. As champions connected throughout the Oakland community, these organizations can help to build a movement around local climate action.

Oakland's success in reducing GHG emissions will ultimately depend on the day-to-day decisions of individuals. For example, achieving a 36% GHG reduction target will require all members of the community to drive an average of 20% less by walking and biking for neighborhood trips, using public transit, combining trips, and telecommuting where possible. Thirty percent of Oakland's homes and businesses will need to undergo energy improvements. Local service providers (e.g., PG&E, AC Transit) will play key roles in enabling individuals to make choices that reduce GHG emissions. These and other organizations will have a big role to play in creating interest and encouraging action throughout the community.



Community Climate Action Guide

Achieving significant GHG reductions will require everyone in the Oakland community working together. Below are ideas to consider as you help to reduce your own climate footprint as a resident, employee, or visitor to Oakland. To view more ideas, download a stand-alone copy of this guide, and access tools for calculating your own carbon footprint, visit the City's website at www.sustainableoakland.com.



First Steps

Greening Your Home

- Try adding a layer before turning on the heat
- Plug all appliances into powerstrips and turn off the strips when not in use
- Replace incandescent light bulbs with compact fluorescent bulbs
- Choose ENERGY STAR labeled appliances
- Insulate your water heater
- Lower the water heater temperature
- Install and use a clothesline
- Install weather stripping around external doors
- Conserve water with water-efficient showerheads and faucets

Getting Around

- Switch one work commute trip per week to biking, walking, taking transit or telecommuting
- Accomplish at least two neighborhood trips per week by biking or walking
- Plan out non-work trips in advance and combine where possible
- Carpool with neighbors, co-workers

Consume Less, Waste Less

- Recycle all eligible materials
- Bring your own bag for shopping
- Purchase durable goods made from recycled materials
- Avoid excessively packaged goods
- Shop at local farmers markets
- Eat meat at one less meal each week

Lead the Way

- Educate your family and establish green family practices
- Discuss action opportunities with neighbors, such as lowering water heater temperature, hiring an energy improvement contractor, or biking to work one day per week
- Discuss safe routes to school, transit, etc with neighbors and help create a safe street environment



Bigger Steps

Greening Your Home

- Have a home energy audit done and take actions that will pay for themselves within 5-10 years
- Look for opportunities to include passive solar design to minimize winter heating needs in new building or remodeling projects
- Collect rainwater for outdoor water needs
- Plant trees on your property
- Plant water-efficient landscaping, including smart controllers (See Bay Friendly Guidelines)
- Consider living arrangements (co-housing) that can yield lower per capita energy use

Getting Around

- Purchase a fuel-efficient vehicle
- Purchase a bike and ride it often
- Choose to live where automobile dependence can be minimized (e.g., near transit, work, school, shopping)
- Try not owning a car
- Fly less often for business; try web meetings & video conferencing

Consume Less, Waste Less

- Repair and reuse goods whenever possible
- Adapt used materials for new purposes (e.g., mason jars for cups)
- When shopping in stores, look for options in Oakland first
- Plant a garden to grow your own food
- Freeze, can, dry and preserve seasonal fruits and vegetables
- Go vegetarian

Lead the Way

- Become a mentor to other members of the community
- Become a community resource and share your skills and experience with others taking local climate action



Chapter 4

Leveraging Near-Term Opportunities and Laying the Groundwork for Long Term Progress: The Three Year Priority Implementation Plan

It is important for the City to prioritize its efforts carefully, and to get started promptly on implementing the highest priority recommended actions when the necessary resources are available. This chapter presents a Three Year Priority Implementation Plan for making progress toward Oakland's 36% GHG reduction target.

The Three Year Priority Implementation Plan is divided into two sections:

- **Priority actions supported by existing resources**
- **Priority actions requiring new resources**

In each section, recommended priority actions are grouped into the three primary GHG reduction categories, along with a set of highlighted community engagement recommendations, and steps to assist Oakland in adapting to climate change, in the following order:

- Transportation & Land Use
- Building Energy Use
- Material Consumption & Waste
- Community Engagement
- Climate Adaptation & Increasing Resilience

Priority actions recommended using existing and anticipated resources are summarized with descriptions of current implementation status. Priority actions recommended for implementation that will require new resources include estimates of resource needs along with recommended implementation responsibility if resources become available.

All recommended priority actions are also included in Chapter 5, which provides a summary of all actions required for Oakland a 36% reduction in GHG emissions by 2020.

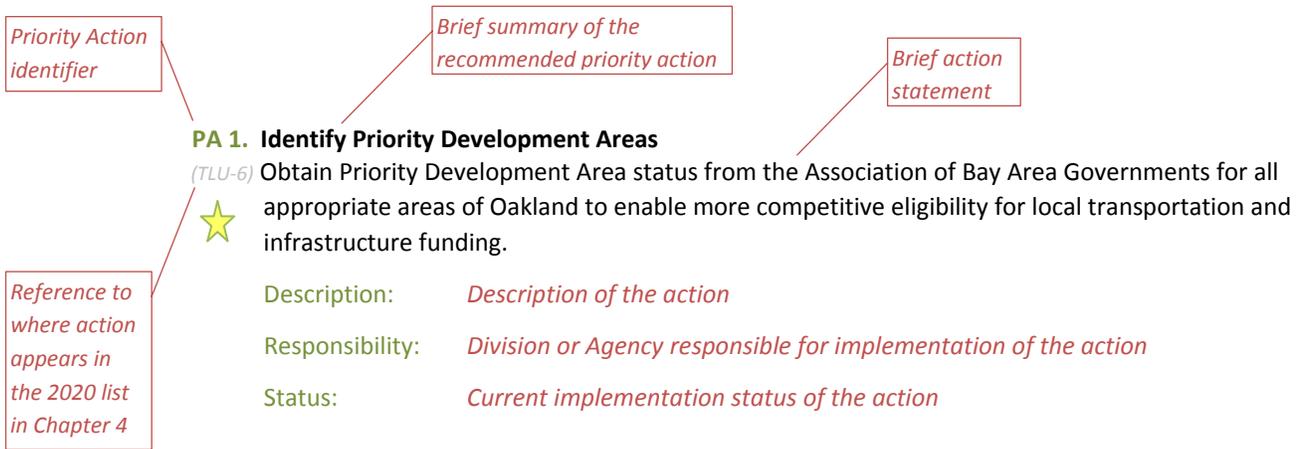
Priority Actions Supported by Existing Resources

During the next three years (2010-2013), the City will implement a prioritized set of recommended actions for which resources are available. These recommended actions can be implemented using existing or anticipated resources, including anticipated grants from the California Energy Commission (CEC) State Energy Program, supported by the American Recovery and Reinvestment Act (ARRA). Some of these actions are in progress.

These priority actions will create GHG reduction benefits and lay the foundation for future actions that can create additional GHG reductions in the coming years. Additional resources to continue and/or expand these actions beyond the next three years, as well as to implement additional energy and climate actions, will be necessary to achieve Oakland’s 36% GHG reduction goals.

How to Read This Section

Each action below is presented through a standard format containing each of the following elements.



★ The star icon shown at left indicates actions in the Three Year Priority Plan that can move forward in a substantive way during the next three years. Some of these actions can be accomplished with existing resources and staffing levels, while others will benefit from anticipated external funding such as recently awarded Stimulus funds.



Transportation and Land Use

Combustion of fossil fuels for transportation is a major source of GHG emissions associated with Oakland, as well as throughout California. This includes people moving to and from home, work, school, shopping, recreation, and other destinations, as well as the transport of goods. Other local air pollutants linked to increased incidence of health problems such as asthma and cancer also commonly result from use of transportation fuels.

Addressing transportation emissions presents a tremendous opportunity to simultaneously reduce GHG emissions and improve the health of Oakland residents. Efforts to reduce GHG emissions from the transportation sector also pose the opportunity to create a more equitable, sustainable, affordable and healthy Oakland by addressing the interconnection between land use and transportation. How and where housing, jobs, shopping, and other opportunities are located has a fundamental effect on both GHG emission and on the choices that people have for meeting their daily needs.

A number of tools are available to help the City reduce GHG emissions associated with transportation and land use. These include: land use and transportation planning; providing interconnected bicycle and pedestrian options; tailoring parking policies to reduce vehicle trips; supporting affordable, safe and reliable public transportation options; promoting fuel-efficient vehicles and low-carbon fuels; partnering with the Port of Oakland to reduce Port-related emissions; engaging employers to reduce commute and business trips; promoting urban forestry; and improving the City vehicle fleet.

Oakland has made progress in a number of these areas, embracing a variety of climate-friendly development principles in the City's General Plan, focusing new development around transit hubs, adopting forward-thinking Bicycle and Pedestrian Master Plans, and adopting a Clean Fleets policy aimed at improving the fuel efficiency of the City's vehicle fleet.

A number of other actions currently underway or planned for implementation are recommended for completion in the next three years. These actions include:

- Identify and Adopt Priority Development Areas in Oakland
- Launch and Develop a Funding Plan for the Downtown Shuttle
- Advance Bus Rapid Transit in Oakland
- Participate in Quarterly SB 375 Planning Discussions

Following are descriptions of each of these actions, along with information regarding implementation status.

Priority Actions

PA 1. Identify and Adopt Priority Development Areas

(TLU-6) Obtain Priority Development Area (PDA) status from the Association of Bay Area Governments for all appropriate areas of Oakland to enable more competitive eligibility for local transportation and infrastructure funding.

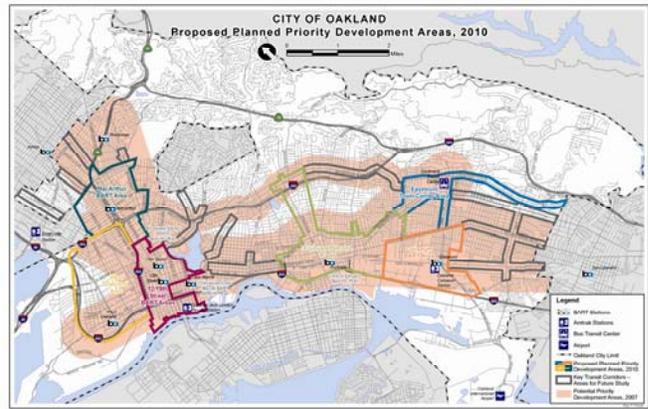


Description:

Identifying Priority Development Areas in Oakland will help the City secure resources for local transportation and infrastructure improvements. PDA designation is awarded through the FOCUS Program (a regional development and conservation strategy), led by four regional agencies: the Association of Bay Area Governments (ABAG), Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District (BAAQMD) and the Bay Conservation and Development Commission (BCDC). The FOCUS Program and the PDA designation have the primary goal of encouraging growth near transit and in the existing communities that surround transit by enhancing



existing neighborhoods and providing good housing and transportation choices for all residents. This includes an explicit focus on promoting housing that will be affordable to low-income residents and attempts to minimize the displacement of existing residents. The City should continue to plan for and approve new development in conformance with current CEQA guidelines.



Designated PDAs will become eligible to receive not only planning and technical assistance but capital funding from various sources including the Station Area Planning Grant Program, the Regional Transportation Plan (Transportation 2035), the Transportation for Livable Communities Program, Environmental Justice grants, Green Infill - Clean Storm water grants, the Proposition 1C: Transit Oriented Development Housing Program and Infill Infrastructure Grant Program, the Transportation Fund for Clean Air grant program, and other State and regional programs.

City Council has approved an application for designation. Follow-on grant applications will need to be focused on infrastructure, transportation, and housing for a range of income levels for transit-oriented development areas and corridors.

Achieving PDA designation of previously designated transit-oriented areas will be accomplished under existing Resources. An additional 0.25 FTE for a grant writing professional would augment Oakland’s capacity to apply for, and chances of receiving, more above-mentioned future funding.

Responsibility: Transportation Services, Strategic Planning, Redevelopment

Status: City Council approved staff recommendations regarding the identification of Priority Development Areas in February 2010. ABAG subsequently approved these recommendations. Staff is now working to align proposals to make Oakland competitive for future transportation, infrastructure and housing funding streams.

PA 2. Launch and Develop a Funding Plan for the Downtown Shuttle

(TLU-13) Launch and sustain a downtown free shuttle to increase transit use in the downtown area. Explore options to expand the shuttle up the Broadway corridor.



Description: The City launched a new downtown shuttle serving the Broadway corridor from Jack London Square to the Uptown area. Rides on the shuttle are free to the public. The shuttle is projected to create a net reduction in GHG emissions by reducing the need for private automobile trips. The shuttle will also benefit downtown merchants.

The launch and initial operating phase of the shuttle is supported by a grant from the Bay Area Air Quality Management District. Funding is in place to support the operation of the shuttle for a two-year period. During this time, the City will work to develop a long-term funding strategy to



sustain the shuttle beyond the grant period, including development of a “fair share” methodology for assigning a portion of the costs to new development.

Existing staff resources are sufficient to support the launch of the shuttle. Additional resources may be needed to perform urban economic analysis, outreach and strategy development to create an ongoing sustainable funding stream beyond the grant period.

Responsibility: Transportation Services, Economic Development

Status: The shuttle began operations in summer 2010.

PA 3. Advance Bus Rapid Transit in Oakland

(TLU-14) Support implementation of bus rapid transit (BRT) in Oakland along the Telegraph Avenue and International Boulevard corridors while minimizing short-term potential impacts to neighborhoods and businesses.



Description: Establishing new dedicated transit service will be critical to reaching our emissions goals and fostering shifts from automobile travel to transit. Bus rapid transit offers a significant opportunity to make transit easier, faster, more reliable and more convenient. The City has an opportunity to work with AC Transit to establish a BRT system on these routes in Oakland.



Existing staff resources and consulting assistance, which have been supported by funding from AC Transit, have been sufficient to analyze the proposed BRT options for Oakland. AC Transit is currently completing the Final Environmental Impact Statement / Report on the project, which will define potential mitigations to address traffic and parking impacts. Once that document is released, City Council will be asked to vote on the project.

Based on its experience with this initial BRT project, the City should consider other opportunities to advance BRT as a local and regional strategy.

Responsibility: Transportation Services / Infrastructure Planning & Programs

Status: Staff is working with AC transit to review the impacts and mitigations of the proposed project, and will be bring the refined project to the City Council for a vote in early 2011.

PA 4. Participate in Quarterly SB 375 Discussions

(TLU-1) Participate in development of the Bay Area Sustainable Community Strategy for reducing vehicle travel in compliance with SB 375, including defining Oakland’s role in achieving regional jobs-housing balance and land use and transportation system integration.



Description: Senate Bill 375, adopted in 2008, established a new framework for reducing GHG emissions throughout California through attention to land use and transportation planning issues. SB 375 requires metropolitan regions of the state to each develop a Sustainable Community Strategy (SCS) demonstrating how each region will reduce vehicle miles traveled, and therefore contribute to GHG reductions. The SCS also presents an opportunity to improve coordination between regional transportation and housing planning.

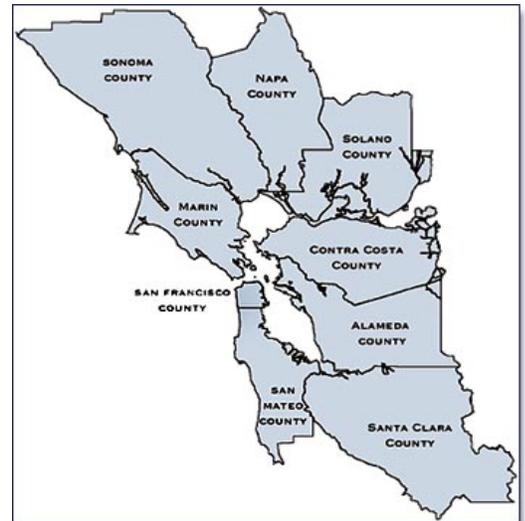
Under the leadership of the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG), partners in the Bay Area will be developing an SCS for the Bay Area over the next 2-3 years in compliance with SB 375 mandates. This regional planning process can play a significant part in reducing transportation-related GHG emissions in Oakland and throughout the region. Oakland’s participation in this process will help to ensure that outcomes reflect the housing and transportation needs of the city’s residents and businesses, and that future regional planning

and infrastructure funds are allocated in proportion to the amount of growth directed to Oakland and other regional centers.

Expected roles of local government and opportunities to engage in this planning process remain unclear. Staff currently has the resources to participate in quarterly conference calls to stay up to date on how the process of developing the Bay Area SCS is unfolding. Further engagement or action would require additional staff resources.

Responsibility: Transportation Services, Strategic Planning, Housing and Community Development

Status: Staff is currently able to participate in quarterly conference calls to follow regional action related to SB 375 and development of the Bay Area Sustainable Community Strategy.



PA 5. Call for Port of Oakland GHG Reduction Targets and Plans

(TLU-38) Call upon the Port to establish GHG reduction goals associated with Port operations in alignment with the City’s GHG reduction target of 36% below 2005 emissions by 2020, and to create plans for achieving those goals.



Description: The Port of Oakland can demonstrate additional leadership in advancing GHG reductions by establishing GHG reduction goals associated with Port operations, and plans for achieving those goals. The Port has developed GHG emission inventories for its own operations, and has taken a number of actions toward reducing those emissions. By establishing a comprehensive GHG reduction plan based on a goal in alignment with the City’s GHG reduction target of 36% below 2005 emissions by 2020, the Port can continue to demonstrate its leadership, and provide a model of operational improvements for its tenants.

The Port of Oakland is a department of the City of Oakland. However, the Charter of the City of Oakland vests the Board of Port Commissioners with exclusive control and management of the Port Department. Port Commissioners are nominated by the Mayor and appointed by the City Council.

The City has sufficient existing resources to call upon the Port as described above. The Port would require separate resources to take the actions described here.

Responsibility: Elected Officials

Status: The City and Port maintain dialogue on these issues via the City-Port Liaison Committee and peer-to-peer staff level discussions.

PA 6. Call for Climate Action by Port Tenants

(TLU-39) Call upon the Port to establish GHG inventories and reduction goals associated with tenant activities, and plans for achieving those goals with appropriate tenant commitments, potentially including requiring specific high-impact GHG reduction measures (e.g., electrification of land-based aviation equipment and maritime vessels).



Description: Beyond the Port’s own operations, GHG emissions associated with tenant activities at the Port can also be significant. Through relationships with its tenants (e.g., lease agreements), the Port can advance additional GHG reductions associated with tenant activities.

Responsibility: Elected Officials

Status: The City and Port maintain dialogue on these issues via the City-Port Liaison Committee and peer-to-peer staff level discussions.

Building Energy Use

Energy used to heat, light and power Oakland's buildings and for outdoor lighting is also a major direct source of GHG emissions. Natural gas consumption is the largest source of GHG emissions related to buildings, followed by emissions from power plants that supply Oakland's electricity.

A number of methods are available to the City to reduce GHG emissions from building energy use. These include: optimizing energy efficiency in new construction; retrofitting existing buildings to reduce energy consumption; promoting energy and water conservation and efficiency; advancing the use of renewable energy; and improving the energy performance of municipal facilities. Oakland's greatest opportunities lie in retrofitting the city's existing building stock.

Oakland already has made progress in a number of these areas, adopting a green building ordinance for civic buildings, implementing energy retrofits in most of the City's existing 100 largest facilities, working with partners to guide implementation of East Bay Energy Watch programs delivering energy efficiency services to local businesses, promoting green building construction, installing more than six megawatts of solar electric panels, and working with partners to submit successful proposals for Stimulus grants to support new programs.

A number of other actions, currently underway or planned for implementation, are recommended for completion in the next three years. These actions include:

- Adopt a Green Building Ordinance for Private Development
- Offer Property Based Energy Financing
- Launch a Downtown Commercial Retrofit Program
- Launch a Residential Green Retrofit Program
- Conduct a Multi-Family Affordable Housing Retrofit Pilot
- Expand Weatherization Program Delivery
- Weatherization and Energy Retrofit Loan Program
- Implement Advanced Operating Procedures for City Facilities
- Retrofit City Facilities to Improve Energy Performance

Following are descriptions of each of these priority actions, along with information regarding implementation status.

Priority Actions

PA 7. Adopt a Green Building Ordinance for Private Development

(BE-1) Adopt a green building ordinance for residential and commercial private development new construction projects & requiring high levels of energy performance.

(BE-3) Include all significant renovation projects in the proposed green building ordinance for residential and commercial private development projects requiring high levels of energy performance.



Description:

By adopting a green building ordinance for private development, Oakland has the opportunity to ensure that new construction and major renovation projects are constructed in a manner that



reduces future operational energy and water use, transportation and waste disposal impacts, and associated GHG emissions. Such a policy can build from the City's existing Civic Green Building Ordinance and adopted green building standards for new affordable housing developments receiving funds through the annual housing Notice of Funding Availability.



Development of a draft green building ordinance for private development has been underway for more than a year. A number of workshops have been held to gather public and targeted industry input on the proposed ordinance, including affected building types, thresholds and requirements, and implementation process. Existing staff resources continue to be sufficient for development of the ordinance, though implementation may require additional training for select City staff, as well as the creation of new compliance guidance documents and process adjustments.

Once the ordinance is adopted, implementation tasks will include: updates to related content on the City's website (e.g., the ordinance, FAQs, links to helpful information); updates and maintenance of application forms and process documents; creation of a how-to manual for the public and training manual for City personnel; and development of compliance monitoring and enforcement procedures. All building and planning staff will need to receive additional training to supplement green building code training provided recently with ARRA funding support. Building inspectors will also receive training tailored for energy "raters" to maximize understanding of how to work with third-party raters. Refresher courses are expected to be available from third-party organizations (e.g., StopWaste.Org) at no cost to the City.

Responsibility: Planning, Building Services

Status: The City adopted the Green Building Ordinance in October 2010.

PA 8. Offer Property-Based Energy Financing

(BE-4) Offer property-based financing and associated outreach for energy efficiency and solar improvements to residential and commercial property owners in Oakland, supported by ARRA funding.



Description: Starting in 2010, Oakland building owners will have a new way to pay for energy and water efficiency and solar energy improvements to their commercial and residential properties. Property owners who enroll in the voluntary CaliforniaFIRST program will be able to receive upfront financing for authorized energy upgrades through a loan that stays with the property. Participants will repay the loan over a 10-to-20 year period as a line item on their property tax bill. By choosing cost-effective energy upgrades, property owners may be able to reduce their utility bills by an amount greater than the loan repayment obligation, creating a net positive cash flow while greening their facilities.

The California FIRST financing program will help to enhance the effectiveness of other commercial and residential energy efficiency and solar programs. Property-based financing is anticipated to expand the number of retrofit projects and to encourage many projects to seek deeper levels of energy savings. California FIRST will be augmented during the next three years by an anticipated grant from the California Energy Commission's (CEC) State Energy Program. This grant will cover program setup costs and buy down interest rates to make the financing more attractive to property owners.

The City has no formal role in the administration of the CaliforniaFIRST financing program. City staff will however continue to advise development of the program and will assist in marketing and outreach with partner agencies.

Responsibility: Environmental Services, Planning, Building Services

Status: The City is participating in efforts to develop and launch the CaliforniaFIRST program on a statewide basis. The launch of this program has been delayed due to concerns expressed by the secondary lending market. Efforts are currently underway by program partners to resolve remaining barriers and establish the program, but no timeline for program launch is currently available. The City will promote CaliforniaFIRST through available channels once the program has launched.

PA 9. Launch a Downtown Commercial Retrofit Program

(BE-12) Offer enhanced incentives and technical assistance through the “Oakland Shines” program to help downtown commercial property owners improve energy efficiency, supported by ARRA funding.

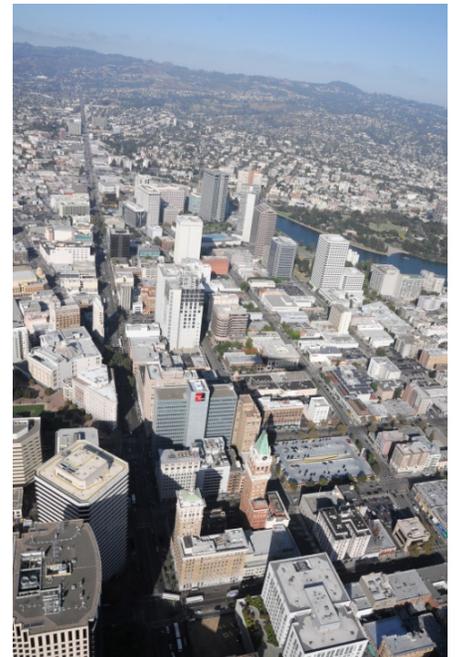


Description: Oakland’s 120-block downtown area is targeted for energy upgrades through concentrated outreach, technical assistance and hefty rebates for energy efficiency improvements. “Oakland Shines” will emphasize improvements to Class B buildings as part of its goal to reach 80% of businesses in downtown Oakland. Energy efficiency upgrades can help building owners reduce energy use and costs, and make their buildings more attractive to tenants.

“Oakland Shines” is funded by a \$4.8 million ARRA grant. It will be administered by a team of local energy consulting firms.

Responsibility: Economic Development, Environmental Services

Status: The CEC is issuing contracts. It is anticipated that this program will launch in January 2011.



