PLANNING HEALTHY PLACES

A GUIDEBOOK FOR ADDRESSING LOCAL SOURCES OF AIR POLLUTANTS IN COMMUNITY PLANNING

MAY 2016

Bay Area Air Quality Management District

Planning Healthy Places

A Guidebook for Addressing Local Sources of Air Pollutants in Community Planning

This report is for information purposes only. Recommendations are advisory and should be followed by local governments at their own discretion. This report may inform local land use planning in the Bay Area, but does not commit local governments or the Air District to any specific course of regulatory action.

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WHAT IS PLANNING HEALTHY PLACES?

Planning Healthy Places is a guidebook that provides important air quality and public health information, and is intended to assist local governments in addressing and minimizing potential air quality issues by providing tools and recommended best practices that can be implemented to reduce exposure and emissions from local sources of air pollutants. The Bay Area Air Quality Management District (Air District) provides this information to be considered by land use planners, elected officials, developers, community groups, public health advocates, and anyone interested in integrating land use, air quality and public health. The Air District intends that the information and recommendations in this guidebook be incorporated into city or county General Plans, neighborhood or specific plans, land use development ordinances, or into single projects. The Air District's primary goal in providing this guidebook is to support and promote infill development - which is vital to reducing vehicle miles traveled (VMT) and the associated air pollutant and greenhouse gas (GHG) emissions - while minimizing local exposure to air pollution and promoting clean, healthy air for existing and future residents.

The Air District acknowledges that many factors other than solely air quality play a role in public health and healthy communities, including adequate housing, access to food and healthcare services, opportunities for active transportation and exercise, water quality, outdoor space, and more. There are many elements to consider and balance when planning for healthy communities, and the Air District encourages local governments and other decision-makers to use this guidebook in conjunction with resources on other aspects of public health.

PLANNING HEALTHY PLACES

Protecting Bay Area public health, air quality and the climate is the core mission of the Bay Area Air Quality Management District (Air District). Clean air is fundamental to public health and the high quality of life that makes the Bay Area a desirable place to live, work and visit. There are millions of emission sources in our region - oil refineries, industrial manufacturers, gas stations, cars and trucks, construction equipment, lawn mowers, fireplaces, consumer products, and more - that collectively emit many different types of air pollutants that are harmful to public health and the global climate. Through Air District and state level regulations and incentive programs, tremendous progress has been made in improving air quality. However, despite this progress, the quest for clean air continues and the challenges ahead seem daunting in our motor vehicle driven society. Transportation related emissions are significant sources of air pollutants such as fine particulate matter (fine PM) and toxic air contaminants (TACs) that have adverse health effects; further reductions in transportation emissions will result in health benefits. Additionally, cars and trucks represent the single largest source of greenhouse gas (GHG) emissions in the Bay Area; reducing these transportation related emissions is critical to achieving GHG reduction goals to stabilize the climate.

New health studies are continually providing evidence that air pollutants are harmful to our health at lower levels than previously thought. Additionally, some communities and neighborhoods in the region experience relatively higher air pollution levels and corresponding negative health impacts than others. Levels of local air pollutants such as fine PM and TACs are highest near air pollution sources, such as freeways, heavily trafficked seaports, and large industrial facilities. In addition, there are many smaller, more discrete sources of air pollution - including gas stations and back-up diesel generators - that exacerbate conditions in communities with already elevated levels of air pollution that can be harmful to people's health.

Placing residences in infill locations near jobs, transit and other services is increasingly important to help to reduce vehicle miles traveled, which will in turn improve overall air quality and reduce GHGs. However, careful planning is needed in areas that may have high localized levels of air pollution. Development in locations near major sources of air pollution could also result in increased local exposure to unhealthy levels of air pollutants to the people living there unless steps are taken to minimize exposure and reduce emissions. To assist local governments in addressing and minimizing potential air quality issues, the Air District is releasing this guidebook which provides recommended best practices that can be implemented to reduce exposure and emissions from local sources of air pollutants. Local governments, developers, and other interested stakeholders are encouraged to utilize this guidebook to implement these air quality solutions.

Figure 1: 2013 Impacted Communities

EFFORTS TO REDUCE AIR POLLUTION & EXPOSURE

For over sixty years the Air District has been implementing programs to reduce air pollution and public exposure. Air District actions include: conducting air monitoring and modeling to identify locations of elevated pollution concentrations and to assess potential health impacts (see Figure 1); adopting regulations, plans and guidelines to reduce emissions from stationary (i.e. industrial) and mobile (i.e. cars) pollution sources; enforcing existing Air District regulations and the state's mobile source regulations; providing grants and incentives to reduce emissions from mobile sources (targeted in the Bay Area's most impacted communities); and outreach and education to Bay Area residents on air quality issues and trends. These efforts, in combination with the California Air Resources Board's (ARB) vast array of regulations to reduce criteria pollutants, and toxic air contaminant (TAC's) including diesel particulate matter emissions from cars, trucks and industrial facilities, have been successful. Levels of criteria pollutants including fine particulates (fine PM), and TACs have been reduced dramatically in the Bay Area. The region has seen a fourfold reduction in cancer risk due to air toxics since 1990.

ON-GOING CHALLENGES

However, despite these accomplishments, some communities in the Bay Area are still disproportionately impacted by unhealthy levels of air pollution. The Air District's Community Air Risk Evaluation (CARE) program, which was initiated to identify, evaluate, and reduce health risks associated with exposure to air pollution, has conducted extensive research into identifying where disproportionately impacted communities are located. The CARE program examines TAC and fine PM emissions data from stationary sources, area sources, and on-road and off-road mobile sources, as well as ozone standard exceedance data, and health data for communities throughout the Bay Area to assess the potential exposure and health risks to sensitive populations such as children and the elderly. Identifying impacted communities and the significant air pollution sources within communities has helped the Air District to target emission reduction strategies for specific sources, and identify

potential land use mitigation strategies to further reduce exposure in these disproportionately impacted areas. Figure 1 shows the most impacted communities in the Bay Area, as identified by the CARE program. It is particularly important for local governments within these CARE communities to implement the recommendations in this guidebook, because existing residents in these areas are exposed to higher concentrations of air pollution than other areas throughout the region.

The information presented in this guidebook builds upon the work conducted under the CARE program. The maps produced in conjunction with this guidebook are based upon local modeling conducted to identify potential impacts of air pollution at a fine grained, smaller scale (down to a 20m X 20m grid), as opposed to the region-wide maps conducted by the CARE program to identify communities which are, overall, more impacted by air quality than others.

CLIMATE CHANGE & PUBLIC HEALTH

As described previously, despite progress in reducing air pollution, some Bay Area residents are disproportionately impacted from exposure to air pollutants, and climate change threatens to further exacerbate air pollution. Longer and more severe heat waves will increase emissions of ozone precursors, accelerate ozone formation, and reduce wind and vertical mixing that disperse pollutants. Higher temperatures and drought conditions will create the conditions that lead to more frequent and more severe wildfires. As a consequence of climate change, Bay Area residents will be susceptible to increased respiratory and cardiovascular disease, as well as heat stroke and heat exhaustion. And the Bay Area communities that are already most impacted by air pollution will also be most vulnerable to the negative health impacts related to climate change. Therefore, it is more important than ever that we plan our communities to safeguard public health and minimize exposure to air pollution.

HEALTH IMPACTS

It is important to understand the potential health outcomes from exposure to certain types of air pollutants. Fine particulate matter and toxic air contaminants are the air pollutants which pose the greatest risk to people's health in the Bay Area.

Toxic Air Contaminants (TACs): The California Air Resources Board (ARB) is responsible for identifying TACs, which are defined as pollutants that "may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health". TACs are emitted from a wide range of sources in the Bay Area including diesel engines, cars, trucks, industrial processes, and gas stations. Types of TACs include diesel particulates, lead, benzene, formaldehyde, and hexavalent chromium, to name a few. These TACs, and others, are present in Bay Area air. Diesel particulate matter is the most significant toxic air contaminant, accounting for roughly 85% of the cancer risk from air toxics in the region. Exposure to TACs can cause serious health effects, including cancer and birth defects. Other adverse health effects can include damage to the immune system, neurological, reproductive (reduced fertility), developmental, and respiratory problems.

Fine Particulate Matter (PM): Epidemiological studies have established that exposure to fine particulate matter has serious adverse health impacts. "Fine" particulate matter refers to very small particles (less than 2.5 microns in diameter) that can travel deep into the lungs and enter the bloodstream. Fine PM originates from a variety of sources, including fossil fuel combustion, residential wood burning and cooking, and natural sources such as wildfires and dust. Researchers established long ago that exposure to PM has negative effects on the respiratory system, such as triggering asthma attacks, aggravating bronchitis, and diminishing lung function. More recent studies have found that fine PM can also harm the cardiovascular system, and may cause atherosclerosis (hardening of the arteries), ischemic strokes (caused by an obstruction of the blood supply to the brain), and heart attacks. Because of the serious cardiovascular effects of exposure to PM, studies have found a clear correlation between PM levels and exposure, and mortality. Studies also indicate that exposure to PM may be related to other negative health effects, including impacts on the brain such as reduced cognitive function, as well as an increased risk of diabetes. Recent research in the United States and internationally has begun to examine the potential health effects of even smaller particles known as ultrafine particles (UFP), which are particles less than 1.0 microns in diameter. Findings to date demonstrate that UFP can evade the body's defense mechanisms and penetrate deeply into lungs, bloodstream and organs. Exposure to fine PM remains the leading public health risk and contributor to premature death from air pollution in the Bay Area. For more information on fine PM and associated health effects, see the Air District's informational report entitled, "Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area" (2012).

