

# **AIR QUALITY AND LAND USE HANDBOOK: A COMMUNITY HEALTH PERSPECTIVE**



**April 2005**

California Environmental Protection Agency  
California Air Resources Board



## Air Agency Contacts

### Federal-

#### U.S. EPA, Region 9

Phone: (866)-EPA-WEST

Website: [www.epa.gov/region09](http://www.epa.gov/region09)

Email: [r9.info@epa.gov](mailto:r9.info@epa.gov)

### -State-

#### California Air Resources Board

Phone: (916) 322-2990 (public info)

(800) 363-7664 (public info)

(800) 952-5588 (complaints)

(866)-397-5462 (env. justice)

Website: [www.arb.ca.gov](http://www.arb.ca.gov)

Email: [helpline@arb.ca.gov](mailto:helpline@arb.ca.gov)

### -Local-

#### Amador County APCD

Phone: (209) 257-0112

Website: [www.amadorapcd.org](http://www.amadorapcd.org)

E-Mail: [jharris@amadorapcd.org](mailto:jharris@amadorapcd.org)

#### Antelope Valley AQMD

Phone: (661) 723-8070

Complaint Line: (888) 732-8070

Website: [www.avaqmd.ca.gov](http://www.avaqmd.ca.gov)

E-Mail: [bbanks@avaqmd.ca.gov](mailto:bbanks@avaqmd.ca.gov)

#### Bay Area AQMD

Phone: (415) 749-5000

Complaint Line: (800) 334-6367

Website: [www.baaqmd.gov](http://www.baaqmd.gov)

E-Mail: [webmaster@baaqmd.gov](mailto:webmaster@baaqmd.gov)

#### Butte County AQMD

Phone: (530) 891-2882

Website: [www.bcaqmd.org](http://www.bcaqmd.org)

E-Mail: [air@bcaqmd.org](mailto:air@bcaqmd.org)

#### Calaveras County APCD

Phone: (209) 754-6504

E-Mail: [lgrewal@co.calaveras.ca.us](mailto:lgrewal@co.calaveras.ca.us)

#### Colusa County APCD

Phone: (530) 458-0590

Website: [www.colusanet.com/apcd](http://www.colusanet.com/apcd)

E-Mail: [ccair@colusanet.com](mailto:ccair@colusanet.com)

#### El Dorado County AQMD

Phone: (530) 621-6662

Website:

[www.co.el-dorado.ca.us/emd/apcd](http://www.co.el-dorado.ca.us/emd/apcd)

E-Mail: [mcctaggart@co.el-dorado.ca.us](mailto:mcctaggart@co.el-dorado.ca.us)

#### Feather River AQMD

Phone: (530) 634-7659

Website: [www.fraqmd.org](http://www.fraqmd.org)

E-Mail: [fracmd@fracmd.org](mailto:fracmd@fracmd.org)

#### Glenn County APCD

Phone: (530) 934-6500

[http://www.countyofglenn.net/air\\_pollution\\_control](http://www.countyofglenn.net/air_pollution_control)

E-Mail: [ktokunaga@countyofglenn.net](mailto:ktokunaga@countyofglenn.net)

#### Great Basin Unified APCD

Phone: (760) 872-8211

Website: [www.gbuapcd.org](http://www.gbuapcd.org)

E-Mail: [gb1@greatbasinapcd.org](mailto:gb1@greatbasinapcd.org)

#### Imperial County APCD

Phone: (760) 482-4606

E-Mail: [reyesromero@imperialcounty.net](mailto:reyesromero@imperialcounty.net)

#### Kern County APCD

Phone: (661) 862-5250

Website: [www.kernair.org](http://www.kernair.org)

E-Mail: [kcapcd@co.kern.ca.us](mailto:kcapcd@co.kern.ca.us)

#### Lake County AQMD

Phone: (707) 263-7000

Website: [www.lcaqmd.net](http://www.lcaqmd.net)

E-Mail: [bobr@pacific.net](mailto:bobr@pacific.net)