PA 10. Encourage Participation in Local Energy Efficiency Programs

(BE-13) Encourage local small businesses and residents to participate in local energy efficiency programs offered through the East Bay Energy Watch regional collaboration between PG&E and East Bay cities.



Description: The City will encourage businesses to improve building energy performance by an average of 20% by enrolling in local energy efficiency programs such as Smart Lights and taking advantage of other PG&E programs and incentives for energy improvements. Smart Lights is administered as a component program of East Bay Energy Watch, a collaborative partnership program offered by PG&E and several East Bay cities. The Smart Lights program facilitates cost-effective lighting efficiency improvements for retail and small businesses in Oakland, offering expert advice and coordinating lighting retrofit implementation.

In addition to Smart Lights, the East Bay Energy Watch program also supports youth training in energy efficiency and offers entry-level residential energy efficiency services through its work with California Youth Energy Services (CYES).

Responsibility: Environmental Services

Status: The City is currently collaborating with East Bay Energy Watch; working with program administrator Quantum Energy Services and Technologies, PG&E, SmartLights, CYES and other East Bay Cities to guide delivery of the program.

PA 11. Launch a Residential Green Retrofit Program

(BE-21) Launch “Energy Upgrade California in Alameda County”, a new energy retrofit program to improve energy efficiency of existing single-family and multi-family residential properties, supported by ARRA funding.



Description: Under the leadership of the Association of Bay Area Governments and StopWaste.Org, Oakland is partnering with other local governments and agencies throughout Alameda County and across the region to develop a new residential green retrofit program. This program will foster energy efficiency, water conservation and other green improvements of existing single-family and multi-family residential properties in Oakland and throughout Alameda County. The program will perform outreach to promote green improvements; provide green construction technical guidance; create a green contractor certification system; connect homeowners, landlords and tenants with financing options (e.g., property-based financing); and providing quality assurance support. The program will also promote the value of third-party certification of energy and green building improvements.

This program was seeded by contributions from local governments throughout Alameda County in 2009. The funding enabled the development of green building technical guidance for single family residential retrofits. The CEC State Energy Program is funding the current activities of Energy Upgrade California in Alameda County. City staff will participate in a regional coordinating committee to optimize program design and will help to promote the program within Oakland.

Responsibility: Environmental Services, Planning, Housing & Community Development

Status: The City is participating in the regional effort including discussions, reviewing draft documents and coordinating the program with other City efforts. This program is scheduled to launch in winter 2010/11.

PA 12. Conduct a Multi-Family Affordable Housing Retrofit Pilot

(BE-22) Create an energy retrofit pilot program targeting multi-family affordable housing by providing funds to reduce risk and enable the acquisition of private investment capital to implement energy savings projects, supported by ARRA funding.



Description: This innovative pilot program will provide forgivable loan funds to be repaid from anticipated energy savings to reduce risk and encourage investment of private capital in multi-family affordable housing energy retrofits. Reduced risk is expected to encourage private capital investment which, when combined with other existing incentives, will support new energy retrofits of multi-family affordable housing properties.

This pilot program will move forward with anticipated funding from a CEC State Energy Program grant. Oakland partnered on a proposal with the San Francisco Mayor’s Office of Housing to develop and launch this pilot program. The program will foster energy retrofits of an estimated 400 units in Oakland by the close of 2012, improving average energy efficiency of participating units by approximately 20%. In the process, the City will participate in State and regional efforts to develop programs and protocols for implementing and evaluating energy retrofits in multi-family housing.

Responsibility: Housing and Community Development

Status: The City is refining the program implementation plan with the partner cities and affordable housing project stakeholders. The program is expecting to begin soliciting private capital in fall 2010.

PA 13. Expand Weatherization Program Delivery

(BE-23) Augment delivery of the existing federal Weatherization Assistance Program with supplemental ARRA funds designated for retrofitting additional homes in Oakland over the next three years.



Description: The City will expand the number of homes in Oakland receiving energy- and cost-saving weatherization services during the next three years. Several hundred low-income homes already receive weatherization assistance each year through delivery of the existing federal Weatherization Assistance Program (WAP) as well as targeted PG&E programs. The American Recovery and Reinvestment Act has recently made approximately \$1.6 million of additional funding available to Oakland through 2012 for weatherization services. These funds will be used to enhance and expand delivery of weatherization services to implement energy retrofits of approximately 250 multi-family and single family homes occupied by low-income households.

Weatherization services currently offered through existing WAP programs administered by Spectrum Community Services, Inc. and the Low Income Energy Efficiency program administered by PG&E will also continue to operate.

Responsibility: Housing and Community Development

Status: The City is currently refining program implementation plans with California Community Services and Development and expects to begin offering services for low-income households by fall 2010.

PA 14. Launch the Weatherization and Energy Retrofit Loan Program

(BE-23) Create the Weatherization and Energy Retrofit Loan Program (WERLP) to provide zero-interest loans to help low-to-moderate income residents improve energy efficiency and reduce energy costs, supported by \$1.8 million of ARRA Community Development Block Grant (CDBG) funds.



Description: The WERLP offers loans of \$6,500 to \$30,000 to owner-occupied low-income and moderate-income households. Loan funds can only be used for energy efficiency-related improvements such as attic insulation, caulking, weather-stripping, water heater insulation, energy-efficient light fixtures, furnace maintenance, energy saving appliances, and systems rehabilitation and replacement. Eligible systems include the furnace, windows, doors, water heater and roof. Loans are interest free and repaid upon sale of property without any periodic payments.

This program expects to serve 75 homes by the end of 2012, with a goal of reducing energy bills by 30% on average, while generating 108 jobs and connecting with trainees from the Oakland Green Jobs Corps. The WERLP is administered as an expanded offering of the City's Lending and Rehabilitation Services.

Responsibility: Housing and Community Development

Status: The program is active and the City is coordinating with local professionals in the building performance industry to ensure that training opportunities are available to local contractors. The City is also working to ensure that the energy retrofits are performed to industry standards.

PA 15. Create an Oakland-Specific Water-Efficient Landscaping Ordinance

(BE-32) Create an Oakland-specific Water Efficient Landscape Ordinance (WELO) to address water conservation.



Description: The City will create an Oakland-specific WELO providing citywide standards for public space that ensure stormwater retention and water conservation features are incorporated into landscaping. The Oakland-specific WELO will be designed to implement California's new model WELO and align with Bay Friendly Landscaping Guidelines.

Responsibility: Strategic Planning

Status: The City plans to begin work on this action within the next three years.

PA 16. Implement Advanced Operating Procedures for City Facilities

(BE-42) Enhance and implement standard operating procedures to improve energy efficiency in City facility operations.



Description: Continuous improvement of written standard operating procedures (SOPs) is necessary to ensure that City facilities operate with superior energy efficiency. New and enhanced written SOPs will be developed through interdepartmental collaboration and added to existing standards the Public Works Agency has used successfully to sustain American Public Works Association accreditation. These SOPs will cover a range of topics including utility cost reporting, energy efficiency retrofitting, direct digital controls, lighting equipment maintenance, and photovoltaic equipment maintenance.

Responsibility: Department of Facilities & Environment

Status: The City will deliver two to four SOPs by the close of 2011.

PA 17. Improve Energy Performance of New City Facilities

(BE-43) Modify the City’s Civic Green Building Ordinance to increase energy efficiency standards for new construction and major renovation of City facilities.



Description: The City will modify energy efficiency requirements within the Civic Green Building Ordinance to increase energy efficiency for new construction and major renovations of municipal facilities. Enhanced requirements may include controls for limiting demand for electricity and natural gas during periods of high pricing or low power availability.

Responsibility: Environmental Services

Status: The City will propose ordinance modifications by 2012.

PA 18. Retrofit City Facilities to Improve Energy Performance

(BE-44) Perform energy efficiency upgrades to existing City facilities, supported by ARRA funding.



Description: The City will retrofit existing municipal facilities to improve energy efficiency and reduce operating costs. Several energy retrofit projects have been funded by the ARRA Energy Efficiency and Conservation formula block grant. These projects include modifications to the Police Administration Building’s lighting, heating, ventilating and air conditioning (HVAC) equipment; the City Administration Building automated HVAC controls; Data Center servers; and lighting systems throughout City facilities.

Responsibility: Environmental Services, Building Services

Status: The projects described above are underway now with completion expected by 2012.

Material Consumption and Waste

The manufacture, transport, use and disposal of material goods represent a major source of GHG emissions. While many of these emissions do not occur within Oakland’s geographic boundaries, consumption and disposal decisions made by each member of the Oakland community play a major role in the creation of these GHG emissions.

The Oakland City Council adopted a Zero Waste Goal in 2006, calling for a 90% reduction in waste sent to landfill by 2020. The City’s Zero Waste Strategic Plan outlines strategies for meeting this goal. These strategies prioritize “systems” solutions to reduce landfilled waste, and expand waste reduction, recycling and composting programs. By pursuing the City’s adopted Zero Waste strategies, Oakland can help to create GHG reductions on the same order of magnitude as those related to transportation and building energy use. Because GHG emissions can affect Oakland regardless of where they are created, reducing emissions associated with materials and waste represents a significant local opportunity.

A number of tools are available to the City to reduce GHG emissions associated with material consumption and waste. These include: restructuring Oakland’s municipal code, garbage franchise agreement, and residential recycling service contracts; increasing reuse, repair, recycling and composting; advocating for statewide producer responsibility legislation, and promoting local food and material choices. Replacing energy-intensive virgin resources with energy-efficient recycled resources can create significant GHG benefits and help to address global resource depletion. Composting organic wastes can help to replace emissions-intensive, petroleum-based fertilizers with carbon-capturing, water-saving compost, and reduces toxic runoff from California’s farms. The Zero Waste hierarchy of reduce, reuse, recycle and compost can be viewed as a global energy efficiency program that significantly reduces the energy and other natural resources used to create consumer goods, from cars to packaging to food.

Oakland has already made progress in a number of these areas, adopting a Zero Waste Goal and Strategic Plan, offering residential curbside compost collection on a citywide basis, adopting a construction and demolition debris ordinance, and promoting responsible purchasing behaviors such as bringing your own bag and buying local and recycled-content products.

A number of other actions currently underway or planned for implementation are recommended for completion in the next three years. These actions include:

- Restructure the City’s Solid Waste Management System
- Refine Implementation of the City’s Construction and Demolition Debris Ordinance
- Promote Waste Reduction at Community Events
- Develop Regulations Enabling Urban Food Production

Following are descriptions of each of these actions, along with information regarding implementation status.



Priority Actions

PA 19. Restructure Solid Waste Management System

(MW-1) Restructure Oakland's municipal code, garbage franchise agreement, and residential recycling service contracts and rates structure to provide comprehensive incentives for residents, businesses, and collections service providers to reduce waste.



Description: The City has a significant opportunity to foster progress toward its Zero Waste goals and reduce GHG emissions by restructuring Oakland's solid waste management system (municipal code, rate structure, and agreements for collection, processing, and landfill). A system can be designed to provide comprehensive incentives for residents, businesses, and collection service providers to recycle more and reduce waste. These changes will help Oakland comply with anticipated future statewide mandatory recycling requirements.

This restructuring exercise may recommend adjustments to the types of materials eligible for recycling, compost, and garbage services; collection frequency; container sizes; and other issues associated with Oakland's solid waste management system. Implementation of mandatory recycling participation and/or disposal bans may also be recommended. The process will result in a system that provides waste reduction and recycling incentives not just for residents and businesses, but also for the collection, processing, transfer and landfill service providers.

The City is engaged in a Zero Waste planning process that is fully funded in this three-year planning horizon. In March 2009, the City Council adopted Evaluative Criteria for developing a new solid waste management system design that is responsive to the Zero Waste by 2020 goal.

Responsibility: Environmental Services

Status: Staff is currently preparing system options to present to City Council.

PA 20. Refine Implementation of C&D Recycling Ordinance

(MW-2) Refine implementation of Oakland's Construction and Demolition (C&D) Debris Waste Reduction & Recycling Ordinance (OMC 15.34) to capture greater amounts of materials for reuse, recycling and composting.



Description: The City will identify opportunities to improve implementation of the City's C&D Debris Recycling Ordinance. More effective implementation can help to capture greater amounts of materials for reuse, recycling and composting. Potential adjustments include improved administrative procedures, new or enhanced data management systems, increased internal training and outreach to affected projects, and coordination with verification requirements of a future green building ordinance for private development. Additional improvements may be aimed at broadening the definition of "affected projects," raising the diversion requirements for affected projects, and identifying and implementing creative incentive programs.

Responsibility: Building Services and Permit Center

Status: The City is currently developing outreach materials for the builder community, training materials for staff, and database modifications to improve program analysis of C&D Debris Recycling Ordinance implementation.

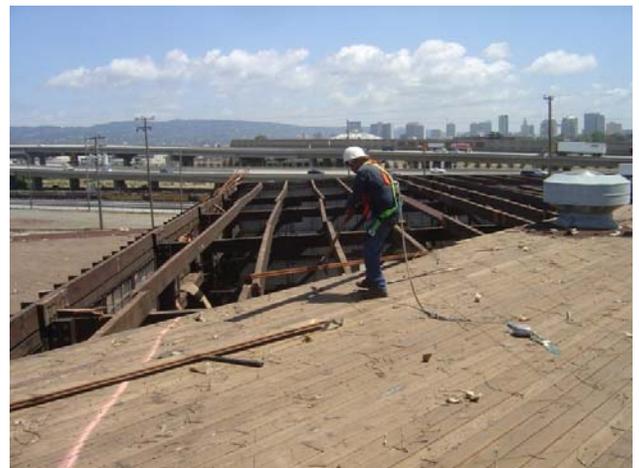


Photo: Matt Southworth

PA 21. Promote Waste Reduction at Community Events

(MW-3) Require development and implementation of waste reduction and recycling plans for all large venues and public events.

★ **Description:** The City will require waste reduction and recycling plans as part of the event permitting process, and require recycling in agreements for City facility rentals. The City will develop and implement waste reduction and recycling plans for City-sponsored events. The City is preparing compliance guides to assist event producers and venue managers in complying with State law on large event/venue recycling, providing technical assistance for compliance and event recycling equipment where appropriate.

Responsibility: Environmental Services

Status: The City has developed drafts of guides for event and venue recycling, and work on the former is nearing completion. The City has coordinated several zero waste City-sponsored events of various sizes, including the Art & Soul Festival and Bike-to-Work Day. The City is working with its event permitting system to insert new requirements for recycling, providing technical assistance to event producers on request, lending collection containers for recycling, and testing the concepts advanced in the draft guides.



PA 22. Develop Regulations Enabling Urban Food Production

(MW-17) Develop regulations that allow for the use of urban land for food production.

★ **Description:** The City will study options and develop new regulations to better allow for and regulate urban agriculture in small scale forms, civic/community gardens, and industrial forms on urban land. This analysis will explore a variety of mechanisms to enable increased local food production. Consideration will be given to issues such as soil toxicity, water access and security. The City will collaborate with the Alameda County Health Department on this effort.

Responsibility: Strategic Planning, Economic Development

Status: The City plans to begin work on this action during the next three years.



PA 23. Encourage Land Owners to Lease Space for Food Production

(MW-18) Encourage local utilities, public agencies and other large land owners to offer commercial leases to local organizations for the purpose of local food production and/or foraging.

★ **Description:** The City will encourage local utilities, public agencies and other large land owners to offer commercial leases to local organizations for the purpose of local food production and/or foraging.

Responsibility: Strategic Planning

Status: The City plans to begin work on this action during the next three years.

Community Engagement

The City has an important role to play in educating and motivating all members of the Oakland community to join in the effort to reduce energy use and GHG emissions. Through its leadership and existing communication channels, the City can help to spur the high levels of community participation needed to solve the challenge of climate change, and seed opportunities for new ideas from the community to further strengthen local efforts. In addition, the City can track and report on Oakland's progress in reducing energy use and GHG emissions, and promote local examples of model practices throughout the community.



However, while the City can put Oakland in position to reduce GHG emissions, Oakland's success in meeting its GHG reduction goals will ultimately depend on the day-to-day decisions of individuals. For example, achieving Oakland's GHG reduction goals will require all members of the community to drive an average of 20% less. Everyone will need to accomplish neighborhood trips by walking and biking, using public transit, combining trips, and telecommuting when possible. 30% of Oakland's housing stock will need to undergo energy improvements, and 30% of Oakland's businesses will need to participate aggressively in energy efficiency and recycling programs. Local organizations will have a big role to play in motivating interest and action throughout the community.

The City of Oakland can foster additional voluntary community action by setting a positive example, offering a vision of needed community actions, and encouraging and collaborating with local organizations where appropriate to accelerate progress. Achieving Oakland's GHG reduction goals will require engagement of early adopters and harder to reach residents alike. Local organizations, including community-based organizations, business, labor, educational institutions and others, can help to educate, motivate and empower the entire Oakland community to participate in and benefit from local climate action. As champions connected throughout the Oakland community, these organizations can help to build a movement around local climate action.

A number of actions that involve community engagement are recommended for completion in the next three years. These actions include:

- Expand Outreach on Energy and Climate Issues
- Partner with Local Organizations to Expand Outreach
- Convene Quarterly Community Climate Forums
- Produce An Annual Climate Progress Report
- Support Local Green Jobs Programs

Following are descriptions of each of these actions, along with information regarding implementation status.

Priority Actions

PA 24. Provide Additional Information on Energy and Climate Issues Through Existing City Channels

(CE-1) Expand the City's website, Green Building Resource Center, and other outreach channels to provide more comprehensive and action-oriented information regarding opportunities to reduce energy use and GHG emissions.



Description:

The City can accelerate community action by enhancing its use of existing outreach channels. For example, content on the City's website can be enhanced to report on Oakland's progress toward reducing GHG emissions; highlight model practices and examples of leadership throughout the community; illuminate opportunities for the community to provide input to relevant City planning documents, policies and programs; and provide action-oriented recommendations for community consideration at home and work.

Other outreach channels can also be enhanced. For example, the City could expand green building information provided through its Green Building Resource Center located near the Planning and Building counters in the Dalziel Building at 250 Frank H. Ogawa Plaza. The City can also expand its promotion of the Alameda County Green Business Program, and encourage more businesses to become certified. The City can provide additional information via annual events such as EarthEXPO, Bike to Work Day, and the Art and Soul Festival.

Responsibility: Environmental Services

Status: New content is being developed for the City’s Green Building Resource Center and green building pages on the City’s website. The City also recently launched the Oakland Green Map, helping members of the Oakland community to find local green resources such as farmers markets, green businesses and bikeways. Further improvements will be made in the process of the current re-design of the City’s website. Energy and climate content on the City’s website can be found by visiting www.sustainableoakland.com.

PA 25. Expand Outreach on Energy and Climate Issues Through Partnerships with Local Organizations

(CE-2) Partner with community-based organizations, neighborhood associations, business associations, and others to promote local climate action throughout the community through new and traditional channels.



Description: By partnering with local organizations, the City can more efficiently and effectively reach the community to foster engagement on energy and climate issues. This outreach can highlight and encourage the community to take advantage of existing climate action programs. It can also help to educate and motivate community members to make additional changes to reduce GHG emissions in the areas of: energy efficiency and conservation at home and work; alternative transportation options; and food and material goods consumption and disposal.



Collaborating organizations may have a geographic, topical or other focus. Examples include community-based organizations, neighborhood associations, business associations, faith-based organizations, community centers, schools and others. Their efforts might include building ongoing local networks, holding neighborhood-scale events and workshops, encouraging engagement on City policy and planning efforts, and implementing community-led demonstration projects. Basic information and messaging can be delivered to local partners for their use under existing resources. New resources would be required to help develop accessible, multi-language educational and promotional materials that collaborating organizations could utilize to support more effective outreach.

Responsibility: Environmental Services

Status: Dozens of local organizations have come together around the development of the draft Energy and Climate Action Plan, demonstrating significant organizing capacity and commitment to energy and climate issues. The City has provided information to these organizations to share through their networks. Great potential exists to enhance these collaborations to expand outreach in the future.

PA 26. Convene Community Climate Forums

(CE-10) Convene community climate forums three times per year to provide informal opportunities for members of the public and local community organizations to learn about local climate protection progress and opportunities, network and provide suggestions.



Description: The Oakland community, including those who live, work, study, shop, and/or play here, includes a wide variety of informed, dedicated individuals with the capacity to contribute ideas to speed progress on energy and climate actions. The City will convene community forums three times each year dedicated to discussion of energy and climate issues.

The community climate forums will be convened as informal meetings enabling community members to learn about energy and climate action progress and opportunities, network, and provide suggestions to City staff and each other. These forums can also provide a venue for partnering organizations to make presentations on related issues.

Responsibility: Environmental Services

Status: Community climate forums will be convened following adoption of the ECAP.

PA 27. Report on Energy and GHG Reduction Progress

(CE-15) Report on Oakland’s progress in reducing energy use and GHG emissions on an annual basis

★ **Description:** An annual climate action progress report on the status of selected climate actions as well as key performance metrics for evaluating Oakland’s progress toward achieving GHG reduction goals will be posted to the City’s website. This report can also be provided to community organizations, associations, networks, businesses, schools, and other interested parties for further dissemination throughout the community.

Responsibility: Environmental Services

Status: Reporting on progress as described can be accomplished with existing resources.

PA 28. Support Local Green Jobs Programs

(CE-20) Engage with local green jobs training providers to coordinate strategic planning and encourage programs to develop local workforce capacity and assess, train and place local residents to perform energy retrofits and other green improvements.

★ **Description:** Many of the actions recommended in the draft ECAP have the potential to create demand for new local green jobs. Examples of such actions include: constructing green buildings; retrofitting existing buildings; installing solar panels; creating new bikeways; providing recycling services; growing more local food; and installing water-efficient landscaping. The City will engage with the Workforce Investment Board, Green Corridor partners and local green jobs training providers (e.g., the Oakland Green Jobs Corps) to encourage curricula and skills development in alignment with projected demand for new green workforce. These efforts can improve training opportunities for Oakland residents and help to increase the employment success of local green job program graduates.



For example, the Oakland Redevelopment Agency has funded a pilot Green Works development program with \$200,000 for the next two years in the Coliseum Redevelopment Area. Funds are being used to provide 40 East Oakland young adults with green education and training via special courses taught through the Peralta Community College District, including green landscape construction and site design. Project participants will work with local neighborhood stakeholders to help construct green landscape design-build projects that improve neighborhood parks and public places in the Coliseum area of East Oakland.

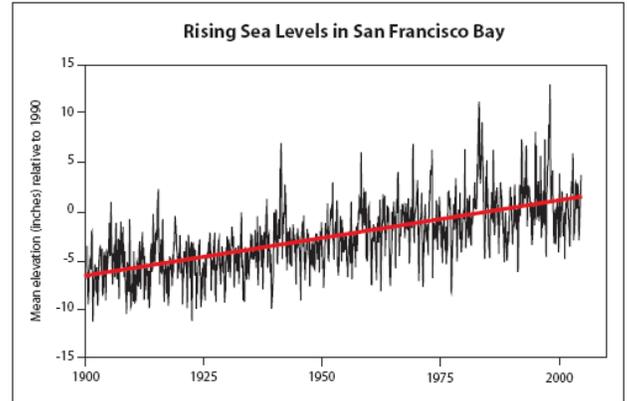
Responsibility: Mayor’s Office, Redevelopment Agency

Status: The City participates in ongoing dialogues with local green job training program providers.

Climate Adaptation and Increasing Resilience

Some impacts of climate change (e.g., sea level rise) are already starting to be observed – the result of decades of fossil fuel combustion and other activities, such as deforestation, that have already happened. It is important to engage in mitigation efforts to lessen future climate impacts and ensure those impacts do not overwhelm our ability to adapt. Taking action to adapt to climate impacts that are already happening, and will continue to happen, is also critically important.

Projected local impacts of climate change include significantly decreased snowpack in the Sierra Mountains (the source of most of Oakland’s potable water supply); rising Bay and Delta waters; increased fire danger; greater frequency and intensity of heat events; added stress on infrastructure; pricing and quality of life impacts; and ecological impacts. The State Climate Action Team has predicted that sea levels may rise between 12 and 36 inches by the end of this century.^{ix} A set of climate scenarios prepared for the California Energy Commission project that mean sea level along the California coast could rise by as much as 4.5 feet by 2100.^x According to maps produced by the Bay Conservation and Development Commission (BCDC) and Oakland-based Pacific Institute, many low-elevation areas of Oakland would be vulnerable to flood events under these scenarios.^{xi}



Climate change vulnerability is a function of exposure to climate impacts, sensitivity to those impacts, and the capacity to adapt and recover. All members of the Oakland community could be affected by some of these impacts (e.g., water use restrictions), and certain population segments may be especially vulnerable. For example, more frequent and severe heat events could exacerbate existing public health problems related to poor air quality, especially affecting the elderly and those living or working in areas with high concentrations of air pollutants. Increased fire danger is likely to affect those living in the Oakland hills, while increased flooding danger in low-lying areas is of additional concern near land or facilities containing hazardous materials. The City of Oakland will continue to work with local and regional partners to explore adaptation strategies to ensure that climate impacts are minimized.