As discussed previously, air pollution control programs and strategies in the state and the Bay Area have helped improve region-wide air quality significantly, despite growth in population and vehicle-miles traveled. However, these regional strategies are not always sufficient in protecting the

health of people who live nearby sources of localized fine PM and toxic air contaminants. Research and epidemiological findings confirm that harmful TAC and fine PM pollutants are found in higher concentrations closer to their source of origin.

A number of health studies have shown that increased pollutant levels occur near busy roadways. For example, according to ARB, a study conducted in the Bay Area found concentrations of traffic-related fine PM and TACs to be highest within 300 meters downwind of freeways. Accordingly, the associated adverse health impacts are elevated in these areas. Evidence from recent studies is rapidly accumulating that indicates that people who live near busy roadways/freeways and other major sources of pollution are more likely to suffer from adverse health effects, including respiratory ailments such as reduced lung function and asthma, cardiovascular disease, low birth weight and pre-term birth, and have higher mortality rates than people who do not live in close proximity to such pollution sources. For instance, a Los Angeles County study found that pregnant women who live within 750 feet of high-volume roads have a 10-20% higher risk of early birth and low-birth weight babies. Health impacts to children living near roadways have been well documented and include wheezing, reduced lung function, and asthma. Other key health findings from health studies include:

- Increased premature death from near-roadway exposure of fine PM (Caiazzo, et al. 2013);
- Emerging consensus that exposure to near-roadway traffic-related pollution causes the development of asthma in children (Perez, et al. 2012);
- Increased non-asthma respiratory symptoms, impaired lung function, all-cause mortality, cardiovascular mortality, and cardiovascular morbility from exposure to traffic emissions (Boehmer, et al. 2013);
- Exposure to fine PM and other traffic-related particles were associated with decreased birth weight in California (Basu, 2013).

In response to earlier findings from the research, ARB developed recommendations for restricting sensitive land uses near heavily trafficked freeways/roadways and other types of air pollution sources (ARB's Air Quality and Land Use Handbook: A Community Health Perspective, April 2005). The U.S. EPA and Federal Highway Administration recently adopted new rules requiring agencies to demonstrate that transportation projects involving significant increases in diesel traffic do not create hazardous "hot spots". The U.S. EPA has also established new air monitoring requirements for locations near busy freeways in order to characterize local air pollutant concentrations, as well as associated exposures to sensitive populations. The implications of localized air pollutant concentrations and associated adverse health impacts make it important that local planners and policy makers take into account the local effects of air pollution on new development, as well as the effect of existing and new sources of air pollution on existing communities.

SENSITIVE POPULATIONS & LAND USES

Children and infants are among the most susceptible to air pollution due to their developing lungs, higher inhalation rates, narrower airways, and less mature immune systems. Children with allergies may also have an enhanced allergic response when exposed to particulate matter pollution. Other sensitive populations include the elderly, pregnant women, and those with respiratory or cardiovascular illnesses affected by air pollution. In recent years, the scientific understanding of the range of health effects of air pollution has increased, and numerous studies are finding adverse health effects from air pollution at levels once considered safe.

Sensitive land uses are places where sensitive populations are most likely to spend their time, such as schools, playgrounds, day care centers, nursing homes, medical facilities, and residential communities. Employment centers and commercial areas (that do not include residential or day care facilities) are generally not considered to be sensitive land uses, although local governments may apply recommendations in this document to such land uses if they so choose.

LOCATION, LOCATION, LOCATION

The Air District has a long history of supporting land use strategies that will reduce automobile use and emissions. Steps taken by the Air District to promote such land use strategies include the provision of tools such as CEQA guidelines for land use development projects, a transportation demand management tool, and control strategies in the 2010 Clean Air Plan (and prior clean air plans) on transportation and land use. The Air District collaborated with the Metropolitan Transportation Commission in 2014 to develop and jointly adopt the Bay Area Commuter Benefits Program which promotes the use of alternative transportation modes such as bicycling, walking, and taking transit. The Air District also provides grants for bicycling, ridesharing and shuttle programs, for example Bay Area BikeShare, to reduce on-road vehicle emissions and promote sustainable transportation modes.

Accordingly, the Air District strongly supports local and regional efforts to reduce vehicle miles traveled and promote “focused growth”, i.e. infill, transit-oriented, and mixed-use development throughout the region. Building such communities is critical to achieving reduced vehicle miles traveled, which will assist the Bay Area in attaining and maintaining health-based ambient air quality standards; in achieving continued reductions in TACs and fine PM from mobile sources; and in meeting GHG reduction goals. Focused growth strategies have the long-term benefit of improving

overall air quality while also providing many other benefits to the Bay Area environment, including the preservation of natural land and open space, improved water quality, and protection of habitat and native wildlife species. Focused growth also provides important economic and equity benefits, including reduced traffic congestion and lower transportation costs, more housing options, and better access to jobs. Plan Bay Area, approved in July 2013, is the Bay Area's long-range plan to meet the requirements of SB 375 and advance focused growth initiatives which will reduce greenhouse gas emissions, improve regional air quality, expand housing and transportation choices, and build a strong regional economy. Plan Bay Area is an important step in creating healthier communities in our region, and the Air District strongly supports its initiatives.

However, despite the many long-term benefits of focused growth, the Air District cautions that locating sensitive populations in close proximity to major sources of air pollution (such as freeways and large industrial facilities) can expose people to harmful air pollution. As noted, concentrations of TACs and fine PM can be substantially elevated adjacent to and downwind of these sources, putting people who live there at risk of developing adverse health effects. Fortunately, negative health effects can be greatly reduced when distance is increased between the source of air pollution and sensitive land uses, and/or when measures are taken to reduce to remove air pollution (for example, through the use of air filtration). Accordingly, the Air District has provided a list of best practices that should be applied when placing sensitive land uses in areas with high levels if air pollution or in close proximity to local sources of air pollution.

The Air District acknowledges that local governments consider and balance many factors when making local land use decisions. This guidebook provides public health and air quality information to be considered along with other issues, such as housing needs, economic development priorities, and other quality of life issues. As previously stated, the overarching goal of this guidebook is to support and encourage infill development while promoting clean, healthy air for existing and future residents. Careful community planning can address the competing issues created by the need for infill development, while also protecting public health. This guidebook provides local governments with the information and tools needed to make their communities as health-protective as can be (from an air quality perspective).

PLANNING STRATEGIES

Planning Healthy Places recommends three primary strategies: (1) reduce or prevent emissions from pollution source(s) when possible; (2) implement best practices where appropriate to reduce exposure to harmful pollutants; and (3) perform a more detailed study of an area when necessary. These recommendations are all described in detail in the following section. A flowchart (pg. 13) and an interactive map are available to assist in identifying where best practices and further study should be applied. The locations shown in purple on the Air District's mapping tool represent where the Air District recommends implementing best practices. The locations shown in blue on the mapping tool represent where the Air District recommends conducting further study. See Figure 2 on pg. 10 for an example of the map, and visit www.baaqmd.gov/planninghealthyplaces for the complete map.

IMPLEMENT BEST PRACTICES TO REDUCE EMISSIONS

One of the most effective ways to reduce the public's exposure to harmful air pollution is to reduce emissions of TACs and fine PM released into the Bay Area air basin. Several agencies at various levels of government work to reduce air pollution. Air quality is regulated at the federal level by the U.S. EPA, at the state level by ARB, and by regional air districts. The Air District implements many programs to reduce the amount of air pollution emitted from stationary and mobile sources of air pollution. However, with over ~19,000 permitted stationary sources of emissions, 5 oil refineries, 150 million vehicle miles driven per day, and numerous sea ports and airports, the cumulative effects of all these sources cannot be completely eliminated.

Local governments can complement federal, state, and regional air quality programs to help protect residents of the Bay Area by implementing strategies that reduce emissions, and therefore the public's exposure to TACs and fine PM, through their land use authority and adoption of local ordinances. Examples include policies that limit the use of diesel generators, or control their emissions; limit the idling of trucks to 2 minutes or less; require the electrification of loading docks in new and existing commercial land uses; transportation demand management strategies; traffic management strategies, and stipulations on development projects to use only the cleanest equipment, vehicles and fuel during construction (a complete list of construction measures, which can be adopted as standard conditions of approval, begins on pg. 25). Local action to reduce air pollutant emissions has the benefit of protecting both existing and future residents from the potential adverse health effects from exposure to air pollution.

The Air District recommends that local governments adopt, as policies and/or enforceable ordinances, the following "best practices to reduce emissions". Implementing as many "best practices to reduce emissions" as is feasible will reduce potential health risks to the greatest extent. Best practices to reduce exposure to air pollution are discussed beginning on pg. 10.

Best Practices to Reduce Emissions of Local Air Pollution

Retrofit Generators to Low or Zero Emitting Technology
Encourage or require existing uses to retrofit generators with Best Available Control Technology to meet ARB's Tier 4 emission standards. Encourage the use of zero emission back-up power.

Electrify Loading Docks
Require the electrification of all loading docks to facilitate plug-in capability, and encourage or require trucks to utilize grid power in order to deliver goods.

Limit Idling Times
Prohibit trucks from idling for more than two minutes, or prohibit idling altogether.

Promote Zero Emission Vehicles and Alternative Fuels
Promote the use of zero emission vehicles and equipment, as well as renewable fuels (such as biogas).