#### Lassen County APCD

Phone: (530) 251-8110

E-Mail: [lassenag@psln.com](mailto:lassenag@psln.com)

#### Mariposa County APCD

Phone: (209) 966-2220

E-Mail: [air@mariposacounty.org](mailto:air@mariposacounty.org)

#### Mendocino County AQMD

Phone: (707) 463-4354

Website:

[www.co.mendocino.ca.us/aqmd](http://www.co.mendocino.ca.us/aqmd)

E-Mail:

[mcaqmd@co.mendocino.ca.us](mailto:mcaqmd@co.mendocino.ca.us)

#### Modoc County APCD

Phone: (530) 233-6419

E-Mail: [modapcd@hdo.net](mailto:modapcd@hdo.net)

#### Mojave Desert AQMD

Phone: (760) 245-1661

(800) 635-4617

Website: [www.mdqmd.ca.gov](http://www.mdqmd.ca.gov)

#### Monterey Bay Unified APCD

Phone: (831) 647-9411

(800) 253-6028 (Complaints)

Website: [www.mbuapcd.org](http://www.mbuapcd.org)

E-Mail: [dquetin@mbuapcd.org](mailto:dquetin@mbuapcd.org)

#### North Coast Unified AQMD

Phone: (707) 443-3093

Website: [www.ncuaqmd.org](http://www.ncuaqmd.org)

E-Mail: [lawrence@ncuaqmd.org](mailto:lawrence@ncuaqmd.org)

#### Northern Sierra AQMD

Phone: (530) 274-9360

Website: [www.myairdistrict.com](http://www.myairdistrict.com)

E-Mail: [office@myairdistrict.com](mailto:office@myairdistrict.com)

#### Northern Sonoma County APCD

Phone: (707) 433-5911

E-Mail: [nsc@sonic.net](mailto:nsc@sonic.net)

#### Placer County APCD

Phone: (530) 889-7130

Website:

<http://www.placer.ca.gov/airpollution/airpolut.htm>

E-Mail: [pcapcd@placer.ca.gov](mailto:pcapcd@placer.ca.gov)

#### Sacramento Metro AQMD

Phone: (916) 874-4800

Website: [www.airquality.org](http://www.airquality.org)

E-Mail: [kshearer@airquality.org](mailto:kshearer@airquality.org)

#### San Diego County APCD

Phone: (858) 650-4700

Website: [www.sdapcd.org](http://www.sdapcd.org)

#### San Joaquin Valley APCD

Phone: (559) 230-6000 (General)

(800) 281-7003

(San Joaquin, Stanislaus, Merced)

(800) 870-1037

(Madera, Fresno, Kings)

(800) 926-5550

(Tulare and Valley portion of Kern)

Website: [www.valleyair.org](http://www.valleyair.org)

E-Mail: [sjvpcd@valleyair.org](mailto:sjvpcd@valleyair.org)

#### San Luis Obispo County APCD

Phone: (805) 781-5912

Website: [www.slocleanair.org](http://www.slocleanair.org)

E-Mail: [info@slocleanair.org](mailto:info@slocleanair.org)

#### Santa Barbara County APCD

Phone (805) 961-8800

Website: [www.sbcapcd.org](http://www.sbcapcd.org)

Email us: [apcd@sbcapcd.org](mailto:apcd@sbcapcd.org)

#### Shasta County AQMD

Phone: (530) 225-5789

Website:

[www.co.shasta.ca.us/Departments/Resource/mgmt/drm/aqmain.htm](http://www.co.shasta.ca.us/Departments/Resource/mgmt/drm/aqmain.htm)

E-Mail: [scdrn@snowcrest.net](mailto:scdrn@snowcrest.net)

#### Siskiyou County APCD

Phone: (530) 841-4029

E-Mail: [ebeck@siskiyou.ca.us](mailto:ebeck@siskiyou.ca.us)

#### South Coast AQMD

Phone: (909) 396-2000

Complaint Line: 1-800-CUT-SMOG

Website: [www.aqmd.gov](http://www.aqmd.gov)