Priority Actions

PA 29. Participate in Regional Climate Adaptation Discussions

(AD-1) Participate in discussions on climate adaptation and resilience issues with local governments and other experts.



Description:

The City will continue to develop capacity around climate adaptation and resilience by exploring relevant issues with local partners and other experts. Where possible, the City will collaborate with local organizations such as BCDC, the Pacific Institute, Climate Bay Area, and other local governments, to develop better understanding of projected local impacts of climate change; how those impacts will affect Oakland; and strategies for moving forward to advance climate adaptation and increase community resilience. The City will monitor and advise major climate adaptation efforts of neighboring cities and entities operating within city boundaries as resources permit with consideration of impacts to Oakland neighborhoods and infrastructure. The City will also collaborate with other local governments to advocate for consideration of urban issues and coastal city issues in the context of regional adaptation discussions. Existing resources will enable the City to participate in occasional meetings of ongoing regional climate adaptation discussions.

Responsibility:

Strategic Planning, Economic Development, Engineering

Status:

The City will identify local governments and other experts (including community groups with relevant expertise where appropriate) to engage in climate adaptation discussions.

Priority Actions Requiring New Resources

Putting Oakland on a steady path of progress toward achieving a 36% reduction in GHG emissions by 2020 will require the implementation of additional actions during the next three years (2010-2013), beyond those recommended for completion under existing and anticipated resources described in the last chapter.

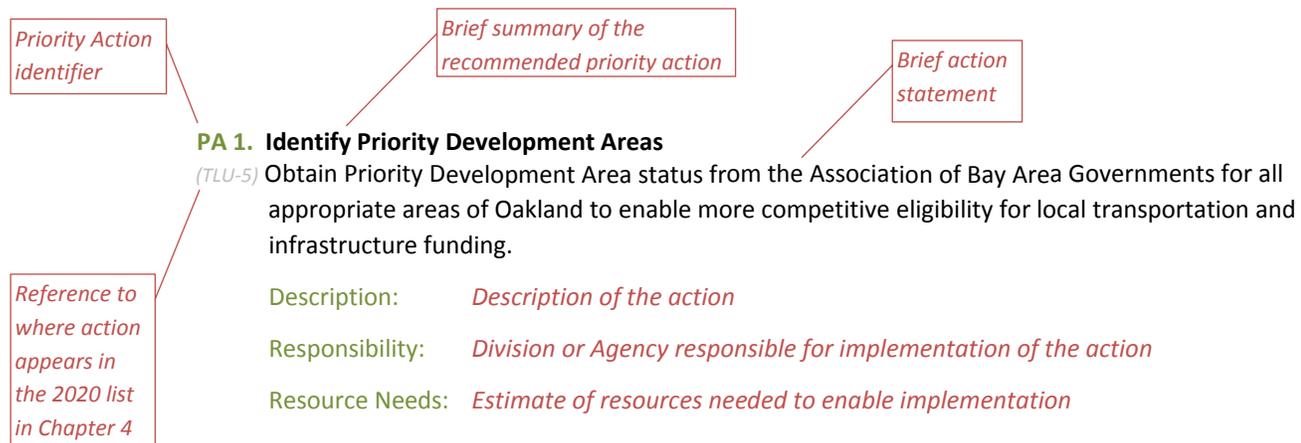
The City should pursue resources to enable implementation of this set of prioritized actions. The action recommendations presented below will move forward if new resources can be found.

These recommendations were developed based on Council-approved criteria used to assist with evaluation and prioritization of potential GHG reduction actions within the ECAP:

- GHG Reduction Potential
- Implementation Cost and Access to Funding
- Financial Rate of Return
- GHG Reduction Cost Effectiveness
- Economic Development Potential
- Creation of Significant Social Equity Benefits
- Feasibility & Speed of Implementation
- Leveraging Partnerships
- Longevity of Benefits

How to Read This Section

Each action is presented through a standard format containing each of the following elements.



Resource Requirements

Resource needs are summarized for each recommended action. The total average annual cost associated with implementing all of these proposed Three Year Priority Actions is projected to be approximately 21 additional staff FTE (2.5 of which can be funded with identified external funds), and an additional \$9 million per year for related expenses (e.g., consultant support). The City will continue to pursue fundraising opportunities for unfunded priority actions.

Transportation and Land Use

The following priority actions are proposed for implementation in the next three years. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Transportation and Land Use priority actions is projected to require an average of approximately 10 additional FTEs (2.5 supported by external funds) and an additional \$6.3 million for annual expenses over the next three years, including \$5.5 million per year for fleet replacement.

PA 30. Develop a Comprehensive Transportation Policy Plan

(TLU-2) Prepare a comprehensive, Oakland Transportation Plan in close collaboration with regional agencies, local service providers, and the community.

Description: The City will seek resources to prepare a comprehensive Oakland Transportation Plan in close collaboration with regional agencies and local service providers (e.g., MTC, AC Transit, BART, AMTRAK) that:

- Provides a new comprehensive vision of how transportation systems throughout Oakland will be developed to meet the needs of people and business, and addressing all modes of travel while minimizing greenhouse gas emissions and air pollutants associated with the transportation sector;
- Plans for transportation infrastructure management under the City's control (e.g., roadways, development around existing transit hubs, alternative transportation infrastructure) in a manner that updates and reinforces the City's existing Land Use and Transportation Element (LUTE) and "Transit First" policy; and,
- Creates a public transit master plan recommending process, program and policy changes designed to significantly increase transit utilization throughout the community, including establishment of transit-oriented land use planning criteria, policies that ensure safe walking and biking access to transit, transit service performance goals and agency implementation responsibilities.

A comprehensive transportation plan will lay a critical foundation for effective transportation planning that not only reduces GHG emissions and other pollutants, but ensures that resources are allocated effectively and efficiently to ensure the best delivery of transportation options and services to all members of the community. This plan will enhance applications for future funding, increase the City's ability to work with external transit agencies on planning and problem solving, and support Oakland's economic development.

Development of a comprehensive Oakland transportation plan would require a minimum of 4 transportation planning FTE for the next three years.

Responsibility: Transportation Services, Strategic Planning, Redevelopment

Resource Needs: 4 FTE for 3 years



PA 31. Improve Transportation & Land Planning Integration in Every Planning Effort

(TLU-3) Require the integration of land use and transportation planning and consideration of GHG reduction opportunities in every planning, major project and redevelopment effort undertaken by the City.

Description: In addition to creating a citywide comprehensive transportation plan, the City will seek resources to reduce long term vehicle miles traveled (VMT) and associated GHG emissions by ensuring that all City planning efforts fully integrate attention to land use and transportation. A number of planning and policy documents (e.g., specific plans for geographic areas) affect land use, transportation and development decisions. Where appropriate, the City can ensure that each such process results in projects that encourage dense, transit-oriented, mixed-use development including housing, retail services and/or employment opportunities centered on transit hubs and corridors.

New development in Oakland, including transit-oriented development, has the potential to benefit communities (e.g., via economic revitalization, reduction in VMT) and has the potential to adversely impact communities (e.g., via displacement, local environmental impacts). The City will make efforts to plan for new development with consideration of these issues.

Integrated planning will include establishing transportation performance goals (e.g., vehicle miles traveled per service population, citywide mode share) for planning efforts and projects consistent with citywide transportation performance goals. Other process improvements may include new requirements for analysis, reporting, and a public review process that addresses not only land use, but the transportation impacts and opportunities to reduce GHG impacts of projects. These changes can also assist the City in clarifying regional funding priorities in relationship to local projects and support evaluation of local and regional transportation planning and funding processes.

Responsibility: Transportation Services, Strategic Planning, Economic Development, Redevelopment

Resource Needs: Variable depending on the level of planning and projects undertaken. For the next three years, the minimum staff requirement to provide minimal transportation planning would be 2 FTE.

PA 32. Create and Adopt a Transportation Impact Fee to Support Implementation

(TLU-7) Adopt a transportation impact fee to support new local low-carbon transportation infrastructure.

Description: The City will seek resources to conduct the necessary research and analysis to enable the adoption of a Transportation Impact Fee (TIF) to support low-carbon transportation infrastructure and planning. A TIF can be used to assign the costs of added vehicle trips to new development, which currently does not pay an appropriate share of the infrastructure or transportation improvements necessary as a result of new development. The TIF will clarify how Oakland will enhance its existing transportation systems and support the development of key infrastructure for future transportation systems, and connect City policy to the City budget and Capital Improvement Program. Adopting a TIF can also expedite permit processing for development projects, and align City policy with neighboring jurisdictions.

Responsibility: Transportation Services, Strategic Planning, Engineering, Building Services

Resource Needs: 0.5 FTE for 2 years, plus \$900,000 of expenses (all costs can be tracked and repaid upon capture of fees through the program)

PA 33. Update Local CEQA Standards to Reduce Emphasis on Congestion Impacts

(TLU-15) Update the process for evaluating local environmental impacts resulting from new development to prioritize consideration of vehicle miles traveled (VMT) impacts above congestion impacts.

Description: The City will seek resources to update the process for evaluating local environmental impacts resulting from new development as required under CEQA. These updates will prioritize consideration of VMT impacts above congestion impacts.

CEQA regulations that have required local jurisdictions to analyze and emphasize reductions in traffic congestion are one significant, but hidden, basis for our ever-expanding auto-oriented transportation network. When new plans or new projects are required to perform an environmental review, invariably the proposed growth leads to additional auto trips. These trips then must be mitigated, if possible. Often this mitigation takes the form of road widening, expanding lanes, adding turn lanes, and finding other ways to speed up traffic and avoid delays. Mitigation actions may encourage more driving, with associated emissions and pollution.

A recent update to State CEQA regulations now gives local jurisdictions the option of developing new criteria for assessing trip impacts. These updates could provide a money-saving incentive to developers, encouraging the design of projects to reduce auto dependence and rely on transit, bicycle and pedestrian networks. Clarification and simplification of the City’s CEQA guidelines will enable a faster and more streamlined review process for economic development that is consistent with the policies of the Land Use and Transportation Element of the General Plan.

The City is seeking resources to update the process used for evaluating environmental impacts of new plans and projects.

Responsibility: Transportation Services, Strategic Planning

Resource Needs: 0.5 FTE for 2 years

PA 34. Accelerate Completion of Bicycle and Pedestrian Plans

(TLU-16) Accelerate the completion of bicycle and pedestrian networks as noted in the Bicycle and Pedestrian Master Plans and other General Plan policies to provide safe, healthy transportation choices for all residents.

Description: The City is seeking resources to accelerate the completion of bicycle and pedestrian networks as noted in the Bicycle and Pedestrian Master Plans and other General Plan policies to provide safe, healthy transportation choices for all residents. Improvements that would increase access to transit, transportation linkages, jobs and commercial activity in disadvantaged neighborhoods are prioritized. The Pedestrian and Bicycle Plans already include processes for updating priorities to include new infrastructure opportunities.



Project development and personnel costs are largely funded by external grants. Additional external grants are available to support additional FTEs. The level of increased staff capacity recommended below would enable the City to double the amount of bicycle facilities it currently produces annually.

Over time, full implementation of the Bicycle Master Plan is projected to cost approximately \$38 million.^{xii} Full implementation of the Pedestrian Master Plan is projected to cost approximately \$50 million.^{xiii}

Responsibility: Transportation Services

Resource Needs: Creation of 2.5 FTE Transportation Services positions offset by external funds to accelerate implementation

PA 35. Establish Alternative Mechanisms for Meeting Parking Requirements

(TLU-28) Develop regulations that would permit parking requirements to be met through alternative approaches demonstrated to reduce parking demand and GHG emissions.

Description: The City will seek resources to conduct a comprehensive review of parking policy regulations for new development. New regulations will be developed for parking requirements in the planning code pertaining to new development on private property. These regulations would permit parking requirements to be met through alternative approaches demonstrated to reduce demand for parking and GHG emissions. These approaches may involve a range of transportation demand management strategies, including on-site car-share vehicles, secure bicycle parking and showers, and subsidized transit passes.

Responsibility: Transportation Services, Strategic Planning, Redevelopment

Resource Needs: 0.5 FTE for 3 years, plus \$250,000 of expenses

PA 36. Conduct a Citywide Dynamic Parking Pricing Study

(TLU-29) Conduct a citywide dynamic parking pricing study to develop a strategy for creating adjustable parking rates at City meters and garages that can: influence drivers to reduce vehicle trips; provide adequate parking supply; encourage economic development; and fund alternative transportation improvements.

Description: The City is applying for a \$50,000 grant to conduct a study of innovative parking pricing and policy approaches for public facilities (on city streets and in City-owned garages). This grant, if received, will begin this study, but more resources will be necessary in order to implement a program citywide.

Current City policy does not recognize differential parking demand between areas of the city, and applies a uniform parking pricing system. This study will recommend adjusting prices based on supply and demand to maximize parking performance. Pricing can be an effective tool for reducing trips and maximizing alternatives to driving, and can help to encourage economic development as well as create new revenue for alternative transportation improvements and neighborhood improvements.

Responsibility: Transportation Services, Strategic Planning, Finance

Resource Needs: 0.5 FTE for 1 year in Transportation Services, plus \$250,000 of expenses

PA 37. Plan for Electric Vehicle Infrastructure

(TLU-33) Participate in regional electric vehicle infrastructure planning and develop new processes to support local use of electric vehicles.

Description: The City will seek resources to address electric vehicle infrastructure planning and develop new processes to facilitate community adoption of electric vehicle technologies. The City is already partnering with other Bay Area cities and other partners in an effort to make the Bay Area the electric vehicle capital of the United States.

Achieving this vision will likely require planning and implementation of electric vehicle charging infrastructure in publicly accessible locations throughout the community, including industrial zones and transit village areas where infrastructure improvements are being contemplated. It will also require increased institutional capacity and changes, such as new permitting processes to enable private residents and businesses to install charging infrastructure.



The City will also seek to add electric vehicles, plug-in hybrid vehicles and supporting charging infrastructure to the municipal vehicle fleet.

Responsibility: Equipment Services, Transportation Services, Building Services

Resource Needs: 0.5 FTE for 2 years, plus \$100,000 of expenses

PA 38. Develop an Urban Forestry Master Plan

(TLU-45) Develop an urban forestry master plan outlining how the City will protect, develop and maintain diversified and appropriate tree plantings on City right-of-ways.

Description: The City will seek resources to develop an urban forestry master plan outlining how the City will protect, develop and maintain diversified and appropriate tree plantings on City right-of-ways in a manner consistent with Bay Friendly Guidelines. This plan will include: the criteria and process for planting of new trees; the maintenance priorities and process for existing trees; and establishing clear roles for the City and community partners.



Responsibility: Department of Operations and Infrastructure

Resource Needs: 0.5 FTE for 1 year

PA 39. Accelerate City Fleet Vehicle Replacement

(TLU-52) Increase the rate of fleet vehicle replacement to retire older inefficient vehicles and continue to replace vehicles with fuel efficient and alternative fuel models.

Description: The City will seek resources to accelerate the rate at which it replaces fleet vehicles, creating increased opportunities to improve fuel efficiency and reduce GHG emissions associated with the municipal vehicle fleet. While proper maintenance can help to preserve vehicle fuel economy, the greatest technological opportunity to reduce GHG emissions associated with the City’s vehicle fleet is at the point of purchasing new vehicles. The City’s adopted Clean Fleets policy requires that vehicles achieving superior fuel efficiency and/or operated on alternative fuels (e.g., compressed natural gas, electric and plug-in hybrid vehicles, trucks with anti-idling controls) be given preference in the procurement of new vehicles. However the recent pace of vehicle replacement has not offered many opportunities to improve overall fleet fuel efficiency.

According to the April 2009 Public Works Agency Performance Audit, the City should “Prepare a five-year equipment replacement plan for the City’s fleet for a review by the operating departments and the Budget Office. The City should increase its funding for the replacement of the equipment fleet by \$5.5 million annually.”^{xiv} The Performance Audit recognizes that the City does not currently have funding to meet these needs.

Responsibility: Equipment Services

Resource Needs: \$5.5 million annually

PA 40. Subsidize Transit and Transportation Alternatives for City Employees

(TLU-53) Provide subsidized transit passes and/or other alternative transportation benefits to City employees to encourage alternatives to driving.

Description: The City will seek resources to provide subsidized transit passes and/or other alternative transportation benefits (e.g., bicycle commuter allowances) to City employees to encourage alternative modes of commuting. The City already participates in the Commuter Check program, offering employees the opportunity to make pre-tax purchases of transit passes for rides on BART and AC Transit. Providing additional transit incentives can be effective at encouraging more employees to use transit for commuting to work.

For example, unlimited use subsidized transit passes can be provided to City employees through participation in the AC Transit Easy Pass program. Likewise, the City could also provide additional benefits to employees who choose to bike or walk to work, such as bicycle commuter or shoe allowances.

Responsibility: Transportation Services, Human Resources – Benefits

Resource Needs: 0.25 FTE in Transportation Services and 0.25 FTE in Human Resources personnel for 1 year, plus \$330,000 of expenses for participation in the Easy Pass program

PA 41. Discontinue Subsidizing Parking for City Employees

(TLU-54) Discontinue the practice of providing parking to City employees based in transit-served locations.

Description: The City will seek resources to discontinue the practice of providing parking to City employees based in transit-served locations. Granting employees parking spaces and additional parking subsidies fosters automobile reliance and use. The City can demonstrate leadership by reducing the number of employees receiving subsidized parking in transit-rich areas of the City. This may result in an increased number of parking spaces available for public use.

This change is projected to save approximately \$450,000 per year in reduced parking subsidies.

Prior to adopting such a policy, the City would need to satisfy any obligations it may have to meet unions representing affected employees.

Responsibility: Human Resources, Transportation Services, Equipment Services

Resource Needs: 0.25 FTE Human Resources and 0.25 FTE Transportation Services for 1 year. Cost of additional pool cars and/or transit subsidy options would be additional

Building Energy Use

The following priority actions are proposed for implementation in the next three years. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Building Energy Use priority actions is projected to require an average of approximately 9 additional FTEs and an additional \$2 million for annual expenses over the next three years.

PA 42. Engage Largest Electricity Consumers in Energy Retrofits

(BE-14) Offer technical assistance to help Oakland's most energy intensive businesses achieve superior energy efficiency results by participating in programs offered by PG&E and other organizations.

Description: The City will seek resources to create a new program that guides the approximately 400 businesses that consume 50% of the electricity used in Oakland into existing energy auditing, water conservation and rebate programs offered by PG&E and other organizations. These 400 firms represent approximately 10% of Oakland's medium-to-large businesses, with 30 of them consuming over 25% of total citywide electricity. This program will engage each targeted business to create an energy efficiency and demand reduction strategy, or roadmap, tailored to that business' opportunities and circumstances, aiming at average annual energy savings of at least 20%. Estimated collective energy costs savings are \$28 million per year.

Implementing this program will require extensive outreach to Oakland's ~400 biggest energy users. The program will aim to secure participation from property owners, tenants and building management companies. The program will create customized roadmaps encouraging businesses to participate in all applicable PG&E energy efficiency and conservation programs and EBMUD water conservation programs, to perform comprehensive energy and water audits, and to implement all cost-effective retrofit opportunities. Property owners would pay for implementing the improvements, factoring in the benefits of rebate programs from PG&E and others. PG&E, East Bay Energy Watch, StopWaste.Org and EBMUD will be among the organizations invited to collaborate and coordinate closely on this program. Some projects may take advantage of property based financing (see PA 8).

Responsibility: Business Development

Resource Needs: 3 FTE for 3 years, plus \$1.5 million of expenses

PA 43. Market Energy Retrofit Opportunities to All Oakland Businesses

(BE-13) Develop a marketing campaign to encourage 30% of businesses to improve building energy performance by 20% and reduce water consumption by enrolling in programs and taking advantage of incentives offered by PG&E and other organizations.

Description: The City will seek resources to create a marketing campaign and offer technical assistance to encourage 30% of Oakland's businesses to implement energy retrofits achieving 20% energy efficiency improvements. Businesses will be encouraged to participate in all applicable programs offered by PG&E and others to receive further assistance and rebates.

Responsibility: Business Development

Resource Needs: 0.5 FTE for 3 years, plus \$2 million of expenses



PA 44. Create a Renter-Occupied Residential Energy Retrofit Program

(BE-24) Create a new energy retrofit program to facilitate energy efficiency and water conservation improvements in existing renter-occupied residential properties by supporting outreach as well as assistance designing model tenant-landlord agreements so that all parties equitably share the costs and benefits of energy efficiency.

Description: The City will seek resources to develop new tools and assistance to foster energy retrofits of renter-occupied properties. This will include engaging stakeholders to provide recommendations on how to ensure that both owners and tenants can be protected and receive benefits from energy efficiency retrofits so that both have an incentive to support energy improvements.

Responsibility: Housing and Community Development, Environmental Services

Resource Needs: 1.3 FTE for 3 years



PA 45. Adopt and Implement a Residential Energy Conservation Ordinance

(BE-25) Adopt an ordinance requiring cost-effective residential energy- and water-related improvements at time of sale, or under other appropriate conditions with consideration of affordability and equity.

Description: The City will seek resources needed to research and develop options for adopting a residential energy conservation ordinance (RECO). A RECO can be an effective tool for increasing energy efficiency of Oakland’s existing housing stock. The RECO can be designed to require cost-effective energy- and water-related improvements at time of sale or under other appropriate conditions, fostering continuous energy improvement of Oakland’s building stock in a manner that is beneficial for residents. Lessons can be drawn from years of RECO implementation in Berkeley. Issues of affordability and equity will be considered in the process of developing an effective and appropriate RECO. The RECO can also be designed to require disclosure of home energy performance based on past utility bills in a prescribed manner, helping to raise the profile of energy use in home buying decisions and spur additional retrofit action.

Responsibility: Planning, Building Services, Environmental Services

Resource Needs: 1.5 FTE average for each of 3 years, plus \$250,000 of expenses

PA 46. Consider Energy Benchmarking Requirements for Commercial Buildings

(BE-15) Consider requiring energy benchmarking of commercial sector buildings by a certain date.

Description: The City will seek resources to research and develop options for requiring energy benchmarking of commercial sector buildings. Benchmarking energy use can yield insights into energy performance and opportunities to save energy and money through improved efficiency and conservation. Energy benchmarking tools are available to help private building owners gain additional perspective on the relative energy use of their buildings, and where opportunities for efficiency improvements may exist. In developing options for requiring energy benchmarking the City will consider issues associated with building types, level of effort needed, verification, related educational tools, and data availability, privacy and automation potential.

Responsibility: Planning, Building Services, Environmental Services

Resource Needs: 1 FTE average for each of 3 years, plus \$250,000 of expenses

PA 47. Encourage the Creation of On-Bill Financing for Energy Retrofits

(BE-5) Engage local utilities (e.g., PG&E, EBMUD) to develop on-bill financing options for energy efficiency improvements to increase energy retrofits in tenant-occupied and other properties.

Description: The City will seek resources to participate in collaborative efforts aimed at encouraging local utilities to offer on-bill financing for building energy improvements. An effective on-bill financing option is critical to facilitating energy retrofits in large numbers of renter-occupied properties that comprise approximately half of Oakland's housing. On-bill financing may also be a valuable tool for accelerating and deepening energy retrofits in owner-occupied properties throughout the city.

Resources will be needed to research and develop viable on-bill financing concepts and pursue the development of a pilot project with PG&E and/or EBMUD.

Responsibility: Environmental Services

Resource Needs: 0.1 FTE for 3 years, plus \$105,000 of expenses

PA 48. Seek Resources to Support Energy Programs

(BE-6) Pursue funding to augment existing, and create new residential and commercial energy programs to reduce energy consumption throughout the community.

Description: The City will continue to seek resources to augment existing, and create new programs to foster a reduction in energy use throughout Oakland's residential and commercial properties. This may include opportunities offered by PG&E, California State Energy Program, Bay Area Air Quality Management District, and others. For example, the City may pursue funding to promote energy retrofits, offer free or subsidized energy audits, provide technical assistance, or provide targeted incentives.

Existing resources are sufficient for responding to a limited number of potential funding opportunities on an annual basis. Additional resources would augment the City's capacity to submit a greater number of competitive proposals.

Responsibility: Environmental Services

Resource Needs: 0.25 FTE for 3 years, plus \$150,000 of expenses

PA 49. Encourage Citywide Energy Conservation and Efficient Product Purchasing

(BE-7) Encourage all businesses and residents to conserve electricity, natural gas and water use, and to choose energy- and water-efficient replacement products.

Description: The City will seek resources to create a marketing campaign and offer technical assistance with local partners to encourage all businesses and residents to reduce their energy consumption through conservation and energy efficient product purchasing. The campaign will provide information about conservation opportunities to all households and businesses, in collaboration with outreach performed by PG&E, EBMUD, trade groups and community-based organizations. All households will be encouraged to achieve average per capita energy use targets of approximately 1,040 kWh of annual electricity consumption and 123 therms of annual natural gas consumption per person. Households currently using energy above these amounts and all businesses will be encouraged to reduce energy and water use by 5% within the next three years through conservation of electricity, natural gas and water, en route to larger conservation and efficiency goals by 2020. The campaign will also encourage the purchase of energy-efficient products and appliances to help residents and businesses reduce energy use. Achieving an overall GHG reduction of 36% with respect to citywide building energy use is estimated to require products that are 10% more efficient and persistent additional conservation efforts to reduce energy use by 16% in 2020.