Promote or Require the Use of Transportation Refrigeration Units (TRU)
The use of TRU's allows delivery trucks to maintain refrigeration in lieu of running/idling the main engine, thereby reduces emissions of diesel PM and TACs.

Transportation Demand Management (TDM) Strategies
Require the implementation of as many TDM strategies as feasible into projects. Examples include, but are not limited to, parking pricing strategies; parking maximums; mandated parking spaces for car-sharing programs; the provision of transit passes in residential, commercial and office developments; charging stations for electric vehicles; bicycle lockers or racks; teleworking policies; bicycling improvements; and more. For a recommended list of TDM strategies, consult the Air District's TDM tool: http://www.baaqmd.gov/plans-and-climate/air-quality-plans/smart-growth.

Traffic Management Strategies
Implement traffic circles at intersections, and lower speed limits. Consistent findings from multiple studies indicate that stop-and-go driving, vehicle idling, and deceleration/acceleration create hot spots. Additionally, many studies show that there are optimal speed limit ranges that result in lower emissions. As a co-benefit, these actions can enhance the pedestrian and bicycling environment.

A full description and detail on each best practice to reduce emissions is located in **Appendix A.**

IMPLEMENT BEST PRACTICES TO REDUCE EXPOSURE

In recent years, communities throughout California have been investigating and implementing best practices to reduce local exposure to air pollution. Reducing exposure to harmful air pollutants is not the same as reducing actual emissions. However, there are a variety of practices that are effective, technically feasible, relatively low cost, and have demonstrated the ability to reduce people's exposure to air pollution, and therefore minimize the potential adverse health effects. Many such best practices can be easily replicated from one jurisdiction to another.

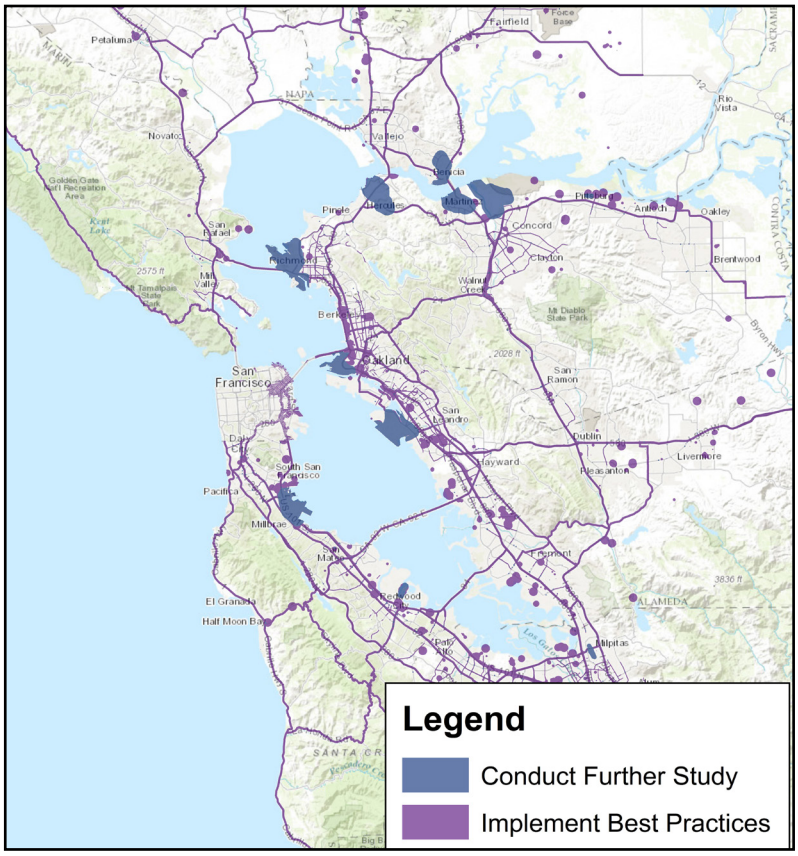

Figure 2

The best practices to reduce exposure are generally oriented for new development. However, many of the best practices to reduce exposure, such as installing air filters, can also be implemented at existing development, though implementation may be more difficult or costly.

The Air District recommends implementing all "best practices to reduce exposure" that are feasible and applicable to a project or plan in locations identified by the Air District as likely to experience elevated levels of air pollution, which are depicted in purple on the Air District's mapping tool (see Figure 2 for an example, visit www.baaqmd.gov/planninghealthyplaces to access the tool).

Summary of Best Practices to Reduce Exposure to Local Air Pollution

Health Protective Distances

Plan sensitive land uses as far from local sources of air pollution such as freeways *as is feasible*.

Install Air Filters

Install air filters rated at a minimum efficiency reporting value (MERV) 13 or higher in buildings associated with sensitive land uses (e.g. schools, residences, hospitals).

Project Phasing

When applicable, and when development is being phased over time (i.e. being built over several years), build residential units and/or sensitive land uses that are closest to the emissions source at the latest date in the future (e.g. in year 5 vs. year 1).

Building Site Design and Operations

When designing a project site or developing a plan area, place sensitive land uses as far away from emission sources (including loading docks, busy roads, etc.) as is feasible. Place open space, commercial buildings, or parking garages between sensitive land uses and air pollution sources. This will help to create a "buffer" separating housing and other sensitive land uses away from air pollutants. Locate operable windows, balconies, and building air intakes as far away from any emission source as is feasible. Incorporating open space (i.e. parks) between buildings can improve air flow and air pollution movement.

Barriers (sound walls)

Consider incorporating solid barriers into site design, similar to a sound wall, between buildings and sources of air pollution (for example, a freeway).

Vegetation

Plant dense rows of trees and other vegetation between sensitive land uses and emission source(s). Large, evergreen trees with long life spans work best in trapping air pollution, including: Pine, Cypress, Hybrid Poplar, and Redwoods.

Consider Limiting Ground Floor Uses

Consider limiting sensitive land uses on the ground floor units of buildings near non-elevated sources, e.g. ground level heavily traveled roadways and freeways.

Alternative Truck Routes

Truck routes can be planned or re-rerouted through non-residential neighborhoods, and to avoid other sensitive land uses such as daycare centers, schools, and elderly facilities.

A full description and detail on each *Best Practice to Reduce Exposure* to air pollution is located in **Appendix B**.

FURTHER STUDY AREAS

The Air District has identified a number of areas within the Bay Area where additional analysis (i.e. further study) is recommended to assess the local concentrations of TACs and fine PM, and therefore the health risks from air pollution. These areas are characterized by "large and complex" industrial facilties such as oil refineries, large airports, and seaports, etc., and the Air District recommends using caution when considering sensitive land uses in these areas. More information on "large and complex" sources is below.

Conducting "further study" would entail air quality modeling to more precisely determine fine PM concentrations and/or to estimate increased health risks from air toxics to determine if there is an unacceptable level of health risk, and to identify measures that can be implemented to reduce the health risks to acceptable levels. Air District staff can provide assistance in conducting "further study", including providing emissions data and information on specific air pollution sources. Once further study is complete, Air District staff can assist in identifying the best measures to reduce health risks. Local jurisdictions or project applicants can request Air District assistance with the "further study" process by contacting the Air District. Contact information is available at www.baaqmd.gov/planninghealthyplaces.

In conjunction with this guidebook is a mapping tool produced by the Air District, which shows where the "large and complex" sources are located. Visit www.baaqmd.gov/planninghealthyplaces to view the maps. The locations depicted in blue show the location of the "large and complex" sources, and are designated as further study. The flowchart on the next page provides an explanation on determining if a project or plan area may be in a location with elevated levels of air pollutants, and where the Air District recommends conducting further study versus implementing best practices.

Large and/or Complex Sources

Large and complex sources, for example oil refineries or seaports, can emit relatively high levels of TACs and fine PM. There are typically numerous emission sources within each of these facilities, making it difficult to characterize the specific local variations of concentrations of TACS and fine PM within the surrounding community.

Larger gas stations with higher volume throughput are considered complex sources due to the *type* of emissions they release. Gas stations emit TACs that are primarily gaseous in nature. Because some of the best practices discussed previously (e.g. air filters) solely reduce fine (and coarse) PM, a more detailed local analysis is necessary to determine potential impacts of gaseous air pollutants and to identify appropriate health protective measures. Gas stations are required to install best available control technology as part of their permit from the Air District. The control technologies reduce upwards of 95% of their emissions, but not all of them. Therefore, aside from increasing the distance between these sources and sensitive land uses, there are fewer options to reduce exposure from these source types. Carbon filters can be used in building ventilation systems to remove odors, gases and vapors; however they are not commonly used in residential buildings due to cost and maintenance requirements.

APPLYING THE PLANNING STRATEGIES

The flowchart below provides a general overview for determining if a particular planning area or project site may be located in an area with elevated concentrations of air pollution, and how to address such situations during the planning process. To accompany the flow chart, the Air District provides an interactive mapping tool of Bay Area communities which identifies the locations that are characterized by elevated air pollution levels or the presence of "large and complex" sources. **The interactive mapping tool depicts areas where the Air District recommends implementing best practices, and where the Air District recommends conducting further study. The mapping tool also quickly shows where no additional analysis or best practices are recommended (from an air quality perspective).** Visit www.baaqmd.gov/planninghealthyplaces to access the mapping tool.

Instructions: Open the Air District's interactive mapping tool. Find your project or plan area by using the search function in the map. Consult the flow chart below.

1. IS YOUR PROJECT OR PLAN IN A BLUE AREA?

--> Yes: Conduct Further Study (see pg. 12).
--> No: Go to Step 2.