Email: [bwallerstein@aqmd.gov](mailto:bwallerstein@aqmd.gov)

#### Tehama County APCD

Phone: (530) 527-3717

Website: [www.tehcoapcd.net](http://www.tehcoapcd.net)

Email: [general@tehcoapcd.net](mailto:general@tehcoapcd.net)

#### Tuolumne County APCD

Phone: (209) 533-5693

E-Mail:

[bsandman@co.tuolumne.ca.us](mailto:bsandman@co.tuolumne.ca.us)

#### Ventura County APCD

Phone: (805) 645-1400

Complaint Line: (805) 654-2797

Website: [www.vcapcd.org](http://www.vcapcd.org)

E-Mail: [info@vcapcd.org](mailto:info@vcapcd.org)

#### Yolo-Solano AQMD

Phone: (530) 757-3650

Website: [www.ysaqmd.org](http://www.ysaqmd.org)

Email: [administration@ysaqmd.org](mailto:administration@ysaqmd.org)

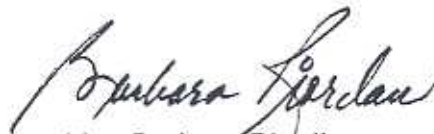
## ***To My Local Government Colleagues....***

I am pleased to introduce this informational guide to air quality and land use issues focused on community health. As a former county supervisor, I know from experience the complexity of local land use decisions. There are multiple factors to consider and balance. This document provides important public health information that we hope will be considered along with housing needs, economic development priorities, and other quality of life issues.

An important focus of this document is prevention. We hope the air quality information provided will help inform decision-makers about the benefits of avoiding certain siting situations. The overarching goal is to avoid placing people in harm's way. Recent studies have shown that public exposure to air pollution can be substantially elevated near freeways and certain other facilities. What is encouraging is that the health risk is greatly reduced with distance. For that reason, we have provided some general recommendations aimed at keeping appropriate distances between sources of air pollution and land uses such as residences.

Land use decisions are a local government responsibility. The Air Resources Board's role is advisory and these recommendations do not establish regulatory standards of any kind. However, we hope that the information in this document will be seriously considered by local elected officials and land use agencies. We also hope that this document will promote enhanced communication between land use agencies and local air pollution control agencies. We developed this document in close coordination with the California Air Pollution Control Officers Association with that goal in mind.

I hope you find this document both informative and useful.

A handwritten signature in black ink, appearing to read "Barbara Riordan". The signature is fluid and cursive, with the first name being more prominent.

Mrs. Barbara Riordan  
Interim Chairman  
California Air Resources Board

## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>ES-1</b>
<b>1. ARB RECOMMENDATIONS ON SITING NEW SENSITIVE LAND USES .....</b>	<b>1</b>
FREEWAYS AND HIGH TRAFFIC ROADS .....	8
DISTRIBUTION CENTERS .....	11
RAIL YARDS .....	15
PORTS .....	19
PETROLEUM REFINERIES .....	21
CHROME PLATING OPERATIONS .....	23
DRY CLEANERS USING PERCHLOROETHYLENE (PERC DRY CLEANERS) .....	27
GASOLINE DISPENSING FACILITIES .....	30
OTHER FACILITY TYPES THAT EMIT AIR POLLUTANTS OF CONCERN .....	32
POTENTIAL SOURCES OF ODOR AND DUST COMPLAINTS .....	32
<b>2. HANDBOOK DEVELOPMENT .....</b>	<b>35</b>
<b>3. KEY COMMUNITY FOCUSED ISSUES LAND USE AGENCIES SHOULD CONSIDER .....</b>	<b>38</b>
INCOMPATIBLE LAND USES .....	38
CUMULATIVE AIR POLLUTION IMPACTS .....	39
<b>4. MECHANISMS FOR INTEGRATING LOCALIZED AIR QUALITY CONCERNS INTO LAND USE PROCESSES .....</b>	<b>40</b>
GENERAL PLANS .....	41
ZONING .....	42
LAND USE PERMITTING PROCESSES .....	43
OUTREACH TO OTHER AGENCIES .....	51
<b>5. AVAILABLE TOOLS TO EVALUATE CUMULATIVE AIR POLLUTION EMISSIONS AND RISK .....</b>	<b>53</b>
<b>6. ARB PROGRAMS TO REDUCE AIR POLLUTION IN COMMUNITIES .....</b>	<b>55</b>
<b>7. WAYS TO ENHANCE MEANINGFUL PUBLIC PARTICIPATION .....</b>	<b>58</b>