Responsibility: Environmental Services

Resource Needs: 1 FTE for 3 years, plus \$2 million of expenses

PA 50. Facilitate Community Solar Programs

(BE-28) Encourage and collaborate with local partners to launch a community solar program to increase local use of renewable energy, including solar-thermal energy to produce heat and hot water.

Description: The City will seek resources to encourage and collaborate with local partners to offer a community solar program(s) promoting increased use of renewable energy. Such a program may perform outreach to residents and businesses about opportunities to utilize solar energy; provide technical assistance including opportunity assessment and procurement support; connect residents to property-secured and other financing opportunities; offer to coordinate collaborative purchasing for local installation of solar energy systems; and/or offer free energy opportunity audits and technical assistance for this purpose.

Responsibility: Environmental Services

Resource Needs: 1.0 FTE for 3 years, plus \$200,000 of expenses



PA 51. Encourage PG&E to Offer Green Power Options

(BE-29) Negotiate with PG&E to offer green power options to local customers.

Description: The City will seek resources to participate in collaborative efforts aimed at encouraging PG&E to offer green power options to local customers. The City will engage directly with PG&E and encourage PG&E to make meaningful local green power offerings available on a voluntary basis. In addition, the City will participate in the public comment process of the California Public Utilities Commission (CPUC), encouraging California utilities to offer green power options to all of their customers.

Responsibility: Environmental Services

Resource Needs: 0.05 FTE, plus \$30,000 of expenses

PA 52. Monitor Community Choice Energy

(BE-30) Continue to monitor the feasibility and utility of implementing community choice energy aggregation (CCA) in Oakland.

Description: The City will continue to monitor the feasibility and utility of implementing a CCA program in Oakland, and will seek resources to enable additional analysis of CCA if warranted. CCA may offer a powerful tool for increasing the renewable energy content of electricity consumed in Oakland. However, a number of technical, financial, legal and political issues must be addressed before moving any CCA proposal forward. New information is likely to be gained from observing early CCA efforts now underway in Marin County and San Francisco. If CCA is demonstrated as a successful model, the City will revisit program design and needed resources under revised objectives. The City encourages continued study of this issue by other partners.

Responsibility: Environmental Services, Finance

Resource Needs: 0.05 FTE per year

Material Consumption and Waste

The following priority actions are proposed for implementation in the next three years. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Material Consumption and Waste priority actions is projected to require an average of at least one additional FTE and an additional \$200,000 annually for expenses through the next three years.

PA 53. Enforce Mandatory Recycling

(MW-4) Enforce mandatory recycling and/or bans on the use, sale, or disposal of certain product types.

Description: The City will seek funds as necessary to enforce future mandatory recycling requirements or bans on the use, sale, or disposal of certain product types. It is anticipated that the State of California may mandate commercial recycling in the future, and that local governments would have a role in the enforcement of such mandates.

Responsibility: Building Services (Code Compliance)

Resource Needs: To be determined



PA 54. Conduct Residential Social Marketing Campaigns and Business Outreach

(MW-5) Conduct new residential social marketing campaigns and increased outreach to businesses and other institutions regarding waste reduction and recycling programs.

Description: The City will seek resources to conduct new residential social marketing campaigns and increased outreach to businesses and other institutions to improve participation in available waste reduction and recycling programs. Reduction of material consumption and waste requires long-term behavioral change in purchasing and discard decisions. Outreach and marketing efforts to that end will require a sustained effort to connect participants to the social good of recycling and waste reduction. The City will coordinate with StopWaste.Org to leverage resources.

Responsibility: Environmental Services

Resource Needs: 0.5 FTE for 3 years, plus \$500,000 of expenses

PA 55. Study Options for Advancing Next-Level Waste Reduction

(MW-6) Study options for advancing the next level of waste reduction activities to help achieve the City's adopted Zero Waste Goal.

Description: The City will seek resources to study and support additional actions that may be needed in the coming years to help Oakland progress toward its Zero Waste goal. These may include actions to further increase rates of recycling and composting, target particular problem materials, etc. The City will continue to collaborate with StopWaste.Org in considering potential actions to further reduce waste toward achieving Zero Waste.

Responsibility: Environmental Services

Resource Needs: 0.5 FTE for 3 years, plus \$150,000 of expenses



Photo: Matt Southworth

Community Engagement

The following priority actions are proposed for implementation in the next three years. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Community Engagement priority actions is projected to require an average of approximately 0.5 additional FTE and an additional \$450,000 for expenses over the next three years.

PA 56. Develop an Oakland Climate Action Model Practices Campaign

(CE-16) Develop a local climate action model practices campaign collaborating with local organizations to document and promote examples of local climate actions to the community.

Description: The City will seek resources to aid local organizations in promoting local model practices and encouraging widespread adoption of affordable energy and climate-friendly behaviors throughout the community. This campaign would utilize multimedia approaches to make it easier for members of the community to promote do-it-yourself actions and teach each other to implement them. Low-cost multimedia technology could be provided to local organizations to document personal and neighborhood climate actions and share them with the larger community.

Examples of actions that might be demonstrated include replacing faucets and showerheads with low-flow devices; lowering the water heater thermostat; purchasing and installing water heater insulation; repairing windows; installing a clothesline; repairing a bicycle; adding air to car tires; using web-based tools to plan trips on BART and AC Transit; identifying materials that can be recycled; building garden boxes and compost bins; and storing kitchen food scraps for composting.

Responsibility: Environmental Services

Resource Needs: 0.25 FTE for one year, plus \$3,000 of expenses

PA 57. Community Climate Action Guide

(CE-3) Develop and distribute a community climate action guide and targeted educational materials in collaboration with local organizations to inspire all members of the Oakland community to take action to reduce GHG emissions.

Description: The City will seek resources to accelerate local action throughout the community by developing and distributing new online and hardcopy materials such as a community climate action guide and other materials targeted at specific actions (e.g., why and how to adjust your water heater temperature). The City can collaborate with local organizations to distribute these materials in an effort to inspire all members of the Oakland community to take action to reduce GHG emissions.

Responsibility: Environmental Services

Resource Needs: 0.5 FTE for one year, plus \$300,000 of expenses



PA 58. Support Local Climate Workshops

(CE-4) Establish a mini-grant program to provide financial and other support to local organizations to convene neighborhood-scale or issue-based community climate action workshops.

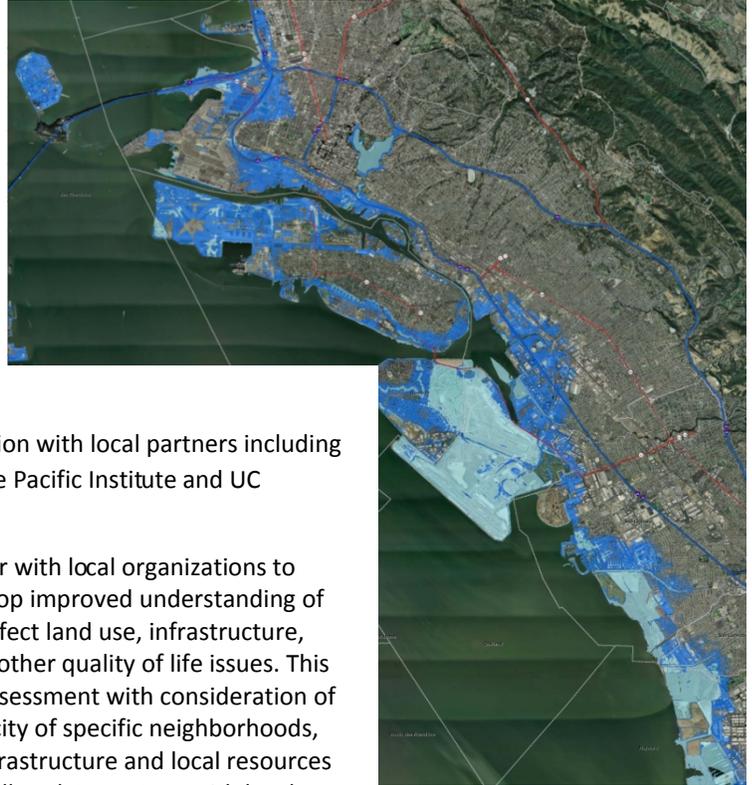
Description: The City will seek resources to accelerate community education and action by supporting local workshops and events dedicated to education and raising awareness about opportunities to address energy and climate issues and create valued co-benefits. These workshops can leverage the existing roles and relationships of collaborating organizations, and can be tailored to geographically, demographically or topically-focused segments of the community. In the process, the City can develop new understanding of how to target new programs and policies to engage all members of the Oakland community effectively and appropriately. Providing information through in-person delivery channels and forums fostering community dialogue about energy and climate issues will be critical to accelerating voluntary climate actions.

Responsibility: Environmental Services

Resource Needs: 0.25 FTE for three years, plus \$150,000 for grants

Climate Adaptation and Improving Resilience

The following priority actions are proposed for implementation in the next three years. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Climate Adaptation priority actions is projected to require an average of at least 0.5 additional FTE and an additional \$80,000 annually for expenses throughout the next three years to study and communicate with the community about climate impacts.



PA 59. Study Potential Local Climate Impacts

(AD-2) Conduct a study of all local climate impacts in collaboration with local partners including the Bay Conservation and Development Commission, the Pacific Institute and UC Berkeley.

Description: The City will seek resources to partner with local organizations to study local climate impacts and develop improved understanding of how these impacts are expected to affect land use, infrastructure, public health, the local economy and other quality of life issues. This study would include a vulnerability assessment with consideration of both projected impacts and the capacity of specific neighborhoods, population segments and affected infrastructure and local resources to adapt to those impacts. The City will seek to partner with local experts at BCDC, the Pacific Institute and UC Berkeley to study climate impacts and translate impacts in a meaningful way that can help to inform future planning decisions in Oakland. Resource needs assume that local and regional partners will act in a lead capacity for the study of climate impacts under separate funding.

Responsibility: Environmental Services, Strategic Planning

Resource Needs: 0.25 FTE for three years, plus \$30,000 of expenses

PA 60. Communicate Climate Impacts to the Community

(AD-3) Communicate information about local climate impacts to the Oakland community to develop: shared understanding; the will for personal and collective action; and local capacity to participate in development of climate adaptation strategies.

Description: The City will seek resources to develop new educational materials and perform outreach to inform the Oakland community about projected climate impacts. Developing a greater shared understanding of potential impacts will be critical to generating the will for personal and collective action that may be needed to implement future adaptation strategies, as well as the capacity of Oakland community members to engage in adaptation planning efforts. This may include developing content that could be delivered through existing channels such as the City's Citizens of Oakland Respond to Emergencies (CORE) program, planned Community Climate Forums (See PA 26), partners that deliver similar services such as Bay Area Red Cross and Alameda County Health Department, and local organizations interested in communicating about climate impacts within their networks. Content would be developed with consideration of opportunities to address identified community vulnerabilities, and tailored to specific audiences. This action would be most effective if local organizations had capacity to assist with development of messaging and delivery of content, which is outside the scope of the proposed budget.

Responsibility: Strategic Planning, Marketing, Economic Development

Resource Needs: 0.2 FTE, plus \$200,000 of expenses

PA 61. Identify and Act on Opportunities to Improve Resilience in City Plans and Policies

(AD-4) Identify potential adaptation strategies to improve community resilience to climate change, and to integrate these with City planning and policy documents and processes where appropriate.

Description: The City will seek resources to research, analyze and recommend adaptation strategies to improve community resilience to projected impacts of climate change and integrate these with City planning and policy documents and processes where appropriate. Example adaptation strategies may include:

- Considering vulnerability to flood events during the project approval process
- Storm/sewer infrastructure design criteria and upgrades in major projects
- Design requirements for new buildings in flood prone areas
- Water efficiency and conservation indoors and outdoors
- Requirements for highly reflective surfaces where feasible (e.g., rooftops, pavement) and urban forest management strategies to reduce heat island effects
- Sea walls to guard against sea level rise and flood events
- Preparedness systems for vulnerable residents
- Development of buffer zone wetlands

The City will seek to identify planning projects such as new area planning processes that could serve as opportunities to pilot appropriate adaptation strategies and development requirements to help inform future adaptation planning efforts.

Responsibility: Multiple Agencies (e.g., CEDA, PWA) based on strategies

Resource Needs: To be determined

Chapter 5

Achieving a 36% Reduction in GHG Emissions: The 2020 Plan

Over 150 separate actions are recommended for implementation by the City during the next ten years. These actions will help to put Oakland in position to achieve a 36% reduction in GHG emissions from 2005 levels in each of the three primary GHG reduction categories (Transportation & Land Use, Building Energy Use, and Material Consumption & Waste) by 2020. Most will require new resources to move forward.

This chapter includes all actions recommended for implementation to achieve a 36% reduction in GHG emissions. Actions recommended for priority implementation in Chapter 4 are included here, along with remaining actions needed to achieve the 2020 target.

As in Chapter 4, recommended actions are grouped into the three primary GHG reduction categories, along with a set of highlighted community engagement recommendations, and steps to assist Oakland in adapting to climate change, in the following order:

- Transportation & Land Use
- Building Energy Use
- Material Consumption & Waste
- Community Engagement
- Climate Adaptation & Increasing Resilience

In Chapter 5, the full list of actions recommended for implementation by 2020 is organized by thematic strategy. Targets have also been identified for key performance metrics, translating the 36% GHG reduction goal into a series of performance targets.

Further information regarding implementation coordination, monitoring, reporting and evaluation is presented in Chapter 2.

Actions to Achieve a 36% GHG Reduction

Following implementation of priority actions during the next three years (2010-2013), many actions will need to be implemented in subsequent years to position Oakland to achieve a 36% reduction in GHG emissions by 2020.

The following pages summarize all of the actions currently envisioned for implementation by 2020 to achieve this GHG reduction goal. This list may be updated every three years concurrent with the development of a new 3 Year Priority Implementation Plan.

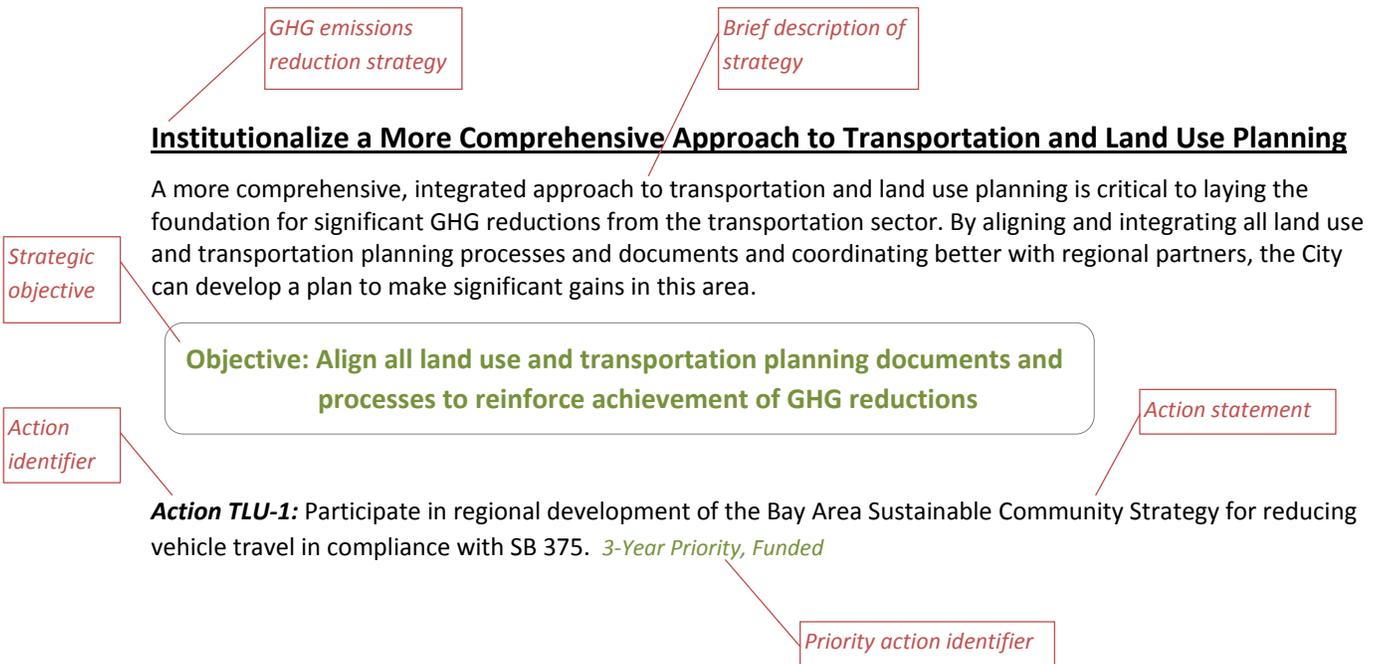
As is the case for actions recommended for priority implementation in the next three years, existing resources are likely to be sufficient to enable implementation of some of the remaining actions on the 2020 list during the period of 2014-2020. Other actions will require new resources to move forward.

The City will benefit from observing actions implemented during the next three years, and will have the opportunity to learn from these observations to improve plans going forward. Successful programs might be continued and expanded, while unsuccessful actions might be dropped or reconfigured for success. Other unforeseen changes in the world (e.g., technological advancements, energy price changes, economic growth rates, new climate models) also have the potential to cause adjustment of future plans.

Actions listed in this chapter are expected to help Oakland achieve a 36% reduction in GHG emissions by 2020.

How to Read This Chapter

Each action below is presented through a standard format containing each of the following elements.



Transportation and Land Use

The combustion of fossil fuels used for transportation is a major source of GHG emissions associated with Oakland. This includes people moving to and from home, work, school, shopping, recreation, and other destinations, as well as the transport of goods. Other local air pollutants linked to increased incidence of health problems such as asthma and cancer also commonly result from use of transportation fuels. Addressing transportation emissions presents a tremendous opportunity to simultaneously reduce GHG emissions and improve the health of Oakland residents, while reducing dependence on foreign oil and local vulnerability to energy price fluctuations.

Achieving a 36% reduction in GHG emissions associated with Transportation and Land Use will require unprecedented local action, **reducing citywide driving by 20% and improving citywide vehicle fuel efficiency.**

A number of strategies are available through which the City can help to reduce GHG emissions associated with Transportation and Land Use.



Key GHG Reduction Strategies:

- Institutionalize a More Comprehensive Approach to Transportation & Land Use Planning
- Advance Infill, Mixed-Use and Transit-Oriented Development
- Advance the Use of Alternative Transportation
- Refine Parking Policies to Encourage Low-Carbon Mobility
- Foster the Use of Low-Carbon Vehicles and Fuels
- Engage the Port of Oakland and Related Industry in Reducing GHG Emissions
- Develop Oakland's Urban Forest
- Reduce Emissions Associated with City Operations

Achieving the 2020 goal of reducing GHG emissions associated with Transportation and Land Use by 36% will require significant action in all of these areas. All members of the Oakland community, including residents, businesses, visitors and the City, will need to make daily decisions to reduce the need for automobile trips. When purchasing new vehicles, members of the community will also need to prioritize fuel efficiency in their decisions wherever possible.

Transportation and Land Use 2020 Goals:

- 20 % reduction in vehicle miles traveled
- 24 million gallons of gasoline and diesel saved on local roads
- Fully integrated transportation and land use planning

Strategies to Achieve 2020 Goals

Institutionalize a More Comprehensive Approach to Transportation and Land Use Planning

A more comprehensive approach to transportation and land use planning is critical to laying the foundation for significant GHG reductions from the transportation sector. Because transit infrastructure can require substantial investment and have a profound impact on other land use and development decisions, proactive integrated planning is key to creating the infrastructure and guiding development in a manner that will reduce the need to drive in Oakland. By aligning and integrating all land use and transportation planning processes and documents and increasing coordination with regional partners, the City can develop a plan to make significant gains in this area.

Objective: Align all land use and transportation planning documents and processes to reinforce achievement of GHG reductions

Action TLU-1: Participate in regional development of the Bay Area Sustainable Community Strategy for reducing vehicle travel in compliance with SB 375, and advocate for infrastructure funding to be provided. *3-Year Priority, Funded*

Action TLU-2: Prepare a comprehensive, integrated Oakland Transportation Plan in close collaboration with regional agencies, local service providers and the community. *3-Year Priority, Resources Needed*

Action TLU-3: Require the integration of land use and transportation planning and consideration of GHG reduction opportunities in every planning, major project and redevelopment effort undertaken by the City. *3-Year Priority, Resources Needed*

Action TLU-4: Identify opportunities to adjust the structure, function and/or composition of the Planning Commission to advance integrated consideration of transportation and land use planning issues.

Action TLU-5: Prioritize GHG reduction opportunities in the City's ongoing Zoning Update process.

Advance Infill, Mixed-Use and Transit-Oriented Development

Well designed, transit-oriented, dense, mixed-use, development providing access to goods and services can significantly reduce the use of fossil-fuel powered transportation. Reducing automobile trips can significantly reduce GHG emissions, local air pollution and related health impacts, and improve neighborhood quality of life.

Objective: Plan new development to minimize dependence on fossil fuel-powered transportation

Action TLU-6: Obtain Priority Development Area status from the Metropolitan Transportation Commission for all appropriate areas of Oakland to enable more competitive eligibility for local transportation and infrastructure funding. *3-Year Priority, Funded*

Action TLU-7: Create and adopt a transportation impact fee for Oakland to support local low-carbon transportation infrastructure and planning. *3-Year Priority, Resources Needed*

Action TLU-8: Develop and require transit-oriented development performance criteria for associated vehicle miles traveled and mode share for all major new development plans and projects throughout the city, emphasizing development proximate to transit hubs and corridors of all modes.

Action TLU-9: Actively promote the construction of housing at a range of price levels near transit hubs and corridors in balance with local employment opportunities to meet the needs of Oakland's workforce, and study adoption of a transit-oriented development affordability policy, including preservation of existing affordability.

Action TLU-10: Develop a comprehensive infrastructure plan (e.g., utilities, sewer, water, storm drains) to support Oakland's capacity to absorb planned infill development and to enable new green improvements (e.g., recycled water, solar technology installation).

Action TLU-11: Engage the community, through the zoning update process and other appropriate mechanisms, to develop a strategy for increasing density adjacent to transit in ways that improve neighborhood livability. For example, update design review standards for high-density multi-family buildings, encouraging design that is aesthetically pleasing, visually understandable, and practical. Insist on the creation of vibrant, safe, and attractive public spaces as a part of every development.

Action TLU-12: Engage the lending community on a shared strategy to improve the financial attractiveness of infill development in Oakland.

Advance the Use of Low-Carbon Transportation Modes

To achieve significant GHG reductions, transportation modes such as transit, bicycling and walking must increasingly become the preferred mode of moving about the city. To be effective, these modes will need to be available, accessible, safe, cost-competitive and desirable in comparison to the private automobile.

Objective: Make transit, biking and walking the preferred modes for local trips

Action TLU-13: Launch and sustain a downtown free shuttle to increase the ease of transit use in the downtown area. Explore options to expand the shuttle route along the Broadway corridor. *3-Year Priority, Funded*

Action TLU-14: Support bus rapid transit in Oakland along the Telegraph Avenue and International Boulevard corridors while minimizing short-term potential impacts to neighborhoods and businesses. *3-Year Priority, Funded*

Action TLU-15: Update the process for evaluating local environmental impacts resulting from new development (as required by the California Environmental Quality Act) to prioritize consideration of vehicle miles traveled impacts above congestion impacts. *3-Year Priority, Resources Needed*

Action TLU-16: Accelerate the completion of bicycle and pedestrian networks as described in the Bicycle and Pedestrian Master Plans and other General Plan policies to provide safe, healthy transportation choices for all residents. *3-Year Priority, Resources Needed*

Action TLU-17: Optimize the design of streets to support transit, bicycling and walking (e.g., via bulb outs, traffic signal synchronization, transit and emergency signal priority).

Action TLU-18: Encourage and assist employers and transportation funding agencies to offer support for alternative transportation strategies that can help reduce the need to drive. These strategies may include transit incentive programs (e.g., AC Transit Easy Pass), enabling telecommuting, flexible schedules, rideshare and car share programs, fuel-efficient workplace vehicles, and enhanced bicycle access in order to reduce the need for employees to drive.

Action TLU-19: Collaborate with regional partners (e.g., AC Transit, BART, shuttles, train, taxis, ferry) to expand and enhance public transit service, interconnections, vehicle amenities, and associated facilities (e.g., smaller transit shuttles to underserved areas of the community, connection timing, NextBus signage expansion).

Action TLU-20: Explore opportunities to implement major transit investments (e.g., streetcar) on the primary trunk lines of the city to improve the availability and reliability of transit service in areas where urban densities and activity centers exist.



Action TLU-21: Collaborate with community partners in developing and providing sustained community outreach and marketing about all available alternative transportation options (e.g., walking, biking, Safe Routes to School, car share programs, “Translink”).