2. IS YOUR PROJECT OR PLAN IN A PURPLE AREA?

--> Yes: Implement best practices to reduce exposure (see pg. 10).
--> No: No further analysis is recommended.

IMPLEMENTATION

Local government agencies can utilize a variety of strategies to reduce exposure to, and emissions of, air pollution, including the adoption of air quality-specific ordinances (e.g. San Francisco's Article 38); standard conditions of approval relating to air quality (e.g. Oakland's Standard Conditions of Approval); and the incorporation of air quality-related policies and measures into general plans and other planning documents (e.g. Richmond, San Jose, Hayward, and Santa Clara County General Plan updates). Several examples of local government actions are described below. The examples are offered to demonstrate that there are ways in which local government agencies can pro-actively address local sources of air pollution within their communities. The Air District recommends that local governments implement policies and/or ordinances that are clear and enforceable, and include a mechanism for monitoring. Strong language in policies and/or ordinances will increase effectiveness of the action.

These examples may change or be updated over time. Visit the Air District's website, www.baaqmd.gov/planninghealthyplaces to view any additions or revisions to the list of case studies highlighted below. The Air District also encourages readers to visit each jurisdiction's website to determine the most up-to-date policies and requirements.

CITY OF SAN FRANCISCO, ARTICLE 38

Article 38 (originally adopted in 2008 and updated in 2014), intended to protect health and welfare in San Francisco, established Air Pollutant Exposure Zones (Zones) and requires enhanced ventilation systems to be installed for all urban infill sensitive land use development within those Zones. San Francisco collaborated with the Air District to create a map of the Air Pollutant Exposure Zones based on air quality modeling. These Zones depict all locations within San Francisco where the estimated cumulative PM2.5 concentration is greater than 10 micrograms/m^3 or where the cumulative excess cancer risk of cancer from air pollutants is greater than 100 in a million. Additionally, the Zones include all locations within 500 feet of any freeway, even if those locations were not otherwise captured by modeling estimates. The Zones also incorporate additional areas of concern, which include zip codes with high hospitalization rates and emergency room visits for air pollution-related conditions (such as asthma, pneumonia, etc.) and concentrations of PM2.5 greater than 9 micrograms/m^3 or cumulative excess cancer risk is greater than 90 in a million.

Article 38 requires enhanced ventilation systems "capable of achieving the protection from particulate matter (PM2.5) equivalent to that associated with MERV 13 filtration (as defined by ASHRAE standard 52.2)" to be installed in sensitive use buildings that are identified within the Air Pollutant Exposure Zones that are either a) newly constructed; b) undergoing a "major alteration to existing building"; or c) subject of an application for a Planning Department-permitted Change of Use. Additional information, including a map of the Air Pollutant Exposure Zones, is located on the City of San Francisco's Article 38 webpage.

SAN FRANCISCO CLEAN CONSTRUCTION ORDINANCE

In April 2007, the City and County of San Francisco (City) adopted an Ordinance requiring public projects to reduce emissions at construction sites starting in 2009. In March 2015, the City expanded the existing Ordinance to require public projects to further reduce emissions at construction sites in certain areas with high levels of background concentrations of air pollutants. The revised Clean Construction Ordinance became operative on September 6, 2015 and contains the following requirements:

- Use Tier 2 or higher engines and the most effective Verified Diesel Emission Control Strategies (VDECS) available for the engine type (Tier 4 engines automatically meet this requirement) as certified by the California Air Resources Board (ARB).
- Prohibit portable diesel engines where access to alternative sources of power are available.
- Restrict idling to two minutes.
- Properly maintain and tune equipment in accordance with manufacturer specifications.

A Construction Emissions Minimization Plan is required for all construction projects within an Air Pollution Exposure Zone, which must include the following:

- An equipment inventory which shall include estimates of the construction timeline by phase with description of each piece of off- road equipment required for each phase.
- Signage indicating idling limits and engine/Verified Diesel Emission Control Strategies requirements.
- Certification Statement.

Monitoring of all construction activities including:

- An equipment inventory which shall include estimates of the construction timeline by phase with description of each piece of off- road equipment required for each phase.
- Quarterly reports documenting compliance with the Emissions Plan which shall be maintained at the project site.

- Final report summarizing construction activities.

CITY OF SAN FRANCISCO, COMMUNITY RISK REDUCTION PLAN

The City and County of San Francisco is developing a Community Risk Reduction Plan (CRRP). The purpose of the CRRP is to protect human health through the reduction of emissions and exposure to ambient air pollution in the City and County of San Francisco. The CRRP is expected to establish citywide objectives and targets for air quality improvement and a set of local actions to reduce health impacts for disproportionately exposed communities in San Francisco.

CITY OF OAKLAND, STANDARD CONDITIONS OF APPROVAL

To help clarify and standardize analysis and decision-making in the environmental review process in the City of Oakland, the City established standard conditions of approvals (SCAs) that apply to all development projects, depending upon the specific circumstances of each project. The SCAs are designed to substantially mitigate environmental effects. There are a number of SCAs on environmental issues ranging from aesthetics, to air quality, to transportation. The SCAs are part of the municipal code, formally adopted by the Oakland City Council in 2008. They were most recently updated in July 2015.

Oakland's SCA's for air quality relate to construction and operations. The SCA's for construction require that "all projects involving construction activities shall implement all of the following applicable air pollution control measures during construction of the project". The SCAs include a number of "basic controls" for dust and exhaust related construction emissions. There are also "enhanced controls" for construction that apply to projects of certain criteria, such as large residential projects, demolition projects, etc. These projects must apply all "basic" and "enhanced" controls (which include additional measures addressing dust and exhaust related emissions).

The City of Oakland also requires conditions to all projects that meet the following criteria:

a. The project involves any of the following sensitive land uses: residential uses; new or expanded daycares, schools, parks, nursing homes, or medical facilities; AND

b. The project is located within 1,000 (or other distance as specified below) of one or more of the following sources of air pollution:

- Freeway;

- Roadway with significant traffic (at least 10,000 vehicles/day);

- Rail line (except BART) with over 30 trains per day;
- Distribution center that accommodates more than 100 trucks per day, more than 40 trucks with operating TRU units per day, or where the TRU unit operations exceed 300 hours per work week.
- Major rail or truck yard (such as the Union Pacific rail yard adjacent to the Port of Oakland);
- Ferry Terminal;
- Stationary pollutant source requiring permit from BAAQMD (such as a diesel generator);
- Within 0.5 miles of the Port of Oakland or Oakland Airport;
- Within 300 feet of a gas station;
- Within 300 feet of a dry cleaner with a machine using PERC (or within 500 feet of a dry cleaner with two or more machines using PERC); AND

c. The project exceeds the health risk screening criteria after a screening analysis is conducted in accordance with the BAAQMD CEQA Guidelines.

Health Risk Reduction Measures
Requirement: The project applicant shall incorporate appropriate measures into the project design in order to reduce the potential health risk due to exposure to toxic air contaminants.
The project applicant shall choose one of the following methods:

1. The project applicant shall retain a qualified air quality consultant to prepare a Health Risk Assessment (HRA) in accordance with California Air Resources Board (CARB) and Office of Environmental Health and Hazard Assessment requirements to determine the health risk of exposure of project residents/occupants/users to air pollutants. The HRA shall be submitted to the City for review and approval. If the HRA concludes that the health risk is at or below acceptable levels, then health risk reduction measures are not required. If the HRA concludes that the health risk exceeds acceptable levels, health risk reduction measures shall be identified to reduce the health risk to acceptable levels. Identified risk reduction measures shall be submitted to the City for review and approval and be included on the project drawings submitted for the construction-related permit or on other documentation submitted to the City;

OR

2. The project applicant shall incorporate the following health risk reduction measures into the project. These features shall be submitted to the City for review and approval and be included on the

project drawings submitted for the construction-related permit or on other documentation submitted to the City:

- Installation of air filtration to reduce cancer risks and Particulate Matter (PM) exposure for residents and other sensitive populations in the project that are in close proximity to sources of air pollution. Air filter devices shall be rated MERV-13 [MERV-16 for projects located in the West Oakland Specific Plan area] or higher. As part of implementing this measure, an ongoing maintenance plan for the building's HVAC air filtration system shall be required.

- Where appropriate, install passive electrostatic filtering systems, especially those with low air velocities (i.e., 1 mph).

- Phasing of residential developments when proposed within 500 feet of freeways such that homes nearest the freeway are built last, if feasible.

- The project shall be designed to locate sensitive receptors as far away as feasible from the source(s) of air pollution. Operable windows, balconies, and building air intakes shall be located as far away from these sources as feasible. If near a distribution center, residents shall be located as far away as feasible from a loading dock or where trucks concentrate to deliver goods.

- Sensitive receptors shall be located on the upper floors of buildings, if feasible.

- Planting trees and/or vegetation between sensitive receptors and pollution source, if feasible. Trees that are best suited to trapping PM shall be planted, including one or more of the following: Pine (*Pinus nigra* var. *maritima*), Cypress (*X Cupressocyparis leylandii*), Hybrid popular (*Populus deltoids X trichocarpa*), and Redwood *(Sequoia sempervirens*).

- Sensitive receptors shall be located as far away from truck activity areas, such as loading docks and delivery areas, as feasible.

- Existing and new diesel generators shall meet CARB's Tier 4 emission standards, if feasible.