## **APPENDICES**

<b>Appendix A</b>	Land Use Classifications And Associated Facility Categories That Could Emit Air Pollutants
<b>Appendix B</b>	Land Use-Based Reference Tools To Evaluate New Projects For Potential Air Pollution Impacts
<b>Appendix C</b>	ARB And Local Air District Information And Tools Concerning Cumulative Air Pollution Impacts
<b>Appendix D</b>	Land Use And Air Quality Agency Roles In The Land Use Process
<b>Appendix E</b>	Special Processes That Apply To School Siting
<b>Appendix F</b>	General Processes Used By Land Use Agencies To Address Air Pollution Impacts
<b>Appendix G</b>	Glossary Of Key Air Pollution Terms

## **Acknowledgments**

The ARB staff would like to acknowledge the exceptional contributions made to this document by members of the ARB Environmental Justice Stakeholders Group. Since 2001, ARB staff has consistently relied on this group to provide critical and constructive input on implementing the specifics of ARB's environmental justice policies and actions. The Stakeholders Group is convened by the ARB, and comprised of representatives from local land use and air agencies, community interest groups, environmental justice organizations, academia, and business. Their assistance and suggestions throughout the development of this Handbook have been invaluable.



## **Executive Summary**

The Air Resources Board's (ARB) primary goal in developing this document is to provide information that will help keep California's children and other vulnerable populations out of harm's way with respect to nearby sources of air pollution. Recent air pollution studies have shown an association between respiratory and other non-cancer health effects and proximity to high traffic roadways. Other studies have shown that diesel exhaust and other cancer-causing chemicals emitted from cars and trucks are responsible for much of the overall cancer risk from airborne toxics in California. Also, ARB community health risk assessments and regulatory programs have produced important air quality information about certain types of facilities that should be considered when siting new residences, schools, day care centers, playgrounds, and medical facilities (i.e., sensitive land uses). Sensitive land uses deserve special attention because children, pregnant women, the elderly, and those with existing health problems are especially vulnerable to the non-cancer effects of air pollution. There is also substantial evidence that children are more sensitive to cancer-causing chemicals.

Focusing attention on these siting situations is an important preventative action. ARB and local air districts have comprehensive efforts underway to address new and existing air pollution sources under their respective jurisdictions. The issue of siting is a local government function. As more data on the connection between proximity and health risk from air pollution become available, it is essential that air agencies share what we know with land use agencies. We hope this document will serve that purpose.

The first section provides ARB recommendations regarding the siting of new sensitive land uses near freeways, distribution centers, rail yards, ports, refineries, chrome plating facilities, dry cleaners, and gasoline dispensing facilities. This list consists of the air pollution sources that we have evaluated from the standpoint of the proximity issue. It is based on available information and reflects ARB's primary areas of jurisdiction – mobile sources and toxic air contaminants. A key air pollutant common to many of these sources is particulate matter from diesel engines. Diesel particulate matter (diesel PM) is a carcinogen identified by ARB as a toxic air contaminant and contributes to particulate pollution statewide.

Reducing diesel particulate emissions is one of ARB's highest public health priorities and the focus of a comprehensive statewide control program that is reducing diesel PM emissions each year. ARB's long-term goal is to reduce diesel PM emissions 85% by 2020. However, cleaning up diesel engines will take time as new engine standards phase in and programs to accelerate fleet turnover or retrofit existing engines are implemented. Also, these efforts are reducing diesel particulate emissions on a statewide basis, but do not yet capture every site where diesel vehicles and engines may congregate. Because living or going to school too close to such air pollution sources may increase both cancer and non-cancer health risks, we are recommending that proximity be considered in the siting of new sensitive land uses.