Action TLU-22: Partner with 511.org and the city's largest employers, event venues and other destinations to ensure that employees and visitors to Oakland have full information about the transportation choices.

Action TLU-23: Partner with and promote community based organizations that provide knowledge and skills such as bicycle safety training, transit system use, etc. to help Oakland residents shift trips to non-auto modes.

Action TLU-24: Encourage the creation of local bike sharing programs.

Action TLU-25: Explore potential strategies for increasing the availability of car share vehicles throughout the city (e.g., consider providing priority car share locations in high trafficked areas to car share companies willing to make car share vehicles available and accessible in less trafficked or underserved areas).

Action TLU-26: Enforce transportation demand management measures that are physically built into projects (e.g., car sharing spots, bike parking and showers, pedestrian-oriented elements).

Action TLU-27: Explore and revise City policies that make transit service difficult (e.g., analyze the true effect of transit on commercial districts, provide potential parking meter revenue if meters are removed), and consider transit-only lanes and amenities on significant thoroughfares.



Refine Parking Policies to Encourage Low-Carbon Mobility

Parking policies and pricing can have a significant impact on local transportation choices, especially in areas served by other transportation options such as public transit. Parking policies and pricing can be tailored to meet the needs of the Oakland community while fostering shifts from automobile use to other transportation modes. Parking pricing can also be used to support the development of alternative transportation options and other community benefits.

Objective: Meet parking needs while creating disincentives to drive

Action TLU-28: Develop regulations that would permit parking requirements to be met through alternative approaches demonstrated to reduce parking demand and GHG emissions (e.g., on-site car-sharing, bicycle parking, transit passes).

3-Year Priority, Resources Needed

Action TLU-29: Conduct a citywide dynamic parking pricing study and develop a strategy to set parking rates at City meters and garages that can reduce trips, favor transit, provide adequate parking supply, encourage economic development, and fund alternative transportation and neighborhood streetscape improvements. *3-Year Priority, Resources Needed*

Action TLU-30: Impose parking maximums on new development and assist developers, lenders, property owners and tenants in preparing strategies to minimize parking demand and encourage shifts to transit and other transportation modes.

Action TLU-31: Develop a strategy to facilitate unbundling of the costs of renting parking from renting building space, where appropriate, to more explicitly charge for parking.

Action TLU-32: Review the process of establishing residential permit parking and consider opportunities to expand this program in appropriate locations.

Foster the Use of Low Carbon Vehicles and Fuels

A portion of transportation in the city will continue to be accomplished through the use of gasoline and diesel-powered automobiles. Improving vehicle fuel efficiency through purchasing decisions and maintenance activities and utilizing low carbon fuels (e.g., biodiesel from waste oils) can help to reduce GHG emissions associated with these vehicle trips.

Objective: Increase representation of low-carbon fuels and vehicles in the citywide fleet

Action TLU-33: Participate in regional electric vehicle infrastructure planning and develop new processes to support local use of electric vehicles. *3-Year Priority, Resources Needed*

Action TLU-34: Collaborate with community partners to develop and provide sustained community outreach and marketing about fuel-efficient vehicles and low carbon fuels (e.g., biodiesels from waste oils).

Action TLU-35: Encourage the responsible local manufacture and production of low-carbon fuels (e.g., biofuels produced from recycled waste oil) through incentives and/or promotional support.

Action TLU-36: Work with large fleet operators such as taxi companies, along with the City's own fleet, to establish minimum GHG performance criteria for all new fleet vehicles and fleet-wide GHG performance goals.

Action TLU-37: Consider regulating the use of certain fuel-powered leaf blowers.



Engage the Port of Oakland and Related Industry in Reducing GHG Emissions

As a primary hub of goods movement, activities associated with the Port of Oakland and its tenants are a significant source of GHG emissions, along with other local air pollution. Oakland is fortunate to reap economic and employment benefits from its Port, but is also troubled with high levels of local air pollution and other problems created by this concentration of goods movement.

GHG emissions associated with the Port and its tenants include emissions associated with building energy consumption, Port-owned vehicles and equipment, harbor craft, cargo handling equipment, berthed vessels, trucks and trains operating within Port property and within Oakland's boundaries, and other stationary sources. Tenant activities create additional GHG emissions outside of Oakland in the form of fuel used to power airplanes, trucks, trains and marine vessels. Emissions associated with these planes and vessels generally fall under the regulatory authority of the Federal Aviation Administration, the International Maritime Association, or State and Federal government. However, Oakland can help to reduce emissions associated with these sources through actions that reduce material consumption and waste, as described in Chapters 4 and 5. See the ECAP Appendix for further information on GHG emission sources related to the Port and its tenants.



Short of incorporating GHG reduction actions and/or performance requirements applicable to the Port of Oakland within the City's General Plan, the City's ability to influence these emission sources is generally limited. However, it is in the collective best interests of the City and the Port to continue collaborating to explore opportunities to reduce emissions associated with

the Port and its tenants. The Port has a significant opportunity to play a leadership role in addressing local sources of GHG emissions and other air pollutants.

The Port has taken a number of steps in recent years to reduce emissions associated with Port operations and on-site tenant activities, including installing infrastructure for alternative fuel vehicles, advancing shoreside electrification for tenant vessels, retrofitting facilities and installing solar energy systems. Many opportunities for additional progress remain, as indicated by measures contained in the Port’s Maritime Air Quality Improvement Plan that would reduce GHG emissions.

Objective: Reduce GHG emissions associated with the Port of Oakland and its tenants

Action TLU-38: Call upon the Port to establish GHG reduction goals associated with Port operations in alignment with the City’s GHG reduction target of 36% below 2005 emissions by 2020, and plans for achieving those goals. *3-Year Priority, Funded*

Action TLU-39: Call upon the Port to establish GHG inventories and reduction goals associated with tenant activities, and plans for achieving those goals with appropriate tenant commitments, potentially including requiring specific high-impact GHG reduction measures (e.g., electrification of land-based, aviation and maritime vessels). *3-Year Priority, Funded*

Action TLU-40: Offer to partner with the Port, where appropriate, in evaluating and developing GHG reduction strategies.

Action TLU-41: Collaborate with the Port to advocate that Port tenants be required to implement actions at Oakland’s ports in demonstrating compliance with statewide fleet emissions reduction targets (e.g., through electrification of docked vessels).

Action TLU-42: Conduct a study of potential options to implement truck re-routing in Oakland to reduce driving and parking of diesel trucks near residential neighborhoods, as well as increased enforcement of anti-idling restrictions.

Action TLU-43: Make land use and planning decisions (e.g., plans for the former Army Base) in a manner that minimizes GHG emissions and other air pollutants associated with the Port and related activities and travel without unduly compromising the economic value of the Port.

Action TLU-44: Identify opportunities to incorporate GHG reduction actions and/or performance requirements applicable to the Port of Oakland within updates to the City’s General Plan.



Grow Oakland’s Urban Forest

Urban forestry can be both an effective GHG mitigation and climate adaptation strategy. Trees provide important benefits in helping to directly and indirectly cool nearby buildings, reducing energy demand. Tree canopies also help to



reduce the urban heat island effect, reducing temperatures throughout the city and helping to mitigate air quality and health problems caused by extreme heat events. Urban forests can also help to provide animal habitat, create economic development benefits in commercial districts, and improve quality of life. However, urban forests require thoughtful and resourced management. Trees must be planted carefully with consideration of infrastructure, public safety and maintenance and other sustainability impacts. The development and maintenance of the urban forest requires an effective public-private partnership.

Objective: Develop Oakland’s urban forest throughout the city

Action TLU-45: Develop an urban forestry master plan outlining how the City will protect, develop and maintain diversified and appropriate tree plantings on City right-of-ways. *3-Year Priority, Resources Needed*

Action TLU-46: Develop a robust urban tree inventory of all trees in proximity to sidewalks, medians, public buildings, parks and other public right-of-ways.

Action TLU-47: Provide preventative maintenance and management of trees in City right-of-ways.

Action TLU-48: Implement a street tree planting pilot project with local partners utilizing advanced planting techniques.

Action TLU-49: Develop a plan to ensure the continued health of all parks and forested land within the city and encourage tree planting on private land throughout the community.

Action TLU-50: Convene community workshops to educate community members on proper tree maintenance.

Action TLU-51: Collaborate with local organizations where appropriate to advance local urban forestry efforts.

Reduce Transportation Impacts of City Operations

The City adopted a Green Fleets policy in 2003, committing to purchase vehicles powered by alternative fuels whenever possible. While efforts in accordance with this policy have been made since, many opportunities remain to improve fleet fuel efficiency and shift to alternative fuel vehicles. Fleet replacement has been significantly underfunded in recent years, resulting in an aging and fuel-inefficient fleet requiring significant maintenance investment. A number of City fleet vehicles now operate on compressed natural gas (CNG), but opportunities exist to convert hundreds of non-emergency vehicles to CNG and other fuel efficient alternatives (e.g., plug-in hybrid electric vehicles). Vehicle replacement with more fuel efficient vehicles continues to represent the largest opportunity to decrease GHG emissions associated with the City's fleet.

Objective: Achieve a 36% reduction in City-related fuel consumption by 2020

Action TLU-52: Increase the rate of fleet vehicle replacement to retire older inefficient vehicles and continue to replace vehicles with fuel efficient and alternative fuel models (e.g., CNG, electric and plug-in hybrid vehicles, trucks with anti-idling controls). *3-Year Priority, Resources Needed*

Action TLU-53: Provide subsidized transit passes (e.g., participate in the AC Transit Easy Pass program) and bicycle or shoe commuter allowances to all City employees. *3-Year Priority, Resources Needed*

Action TLU-54: Discontinue the practice of providing parking to City employees based in transit-rich locations. *3-Year Priority, Resources Needed*

Action TLU-55: Support employee commute trip reduction by enabling flexible work schedules and encouraging telecommuting where possible.

Action TLU-56: Explore opportunities to enable access to more City services online to reduce the need for customers to drive to City offices.

Action TLU-57: Continue efforts to reduce the size of the City's vehicle fleet by utilizing pool cars and car share programs and eliminating underutilized inefficient vehicles.

Action TLU-58: Perform regular preventive maintenance (e.g., tire inflation) of the City's vehicle fleet to ensure optimum fuel efficiency performance.

Action TLU-59: Expand employee education programs training staff on how to reserve pool cars and car share vehicles, planning practices for optimizing and reducing trips, and vehicle maintenance and driving habits that promote optimum fuel efficiency.

Action TLU-60: Expand the City's capacity to support the use of alternative fuel vehicles, such as through the installation of new electric vehicle charging infrastructure.

Action TLU-61: Integrate fuel-efficient and zero emission specialized vehicles (e.g., cargo trikes for park maintenance) into the City's fleet where appropriate.

Building Energy Use

Building Energy Use, including energy used to heat, light and power Oakland's buildings and other stationary devices such as streetlights, as well as to pump and treat water consumed in Oakland, is a major direct source of greenhouse gas emissions.

Natural gas consumption represents the majority of GHG emissions from this sector, followed closely by electricity use. The combustion of natural gas, primarily to heat buildings, heat water and cook, results directly in GHG emissions. Electricity consumption results in the creation of GHG emissions at the power plant(s) generating and providing the electricity. Most electricity generation occurs outside of Oakland's boundaries, but those GHG emissions are included here given the direct relationship to electricity consumption occurring in Oakland.



A number of strategies are available through which the City can help to reduce GHG emissions associated with Building Energy Use.

Key GHG Reduction Strategies:

- Optimize energy efficiency in new buildings
- Retrofit existing buildings to reduce energy consumption
- Promote energy and water conservation and efficiency
- Advance the use of renewable energy
- Improve the energy performance of municipal facilities

Achieving the 2020 goal of reducing GHG emissions associated with Building Energy Use by 36% will require significant action in all of these areas. Improving energy performance in existing buildings is especially important. A community-wide movement will be needed to: reach all businesses and guide 30% of them through energy efficiency programs; encourage property owners to retrofit 30% of Oakland's homes; and foster dedicated energy conservation behaviors on the part of every member of the Oakland community.

Building Energy Use 2020 Goals:

- Construct all new buildings citywide to high energy standards
- Retrofit 30% of commercial space and homes between 2010 and 2020
- Achieve 32% electricity savings across all sectors
- Achieve 14% natural gas savings across all sectors
- Achieve a 33% renewable portfolio standard for grid electricity
- Generate 3% of building energy consumption from new local renewable energy

Strategies to Achieve 2020 Goals

Optimize Energy Efficiency & Consumption in New Buildings

Every year new buildings continue to be constructed in Oakland. Achieving long term energy reductions starts by ensuring that all new buildings are constructed to high performance energy standards. Recent updates to the State's Title 24 building energy code have raised the energy performance bar in California, but new buildings in Oakland can achieve even higher levels of energy efficiency.

Objective: Achieve 10% better energy performance than Title 24 in all new building stock

Action BE-1: Adopt a green building ordinance for residential and commercial private development new construction projects requiring high levels of energy performance and water efficiency. *3-Year Priority, Funded*

Action BE-2: Ensure enforcement of building energy codes in accordance with all code requirements.

Retrofit Oakland's Existing Building Stock to Reduce Energy Consumption

There are more than 100,000 residential and commercial buildings in Oakland, built over many decades, many of which offer significant opportunities for improved energy performance. Reducing citywide energy consumption will require retrofitting all of these buildings to improve energy efficiency. Many energy efficiency improvements offer significant cost savings opportunities, and can also improve indoor occupant health, comfort, productivity and quality of life. Energy retrofits can reduce energy consumption and energy costs as much as 25-35% per building, often creating a net positive cash flow from day one. With a large and experienced pool of energy contractors, Oakland is well positioned to become the energy retrofit capital of America.

All Building Types

Action BE-3: Include all significant renovation projects in the proposed green building ordinance for residential and commercial private development projects requiring high levels of energy performance. *3-Year Priority, Funded*

Action BE-4: Offer property-based financing and associated outreach for energy efficiency and solar improvements to residential and commercial property owners in Oakland. *3-Year Priority, Funded*

Action BE-5: Engage local utilities (e.g., PG&E, EBMUD) to develop on-bill financing options for energy efficiency improvements to increase energy retrofits in tenant-occupied and other properties. *3-Year Priority, Resources Needed*

Action BE-6: Pursue funding to augment existing and create new residential and commercial energy programs to reduce energy consumption throughout the community. *3-Year Priority, Resources Needed*

Action BE-7: Encourage all businesses and households to use 16% less energy through conservation actions such as turning off unnecessary equipment and right-sizing the use of energized equipment. *3-Year Priority, Resources Needed*

Action BE-8: Coordinate with other jurisdictions in our region to explore the potential benefits, consequences and opportunities of enhancing local influence and control over public goods funding from the CPUC for energy efficiency programs, and request an accounting of current guidelines, revenues, and expenditures from the public goods surcharge with intent to petition the CPUC for use of public goods surcharge funds.

Action BE-9: Engage the lending community in discussions about developing energy-related financing offerings, including an on-bill financing program.

Action BE-10: Develop and promote a suite of energy efficient upgrades specifically for historic buildings so that these buildings can be made energy efficient while also retaining their historic status. Encourage energy retrofit training programs to include training on issues specific to historically significant older buildings.



Action BE-11: Promote the benefits of investing in energy efficiency in existing properties and provide guidance on getting started to property owners and tenants through a targeted marketing and outreach campaign in collaboration with local partners.

Commercial/Industrial Buildings

Objective: Perform efficiency retrofits in 30% of Oakland’s commercial building stock by 2020, resulting in 20% less building-related electricity and natural gas consumption

Action BE-12: Offer enhanced incentives and technical assistance to help downtown commercial property owners improve energy efficiency. *3-Year Priority, Funded*

Action BE-13: Encourage businesses to participate in local energy efficiency programs offered through the East Bay Energy Watch regional collaboration between PG&E and East Bay cities. *3-Year Priority, Partially Funded*

Action BE-14: Launch a program offering technical assistance to help Oakland’s most energy intensive businesses to develop and implement energy efficiency and conservation strategies. *3-Year Priority, Resources Needed*

Action BE-15: Consider requiring energy benchmarking of commercial sector buildings by a certain date. *3-Year Priority, Resources Needed*

Action BE-16: Adopt an ordinance requiring cost-effective commercial energy-related improvements at time of lease or sale or under other appropriate conditions based on analysis of existing commercial retrofit programs.

Action BE-17: Develop analytical tools and invest in strategic planning to identify energy improvement opportunities and new initiatives to reduce energy use in commercial buildings.

Action BE-18: Encourage the use of building feedback systems to assist local building owners in identifying, implementing, tracking and reporting on energy efficiency improvements over time.

Action BE-19: Enhance and expand existing small commercial energy retrofit assistance programs to help existing owner-occupied and rented small commercial properties reduce energy use and save money via energy audits, technical assistance, retrofit incentives, and/or continuous commissioning support.

Action BE-20: Create a community “Kilowatt Crackdown” challenge program in collaboration with BOMA and the Oakland Partnership pushing commercial office buildings to reduce energy use while competing for recognition based on energy performance and progress.



Residential Buildings

Objective: Retrofit 30% of Oakland’s residential building stock by 2020, resulting in 10% less building-related electricity and natural gas consumption

Action BE-21: Launch a new energy retrofit program to improve energy efficiency of existing single-family and multi-family residential properties via promoting green improvements, providing green construction specs, certifying green contractors, connecting homeowners, landlords and tenants with financing options (e.g., new property-based financing), and providing quality assurance support. *3-Year Priority, Funded*

Action BE-22: Create an energy retrofit pilot program targeting multi-family affordable housing by providing funds to reduce risk and enable the acquisition of private investment capital to implement energy savings projects. *3-Year Priority, Funded*

Action BE-23: Expand, enhance and promote delivery of weatherization and energy retrofit assistance services to help low-to-moderate income residents improve energy efficiency and reduce energy costs. *3-Year Priority, Funded*

Action BE-24: Develop new energy retrofit programs to facilitate energy efficiency improvements of existing renter-occupied residential properties by supporting outreach as well as assistance designing tenant-landlord agreements so that all parties equitably share the costs and benefits of energy efficiency. *3-Year Priority, Resources Needed*

Action BE-25: Adopt an ordinance requiring cost-effective residential energy-related improvements at time of sale, or under other appropriate conditions. *3-Year Priority, Resources Needed*

Action BE-26: Support local programs delivering entry-level residential energy efficiency services to Oakland neighborhoods (e.g., California Youth Energy Services).

Action BE-27: Support do-it-yourself home energy improvements by providing appropriate tools for home energy evaluation and improvement through Oakland’s Tool Lending Library.



Increase the Use of Clean Renewable Energy

Even after conservation and significant improvements in energy efficiency, remaining energy consumption will need to be supported by more clean, renewable energy sources. Governor Schwarzenegger has established a 33% renewable portfolio standard (RPS), requiring 33% of electricity provided by utilities such as PG&E to come from renewable energy sources by 2020. Oakland can go further toward achieving higher rates of renewable energy use through additional action to increase local renewable energy generation from solar, wind and other sources.

Objective: Achieve a minimum of 33% renewable energy on the electricity grid, along with new local renewable systems generating an additional 3% of Oakland’s energy for buildings

Action BE-28: Encourage and collaborate with local partners to launch a community solar program to increase local use of renewable energy, including solar-thermal energy to produce heat and hot water. *3-Year Priority, Resources Needed*

Action BE-29: Negotiate with PG&E to offer local green power options to Oakland customers. *3-Year Priority, Resources Needed*

Action BE-30: Continue to monitor the feasibility and utility of implementing community choice energy aggregation (CCA) in Oakland. *3-Year Priority, Resources Needed*

Action BE-31: Study potential local solar, wind, wave, combined heat and power, and anaerobic digestion opportunities and develop strategic plans for increased clean energy use in Oakland.



Promote Water Conservation and Efficiency

The treatment and transport of water is energy intensive, consuming approximately 19% of the state’s electricity, 30% of its natural gas and 80 million gallons of diesel fuel in 2001. By reducing potable water consumption we can conserve a precious and limited resource, and reduce associated pumping and treatment energy and GHG impacts. The City can continue collaborating with the East Bay Municipal Utility District (EBMUD), StopWaste.Org, PG&E and community organizations to promote and support water conservation and efficiency.

Objective: Reduce energy consumption through water conservation and efficiency in new and existing buildings and infrastructure.

Action BE-32: Create an Oakland-specific Water Efficient Landscape Ordinance (WELO) to address water conservation. *3-Year Priority, Funded*

Action BE-33: Expand promotion of water conservation and efficiency practices such as water-efficient landscaping and irrigation and lawn replacement. Continue promoting StopWaste.Org publications titled “Bay Friendly Landscaping Guidelines: Sustainable Practices for the Landscape Professional” and “Bay Friendly Gardening: From Your Backyard to the Bay” through targeted outreach campaigns in partnership with local organizations.

Action BE-34: Participate in outreach campaigns by EBMUD, StopWaste.Org and others to encourage water monitoring, conservation and efficiency by Oakland’s largest water consumers.

Action BE-35: Encourage the installation of rainwater harvesting through water collecting cisterns in new development to capture water during the rainy season for outdoor uses and/or indoor uses.

Action BE-36: Encourage the installation of rainwater and greywater systems where appropriate in accordance with State and local codes.

Action BE-37: Advocate for enhancing water metering practices (e.g., installation of smart meters, sub-meters for tenant-occupied spaces) to enable monitoring and evaluation of consumption patterns.

Action BE-38: Support the efforts of EBMUD to provide incentives and support to encourage water conservation and efficiency.

Action BE-39: Encourage the installation of water efficient fixtures and plumbing in private development, including products labeled under the EPA’s WaterSense program.

Action BE-40: Increase the amount of public space landscaped with drought-resistant plants and trees meeting Bay Friendly Landscaping Guidelines.

Action BE-41: Create standard operating procedures for installing water efficient fixtures and equipment in municipal buildings, landscapes, ballfields and swimming pools at regular replacement schedules, and proactively when cost-effective.



Optimize Energy Efficiency & Consumption in City Facilities

The City has built in energy efficiency or performed energy retrofits in over 100 of its largest buildings during the last twenty years. However, significant potential remains to reduce energy use and improve performance in existing City facilities.

Objective: Reduce GHG emissions from energy consumption in City buildings and streetlights by 36% by 2020, achieving 10% through conservation

Action BE-42: Enhance and implement standard operating procedures to improve energy conservation and efficiency in ongoing City facility operations. Require City facilities over a certain age to participate with the LEED O&M program. *3-Year Priority, Funded*

Action BE-43: Modify the City’s Civic Green Building Ordinance to increase energy efficiency standards for new construction and major renovation of City facilities. *3-Year Priority, Funded*

Action BE-44: Perform energy efficiency upgrades to City facilities and operations. *3-Year Priority, Funded*

Action BE-45: Explore opportunities to install alternative energy technologies (e.g., via solar power purchase agreements) or purchase grid-based renewable energy for City facilities.

Action BE-46: Replace streetlights with energy-efficient advanced technology models in all appropriate locations during the course of normal technology replacement schedules.

Action BE-47: Develop and provide training to City employees on targeted energy and climate issues.

Material Consumption and Waste

The Oakland City Council adopted a Zero Waste goal in 2006, calling for a 90% reduction in waste sent to landfill by 2020. The City's Zero Waste Strategic Plan outlines strategies for meeting this goal. These strategies prioritize “systems” solutions to reduce landfilled waste, and expand waste reduction, recycling and composting programs. By pursuing the City's adopted Zero Waste strategies, Oakland can create GHG reductions on the same order of magnitude as those related to transportation and building energy use.

From a lifecycle perspective, GHG impacts associated with the manufacture, transport, use and disposal of material goods and food represent a major source of GHG emissions. While many of these emissions do not occur within Oakland's geographic boundaries, consumption and disposal choices in Oakland can help to reduce GHG emissions elsewhere.

A number of strategies are available through which the City can help to reduce GHG emissions associated with Material Consumption & Waste Reduction.

Key GHG Reduction Strategies:

- Expand and Improve Waste Reduction, Reuse, Recycling, and Composting
- Encourage Sustainable Consumption
- Promote Local Food

Achieving Oakland's adopted Zero Waste goal will require significant action in each of these areas.

The City can position Oakland to keep many more materials out of landfills by restructuring elements of Oakland's solid waste management system. This may include changes to Oakland's municipal code, garbage franchise agreement, residential recycling service contracts, and rate structure. Expanding and refining implementation of the City's Construction and Demolition Debris Recycling Ordinance can foster reuse and keep materials out of landfill. Other actions described in this section can also play important roles in reducing waste. All members of the community will need to make individual purchasing, consumption and disposal choices to help Oakland reach Zero Waste goals.



Material Consumption & Waste Goals:

- Achieve a 90% reduction (~375,000 tons) in waste sent to landfill by 2020
- Increase local food production

Strategies to Achieve 2020 Goals

Expand and Improve Waste Reduction, Reuse, Recycling, and Composting

Achieving Zero Waste will require expanded and improved waste reduction reuse, recycling, and composting systems. By structuring these systems to better reward behaviors that keep waste out of landfills, the City can foster significant GHG reductions associated with the lifecycle impacts of materials.