- Emissions from diesel trucks shall be reduced through implementing the following measures, if feasible: Installing electrical hook-ups for diesel trucks at loading docks; Requiring trucks to use Transportation Refrigeration Units (TRU) that meet Tier 4 emission standards; Requiring truck-intensive projects to use advanced exhaust technology (e.g., hybrid) or alternative fuels; Prohibiting trucks from idling for more than two minutes; Establishing truck routes to avoid sensitive receptors in the project. A truck route program, along with truck calming, parking, and delivery restrictions, shall be implemented.

Maintenance of Health Risk Reduction Measures

Requirement: The project applicant shall maintain, repair, and/or replace installed health risk reduction measures, including but not limited to the HVAC system (if applicable), on an ongoing and as-needed basis. Prior to occupancy, the project applicant shall prepare and then distribute to the building manager/operator an operation and maintenance manual for the HVAC system and filter including the maintenance and replacement schedule for the filter.

Stationary Sources of Air Pollution (Toxic Air Contaminants): The following condition applies to all projects that involve a stationary pollutant source requiring a permit from BAAQMD, including but not limited to back-up diesel generators. The California Building Code requires back-up diesel generators for all buildings over 70 feet tall.

Requirement: The project applicant shall incorporate appropriate measures into the project design in order to reduce the potential health risk due to on-site stationary sources of toxic air contaminants. The project applicant shall choose one of the following methods:

- The project applicant shall retain a qualified air quality consultant to prepare a Health Risk Assessment (HRA) in accordance with California Air Resources Board (CARB) and Office of Environmental Health and Hazard Assessment requirements to determine the health risk associated with proposed stationary sources of pollution in the project. The HRA shall be submitted to the City for review and approval. If the HRA concludes that the health risk is at or below acceptable levels, then health risk reduction measures are not required. If the HRA concludes the health risk exceeds acceptable levels, health risk reduction measures shall be identified to reduce the health risk to acceptable levels. Identified risk reduction measures shall be submitted to the City for review and approval and be included on the project drawings submitted for the construction-related permit or on other documentation submitted to the City.

OR

- The project applicant shall incorporate the following health risk reduction measures into the project. These features shall be submitted to the City for review and approval and be included on the project drawings submitted for the construction-related permit or on other documentation submitted to the City: Installation of non-diesel fueled generators, if feasible, or; Installation of diesel generators with an EPA-certified Tier 4 engine or engines that are retrofitted with a CARB Level 3 Verified Diesel Emissions Control Strategy, if feasible.

Truck-Related Risk Reduction Measures (Toxic Air Contaminants): The following condition applies to all projects that involve new truck loading docks or a truck fleet of any size registered to the project applicant/operator.

Truck Loading Docks

Requirement: The project applicant shall locate proposed truck loading docks as far from nearby sensitive receptors as feasible.

Truck Fleet Emission Standards

Requirement: The project applicant shall comply with all applicable California Air Resources Board (CARB) requirements to control emissions from diesel engines and demonstrate compliance to the satisfaction of the City. Methods to comply include, but are not limited to, new clean diesel trucks, lower-tier diesel engine trucks with added Particulate Matter (PM) filters, hybrid trucks, alternative energy trucks, or other methods that achieve the applicable CARB emission standard. Compliance with this requirement shall be verified through CARB's Verification.

CITY OF SAN JOSE, 2040 GENERAL PLAN

The City of San Jose (City) updated its general plan in 2012. The City's 2040 General Plan includes a number of environmentally sustainable and environmental justice goals and initiatives, including reducing residents' exposure to toxic air contaminants. To promote implementation of these policies, City staff has identified measurements and tracking tools to monitor the City's progress, as well as specific policies and action statements.

Policies on Toxic Air Contaminants

- Require completion of air quality modeling for sensitive land uses such as new residential developments that are located near sources of pollution, such as freeways and industrial uses.

- Require new residential development projects and projects categorized as sensitive receptors to incorporate effective mitigation into project designs or be located an adequate distance from sources of toxic air contaminants (TACs) to avoid significant risks to health and safety.

- For projects that emit toxic air contaminants, require project proponents to prepare health risk assessments in accordance with Air District recommended procedures as part of environmental review and employ effective mitigation to reduce possible health risks to a less than significant level. Alternatively, require new projects (such as but not limited to industrial, manufacturing, and processing facilities) that are sources of TACs to be located an adequate distance from residential areas and other sensitive populations.

- Review projects generating significant heavy duty truck traffic to designate truck routes that minimize exposure of sensitive populations to TACs and particulate matter.

- Encourage the installation of appropriate air filtration at existing schools, residences, and other sensitive land uses adversely affected by pollution sources.

- Encourage the use of pollution absorbing trees and vegetation in buffer areas between substantial sources of TACs and sensitive land uses.

Actions on Toxic Air Contaminants

- Develop and adopt a comprehensive Community Risk Reduction Plan that includes: baseline inventory of toxic air contaminants and particulate matter smaller than 2.5 microns (PM2.5) emissions from all sources, emissions reduction targets, and enforceable emission reduction strategies and performance measures. The Community Risk Reduction Plan will include enforcement and monitoring tools to ensure regular review of progress toward the emission reduction targets, progress reporting to the public and responsible agencies, and periodic updates of the plan, as appropriate.

- Consult with the Air District to identify stationary and mobile TAC sources and determine the need for and requirements of a health risk assessment for proposed developments.

- For new projects that generate truck traffic, require signs which remind drivers that the State truck idling law limits truck idling to five minutes.

CITY OF RICHMOND, GENERAL PLAN

The City of Richmond (City) updated its General Plan in 2012, and it includes a voluntary *Community Health and Wellness* element. The purpose of the new element is to "establish a strong policy framework for developing conditions that will improve the physical health and emotional well-being of Richmond residents." The element also seeks to make the connection between community and environmental health and compact, sustainable development. Richmond's General Plan states that "...many residents and workers are impacted by air, water, soil and noise pollution. Richmond has many heavy industrial land uses including a seaport, major refinery, and significant railroad terminal that contribute to local air and noise pollution." To address these impacts, the City adopted policies in the General Plan to reduce emissions of, and exposure to, air pollutants (see below).

City staff also recommends improvements to air quality by working with the Air District and industrial operators to reduce emissions from industry, ships, trucks and automobiles; especially to reduce exposure to children and seniors. Specific air quality-related policies within the *Community Health and Wellness* element include:

- Support regional policies and efforts that improve air quality to protect human and environmental health and minimize disproportionate impacts on

sensitive population groups. Work with businesses and industry, residents and regulatory agencies to reduce the impact of direct, indirect and cumulative impacts of stationary and non-stationary sources of pollution such as industry, the Port, railroads, diesel trucks and busy roadways. Ensure that sensitive uses such as schools, childcare centers, parks and playgrounds, housing and community gathering places are protected from adverse impacts of emissions.

- Continue to work with stakeholders to reduce impacts associated with air quality on disadvantaged neighborhoods and continue to participate in regional planning efforts with nearby jurisdictions and the Bay Area Air Quality Management District to meet or exceed air quality standards. Support regional, state and federal efforts to enforce existing pollution control laws and strengthen regulations.

CITY OF HAYWARD, GENERAL PLAN

The 2040 Hayward General Plan (Approved July 2014) integrates the typical elements of a community risk reduction plan into the policy framework of the General Plan. The policy framework includes specific long-term goals, policies, and implementation programs to reduce communitywide exposure to TACs and PM2.5. This integrated approach allows the City to incorporate the analysis and components of a "stand-alone" community risk reduction plan into appropriate section of the General Plan. One of the long-term goals of the Plan (NR-2) is to improve the health and sustainability of the community through continued local efforts to improve regional air quality, reduce greenhouse gas emissions, and reduce community exposure to health risks associated with toxic air contaminants and fine particulate matter. Notable policies and programs under this goal include:

- NR-2.13 Wood Stove and Fireplace Replacement: The City shall promote the replacement of non-EPA certified fireplaces and woodstoves and encourage city residents to participate in Bay Area Air Quality Management District programs, such as the Wood Stove Rebate Program.

- NR-2.15 Community Risk Reduction Strategy: The City shall maintain and implement the General Plan as Hayward's community risk reduction strategy to reduce health risks associated with toxic air contaminants (TACs) and fine particulate matter (PM2.5) in both existing and new development.

- NR-2.16 Sensitive Uses: The City shall minimize exposure of sensitive receptors to toxic air contaminants (TAC), fine particulate matter (PM2.5), and odors to the extent possible, and consider distance, orientation, and wind direction when siting sensitive land uses in proximity to TAC- and PM2.5-emitting sources and odor sources in order to minimize health risk.

- NR-2.17 Source Reduction Measures: The City shall coordinate with and support the efforts of the Bay Area Air Quality Management District, the California Air Resources Board, the U.S. Environmental Protection Agency, and other agencies as appropriate to implement source reduction measures and best management practices that address both existing and new sources of toxic air contaminants (TAC), fine particulate matter (PM2.5), and odors.

- NR-2.18 Exposure Reduction Measures for New Receptors: The City shall require development projects to implement all applicable best management practices that will reduce exposure of new sensitive receptors (e.g., hospitals, schools, daycare facilities, elderly housing and convalescent facilities) to odors, toxic air contaminants (TAC) and fine particulate matter (PM2.5).

- NR-2.19 Exposure Reduction Measures for both Existing and New Receptors: The City shall work with area businesses, residents and partnering organizations to provide information about best management practices that can be implemented on a voluntary basis to reduce exposure of sensitive receptors to toxic air contaminants (TAC) and fine particulate matter (PM2.5).