There are also other key toxic air contaminants associated with specific types of facilities. Most of these are subject to stringent state and local air district regulations. However, what we know today indicates that keeping new homes and other sensitive land uses from siting too close to such facilities would provide additional health protection. Chrome platers are a prime example of facilities that should not be located near vulnerable communities because of the cancer health risks from exposure to the toxic material used during their operations.

In addition to source specific recommendations, we also encourage land use agencies to use their planning processes to ensure the appropriate separation of industrial facilities and sensitive land uses. While we provide some suggestions, how to best achieve that goal is a local issue. In the development of these guidelines, we received valuable input from local government about the spectrum of issues that must be considered in the land use planning process. This includes addressing housing and transportation needs, the benefits of urban infill, community economic development priorities, and other quality of life issues. All of these factors are important considerations. The recommendations in the Handbook need to be balanced with other State and local policies.

Our purpose with this document is to highlight the potential health impacts associated with proximity to air pollution sources so planners explicitly consider this issue in planning processes. We believe that with careful evaluation, infill development, mixed use, higher density, transit-oriented development, and other concepts that benefit regional air quality can be compatible with protecting the health of individuals at the neighborhood level. One suggestion for achieving this goal is more communication between air agencies and land use planners. Local air districts are an important resource that should be consulted regarding sources of air pollution in their jurisdictions. ARB staff will also continue to provide updated technical information as it becomes available.

Our recommendations are as specific as possible given the nature of the available data. In some cases, like refineries, we suggest that the siting of new sensitive land uses should be avoided immediately downwind. However, we leave definition of the size of this area to local agencies based on facility specific considerations. Also, project design that would reduce air pollution exposure may be part of the picture and we encourage consultation with air agencies on this subject.

In developing the recommendations, our first consideration was the adequacy of the data available for an air pollution source category. Using that data, we assessed whether we could reasonably characterize the relative exposure and health risk from a proximity standpoint. That screening provided the list of air pollution sources that we were able to address with specific recommendations. We also considered the practical implications of making hard and fast recommendations where the potential impact area is large, emissions will be reduced with time, and air agencies are in the process of looking at options for additional emission control. In the end, we tailored our recommendations to minimize the highest exposures for each source category independently. Due to the large variability in relative risk in the source categories, we chose not to apply

a uniform, quantified risk threshold as is typically done in air quality permitting programs. Instead, because these guidelines are not regulatory or binding on local agencies, we took a more qualitative approach in developing the distance-based recommendations.

Where possible, we recommend a minimum separation between a new sensitive land use and known air pollution risks. In other cases, we acknowledge that the existing health risk is too high in a relatively large area, that air agencies are working to reduce that risk, and that in the meantime, we recommend keeping new sensitive land uses out of the highest exposure areas. However, it is critical to note that our implied identification of the high exposure areas for these sources does not mean that the risk in the remaining impact area is insignificant. Rather, we hope this document will bring further attention to the potential health risk throughout the impact area and help garner support for our ongoing efforts to reduce health risk associated with air pollution sources. Areas downwind of major ports, rail yards, and other inter-modal transportation facilities are prime examples.

We developed these recommendations as a means to share important public health information. The underlying data are publicly available and referenced in this document. We also describe our rationale and the factors considered in developing each recommendation, including data limitations and uncertainties. These recommendations are advisory and should not be interpreted as defined “buffer zones.” We recognize the opportunity for more detailed site-specific analyses always exists, and that there is no “one size fits all” solution to land use planning.

As California continues to grow, we collectively have the opportunity to use all the information at hand to avoid siting scenarios that may pose a health risk. As part of ARB’s focus on communities and children’s health, we encourage land use agencies to apply these recommendations and work more closely with air agencies. We also hope that this document will help educate a wider audience about the value of preventative action to reduce environmental exposures to air pollution.