Objective: Reduce community-wide waste sent to landfill to 40,000 tons by 2020

Action MW-1: Restructure Oakland’s solid waste management system (municipal code, garbage franchise agreement, and residential recycling service contracts) to provide comprehensive incentives for residents, businesses, and collection service providers to reduce waste and recycle more. These changes will help Oakland comply with potential statewide mandatory recycling requirements, including for multi-family residential properties. The outcome of this restructuring exercise may recommend adjustments to the types of recycling, compost, and garbage services offered, collection frequency, and container sizes, and the implementation of mandatory recycling participation and/or disposal bans. *3-Year Priority, Funded*

Action MW-2: Refine implementation of Oakland’s Construction and Demolition (C&D) Debris Recycling Ordinance to capture greater amounts of materials for reuse, recycling and composting, and consider opportunities to expand the ordinance to include a broader range of projects with potential incentives for deconstruction and salvage. *3-Year Priority, Funded*

Action MW-3: Require development and implementation of waste reduction and recycling plans for all large venues and public events. *3-Year Priority, Funded*

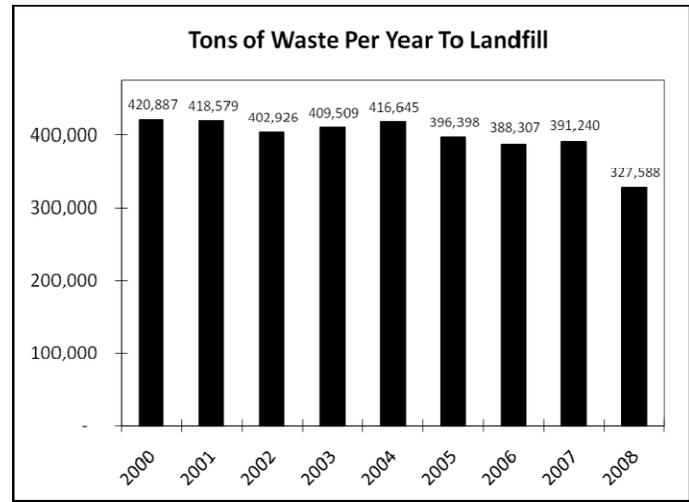
Action MW-4: Enforce mandatory statewide and countywide bans on sale, use, or disposal of material types, and implement selected local bans. *3-Year Priority, Resources Needed*

Action MW-5: Conduct new residential social marketing campaigns and increased outreach to businesses and other institutions to improve the effectiveness of waste reduction and recycling programs. *3-Year Priority, Resources Needed*

Action MW-6: Study options for deepening future waste reduction activities to help achieve the City’s adopted Zero Waste Goal, including consideration of commercial food scraps. *3-Year Priority, Resources Needed*

Action MW-7: Identify and retain sufficient industrially zoned lands through zoning and specific plans to support Zero Waste business development and infrastructure, and associated green jobs. Provide appropriate locations for new and existing recycling facilities.

Figure 9. Oakland Citywide Waste Sent to Landfill



Action MW-8: Adopt Zero Waste practices in City operations, facilities, capital improvement and maintenance practices.

Action MW-9: Require reporting on implementation of the City’s Environmentally Preferable Purchasing Policy.

Action MW-10: Require reporting from state-recognized institutions in Oakland that are exempt from local waste reduction rules (e.g., public school systems, State/Federal offices, the Port, Oakland Housing Authority) to increase waste reduction and recycling at their facilities.

Action MW-11: Facilitate easier recycling of organic materials in multi-family buildings through revised design requirements.

Action MW-12: Promote Bay Friendly Landscaping practices to reduce excess plant debris from being sent to landfill and the need for nitrogen-based synthetic fertilizers.



Encourage Sustainable Consumption

Achieving Zero Waste begins with purchasing and material consumption choices that reduce the potential for waste generation. By placing emphasis on reuse and repair opportunities, and purchasing new materials only when necessary, it is possible to reduce upstream GHG impacts associated with the manufacture and transport of goods, as well as downstream impact such as landfill gas creation.

Objective: Support Oakland’s waste reduction goals through sustainable consumption practices

Action MW-13: Promote reduction of product waste and better management of hard-to-recycle and toxic products through producer responsibility. Support statewide producer responsibility legislation. Support the creation of convenient and cost-effective product take-back opportunities for the public through existing retail distribution systems.

Action MW-14: Promote members of the Alameda County Green Business Program and support program efforts to expand to include additional business types.

Action MW-15: Foster local reuse and repair opportunities, including through expanded community outreach efforts promoting re-use of buildings and materials, and “buy local” programs focusing on goods made from recycled materials.

Action MW-16: Encourage businesses capable of manufacturing needed products from existing waste streams and businesses utilizing low impact packaging techniques to locate in Oakland.

Promote Local Food

Globally, up to 32% of GHG emissions are related to food system activities including production, transportation, processing, and storage. A low-carbon food system emphasizes food that is produced with efficient use of resources, and food that is produced, processed and distributed near where it is consumed. Significant opportunities to reduce GHG emissions associated with the food system exist in decreasing consumption of meat and foods grown with intensive use of manufactured fertilizers. A local food system can help to reduce transportation-related GHG emissions and upstream use of GHG-intensive fertilizers, while creating local green jobs and strengthening the local economy.



The City recognizes that local food production can also create adverse impacts related to issues such as noise, trucking, lighting, odors, and air quality. Efforts to expand local food production should include consideration of both beneficial and adverse potential impacts.

Oakland is home to a range of innovative food system initiatives, including the Oakland Food Policy Council (OFPC). The OFPC was launched in 2009 to develop recommendations to support the development of Oakland’s local food sector and increase community access to healthy foods. The City has an opportunity to promote, integrate and build upon existing local food initiatives distinguishing Oakland.

Objective: Increase opportunities for urban agriculture in Oakland

Foster More Local Food Production

Action MW-17: Develop regulations that allow for the use of urban land for food production. *3-Year Priority, Funded*

Action MW-18: Encourage local utilities, public agencies and other large land owners to offer commercial leases to local organizations for the purpose of local food production and/or foraging. *3-Year Priority, Funded*

Action MW-19: Evaluate the potential of creating additional community gardens on City-controlled public land.

Action MW-20: Encourage the inclusion of food-producing gardens, including roof-top gardens, in private development where appropriate, with consideration of Bay Friendly principles.

Action MW-21: Provide information maintained by the City on brownfield sites to members of the public interested in exploring the potential for urban agriculture.

Action MW-22: Promote the efforts of local organizations that provide training on gardening and composting.

Action MW-23: Provide a portion of compost generated through the City’s residential recycling program back to the community.

Action MW-24: Include a preference for inclusion of community gardens and sustainable local food production in evaluating applications for City funds and contracts.

Action MW-25: Encourage partnerships among private and non-profit sector organizations to create shared commercial kitchens in underserved areas of Oakland to stimulate local food microenterprises.



Develop Markets for Local Food

Action MW-26: Integrate consideration of local food procurement and food related impacts into processes for selecting food for City sponsored events and contracts.

Action MW-27: Work with partners to add consideration of local food procurement and food related impacts to green business certification criteria.

Action MW-28: Encourage efforts of local organizations to promote local food procurement and consideration of food related impacts to the community, focusing on large employers and other targeted venues.

Action MW-29: Advance economic development strategies that promote sustainable food production in Oakland.

Action MW-30: Review and align permit and other requirements for farmers markets, community supported agriculture programs and other local food distribution efforts.



Community Engagement

Oakland's success in meeting its GHG reduction goals will ultimately depend largely on the day-to-day decisions of all members of the Oakland community, including residents, businesses and other institutions.

The City has an important role to play in educating and motivating all members of the Oakland community to join in the effort to reduce energy use and GHG emissions. By leveraging its leadership and existing communication channels, the City will help to spur the high levels of community participation needed to solve these challenges, and provide opportunities for new ideas from the community to further strengthen local efforts. In addition, the City will monitor and report on Oakland's progress in reducing energy use and GHG emissions, and promote local examples of leadership throughout the community.



The City can implement a number of strategies to engage the community to increase citywide climate action.

Key GHG Reduction Strategies:

- Encourage Community Energy and Climate Action
- Create New Opportunities for Community Engagement
- Track and Promote Community Action

Achieving Oakland's GHG reduction goals across Transportation & Land Use, Building Energy Use, and Material Consumption & Waste will require significant action in each of these areas. By collaborating with local organizations, the City can help to spur local action that will be needed to reduce driving citywide by 20%, retrofit 30% of Oakland's housing stock with energy improvements, enroll 30% of businesses in local energy efficiency programs, and reduce waste sent to landfill by 90% by 2020. Actions to reach these goals can in turn help to create new local green job opportunities for Oakland residents.

Local organizations, including community-based organizations, business, labor, educational institutions and others, can educate, motivate and empower the Oakland community to participate in and benefit from local climate action. As champions connected throughout the Oakland community, these organizations can help to build a movement around local climate action.

Community Engagement Strategies

Encourage Community Energy and Climate Action

Working in collaboration with local organizations, the City can help to educate and motivate all members of the Oakland community to take individual action on energy and climate issues.

Action CE-1: Expand the City’s website, Green Building Resource Center, and other outreach channels to provide more comprehensive and action-oriented information regarding opportunities to reduce energy use and GHG emissions. *3-Year Priority, Funded*

Action CE-2: Partner with community-based organizations, neighborhood associations, business associations, and others to promote local climate action throughout the community through new and traditional channels. *3-Year Priority, Funded*

Action CE-3: Develop and distribute a community climate action guide and targeted educational materials in collaboration with local organizations to inspire all members of the Oakland community to take action to reduce GHG emissions. *3-Year Priority, Resources Needed*

Action CE-4: Provide support to local organizations to convene neighborhood-scale or issue-based community climate action workshops. *3-Year Priority, Resources Needed*

Action CE-5: Create citywide and neighborhood scale opt in electronic listservs and other information sharing opportunities focused on targeted climate protection topics (e.g., community gardening, installing rooftop solar) to help interested residents and other parties connect with each other, share wisdom, etc.

Action CE-6: Promote climate-related volunteer events throughout the community in partnership with local organizations.

Action CE-7: Create a community climate challenge campaign and work with local business partners to identify and provide incentives for participation and achievement.

Action CE-8: Encourage OUSD and other organizations to provide educational opportunities on energy and climate issues to local youth, and to integrate energy and climate action within operational practices where possible (e.g., safe routes to school and green schools programs).

Action CE-9: Engage the local philanthropic community to provide support for model projects with potential for replication throughout the community, especially in areas with the least resources and/or least engagement in local climate actions.



Create New Opportunities for Community Engagement

The City will provide ongoing opportunities for new community ideas on energy and climate action to further strengthen local efforts.

Action CE-10: Convene community climate forums to provide informal opportunities for members of the public and local community organizations to learn about local climate protection progress and provide input on future activities. *3-Year Priority, Funded*

Action CE-11: Establish and highlight opportunities for members of the community to provide suggestions to City staff and policy makers regarding how the City can further augment its climate protection efforts through adjustments to local planning, policies and programs.

Action CE-12: Provide information through local organizations, community information channels and the City’s website to assist the Oakland community in identifying opportunities to advance local climate action through planned updates to City planning documents, policies and programs.

Action CE-13: Include content in regular community surveys conducted by the City to help inform future energy and climate action planning decisions, and engage local partners in additional surveying efforts where appropriate.

Action CE-14: Engage the community in visioning Oakland in 2050 to help identify steps toward achieving significant GHG reductions in the process of realizing that vision.



Track and Promote Community Action

The City will monitor and report on Oakland’s progress in reducing energy use and GHG emissions, and promote local examples of model practices throughout the community.

Action CE-15: Report on Oakland’s progress in reducing energy use and GHG emissions on an annual basis. *3-Year Priority, Funded*

Action CE-16: Develop a local climate action model practices campaign collaborating with local organizations to document and promote examples of local climate actions to the community. *3-Year Priority, Resources Needed*

Action CE-17: Expand energy and climate content on the City’s website and other outreach tools to track progress and promote the GHG reduction achievements of the City and the Oakland community, as well as tools to support local action and opportunities to get involved.

Action CE-18: Create a community climate leaders recognition program and promote model actions and performance through an annual recognition program.

Action CE-19: Promote green community events throughout the city.

Develop the Local Green Workforce to Support Local Green Businesses

The emerging green economy will continue to create new demand for trained professionals capable of delivering work such as building energy retrofits, development of bikeways, product repair, installation of solar panels and construction debris collection for reuse. Oakland has an opportunity to build on its investment in local green jobs training programs to develop a local green workforce and provide employment opportunities for disadvantaged residents.

Objective: Train workers for new green jobs to support energy and climate actions

Action CE-20: Engage with local green jobs training providers to coordinate strategic planning and encourage programs to develop local workforce capacity and assess, train and place local residents in jobs to perform energy retrofits and other green improvements. *3-Year Priority, Funded*

Action CE-21: Facilitate the hiring of green jobs program graduates through promotion and subsidized internship placement with local employers.

Action CE-22: Work with local partners to develop a community green jobs electronic bulletin board promoting local green job opportunities.



Adapting and Increasing Resilience to Climate Change

Some impacts of climate change (e.g., sea level rise) are already starting to be observed. Additional impacts projected to occur during this century have the potential to significantly affect our community. In addition to taking action to reduce GHG emissions that cause climate change, Oakland must take simultaneous action to adapt to unavoidable local climate impacts.

Oakland is a large and diverse community; climate impacts will be experienced in a number of areas.

Due to its location, Oakland is vulnerable to a number of climate impacts, including sea level rise, reductions in water supply due to shrinking snowpack in the Sierra Mountains, wildfires, extreme heat, flooding, added stress on infrastructure, ecological impacts and other potential pricing and quality of life impacts. For example, a set of climate scenarios prepared for the California Energy Commission project that mean sea level along the California coast could rise by as much as 4.5 feet by 2100.^{xv} Many low-elevation areas of Oakland would be vulnerable to flood events under these scenarios.^{xvi}

A number of strategies are available through which the City can help Oakland to adapt to the impacts of climate change and increase community resilience.

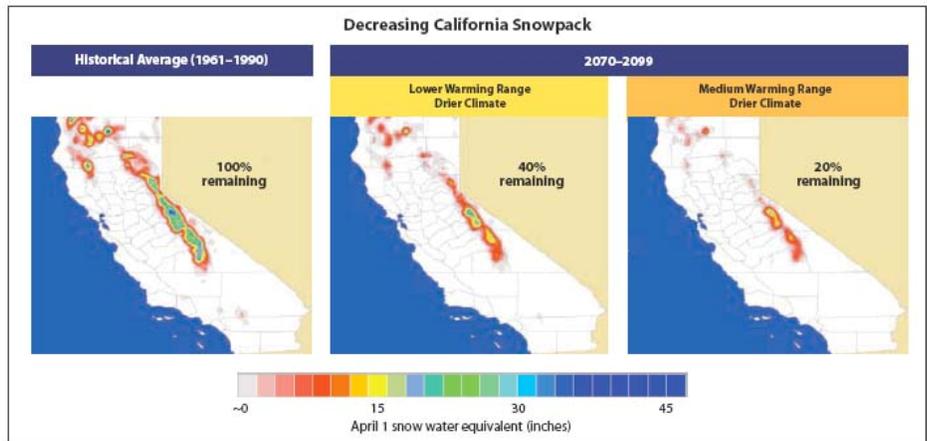
Key Adaptation Strategies:

- Study Potential Local Climate Impacts
- Communicate Climate Impacts to the Community
- Identify and Act on Opportunities to Improve Resilience

Adapting to future climate impacts will likely require significant action in each of these areas. Some adaptation measures, such as water conservation and urban forestry, can serve to minimize existing vulnerabilities and provide social, economic and environmental benefits regardless of the extent of potential climate impacts. A number of these actions also create mitigation benefits (e.g., water efficiency reduces energy needed to provide and treat water, urban trees reduce heat island effect and associated building cooling needs) and have been discussed elsewhere in the ECAP. Other adaptation measures can be more capital-intensive, including:

- Protecting and restoring Oakland’s creeks and estuary;
- Upgrading sewer and stormwater infrastructure to accommodate sea-level rise and increased stormwater volumes;
- Augmenting water supply with seawater desalination;
- Armoring the coast against sea-level rise through levees and seawalls; and,
- Updating peak electrical transmission capacity for summer cooling to help reduce human health impacts.

The City will continue to develop its internal capacity around these issues and will work with local partners to explore adaptation strategies concurrently with efforts to reduce GHG emissions to ensure that climate impacts are minimized.



Source: State Climate Action Team Report

Strategies to Achieve 2020 Goals

Study Potential Local Climate Impacts

The first step in addressing climate adaptation is to study projected climate impacts and develop an understanding of how those impacts may affect important local issues such as land use, infrastructure, public health, the local economy and other quality of life issues. Opportunities exist to leverage the work of local partners and State agencies that have begun to study these impacts.

Action AD-1: Participate in discussions on climate adaptation and resilience issues with local governments and other experts. *3-Year Priority, Funded*

Action AD-2: Conduct a study of all local climate impacts in collaboration with local partners including the Bay Conservation and Development Commission, the Pacific Institute and UC Berkeley. *3-Year Priority, Resources Needed*

Communicate Climate Impacts to the Community

As projected climate impacts become understood, it will be important to educate the Oakland community about these impacts to lay the foundation for public discussion of future planning decisions and adaptation strategies. Developing a greater shared understanding of potential impacts will be critical to generating the will for personal and collective action that may be needed to implement future adaptation strategies.

Action AD-3: Communicate information about local climate impacts to the Oakland community to develop shared understanding, the will for personal and collective action, and local capacity to participate in the development of climate adaptation strategies. *3-Year Priority, Resources Needed*

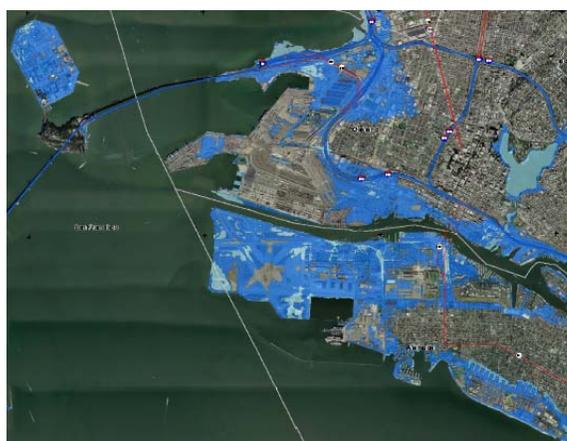


Figure 10. Projected area in danger of 100-year flood event based on 4.5 foot sea level rise. Courtesy of Pacific Institute

Identify and Act on Opportunities to Improve Resilience

Taking action to adapt to projected climate impacts will help to increase community resilience in Oakland, minimize vulnerabilities and encourage sustainable development.

Action AD-4: Integrate climate adaptation strategies into City planning and policy documents and processes where appropriate. *3-Year Priority, Resources Needed*

Action AD-5: Update community emergency preparedness and recovery plans, infrastructure (e.g., consider community cooling centers) and communication networks as appropriate based on projected climate impact scenarios with consideration for vulnerable communities.

Action AD-6: Encourage and participate actively in efforts of regional partners including BCDC to engage in the development of a regional climate adaptation strategy informed by climate impact modeling, scenario analysis and development of adaptation strategies to advance regional climate adaptation capacity and resilience. Collaborate with local partners to ensure that the actions (e.g., construction of sea walls) of neighboring jurisdictions or other agencies do not indirectly exacerbate impacts to Oakland neighborhoods.

Action AD-7: Develop a climate adaptation plan for Oakland identifying strategies to improve community resilience to climate change in collaboration with State, regional and local stakeholders.

Action AD-8: Update planning documents and building codes to include requirements for high albedo (reflective) surfaces where possible (e.g., rooftops, pavement) to reduce the urban heat island effect and mitigate public health impacts of extreme heat events.

Action AD-9: Promote the development of Oakland's urban forest (see pages PA 38, page 46).

Action AD-10: Promote indoor and outdoor water conservation and efficiency (see pages 69 and 70).

Action AD-11: Promote measures to reduce the impact of flood events by encouraging stormwater catchment and diversion through use of rain barrels, bio-swales, permeable surfaces, and green roofs.

Action AD-12: Encourage the efforts of the East Bay Municipal Utility District to develop infrastructure to deliver recycled water to Oakland properties for appropriate uses, reducing dependence on external water supplies.

Action AD-13: Consider opportunities to raise revenue to support local climate impact modeling and planning at the local or regional level (e.g., water use fees, development impact fees).

Action AD-14: Provide training for City staff on projected climate impacts, vulnerability issues, and adaptation strategies.

Action AD-15: Explore how the City can achieve dedicated land for urban agriculture within Oakland city limits.

Advocacy Recommendations

Achieving Oakland's GHG reduction goals will require ongoing climate action at all levels by multiple partners. These include Federal, State and County government; regional agencies such as the Association of Bay Area Governments (ABAG), Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District (Air District), Bay Conservation and Development Commission (BCDC), Joint Policy Committee (JPC), and StopWaste.Org; and other partners such as the California Public Utilities Commission (CPUC), Pacific Gas & Electric (PG&E) and the East Bay Municipal Utility District (EBMUD). Energy and climate are gaining attention from each of these organizations.

Many actions that can help to reduce energy use and GHG emissions in Oakland would be most efficiently, effectively and appropriately implemented at a regional level by these partners. Local governments will continue to lack the resources to solve the climate challenge without policy, financial and other support from these partners. The City should advocate for further action by these agencies that will help achieve Oakland's GHG reduction goals. Examples of advocacy opportunities include:

Transportation and Land Use

- Increasing funding for local transit projects, and prioritizing transit relative to highway projects (MTC, State, Federal gov't)
- Adopting indirect source rules to place fees on new development to support low carbon transportation (CARB)
- Imposing new revenue generating fees (e.g., gas tax, mileage tax) to fund regional transit upgrades (JPC, MTC, Air District)
- Developing better models to help local and regional planners quantify GHG impacts of land use and transportation scenarios (State, MTC, ABAG, CARB)
- Providing support for infrastructure upgrades needed to absorb additional development in urban areas (Federal gov't, State, CPUC, ABAG)
- Requiring Port tenants to implement actions at Oakland's ports in demonstrating compliance with statewide fleet emissions reduction targets (e.g., through electrification of docked vessels) (Federal gov't, State)
- Providing support and requiring monitoring devices to reduce idling in trucks serving the Port (CARB)
- Placing a moratorium on regional freeway capacity expansion (State, Federal gov't)
- Enforcing speed limits and anti-idling rules (State, CARB)

Building Energy Use

- Increasing the percentage of grid electricity that must be supplied from renewable energy sources, including applying this to all direct access contracts (State)
- Improving feed-in tariff and net metering policies (e.g., single solar power systems serving multiple tenants) (State, CPUC)
- Increasing investment in developing advanced renewable energy technologies (Federal gov't, State)
- Requiring utilities to offer on-bill financing programs, either directly or through third-party collaborations (State, CPUC)
- Authorizing utilities to provide better data to local governments for energy program strategic planning (State, CPUC)
- Revising California's commercial new construction regulations to properly account for natural ventilation (State)
- Developing an effective and equitable cap-and-trade system for reducing GHG emissions (State, Federal gov't)

Material Consumption and Waste Reduction

- Imposing revenue generating fees (e.g., on GHG-intensive or non-durable goods) to support GHG reductions (State, JPC)
- Requiring manufacturer product responsibility for reducing product waste and problem materials (State)
- Requiring mandatory product impact labeling, commercial recycling and other waste reduction measures (State)
- Conducting regional social marketing campaigns to increase recycling and waste reduction (StopWaste.Org)

Adaptation and Resilience

- Advancing climate impacts modeling and developing local climate adaptation strategies (State, BCDC)

Endnotes

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- ⁱ Adapted from a whitepaper titled “Products, Packaging and US Greenhouse Gas Emissions” written by Joshua Stolaroff and published by the Product Policy Institute in September 2009. For the purposes of this illustration, GHG emissions associated with Products & Packaging and the Provision of Food have been combined under the heading Material Consumption & Waste, and GHG emissions associated with Infrastructure (1% of total pie) have been combined under the heading Building HVAC & Lighting.
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- ^{xii} City of Oakland. “Bicycle Master Plan”. Page 113. December 2007.
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City Leadership on Energy and Climate

Highlights of Oakland's leading energy, climate and sustainable city policies include:

- Energy and Climate Action Plan
- Green Building Ordinance for Private Development
- Civic Bay Friendly Landscaping Ordinance
- Bicycle Parking Ordinance
- Extended Producer Responsibility Resolution
- Environmentally Preferable Purchasing Policy
- Food Policy Council Resolution
- Resolution to Develop an Oil Independence Action Plan
- Bicycle Master Plan
- Green Food Service Ware
- Green Building Guidelines Resolution
- Zero Waste Strategic Plan Resolution
- Food Policy Plan Resolution
- Urban Environmental Accords Resolution
- Chicago Climate Exchange Resolution
- Civic Green Building Ordinance
- Green Fleet Resolution
- Seventy-five Percent Waste Reduction Resolution
- Construction and Demolition Recycling Ordinance
- Pedestrian Master Plan
- Dioxin and Public Health Resolution
- Climate Protection Resolution
- Sustainable Development Resolution
- Transit First Policy
- Living Wage Ordinance
- Creek Protection, Storm Water Management and Discharge Control Ordinance
- Pest Management Resolution
- Recycling Space Allocation Ordinance
- Recycled Content Procurement and Source Reduction Policy
- Alameda County Waste Reduction and Recycling Act

2000's

1990's



Brooke Levin

Oakland celebrates its 160th birthday in 2012

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The Energy and Climate Action Plan was developed under the leadership of the Public Works Agency – Environmental Services Division with contributions from numerous City staff, partner organizations and members of the Oakland community.