SANTA CLARA COUNTY, GENERAL PLAN

The Health Element of the Santa Clara County General Plan has been prepared at the direction of the Santa Clara County Board of Supervisors as a new element, incorporating and updating certain existing subject matter and policies from the existing Health and Safety Chapters, and building a renewed emphasis on collaborative, comprehensive approaches to planning for community health. Under the "Air Quality and Climate Change," section there are major strategies and policies intended to convey a comprehensive approach for improving air quality, protecting the climate, and protecting public health. Examples include:

- HE-G.4 Off-road source: Encourage mobile source emission reduction from off-road equipment such as construction, farming, lawn and garden, and recreational vehicles by retrofitting, retiring and replacing equipment and by using alternate fuel vehicles.

- HE-G.7 Sensitive receptor uses: Promote measures to protect sensitive receptor uses, such as residential areas, schools, day care centers, recreational playfields and trails, and medical facilities by locating uses away from major roadways and stationary area sources of pollution, where possible, or incorporating feasible, effective mitigation measures.

- HE-G.8 CARE Communities focus: Promote awareness of geographic areas subject to persistently poorer air quality and assist the Air District in monitoring and reducing emissions from all sources in CARE communities

- HE-G.9 Healthy infill development: Promote measures and mitigations for infill development to protect residents from air and noise pollution, such as more stringent building performance standards, proper siting criteria, development and environmental review processes, and enhanced air filtration.

PLANNING FOR CONSTRUCTION

While construction activities are typically short-term or temporary in duration, they can generate a substantial amount of particulate matter and other criteria pollutants, toxic air contaminants, fugitive dust, and greenhouse gases. Therefore the emissions associated with construction activity can have regional implications to the attainment status of state and federal ambient air quality standards, but more importantly may adversely impact the health of nearby sensitive populations.

All of the best practices for construction should be required at the time grading permits are issued. Implementation of these best practices, or others that achieve the same or greater emission reductions, should ensure that regional or local air quality impacts from construction are minimized to the maximum extent feasible.

Emissions from construction equipment are regulated by both the US EPA and ARB. The emission standards for new engines vary according to the rated horsepower of the engine and model year of the equipment, and are set forth in a series of tiers (1-4), with each tier becoming progressively cleaner for either nitrogen oxides (NOx) and/or PM emissions. In addition, ARB's In-Use Off-Road Diesel Vehicle Regulation (Off-Road rule) generally applies to all self-propelled off-road diesel vehicles over 25 horsepower used in California. The Off-Road rule requires off-road fleet owners subject to the rule to meet fleet wide emission limits based on the size of their fleet and to reduce their emissions by retiring, replacing, or repowering older engines or installing Verified Diesel Emission Control Strategy, or VDECS. Compliance dates range from 2014 for larger fleets to 2019 for the smallest fleets.

The overall purpose of the Off-Road rule is to encourage turnover of older, higher-emitting equipment to cleaner, lower-emitting equipment in construction fleets. This turnover will help to further reduce emissions of NOx and fine PM within California communities.

While such programs and regulations will gradually reduce air pollution from the construction fleet, best practices are still needed to reduce air pollutants at the local level, which will help to protect sensitive populations that may be in close proximity to construction activity.

Construction Best Practices

Table 1 presents a current list of best practices for construction equipment identified by the Air District. The best practices address both dust generated by construction activity as well as exhaust from construction equipment. This list will be updated as new technologies or strategies become available to further reduce the air quality and health impacts associated with construction activity. All of the best practices applicable to a project should be required at the time grading permits are issued.

Table 1: Best Practices for Construction

For Dust

All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. Maintain minimum soil moisture of 12 percent. Moisture content can be verified by lab samples or moisture probe.

All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping should be done in conjunction with thorough watering of the subject roads.

All vehicle speeds on unpaved roads shall be limited to 15 mph.

All roadway, driveway and sidewalk paving shall be completed as soon as possible. Building pads shall be paved as soon as possible after grading.

All construction sites shall provide a posted sign visible to the public with the telephone number and person to contact at the Lead Agency regarding dust complaints. The recommended response time for corrective action shall be within 48 hours. The Air District's Complaint Line (1-800-334-6367) shall also be included on posted signs to ensure compliance with applicable regulations.

All excavation, grading, and/or demolition activities shall be suspended when average wind speeds

exceed 20 mph.

Wind breaks (e.g. trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks should have maximum 50 percent air porosity.

Vegetative ground cover (e.g. fast germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established.`

The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time).

All trucks and equipment, including their tires, shall be washed off prior to leaving the site.

Site accesses to a distance of 100 feet from the paved road shall be treated with a six- to 12-inch compacted layer of wood chips, mulch, or gravel.

Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than one percent.

For Exhaust

The applicant/general contractor for the project shall demonstrate to the local jurisdiction that all off-road equipment greater than 25 hp that will be operating for more than 20 hours over the entire duration of the construction activities at the site, including equipment from subcontractors meets the following requirement:

1) Be Zero Emissions OR 2) have engines that meet for exceed either US EPA or ARB Tier 2 off-road emission standards; and 3) have engines are retrofitted with an ARB Level 3 Verified Diesel Emissions Control Strategy (VDECS), if one is available for the equipment being used (equipment with engines meeting Tier 4 Interim or Tier 4 Final emission standards automatically meet this requirement, therefore a VDECS would not be required).

Idling time of diesel powered construction equipment, trucks and generators shall be limited to no more than 2 minutes. Clear signage shall be provided for construction workers at all access points.

All construction equipment shall be maintained and properly tuned in accordance with the manufacturers' specifications.

Portable diesel generators shall be prohibited. Grid power electricity should be used to provide power at construction sites; or propane and natural gas generators may be used when grid power electricity is not feasible.

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GLOSSARY

Bay Area Air Quality Management District (Air District)
A regional air pollution control agency with jurisdiction over the nine counties that surround the Bay (excepting northeastern Solano and northern Sonoma counties); the Air District oversees policies and adopts regulations for the control of air pollution from stationary sources.

Best Practices to Reduce Emissions
Measures that reduce actual emissions, and therefore reduce health risks from air pollution. The Air District recommends that local governments adopt best practices as community-wide policies or ordinances. See pg. 9 for a complete list of best practices to reduce emissions.

Best Practices to Reduce Exposure
Measures that do not reduce actual emissions, but reduce people's exposure to pollutants and therefore reduce health risks. Examples include air filters, vegetation, and alternative truck routes. The Air District recommends implementing these types of measures in areas with elevated health risks (purple areas on Air District maps). See pg. 10 for the map, and for a complete list of best practices to reduce exposure.

California Air Resources Board (ARB)
A state agency, whose mission is to promote and protect public health, welfare and ecological resources through the reduction of air pollutants; the ARB oversees policies and adopts regulations for the control of air pollution from primarily mobile sources.

Cumulative Impact
The impact on the environment and the public which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time

Fine Particulate Matter (PM)
Includes tiny particles with a diameter less than or equal to 2.5 microns. This fraction of particulate matter penetrates more deeply into the lungs than larger particles.

Further Study
Conducting further study would entail air quality modeling of fine PM concentrations, and/or estimating increased health risks from air toxics to determine if there is an unacceptable level of health risk, and to identify if measures can be implemented to reduce health risks to acceptable levels.

Mobile Sources of Air Pollution
Sources of air pollution such as automobiles, motorcycles, trucks, off-road vehicles, boats and airplanes.

Sensitive Land uses

Places where sensitive populations are most likely to spend their time, such as schools, playgrounds, daycare centers, nursing homes, medical facilities, and residential communities.

Sensitive Populations

People, including infants, children, the elderly, and those with pre-existing conditions (such as asthma) that are at greater risk than the general population to the adverse health effects of air pollutants.

Stationary Sources of Air Pollution

Non-mobile sources such as power plants, refineries and manufacturing facilities which emit air pollutants.

Toxic Air Contaminants (TACs) or Air Toxics

TACs are air pollutants, identified by the ARB, which may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential health hazard. Health effects may occur at extremely low levels of TACs.

APPENDIX A: BEST PRACTICES TO REDUCE EMISSIONS OF LOCAL AIR POLLUTION

The Air District recommends that local government agencies adopt the following "best practices to reduce emissions" as enforceable ordinances or standard conditions of approval, and/or as community-wide policies. Implementing all of the "best practices to reduce emissions" will likely result in the greatest reduction in local levels of air pollutants. However, the Air District acknowledges that implementing all of the following "best practices to reduce emissions" may not be feasible or appropriate in every community.

The research regarding the availability and effectiveness of "best practices to reduce exposure" is continually evolving. Air District staff will update the recommended measures as new information becomes available.

RETROFIT GENERATORS (TO LOW OR ZERO EMISSIONS)

Many buildings in developed areas include back-up diesel generators to provide emergency power in the event of power failure. Even if such engines are not used for emergency purposes, they are still operated periodically for maintenance and testing. Diesel backup generators, specifically older ones, can have significant diesel particulate matter emissions. As part of its diesel risk reduction program, ARB adopted an air toxic control measure for stationary engines, or generators. The measure requires that new generators, including back-up generators and generators used in construction, be certified to meet emission standards set by ARB and US EPA (ARB and US EPA have identical emission standards for generators). ARB/US EPA emission standards apply to generators larger than 50 horse power and are set forth as Tiers 1 through 4, with Tier 4 engines being the cleanest. Generator engines certified as Tier 4 reduce PM emissions 85 to 90 percent over a non-tiered engine, whereas Tier 1 only reduces PM emissions by 25 percent. By 2015, all new generator engines must have met Tier 4 emission standards. But since these regulations apply only to new engines, older existing generators can continue contributing to local air pollution. Local governments can require, via a local ordinance, development agreement, or other means, that existing older generators not subject to ARB limits be replaced with a new low or zero emitting generator or be retrofitted with control technologies such as diesel particulate filters, resulting in significant reductions in diesel PM emissions. New, zero emission back-up power technologies are also becoming available, including fuel cell back-up power (example: Bloom Energy).