## **1. ARB Recommendations on Siting New Sensitive Land Uses**

Protecting California's communities and our children from the health effects of air pollution is one of the most fundamental goals of state and local air pollution control programs. Our focus on children reflects their special vulnerability to the health impacts of air pollution. Other vulnerable populations include the elderly, pregnant women, and those with serious health problems affected by air pollution. With this document, we hope to more effectively engage local land use agencies as partners in our efforts to reduce health risk from air pollution in all California communities.

Later sections emphasize the need to strengthen the connection between air quality and land use in both planning and permitting processes. Because the siting process for many, but not all air pollution sources involves permitting by local air districts, there is an opportunity for interagency coordination where the proposed location might pose a problem. To enhance the evaluation process from a land use perspective, section 4 includes recommended project related questions to help screen for potential proximity related issues.

Unlike industrial and other stationary sources of air pollution, the siting of new homes or day care centers does not require an air quality permit. Because these situations fall outside the air quality permitting process, it is especially important that land use agencies be aware of potential air pollution impacts.

The following recommendations address the issue of siting "sensitive land uses" near specific sources of air pollution; namely:

- High traffic freeways and roads
- Distribution centers
- Rail yards
- Ports
- Refineries
- Chrome plating facilities
- Dry cleaners
- Large gas dispensing facilities

The recommendations for each category include a summary of key information and guidance on what to avoid from a public health perspective.

*Sensitive individuals refer to those segments of the population most susceptible to poor air quality (i.e., children, the elderly, and those with pre-existing serious health problems affected by air quality). Land uses where sensitive individuals are most likely to spend time include schools and schoolyards, parks and playgrounds, daycare centers, nursing homes, hospitals, and residential communities (sensitive sites or sensitive land uses).*

We are characterizing sensitive land uses as simply as we can by using the example of residences, schools, day care centers, playgrounds, and medical facilities. However, a variety of facilities are encompassed. For example, residences can include houses, apartments, and senior living complexes. Medical facilities can include hospitals, convalescent homes, and health clinics. Playgrounds could be play areas associated with parks or community centers.

In developing these recommendations, ARB first considered the adequacy of the data available for each air pollution source category. We assessed whether we could generally characterize the relative exposure and health risk from a proximity standpoint. The documented non-cancer health risks include triggering of asthma attacks, heart attacks, and increases in daily mortality and hospitalization for heart and respiratory diseases. These health impacts are well documented in epidemiological studies, but less easy to quantify from a particular air pollution source. Therefore, the cancer health impacts are used in this document to provide a picture of relative risk. This screening process provided the list of source categories we were able to address with specific recommendations. In evaluating the available information, we also considered the practical implications of making hard and fast recommendations where the potential impact area is large, emissions will be reduced with time, and air agencies are in the process of looking at options for additional emission control. Due to the large variability in relative risk between the source categories, we chose not to apply a uniform, quantified risk threshold as is typically done in regulatory programs. Therefore, in the end, we tailored our recommendations to minimize the highest exposures for each source category independently. Additionally, because this guidance is not regulatory or binding on local agencies, we took a more qualitative approach to developing distance based recommendations.

Where possible, we recommend a minimum separation between new sensitive land uses and existing sources. However, this is not always possible, particularly where there is an elevated health risk over large geographical areas. Areas downwind of ports and rail yards are prime examples. In such cases, we recommend doing everything possible to avoid locating sensitive receptors within the highest risk zones. Concurrently, air agencies and others will be working to reduce the overall risk through controls and measures within their scope of authority.

The recommendations were developed from the standpoint of siting new sensitive land uses. Project-specific data for new and existing air pollution sources are available as part of the air quality permitting process. Where such information is available, it should be used. Our recommendations are designed to fill a gap where information about existing facilities may not be readily available. These recommendations are only guidelines and are not designed to substitute for more specific information if it exists.

A summary of our recommendations is shown in Table 1-1. The basis and references<sup>1</sup> supporting each of these recommendations, including health studies, air quality modeling and monitoring studies is discussed below beginning with freeways and summarized in Table 1-2. As new information becomes available, it will be included on ARB's community health web page.