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The Human Health Effects of Rail Transport of Coal Through Multnomah County, Oregon

A Health Analysis and Recommendations for Further Action



**Health Assessment
and Evaluation**



February 2013

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Prevent. Promote. Protect.

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Introduction

Balancing the potential benefits and harms of using coal as an energy source is an ongoing challenge for local communities and the global economy. Coal is a natural resource that has long been used to power a wide variety of activities. It is a non-renewable resource; the bulk of the coal mined today is about 300 million years old and will not be replaced during human existence. Though it is a naturally occurring substance, coal can be dangerous to human health, especially in its particulate form. Additionally, the extraction, transportation, and combustion of coal can have major impacts on natural, social, and economic conditions.

This health analysis considers the potential impacts and human health consequences of three proposed coal export projects that could result in rail transport of coal through Multnomah County.

The goals of this analysis are to:

- Synthesize scientific knowledge about the human health impacts of coal transportation by rail
- Identify the populations in Multnomah County who might be affected
- Describe the most likely human health impacts of coal transportation locally

To do so, the effects of the following are examined:

- Rail freight traffic in general, such as noise, locomotive emissions, and roadway congestion
- Coal as a specific cargo

The Multnomah County Health Department conducted this analysis at the request of Multnomah County Chair Jeff Cogen. As Chair and CEO of Multnomah County, Chair Cogen has responsibility for protecting the health of county residents. Based on the findings, the Health Department has identified potential actions for consideration by the County Chair and other concerned community leaders.

Overview of Analysis

This analysis considers the potential impacts of coal export projects that could result in the transport of coal through Multnomah County. Though coal would travel through the county, it would not be mined, loaded, unloaded, or burned here. This analysis considers the proposed Kinder Morgan Terminal, Millennium Bulk Terminal, and Port of Coos Bay projects. The analysis is based on descriptions of the projects provided by two sources: a white paper by the Western Organization of Resource Councils¹ and investigative research by *The Oregonian*² (see *Table 1*). This analysis considered the impacts of the three proposed projects together, using conservative estimates for the number of trains and volume of coal they will carry.

Table 1: Potential Routes and Freight Volumes of Proposed Projects

Project	Annual Coal Shipments (est. millions of tons)	Trains Per Day (est.)	Possible Route to Port
Kinder Morgan	15.0 initially, then up to 30.0	4-6	Along the north bank of the Columbia River on BNSF rails, crossing into Multnomah County on the Columbia River Rail Bridge at Hayden Island, turning northwest onto Portland & Western rail line along U.S. 30
Millennium	27.6 initially, then up to 48.5	8-9	Could travel on either bank of the Columbia River - if carried by Union Pacific, could travel along the south bank parallel to Columbia Blvd. and through Kenton before turning north on the Columbia River Rail Bridge
Coos Bay	6.6 initially, then up to 11.0	4	On Union Pacific tracks parallel to I-84, then south through the Central East Side of Portland and along Route 99E

Sources: *The Oregonian*² and WORC¹

This analysis focuses on one specific stage of the coal cycle (transportation) by one shipping mode (rail) in one geographic location (Multnomah County). This means that the analysis does *not* consider the health impact of coal that would be carried on barges along the Columbia River or trains that might travel along the north bank of the Columbia River in Washington State. Nor does it address potential indirect effects of coal transportation which could have positive or negative health consequences.

Positive indirect effects might include economic development related to railcar construction, increased public revenue from taxes on diesel-fueled coal trains, and/or improved rail infrastructure.

Negative indirect effects might include displacement of other products carried by rail, fisheries depletion that could affect people's

diets and livelihoods, or health impacts of substances sprayed on coal to reduce dust. These issues, as well as the broader implications of the extraction, transportation, and combustion of coal on climate change, are discussed in many studies and white papers in the health and environment sectors³⁻⁶ and energy sectors.⁷⁻⁹

Methods

This health analysis used two techniques: *literature review* and *spatial analysis*. Literature review is a systematic process of synthesizing previous research on a topic. This analysis relied as much as possible on peer-reviewed scientific literature, but also used other sources such as documents produced by not-for-profit organizations, the railroad industry, and the general media.

Spatial analysis involves using mapping software to understand geographical differences. This analysis used spatial analysis

to identify and describe the populations in the county who may be most affected by coal transportation by rail. The data about the population were obtained from the U.S. Census Bureau, the Portland State University Population Research Center, and a tabulation of Census data computed by the Metro regional government called the Equity Composite.¹⁰ *The Oregonian* provided a computer file mapping the potential routes for the proposed projects.

Literature review findings

The literature review identified six potential local environmental effects of concern related to coal transportation:

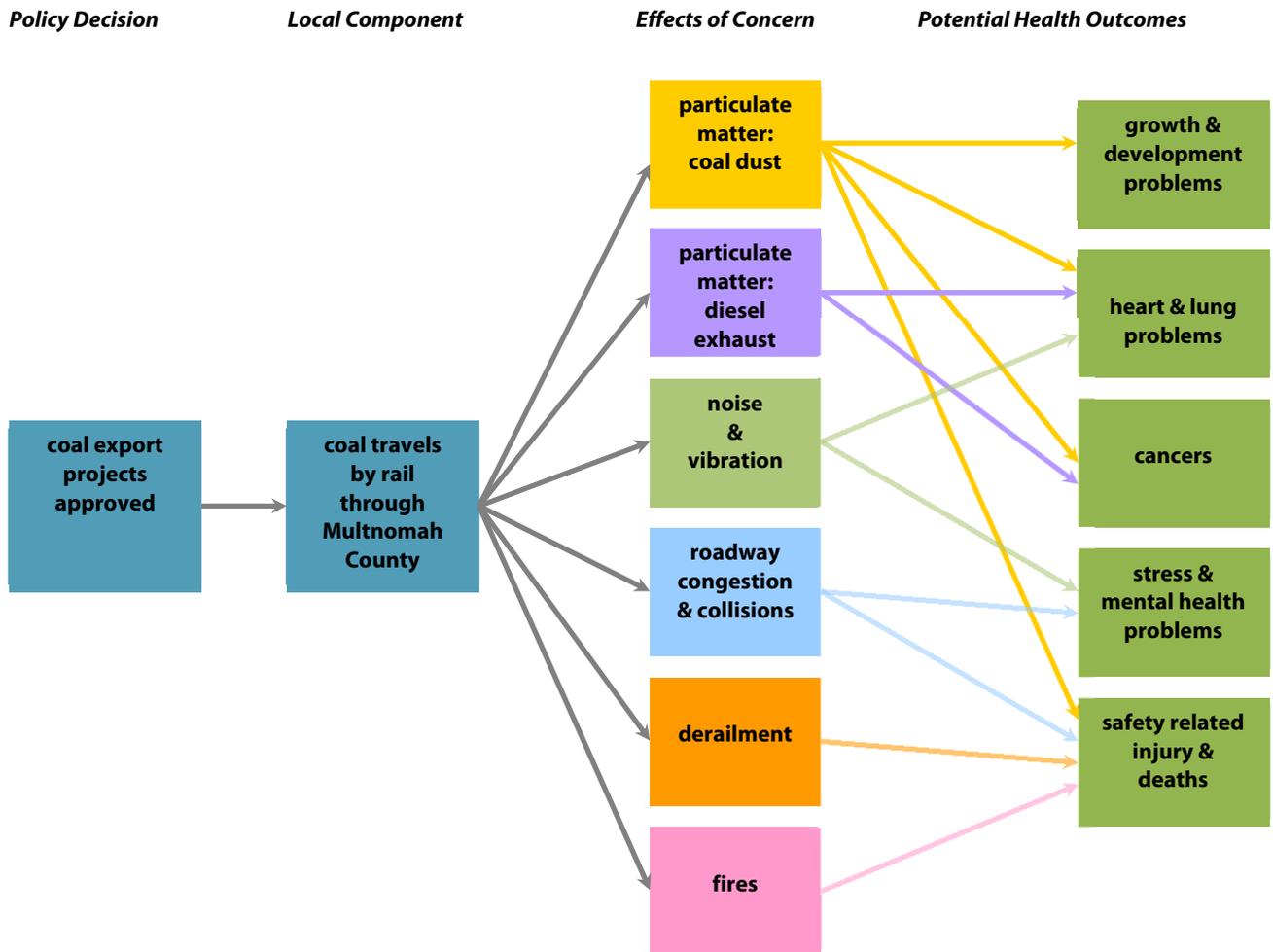
1. Emission of particulate matter in the form of coal dust
2. Emission of particulate matter in the form of diesel locomotive exhaust
3. Production of noise and vibration by train movement
4. Congestion and collisions along roadways and rail lines
5. Train derailments
6. Fires due to spontaneous combustion of coal

The literature review also found that the above six effects are associated with the occurrence of the following health outcomes:

- Heart and lung problems
- Cancers
- Growth and development problems
- Stress and mental health problems
- Injury
- Death

Nearly all of these health outcomes are associated with more than one of the environmental effects of concern. The schematic diagram in *Figure 1* illustrates these relationships. The colored arrows represent effects of concern; the arrows point to the health outcomes with which the effects are associated.

Figure 1: Relationships between coal transportation by rail, environmental effects of concern, and health outcomes



This figure does not reflect the possible cumulative or synergistic impacts of these health outcomes on individual and community-level health.

Potential effects of concern, associated health outcomes, and local implications

This section reviews each of the six environmental effects and their associated health outcomes. For each effect, this analysis examines how the three proposed coal transport projects might impact Multnomah County and provides a concluding statement that summarizes the analysis of that impact.

Emission of particulate matter: Coal dust

Associated health outcomes: heart and lung conditions such as heart attacks, strokes, asthma, and coal worker's pneumoconiosis (black lung disease); cancers; growth and development problems; community-level health

Particulate matter is a general term to describe small particles in the air, of which coal dust is one type. Particulate matter is toxic to human beings because it can enter the bloodstream after being inhaled. According to the World Health Organization, particulate matter is hazardous to human health even in extremely small quantities.¹¹

Heart and lung conditions

Particulate matter can threaten cardiopulmonary health, the effective circulation of blood and utilization of oxygen in the body. The World Health Organization has reported that long-term exposure to particulate matter in the environment leads to a reduction in life expectancy from cardiopulmonary mortality.¹² Particulate matter is associated with a host of respiratory problems, including

impaired lung functioning¹³ and inhibited lung development in young people.¹⁴ Particulate matter can exacerbate and contribute to the onset of asthma,¹⁵⁻¹⁷ a disease that affects about nine percent of Multnomah County residents.¹⁸ Young people, older adults, and people with heart conditions are especially vulnerable to these problems.

Coal dust, as one specific type of particulate matter, is associated with certain health outcomes. Extreme exposure to coal dust, such as working 10 or more years in a coal mine,¹⁹ can lead to coal workers' pneumoconiosis (CWP), a debilitating condition that often causes death. CWP is extremely rare in Oregon. From 1968 to 2006, only one Oregonian died from CWP.¹⁹

Cancers

Inhalation of particulate matter in general is associated with increased risk of multiple types of cancer.²⁰

Cadmium, which can be present in coal dust, has been found to contribute to risk for lung and nasal cancer.^{21,22} However, an expert panel convened by the World Health Organization in 1997 found no conclusive link between coal dust and cancer.²³ Consultants reviewing the health effects of coal dust for an Australian mining company in 2005 came to the same conclusion.²⁴

Growth and development problems

Coal dust may contain traces of the heavy metals, such as lead, mercury, chromium, and uranium, that are toxic to the human nervous system. Children are particularly vulnerable to

heavy metals which can lead to decreases in birth weight and children's growth rate, and intellectual development problems.²⁵ The amounts of these metals in a sample of coal vary depending on where the coal is mined. There is little evidence about the effect that heavy metals in coal dust may have on people exposed to coal dust in the environment.

Community-level health

There may be other effects of environmental coal dust on human health, but it is difficult to draw conclusions based on the limited research available. Most of what is known about the health impacts of coal dust on people is based on high levels of exposure—usually occurring in coal mining or processing workplaces. Little is known about people exposed to low levels, such as people who live in communities through which coal is transported. However, some studies suggest that living near coal operations has health effects. For example, research conducted near coal mines in England found that children living closer to coal mines more frequently visited physicians with respiratory complaints than did those living farther away.^{26–28} However, the same research team found that, despite increased doctors' appointments, there was little conclusive evidence that children's health status was worse as a result of the increased dust levels in the community.

Studies of communities in the Appalachian region of the U.S. suggest that there are community-level health effects of coal exposure.^{29–32} These studies have found that even people who do not work in mines, but live near them, may experience higher mortality rates related to heart, respiratory, and kidney problems. However, the mechanisms for these impacts are not fully understood and may be the result of other factors such as the effect of high poverty rates on community health.

Implications for Multnomah County

The three proposed coal transport projects will not result in the loading and unloading of coal in Multnomah County, but might result in roughly 125,000 tons of coal moving through the county per day. Estimates of the amount of coal dust shed by trains during shipping vary from less than one percent to up to three percent of the load.^{33–36}

Due to their concern about the serious threat that coal dust poses to the stability of the train structure and its rail lines, BNSF Railway has been conducting research regarding the impacts of coal dust from loaded coal cars as they depart from the Powder River Basin.³⁷ From these studies, BNSF Railway reports that shippers can take steps to reduce coal dust releases, including the use of a proper loading chute and the application of a dust suppression topper agent (e.g., a surfactant) to the coal shipment at the time of loading.

The company states that the proper application of certain topper agents along with the use of a modified loading chute can potentially reduce coal dust levels by at least 85 percent. However, there is no evidence of independent verification of these findings. In a series of cases before the federal Surface Transportation Board, utility companies that are required to follow BNSF Railway's rules for shipping coal have argued that there is insufficient evidence for the effectiveness of these substances and that shippers should not be responsible for the costs of applying them.^{38–41}

The available research, including studies by railroads, government agencies and university researchers, suggests that many factors, such as how the coal is loaded, the speed the train is traveling, weather conditions, and the use of protective sprays, would influence the amount of coal dust released by trains traveling through Multnomah County.

Conclusion

There are well-established health risks of exposure to coal dust in occupational settings. However, there are significant gaps in the scientific literature regarding how much coal dust is shed by trains carrying coal, how far coal dust travels from rail lines, and the health effects of inhaling this environmental coal dust. This makes it difficult to conclusively state what the local impacts of coal dust might be.

Emission of particulate matter: Diesel locomotive exhaust

Associated health outcomes: heart and lung conditions such as heart attacks, strokes, and asthma; cancer

As discussed in the *coal dust* section above, particulate matter in the environment is dangerous to human health. Diesel particulate matter, a specific type of particulate matter that is released by engines powered by diesel fuel, has distinctive health hazards.

Heart and lung conditions

Inhalation of particulate matter is associated with several heart and lung conditions, as discussed in the *coal dust* section above.

Cancers

Inhalation of particulate matter is associated with cancers, as discussed in the *coal dust* section above. In the case of diesel particulate matter specifically, the relationship with cancer is conclusively documented. Diesel particulate matter is one of a few substances that is designated as a known carcinogen by the World Health Organization.⁴²

Implications for Multnomah County

Freight train locomotives are powered by very large diesel engines. Diesel particulate matter is one of the air toxins that contributes the most to air pollution-related health risks in the Portland region. According to a recent

estimate by the Oregon Department of Environmental Quality, in 2017 the region's airshed will have on average more than ten times the level of diesel particulate that is considered safe.⁴³ However, in general, trains contribute a relatively small percentage of total diesel particulate air pollution in our region (i.e., an estimated 7%).⁴⁴

The three proposed coal transport projects might result in 16-19 new train trips through Multnomah County. This might represent an estimated 15-20 percent increase in total train trips in Multnomah County compared to the current number of trips. Thus, the trains carrying coal would contribute a moderate increment of train-related diesel emissions in the region.

Conclusion

By virtue of using diesel engines, rail transportation of coal through Multnomah County will result in the emission of diesel particulate matter, a known health hazard. However, coal trains would add a relatively small increase to already-high levels of diesel particulate matter in the region, the vast majority of which is released by sources other than trains.

Production of noise and vibration by train movement

Associated health outcomes: stress and mental health problems; high blood pressure

High blood pressure

Noise can threaten cardiopulmonary health, the effective circulation of blood and utilization of oxygen in the human body. Noise, especially at high levels, can contribute to high blood pressure, a risk factor for heart disease.⁴⁵⁻⁴⁷

Stress and mental health

Noise and vibration, such as that produced by trains, can affect people's stress levels and mental well-being. Stress influences health through the secretion of stress-related hormones and causing behaviors (particularly coping mechanisms) that can increase risk of disease.⁴⁷ At lower environmental noise levels, there is a weak association between noise and mental health symptoms and anxiety.⁴⁸ One study of military aircraft noise found that exposure to higher levels of noise was associated with nervousness and depression.⁴⁹ Because reaction to noise is influenced in part by the time between noises⁵⁰ and the "difference in sound pressure levels [loudness] between a noise event and background,"⁵¹ train noise is particularly disruptive.

Implications for Multnomah County

Trains are one of many sources of noise in Multnomah County, and noise from trains has long been a concern of several county neighborhoods, such as Cathedral Park, Brooklyn, and Eastmoreland. While train vibration is felt only locally, horn noise can travel long distances and would contribute to background urban noise. As discussed above, coal trains might represent a moderate increase in freight rail traffic in the region.

Conclusion

Coal trains could produce more noise per trip than other trains as a result of their length and heavy load. However, activity near rail yards, such as loading and unloading, causes the majority of train-related noise, and these activities will not take place in Multnomah County. Therefore, trains carrying coal would likely add a relatively small increment of noise in areas that already experience industrial noise.

Traffic congestion and collisions along roadways and rail lines

Associated health outcomes: stress; injury and deaths

Stress

Train traffic-related congestion may cause stress. Stress influences health through the secretion of stress-related hormones and causing behaviors (particularly coping mechanisms) that can increase risk of disease.⁴⁷

Safety-related injury and deaths

Safety concerns include train collisions with other motor vehicles, bicycles, or pedestrians; decreased visibility near rail tracks due to dust; and property damage, such as to vehicle windshields by pieces of coal falling from trains. Congestion at intersections crossed by coal trains could increase response times for emergency vehicles and/or disrupt emergency routes, which could lead to increased severity of medical problems and even death due to delayed medical care.

Implications for Multnomah County

Comparing the potential routes to federal transportation data suggests that there are approximately 50 locations where coal trains might cross public roadways in Multnomah County. Like other trains that travel through Multnomah County, each coal train would travel through several at-grade crossings per trip. Given the length and weight of coal trains, the force of a collision involving a coal train could cause major injuries and property damage. According to the Federal Railroad Administration, there were three train-involved collisions in Multnomah County in the first three quarters of 2012 (January-September). These collisions resulted in two injuries and no fatalities.⁵² Over the past ten years, there have been seven deaths and 224 train-related injuries in Multnomah County for any reason. The data

for the past ten years shows that these incidents are on the decline.⁵³

As trains pass through at-grade crossings, the flow of motor vehicles, bicycles, and pedestrians is disrupted and delayed. Trains are required to travel at low speeds through urban areas to decrease the risk and severity of collisions. Because of their length (up to 1 ¼ miles long) and low speed, coal trains could block roadways for relatively long periods of time. In densely settled areas, such as the city of Portland, this could result in a cumulative delay of up to two hours per day at each crossing.⁵⁴ It could also disrupt routes and increase response times for emergency vehicles called to fires, medical incidents, and other public safety crises.

Conclusion

Coal trains could cause significant delays and result in roadway congestion, including delays in emergency response. Coal trains could also collide with vehicles and pedestrians, but U.S. data indicates that coal train collisions are rare. In Multnomah County, train collisions (carrying all types of cargo) are infrequent and are on the decline. There is no evidence that increased coal train traffic would change this trend.

Train derailment

Associated health outcomes: injury and deaths

Injury and deaths

Coal dust is known to degrade railroad tracks and prevent adequate water drainage from the railbed. Poor drainage contributes to slippery and warped rails. The National Wildlife Federation reports that there were thirteen derailments of trains carrying coal in the United States in 2012, representing 1 percent of all U.S. train derailments (13 out of 930). The 930 derailments and collisions in the

U.S. caused eight fatalities in 2012, none of which were in Multnomah County.

Implications for Multnomah County

According to the Federal Railroad Administration, there were five train derailments reported in Multnomah County in the first three quarters of 2012 (January–October) and there were no related injuries or deaths.⁵² Two derailments occurred in rail yards and three were due to track defects.

Conclusion

These data suggest that train derailments are fairly uncommon in Multnomah County and that the introduction of coal trains is unlikely to result in many additional derailments.

Fires due to spontaneous combustion of coal

Associated health outcomes: injury and deaths

Injury and deaths

Coal combusts at low temperatures. Spontaneous combustion occurs because coal produces heat as it decomposes upon contact with oxygen. Fires are most likely to occur in areas where coal is stored in large piles for long periods of time without being moved, such as at power plants.⁵⁵ Spontaneous combustion is more likely in freshly-mined coal. Packing strategies such as those that compact the coal can reduce the likelihood of combustion while being transported by train.⁵⁶ Given coal’s combustibility, fires and attendant injuries and property damage could also occur as a result of a train collision.

Implications for Multnomah County

Coal from the Powder River Basin would only travel through Multnomah County; it would not be stored or processed within the county. However, Powder River Basin coal may be particularly susceptible to spontaneous

combustion as a result of its chemical composition. According to discussions between mining and energy companies that handle Powder River Basin coal, there have been reports of fires in railcars and barges transporting this type of coal.⁵⁵ Based on what we know about the proposed projects, coal would be transported in uncovered cars to let heat dissipate, which would decrease the likelihood that coal would catch fire.

Conclusion

Though Powder River Basin coal may be particularly susceptible to combustion, the literature review suggests that fires in railcars carrying coal through Multnomah County are unlikely. This is because coal is most likely to catch fire where it is mined, processed, or stored and because shippers use packing techniques to prevent fires during transit.

Spatial analysis findings: Populations in Multnomah County likely to be affected

The literature review indicated that some populations in Multnomah County could be more vulnerable to the health impacts of coal transportation than others. Vulnerable populations include:

- People living close to the rail lines carrying coal
- People who are susceptible because of their age (i.e., youth and older adults)
- Populations who are at increased risk of the associated health outcomes due to their race, ethnicity, income, and/or level of exposure to other health risks.

For people who fall into several of these categories, risks may be multiplied. This section describes each of these populations to the extent that local data were available.

Populations living near rail lines that might carry coal: Census tract-level analysis

Generally, it is reasonable to expect that residents living closer to rail lines carrying coal would be exposed to higher levels of coal dust and diesel particulate matter than those living further away. Similarly, noise-related problems

and traffic delays are more likely to occur among those living and working closer to railroad tracks.

As previously stated, there are significant gaps in the scientific literature regarding how much coal dust is shed by trains carrying coal, how far coal dust travels from rail lines, and the health effects of inhaling this environmental coal dust. The lack of scientific information limits the ability of this analysis to quantify the number of people potentially affected or the severity of the effects.