ELECTRIFY LOADING DOCKS

Heavy duty diesel trucks are the predominant means to deliver goods to grocery stores, shopping malls, and other commercial and retail land uses. Diesel trucks normally need to idle their main diesel engine during loading and unloading operations to operate mechanical lift equipment or

to run the air conditioner or heater in the cab of the truck. This idling of the main diesel engine produces a substantial amount of diesel particulate matter emissions and can impact the health of nearby people. The particulate matter emissions can be reduced or eliminated by requiring the electrification of all loading docks. Trucks that are equipped to utilize grid power can significantly reduce their emissions. Installing electrical outlets at all loading docks and promoting or requiring only trucks capable of plugging-in to deliver goods will lead to localized reductions in diesel emissions, thereby decreasing the potential for health risks to those that live and work in the area.

LIMIT IDLING TIMES

Prohibiting trucks from idling for more than two minutes can reduce emissions by limiting the amount of time that trucks run their engines. Idling limits could apply to all types and sizes of trucks, and/or buses, that spend extended periods of time at idle when loading and unloading, staging or when not in active use. ARB regulations limit idling time to no more than five continuous minutes (for commercial motor vehicles with gross vehicular weight ratings of greater than 10,000 pounds). Local governments may, and often do, pass local ordinances that further limit allowable idling time to no more than two continuous minutes. In addition, local enforcement of ARB or local idling limits increases their effectiveness. Strict local limits on idling diesel engines, combined with local enforcement, can reduce local exposure to diesel exhaust.

ARB's idling regulation contains a number of exemptions that allow for longer idling periods when safety or power needs for equipment are required. Communities should consider if similar exemptions are appropriate when adopting a local ordinance on idling time limits.

ZERO EMISSION TECHNOLOGY & ALTERNATIVE FUELS

Zero emission (i.e. plug-in electric or hydrogen powered) vehicles have become more commonplace but will need the necessary infrastructure to continue to grow. Local governments can promote this infrastructure by requiring it at new or existing development (for example, required plug-in stations for electric vehicles). Diesel powered on-road and off-road equipment manufacturers are constantly developing new technologies and strategies to reduce diesel particulate matter emissions in order to comply with increasingly stringent ARB regulations. In addition, fuel providers are also developing lower emission and renewable fuels, such as biodiesel, to comply with ARB fuels regulations. Promoting the use of these new technologies and fuels within our communities, either through requirements or incentives, can reduce or eliminate the adverse health impacts from local sources of TACs and PM air pollution.

For example, truck manufacturers have begun offering diesel electric hybrids for all but the heaviest trucks. Gasoline hybrids are available for lighter weight trucks. The availability of propane and natural gas powered trucks is somewhat limited in terms of weight class and usage, although there are some well-established markets for natural and/or bio gas buses and garbage trucks. Trucks powered by battery or fuel cell hybrid electric are currently limited to demonstration projects, but when commercialized will present the lowest emission option.

PROMOTE OR REQUIRE THE USE OF TRANSPORTATION REFRIGERATION UNITS (TRU)

Trucks delivering goods often need to keep perishable items refrigerated or at a constant temperature. The use of Transportation Refrigeration Units (TRUs) in lieu of running the main engine on delivery trucks maintains refrigeration while minimizing diesel emissions. TRUs are refrigeration systems powered by diesel internal combustion engines designed to refrigerate perishable products that are transported in various containers, including semi-trailers, truck vans, shipping containers, and rail cars. Local policies or programs that promote the use of transportation refrigeration units, especially if they meet the federal Environmental Protection Agency's (US EPA) Tier 4 emission standards, can reduce emissions of diesel particulate matter and toxic air contaminants by 50 to 80 percent. It should be noted that while TRU engines are relatively small, ranging from 9 to 36 horsepower, significant numbers of these engines congregating at distribution centers, truck stops, and other facilities, could still result in the potential for adverse health risks to sensitive populations nearby.

TRANSPORTATION DEMAND MANAGEMENT (TDM) STRATEGIES

As previously mentioned in this guidebook, the Air District strongly supports local and regional efforts to reduce vehicle miles traveled and promote "focused growth", i.e. infill, transit-oriented, and mixed-use development throughout the region. Building such communities is critical to achieving reduced vehicle miles traveled, which will: reduce criteria pollutants, greenhouse gases, and toxic air contaminant and fine PM emissions from passenger vehicles, as well as assist the Bay Area in attaining and maintaining health-based ambient air quality standards. Focused growth strategies have the long-term benefit of improving overall air quality while also providing many other benefits to the Bay Area environment, including the preservation of natural land and open space, improved water quality, and protection of habitat and native wildlife species. Focused growth also provides important economic and equity benefits, including reduced traffic congestion and lower transportation costs, more housing options, and better access to jobs.

The Air District recommends requiring the implementation of as many TDM strategies as is feasible into projects and plans. Examples include, but are not limited to, parking pricing strategies; parking maximums; mandated parking spaces for car-sharing programs; the provision of transit passes in residential, commercial and office developments; charging stations for electric vehicles; bicycle lockers or racks; teleworking policies; bicycling improvements; and more. For a recommended list of TDM strategies, consult the Air District's TDM tool: http://www.baaqmd.gov/plans-and-climate/air-quality-plans/smart-growth.

TRAFFIC MANAGEMENT STRATEGIES

Studies demonstrate that managing how traffic flows is a strategy to reduce the amount of air pollution emitted from vehicles.

Traffic Smoothing

Reducing acceleration and deceleration can reduce fuel consumption and emissions. Creating a more constant traffic speed (i.e. traffic smoothing) can reduce emissions fairly significantly (up to ~50%, according to several studies). Strategies to smooth traffic include installing roundabouts at stop-controlled intersections.

Speed Limits

Driving speed is one of the most important factors that determine vehicle emissions, according to ARB. A study by El-Shawarby et al (2005) found that fuel consumption and emission rates are optimum in the range of 38-55 mph. Outside of this range, both fuel consumption and emission rates increase considerably.

APPENDIX B: BEST PRACTICES TO REDUCE EXPOSURE TO LOCAL AIR POLLUTION

The Air District recommends that local government agencies adopt the following "best practices to reduce exposure" as enforceable ordinances or standard conditions of approval, and/or as community-wide policies. Implementing all of the "best practices to reduce exposure" will likely result in the greatest reduction in potential health risks from air pollution. However, the Air District acknowledges that implementing all of the following "best practices to reduce exposure" may not be feasible or appropriate in every community. Of particular importance is the best practice related to air filtration, which is one of the most effective strategies to reduce exposure.

The research regarding the availability and effectiveness of "best practices to reduce exposure" is continually evolving. Air District staff will update the recommended measures as new information becomes available.

HEALTH PROTECTIVE DISTANCE

As stated, from an air quality standpoint, reducing vehicle miles travled (VMT) is crucial. Reducing VMT will reduce criteria pollutants, greenhouse gases, and toxic air contaminants. Cars and trucks represent the single largest source of greenhouse gas emissions in the Bay Area; reducing these transportation-related emissions through integrated land use and transportation planning and infill development is critical to achieving GHG reduction goals to stabilize the climate. Transportation is also a significant source of fine PM and TACs. Therefore, reducing VMT is a high priority for air quality and the climate. However, increased development in certain locations near major sources of air pollution may result in increased local exposure to unhealthy levels of air pollutants to the people living there unless steps are taken to reduce exposure and reduce emissions. This guidebook includes many strategies to reduce both emissions and exposure. One strategy for reducing exposure is to plan sensitive land uses farther from localized air pollution sources (such as freeways) as is feasible and appropriate. This is one of the most effective health protective strategies that can be implemented to protect children and other vulnerable populations from the harmful effects of air pollution. In general, as the distance from a local source of air pollution increases, the level of air pollution and associated health risk decreases.

A means to implement or consider proximity to air pollution sources is zoning. For example, when updating or making revisions to a zoning code in an area characterized by elevated levels of air pollution (such as immediately adjacent to a freeway), local government may choose to designate the land use as commercial, office, or parking instead of residential, if that is feasible or appropriate given the context. The Air District aknowledges that local land use decisions are complicated and many factors need to be considered and balanced. The Air District simply encourages local

governments to consider air quality along with other public health elements when making land use decisions.

The Air District recognizes that in dense urban communities, implementing a health protective distance between sensitive land uses and sources of air pollution may not always be feasible. If it is not possible to implement health protective distances, then the additional best practices to reduce exposure to local air pollution will help to reduce health risks, if fully implemented.

AIR FILTERS

Because many people spend a majority of their time indoors, reducing the entry of air pollutants into a home (or school, daycare, etc.) is a viable option to mitigate the adverse health impacts related to air pollutant exposures, particularly fine PM. Heating, ventilating, and air conditioning (HVAC) systems control the air flow in buildings by circulating outside air through, and eventually out of a building. The use of high efficiency filtration in central HVAC systems and in portable air cleaners has been shown to be effective in most circumstances. Depending on the particle size, high efficiency filters can remove 50% - 98% of particles in the air, and portable air cleaners (designed for homes without a central HVAC) can remove 30% to 90% of particles.