---

<sup>1</sup>Detailed information on these references are available on ARB's website at: <http://www.ARB.ca.gov/ch/landuse.htm>.

**Table 1-1**

**Recommendations on Siting New Sensitive Land Uses  
Such As Residences, Schools, Daycare Centers, Playgrounds, or Medical  
Facilities\***

<b>Source Category</b>	<b>Advisory Recommendations</b>
Freeways and High-Traffic Roads	<ul style="list-style-type: none"> <li>• Avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day.</li> </ul>
Distribution Centers	<ul style="list-style-type: none"> <li>• Avoid siting new sensitive land uses within 1,000 feet of a distribution center (that accommodates more than 100 trucks per day, more than 40 trucks with operating transport refrigeration units (TRUs) per day, or where TRU unit operations exceed 300 hours per week).</li> <li>• Take into account the configuration of existing distribution centers and avoid locating residences and other new sensitive land uses near entry and exit points.</li> </ul>
Rail Yards	<ul style="list-style-type: none"> <li>• Avoid siting new sensitive land uses within 1,000 feet of a major service and maintenance rail yard.</li> <li>• Within one mile of a rail yard, consider possible siting limitations and mitigation approaches.</li> </ul>
Ports	<ul style="list-style-type: none"> <li>• Avoid siting of new sensitive land uses immediately downwind of ports in the most heavily impacted zones. Consult local air districts or the ARB on the status of pending analyses of health risks.</li> </ul>
Refineries	<ul style="list-style-type: none"> <li>• Avoid siting new sensitive land uses immediately downwind of petroleum refineries. Consult with local air districts and other local agencies to determine an appropriate separation.</li> </ul>
Chrome Platers	<ul style="list-style-type: none"> <li>• Avoid siting new sensitive land uses within 1,000 feet of a chrome plater.</li> </ul>
Dry Cleaners Using Perchloro-ethylene	<ul style="list-style-type: none"> <li>• Avoid siting new sensitive land uses within 300 feet of any dry cleaning operation. For operations with two or more machines, provide 500 feet. For operations with 3 or more machines, consult with the local air district.</li> <li>• Do not site new sensitive land uses in the same building with perc dry cleaning operations.</li> </ul>
Gasoline Dispensing Facilities	<ul style="list-style-type: none"> <li>• Avoid siting new sensitive land uses within 300 feet of a large gas station (defined as a facility with a throughput of 3.6 million gallons per year or greater). A 50 foot separation is recommended for typical gas dispensing facilities.</li> </ul>

**\*Notes:**

- These recommendations are advisory. Land use agencies have to balance other considerations, including housing and transportation needs, economic development priorities, and other quality of life issues.

- Recommendations are based primarily on data showing that the air pollution exposures addressed here (i.e., localized) can be reduced as much as 80% with the recommended separation.
- The relative risk for these categories varies greatly (see Table 1-2). To determine the actual risk near a particular facility, a site-specific analysis would be required. Risk from diesel PM will decrease over time as cleaner technology phases in.
- These recommendations are designed to fill a gap where information about existing facilities may not be readily available and are not designed to substitute for more specific information if it exists. The recommended distances take into account other factors in addition to available health risk data (see individual category descriptions).
- Site-specific project design improvements may help reduce air pollution exposures and should also be considered when siting new sensitive land uses.
- This table does not imply that mixed residential and commercial development in general is incompatible. Rather it focuses on known problems like dry cleaners using perchloroethylene that can be addressed with reasonable preventative actions.
- A summary of the basis for the distance recommendations can be found in Table 1-2.