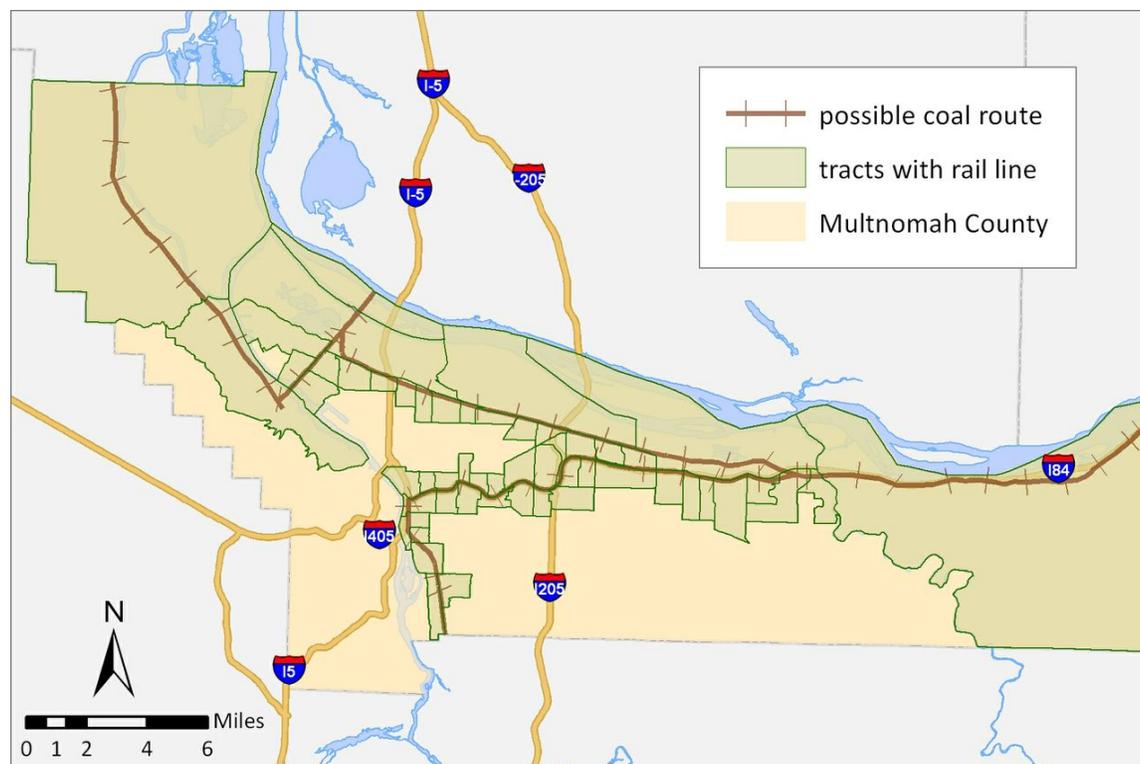
However, this analysis drew upon the available literature to estimate that coal dust may travel approximately 500 m to 2 km (1/3 to 1 ¼ miles) from the train tracks, depending on weather conditions and train speed.^{57,58} Census tracts—relatively small geographic areas used for census-taking—offer a rough proxy for the 2 km distance from the rail line. Using this approximation allowed the Health Department to utilize Census Bureau data to describe potentially affected populations.

Almost one-third of Multnomah County's population lives in census tracts that either border or cross rail lines that may carry coal. As shown in *Figure 2*, many of these people live

near major roadways and industrial areas and probably already experience a high burden of air pollution and noise disturbance.

Accordingly, the potential burdens of the coal export projects would fall on the same populations who are already exposed to the highest levels of air toxins and industrial noise.

Figure 2: Census tracts containing or adjacent to rail lines that might carry coal



Sources: Metro,⁵⁹ Census 2010, *The Oregonian*²

Table 2, on the following page, presents the most current census data available at the tract level regarding populations who may be especially vulnerable to health impacts related to coal transport. As shown in Table 2, the demographics of the tracts near rail lines are similar to the county population as a whole; however, people of color make up a larger proportion of the population in tracts near rail lines than they do in the county as a whole. As a result, people of color may be disproportionately exposed to the effects coal transportation.

Not only are people of color in Multnomah County more likely to live by the rail lines that

might carry coal, they may also be more vulnerable to some of the health consequences of coal transportation, such as heart disease. For example, in Multnomah County, African Americans have a higher rate of deaths caused by strokes as compared to Whites.⁶⁰

The causes of these racial and ethnic differences are complex. A wide body of research has found that race and ethnicity are associated with health status—independent of poverty status—because of stress, access to health care, and other factors.

. **Table 2:** Characteristics of population living near rail lines that may carry coal (estimates)

	Tracts that contain or border rail lines that may carry coal	Multnomah County overall
	Number (%)	Number (%)
Race/ethnicity (source: Census 2010)		
Basis of computations: Total population in 2010	229,482	735,334
People of color (Non-White + Hispanic Whites)	62,218 (27.1%)	172,913 (23.5%)
Hispanic of any race	28,503 (12.4%)	80,138 (10.9%)
Non-Hispanic		
White	167,264 (72.9%)	562,421 (76.5%)
Black	18,376 (8.0%)	41,401 (5.6%)
Asian	13,255 (5.8%)	47,950 (6.5%)
American Indian/Alaska Native	2,920 (1.3%)	7,825 (1.1%)
Native Hawaiian/Pacific Islander	1,667 (.7%)	4,029 (.5%)
Age (source: Portland State University 2011 Population Estimates)		
Basis of computations: Estimated population in 2011	231,413	741,961
Over 65 yrs.	25,841 (11.2%)	79,977 (10.8%)
Under 18 yrs.	47,832 (20.7%)	154,840 (20.9%)
Other social characteristics (source: American Community Survey 2006-2010)		
Basis of computations: Population for whom poverty status is determined, 2006-10 estimate (Table S1701)	216,063	697,596
With incomes at or below 200% of federal poverty level	78,264 (36.2%)	239,753 (34.4%)
Basis of computations: Population 5 years and over (Table SF4 DP02)	210,532	667,150
Speak English less than very well	19,920 (9.5%)	62,241 (9.3%)

Populations who might experience the greatest effects: Census block group-level analysis

Of people who live within 2 km of rail lines carrying coal, those who live within 500 m are even more likely to be affected. An estimated 82,000 people, or about one in nine Multnomah County residents, live within 500 m of the rail lines that might carry coal.* This is close enough to predict that these people would experience some, if not many, of the effects of coal transportation.

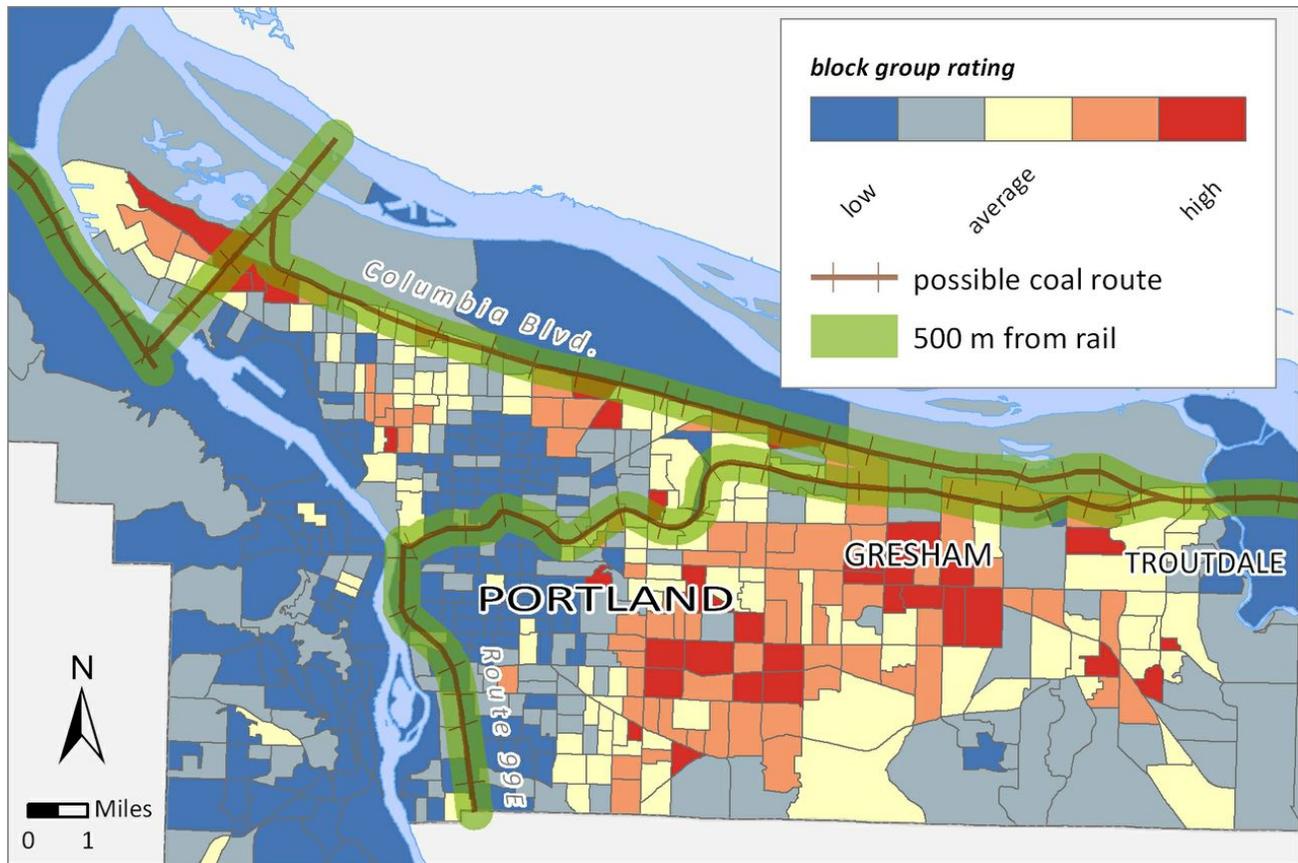
To describe the population living within 500 m of the proposed coal routes, this analysis used a recent analysis conducted by Metro, called the Equity Composite.¹⁰ Metro used data at the census block group level to identify populations that have historically experienced social and health disadvantages based on race, ethnicity, age, or income and compared it to other areas in the metropolitan area. Block groups are geographic units created by the Census Bureau that are one level smaller than census tracts. The map of the demographic measure from the Equity Composite provides a rough illustration of the characteristics of the population living within 500 m of the potential coal train routes.

Figure 3 on the following page shows that some of the block groups near the proposed coal transportation routes have relatively high proportions of residents belonging to disadvantaged demographic groups. These block groups are shaded in red or orange and cluster along rail lines that parallel Columbia Boulevard and neighborhoods in North Portland (e.g., Kenton and St. Johns). By contrast, more advantaged block groups, shaded in blue, are common along the lines that parallel Interstate 84 and Oregon Route 99E.

This suggests that, given similar volumes of rail traffic, people who live along the Columbia Boulevard and Willamette Bridge rail lines could suffer more serious health effects than would their counterparts in other parts of the county because the racial, ethnic, income, and age composition of these areas increase their vulnerability to health problems.

* A more conservative estimate of how far coal dust might travel, based on the findings of two articles.^{57,58}

Figure 3: Concentration of vulnerable demographic groups in census block groups (Metro Equity Composite demographic measure) with 500-meter radius from rail lines that might carry coal



Sources: *The Oregonian*,² Metro regional government^{10,59}

Key Concerns and Recommendations for Potential Actions

The purpose of this health analysis was to help Multnomah County better understand the potential health impacts of transporting coal by rail before any of the proposed projects are implemented. Health risks attributable to coal transportation would add to the multiple effects of rail freight that Multnomah County residents already experience. A substantial increase in rail traffic—carrying coal or other freight—would likely increase the proportion of the population affected by these issues and/or the magnitude of the effects. Ultimately, it is reasonable to expect that this would likely increase the prevalence and/or severity of the associated health outcomes, as well.

In addition, coal transportation might result in cumulative and/or synergistic impacts that this analysis is unable to estimate. *Cumulative impacts* are the sum total of the various individual impacts. *Synergistic impacts* describes how combinations of environmental or health factors can strengthen, weaken, or block the effects of other factors.

Policymakers, community leaders and residents must weigh these new potential risks in light of existing risks as well as the potential positive effects of expanded rail transportation on the local economy.

Concerns

This analysis of the potential health consequences of coal transportation through Multnomah County identifies two key concerns:

Additional rail freight traffic increases health risks

Specifically, there is likely to be increased exposure to diesel particulate matter as a result

of locomotive exhaust. This conclusion is based on:

- The well-established connection between exposure to diesel particulate matter and health problems
- The high likelihood that coal trains, as any other train, would emit diesel particulate matter
- The severity of the health outcomes associated with diesel particulate matter (e.g., respiratory problems, cancer)

The geographic areas of highest concern are located near the tracks by Columbia Boulevard and in North Portland neighborhoods (e.g., Kenton and St. Johns). Residents in some of these areas of concern are already exposed to relatively high levels of diesel particulate matter from living near major roadways and industrial areas. The social groups of highest concern are: communities of color, children, older adults, and people earning low incomes.

The health risk posed by coal traveling as rail cargo through Multnomah County is uncertain due to insufficient scientific evidence

Given the well-established risks of exposure to coal dust in occupational settings, the Health Department concludes that more research is needed to assess:

- How coal dust could disperse during coal transportation by rail and the extent that people would be exposed
- What the immediate, cumulative, synergistic and long-term health impacts of this dust could be on a community

Recommendations

The Multnomah County Health Department recommends the following actions for consideration by local policymakers and community leaders to address these key concerns and raise awareness about Multnomah County's potential vulnerability.

Invoke the precautionary principle

The precautionary principle holds that in the event of insufficient evidence that an action may cause harms, the burden of proof falls on those taking the action to demonstrate that it will not be harmful.⁶¹

Under the precautionary principle, it is reasonable for policymakers to call upon the coal industry, including rail companies who would be transporting coal, to demonstrate that coal transportation would *not* be harmful to the public's health and safety. This call to industry could catalyze further public discussion about the uncertain risk of coal transportation, the demands for more research, and the need for local planning to assure the health and safety of Multnomah County communities.

Call for a programmatic federal Environmental Impact Statement of coal export in the Pacific Northwest

The information and evidence gaps identified in this analysis reinforce the calls from other communities and organizations for a comprehensive review of the risks and threats of coal export projects by the relevant federal agencies (e.g., the Federal Bureau of Land Management and U.S. Army Corps of Engineers).

The proposed plans for transport of coal across the Pacific Northwest do not exist in isolation, but rather will affect communities throughout the region. Therefore, it is reasonable for local policymakers to call for the federal government to conduct a region-wide review of the environmental, health, and transportation issues related to exporting coal from Northwest ports. Such a "programmatic" environmental impact statement (EIS)⁶² could address several potential health impacts identified through this analysis including: roadway congestion, collisions, and the disproportionate impact on environmental justice communities, such as people of color and people already exposed to the health burdens of industrial processes.

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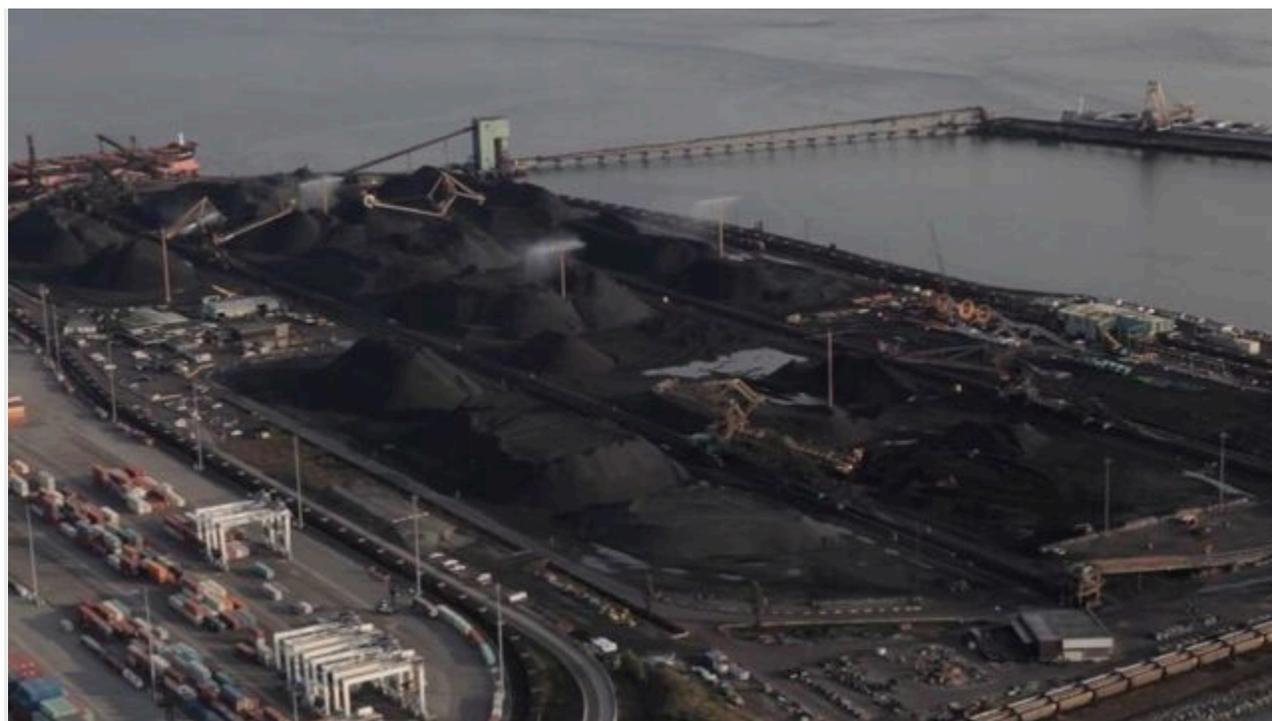
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What Coal-Train Dust Means For Human Health

by Ashley Ahearn KUOW | March 10, 2013 11 p.m. | Updated: Feb. 18, 2015 8:14 a.m.



The Westshore Terminal near Vancouver, B.C. handles about 30 million tons of coal per year, loading it onto ships for export. Westshore spent \$7 million upgrading pumps, rain guns and misting devices around the site used to dampen and control coal dust.

Katie Campbell

Coal in the Northwest



This is the first in a [two-part series](/tagged/coal dust series/ ""). TSAWWASSEN, B.C. — With five coal export terminals under consideration in Washington and Oregon, Northwest residents are grappling for the first time with issues that are old hat in coal states like West Virginia and Kentucky. One of those issues: coal dust. How much of it will escape along the journey from mines in Wyoming and Montana to proposed export terminals on the West Coast? And what might that dust mean for public health?

Where better to look for insight than the largest existing coal export terminal on the West Coast? At the Westshore terminal near Vancouver, British Columbia there are, at any given moment, about 1.5 million tons of coal stored in piles 8 1/2 stories high. "The big job is to keep it here," says Ray Dykes, a spokesman for Westshore on a recent tour. "That's why all these sprays and new equipment is coming on." Westshore has just spent \$7 million upgrading the series of pumps, rain guns and misting devices around the site used to dampen and control dust from the coal piles. Water costs them about \$1.5 million each year. Westshore buys the water from the public water system.

This terminal has been in operation for 40 years. In the local bar, people talk about black dust collecting on their Venetian blinds. House painting companies [advertise](<http://www.warlinepainting.ca/tsawwassen.asp>) special cleaning treatments to remove coal dust before new paint is applied. There have been complaints about dust in neighboring communities like Point Roberts, just across the border in Whatcom County. But Westshore Terminal has had bigger problems lately. In December, a coal tanker went off course and [crashed](<http://www.vancouversun.com/news/Ship+crashes+into+dock+Westshore+Terminals/7667184/story.html>) into the conveyor belt whirring along behind where Dykes is standing. About 30 tons of coal ended up in the water.



The causeway at Westshore Terminal after the December collision. Credit: Ray Dykes/Westshore

"This has been a fun day for the environmentalists," Dykes says, "but 8,300 other ships went by without an incident and they jumped all over this one...accidents happen. Do we not fly because one plane crashes?"

Thousands of pounds of coal spilling into the water is not a good thing for the environment, but it is a relatively rare occurrence.

Here's a more likely scenario for the Northwest:

Dust escaping from coal trains moving through the region every day. Trains en route from Wyoming and Montana mines, through Spokane then down along the Columbia River to terminals along the coast.

There's some debate over how much dust comes off those trains along the way.

"The coal dust issue itself has been blown out of proportion in my estimation," says Mike Elliott, a member of the Brotherhood of Locomotive Engineers and Trainmen who has been working on the rails for almost 20 years. "It wasn't an issue that was happening away from the mine sites within about a 30 mile radius."

But Elliott's own employer, BNSF Railway, has made statements to the contrary. BNSF would be the main rail company involved in moving coal through Washington and Oregon if new terminals are built in this region.

In 2009 a representative from the company [testified](#) before a federal review board. He was asked how much dust escapes from each coal train car during a 400 mile trip. His answer? 645 pounds per car.

Since the 2009 testimony coal companies have been required to apply what's called surfactant or topper agent to the trains before they leave the mines. These compounds are mainly made up of magnesium chloride, which is commonly used to suppress dust on logging roads.



Dust comes off of a coal train in Campbell County, Wyo. Credit: Michael Werner

BNSF Railway declined EarthFix's repeated requests for an interview about coal dust. But Courtney Wallace, a spokesperson for the company, emailed a statement.

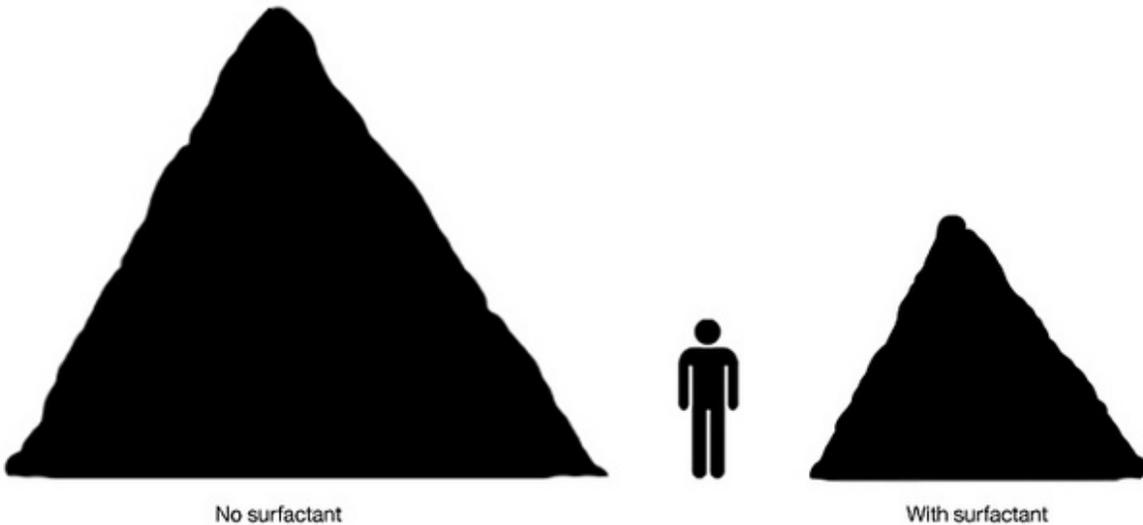
It said "BNSF has a vested interest to ensure shippers are in compliance with our coal-loading rule, as coal dust poses a serious threat to the stability of our tracks."

[BNSF research](#) has shown that the surfactants reduce the coal dust by about 85%.

That should bring the 645-pound figure down to about 100 pounds of coal dust escaping per car.

There are usually about 125 cars per coal train.

Sizing Up Coal Dust



BNSF Railway estimates 645 pounds of coal dust can escape from each car in a loaded coal train over a 400-mile journey. The company says chemical surfactants sprayed on top of coal cars can reduce dust escape by 85 percent.

This graphic, drawn to scale, shows how much coal could escape from a 125-car coal train with and without surfactant applied.

NOTE: The human figure represents a 5-foot-10 tall adult; the coal dust piles represent 80,625 pounds of coal (left) and 12,094 pounds of coal dust (right).

Credit: Courtney Flatt

“So no matter what (BNSF) and the coal companies have done, we can say for sure the coal dust is not zero,” says Dan Jaffe, a professor of environmental and atmospheric science at the University of Washington. Last year Jaffe and a student measured the size and distribution of particles of pollution in the air as coal trains passed through the Seattle area. Right now a few trains per day come through en route to existing coal export terminals in British Columbia. Jaffe’s research hasn’t been published yet and he stresses that more sampling needs to be done. But his preliminary results show that the air pollution signature from a passing coal train is different from other trains.

“Trains that were carrying coal exhibited some larger particles suggesting that there was some loss of coal dust as they were traveling by,” Jaffe said in an interview.

Coal has been transported via train for decades, yet little research has been done on the potential health effects for people who live near coal train routes. Much more is known about the health effects of exposure to [diesel exhaust](#) from the train locomotives. These very small particles of air pollution get deep into the lungs and have been connected to asthma, cardiovascular problems. Coal dust has been shown to coat the lungs of coal miners, contributing to problems like chronic bronchitis, decreased lung function, cancer and death. “Presumably miners have higher exposures than would be alongside the tracks but we don’t know that,” says Juliet Van Eenwyk, an epidemiologist with the Washington State Department of Health.



[" title="dust2 by EarthFix, on Flickr">](#)

Coal dust swirls while crews clean up after 30 train cars of coal overturned in eastern Washington in 2012. Click image for video of clean-up. Credit: Courtney Flatt

Both Van Eenwyk and Jaffe say trackside monitoring needs to be done to better understand the risk of coal dust exposure.

What we do know, Van Eenwyk says, is that children's lungs are more vulnerable. If they're exposed to air pollution they can suffer from decreased lung function for the rest of their lives.

"There could be ramifications for children at lower levels of breathing the coal dust," she says.

There are a lot of factors that could influence how much coal might escape from trains along their journey to the Northwest coast. Wind, rain and hot dry weather could all play a role in how the coal dust behaves.

Public health officials in [Washington](#) and [Oregon](#) say there's enough risk to merit more specific sampling and research about coal dust before any decisions are made about the proposed coal export terminals in the Northwest.

Video by Katie Campbell. Coal dust graphic by Courtney Flatt. Bonnie Stewart contributed to this report.

Tuesday: What coal dust means for the environment.