The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) uses a Minimum Efficiency Reporting Value (MERV) measurement scale to rate the effectiveness of air filters on a scale of 1 to 16. For example, MERV-13 air filtration devices installed on an HVAC air intake system can remove 80-90% of indoor particulate matter (greater than 0.3 microns in diameter). High Efficiency Particle Filters, or HEPA filters, are effective at removing mold, pollen and ultrafine particles. HEPA filters have a particle size removal efficiency of > 99.999% for particles 0.3 - 1 micron in diameter which is roughly equivalent to a MERV 20 rating (US EPA, Residential Air Cleaners August 2009). However, only a few HEPA filters are designed for use in residential applications.

Studies conducted in California (Bhangar et al 2011, Less et al., 2015) have shown that particulate levels in homes with high efficiency filtration systems were 50% to 74% lower than those without filtration systems. Modeling simulations (Brown et al 2014) showed similar findings. The effectiveness of air filters in reducing health risks depends heavily on properly sealed ducting and maintenance. Higher MERV rated filters also require increased air pressure, which requires more energy use and can cause ducts to fail if not properly installed and sealed. However, while air filtration systems do result in additional energy use, a well-sealed building envelope will help reduce energy use and will also increase the effectiveness of air filtration. An ongoing maintenance plan for a building's HVAC air filtration system should therefore be included in any air filtration best practice adopted by a local government. For additional information on air filters, see the U.S. EPA's document, "Residential Air Cleaners: A Summary of Available Information August 2009".

HVAC filtration is an effective and feasible air quality mitigation strategy. It is becoming increasingly common in Bay Area jurisdictions. For example, San Francisco requires MERV 13 air filters in new residential buildings located within designated "air pollutant exposure zones" (locations where toxic risk or fine PM levels exceed designated thresholds).

The Air District recommends requiring the installation and implementation of an air filtration system in sensitive land uses (minimum of MERV 13) along with a maintenance plan detailing how the filtration system will be maintained.

PROJECT PHASING

In 2008, the California Air Resources Board adopted the On-Road Heavy Duty Diesel Vehicle (in use) regulation to dramatically reduce diesel particulate matter emissions from trucks and buses. The regulation requires owners of diesel trucks to retrofit or replace their engines so that by 2016, nearly all trucks would have diesel particulate matter emissions equal to a 2010 or newer model year engine. The regulation went into effect in 2012, and will result in significant reductions in diesel particulate matter emissions from on-road diesel trucks and buses as truck and bus owners comply with the regulation. ARB estimates there should be up to an 80 percent reduction in diesel particulate matter by 2023 from on-road trucks and buses. Accordingly, it is expected that the geographic scope of areas with unhealthy levels of diesel exhaust will decrease in future years as this truck and bus fleet becomes cleaner.

The ARB regulation makes project phasing an effective strategy for reducing people's exposure to fine PM and TAC emissions when the project or plan area is impacted from a source of emissions that includes on-road trucks and buses, such as a freeway or distribution center. When it is feasible to do so, such as on a relatively large project site, buildings that will be closest to the source of diesel particulate matter from on-road trucks or buses could be built last, so that air pollution from nearby highways or roadways will have time to decline based on the turnover of older diesel trucks and buses resulting from the ARB regulation. Phasing development near highways and major roadways can reduce exposure to fine PM concentrations and TACs.

BUILDING AND SITE DESIGN

Designing residential buildings and sites to locate people away from emission sources is an effective way to protect people's health.

Building Design

Building design can be an important factor in reducing exposure to PM and TACs by improving indoor air quality, especially when considering the location of the air intake for building ventilation. Generally, air pollution decreases with distance and with height, therefore air intake locations should be located as far as is feasible away from emission sources to provide the cleanest air to building occupants.

Other beneficial design features may further improve indoor air quality. Operable windows and balconies could be installed away from high volume roadways or other sources of air pollution, if feasible. For example, if local sources of air pollution are located on the west of the building, operable windows and balconies could be installed on the east side of the building (if feasible) where the concentrations of fine PM and TACs are likely to be lower.

Site Design

When designing a plan or project that includes sensitive land uses near local sources of fine PM and TACs, buildings within the development that do not house people, such as parking garages, commercial buildings or open space, could be located closest to the local source of emissions (such as a freeway), and act as a barrier between the pollution source and residential or other sensitive land uses. Also, implementing open space such as parks (that do not have recreational amenities such as basketball or tennis courts, soccer fields, playgrounds, etc.) between buildings can improve air flow and air pollution movement. This strategy can help to reduce build up of air pollution, or air pollution "hot spots".

SOLID BARRIERS

Consider incorporating solid barriers, similar to sound walls, between buildings and sources of air pollution. Studies have demonstrated that barriers can reduce air pollutant levels, while also reducing noise (co-benefit). Recent research indicates that sound walls, in conjunction with vegetation (see below) is more effective than either strategy implemented on it's own to reduce air pollutant levels.

VEGETATION

Planting certain trees can be an effective strategy for reducing exposure to air pollution. Some trees and vegetation type may trap and filter coarse and fine particulates in the leaves, stems, and twigs. Trapped particles are eventually washed to the ground by rainfall. Trees also lower the air temperature by providing shade over streets and parking lots, thereby reducing evaporative emissions from vehicles and energy consumed on air conditioning during summer months.

The effectiveness of fine PM removal depends on the tree species planted. Large, evergreen trees (those with foliage year-round) with long-life spans are best. In addition, trees with branches and leaves that have a sticky surface are best at trapping fine PM. Trees with a fine, complex foliage structure that allows significant in-canopy airflow will also perform better at trapping particulate matter. Pines, Cypress, Hybrid Popular, and Redwoods are an example of trees that do well in trapping pollution.

In addition to the type of tree, the placement of the trees, relative to major roadways or other diesel emission sources, and how densely they are planted, are important considerations in using trees as a strategy to reduce air pollution exposure. Trees should be planted between land uses and the source of emissions, and as densely as feasible, while still maintaining the health of the trees. Additionally, some trees emit volatile organic compounds (VOCs) which can lead to the formation of ozone. Care should be taken that trees planted with the intent to reduce fine PM do not also emit high levels of VOCs.

Research is continuing to determine and quantify the effectiveness of planting of trees near a source of particulate matter in reducing exposure.

The Urban Forest Ecosystems Institute at California Polytechnic University, San Luis Obispo (which partners with CalFire, the U.S. Forest Service and PG&E) maintains SelecTree, a tree selection tool

designed to help users select appropriate trees based on a number of considerations, including leaf and flower characteristics, site conditions and constraints (such as soil conditions, soil pH, seaside exposure, etc.), pest and disease information, health and safety concerns (non-native CA species, fire resistance, biogenic emissions, root damage potential, etc.) and special values (attracts wildlife). The Air District encourages the ues of this tool to assist in making comprehensive decisions on tree selection while also taking into consideration a tree's biogenic emissions.

In addition, the Air District may undertake a guidance document on trees, which will include recommendations on the types of tress that are preferred for air quality (biogenic emissions), exposure reduction, and climate protection/carbon sequestration, while also considering other factors including water quality, pest management, pollen reduction, aesthetics and more.

LIMIT GROUND FLOOR USES

Placing residential development on the second floor of a building or higher can be an effective strategy for reducing exposure to local pollutants from a nearby at-grade highway or busy roadway. This strategy is often applied to mixed use buildings on infill sites, where the ground floor is reserved for commercial space and the second and subsequent floors are used for residential. Limiting ground floor residential development is generally most effective when the adjacent roadway is not elevated.

ALTERNATIVE TRUCK ROUTES

Truck routes can be planned or re-routed through non-residential neighborhoods, and to avoid other sensitive land uses such as daycare centers, schools, and elderly facilities. For example, the City of Oakland recently worked with community groups to re-route trucks away from residential streets around the Oakland Coliseum to address local concern about air pollution levels.

APPENDIX C
TECHNICAL NOTES

The mapping tool created by the Air District include blue and purple areas (located: www.baaqmd.gov/planninghealthyplaces).

The blue areas represent "large and/or complex" sources where further study is recommended. The Air District relied on ARB's document entitled, "2005 Air Quality Land Use Handbook: A Community Health Perspective" (ARB Land Use Handbook) to define "large and/or complex" sources, and their associated further study areas. The further study areas are defined below:

- 0.5 miles around all major airports, including OAK, SFO, SJC;
- 0.5 miles around all oil refineries;
- 0.5 miles around the Port of Oakland; 1,000 feet around all other seaports;
- 1,000 feet around railyards (except Caltrain yards in San Jose & San Francisco - these are included in AQ modeling in purple areas)
- 150 feet around medium gas stations (based on Air District emissions data); and
- 300 feet around large gas stations (based on Air District emissions data).

The purple areas on the maps are based on a screening level, cumulative analysis of all mobile and stationary sources of air pollution in the region. To create the purple areas, the Air District identified areas that exceed 100 in a million for cancer risk, and/or exceed fine PM concentrations of 0.8 micrograms per cubic meter, and/or are within 500 feet of a freeway, 175 feet of a major roadway (>30k AADT), or 500 feet of a ferry terminal. Implementation of best practices to reduce emissions and exposure will reduce the health risks; however, the emissions and exposures will not be completely eliminated.

The Air District will be releasing a document that will provide greater detail on the methodology used to model the estimated levels of air pollutants and health risks on a cumulative basis throughout the region. This document will be available at: www.baaqmd.gov/planninghealthyplaces upon completion (est. late spring / early summer 2016).