**Table 1-2**

**Summary of Basis for Advisory Recommendations**

<b>Source Category</b>	<b>Range of Relative Cancer Risk<sup>1,2</sup></b>	<b>Summary of Basis for Advisory Recommendations</b>
Freeways and High-Traffic Roads	300 – 1,700	<ul style="list-style-type: none"> <li>In traffic-related studies, the additional non-cancer health risk attributable to proximity was seen within 1,000 feet and was strongest within 300 feet. California freeway studies show about a 70% drop off in particulate pollution levels at 500 feet.</li> </ul>
Distribution Centers <sup>3</sup>	Up to 500	<ul style="list-style-type: none"> <li>Because ARB regulations will restrict truck idling at distribution centers, transport refrigeration unit (TRU) operations are the largest onsite diesel PM emission source followed by truck travel in and out of distribution centers.</li> <li>Based on ARB and South Coast District emissions and modeling analyses, we estimate an 80 percent drop-off in pollutant concentrations at approximately 1,000 feet from a distribution center.</li> </ul>
Rail Yards	Up to 500	<ul style="list-style-type: none"> <li>The air quality modeling conducted for the Roseville Rail Yard Study predicted the highest impact is within 1,000 feet of the Yard, and is associated with service and maintenance activities. The next highest impact is between a half to one mile of the Yard, depending on wind direction and intensity.</li> </ul>
Ports	Studies underway	<ul style="list-style-type: none"> <li>ARB will evaluate the impacts of ports and develop a new comprehensive plan that will describe the steps needed to reduce public health impacts from port and rail activities in California. In the interim, a general advisory is appropriate based on the magnitude of diesel PM emissions associated with ports.</li> </ul>
Refineries	Under 10	<ul style="list-style-type: none"> <li>Risk assessments conducted at California refineries show risks from air toxics to be under 10 chances of cancer per million.<sup>4</sup></li> <li>Distance recommendations were based on the amount and potentially hazardous nature of many of the pollutants released as part of the refinery process, particularly during non-routine emissions releases.</li> </ul>
Chrome Platers	10-100	<ul style="list-style-type: none"> <li>ARB modeling and monitoring studies show localized risk of hexavalent chromium diminishing significantly at 300 feet. There are data limitations in both the modeling and monitoring studies. These include variability of plating activities and uncertainty of emissions such as fugitive dust. Hexavalent chromium is one of the most potent toxic air contaminants. Considering these factors, a distance of 1,000 feet was used as a precautionary measure.</li> </ul>
Dry Cleaners Using Perchloroethylene (perc)	15-150	<ul style="list-style-type: none"> <li>Local air district studies indicate that individual cancer risk can be reduced by as much as 75 percent by establishing a 300 foot separation between a sensitive land use and a one-machine perc dry cleaning operation. For larger operations (2 machines or more), a separation of 500 feet can reduce risk by over 85 percent.</li> </ul>

Source Category	Range of Relative Cancer Risk <sup>1,2</sup>	Summary of Basis for Advisory Recommendations
Gasoline Dispensing Facilities (GDF) <sup>5</sup>	<p>Typical GDF: Less than 10</p> <p>Large GDF: Between Less than 10 and 120</p>	<ul style="list-style-type: none"> <li>Based on the CAPCOA Gasoline Service Station Industry-wide Risk Assessment Guidelines, most typical GDFs (less than 3.6 million gallons per year) have a risk of less than 10 at 50 feet under urban air dispersion conditions. Over the last few years, there has been a growing number of extremely large GDFs with sales over 3.6 and as high as 19 million gallons per year. Under rural air dispersion conditions, these large GDFs can pose a larger risk at a greater distance.</li> </ul>

<sup>1</sup>For cancer health effects, risk is expressed as an estimate of the increased chances of getting cancer due to facility emissions over a 70-year lifetime. This increase in risk is expressed as chances in a million (e.g., 10 chances in a million).

<sup>2</sup>The estimated cancer risks are a function of the proximity to the specific category and were calculated independent of the regional health risk from air pollution. For example, the estimated regional cancer risk from air toxics in the Los Angeles region (South Coast Air Basin) is approximately 1,000 in a million.

<sup>3</sup>Analysis based on refrigerator trucks.

<sup>4</sup>Although risk assessments performed by refineries indicate they represent a low cancer risk, there is limited data on non-cancer effects of pollutants that are emitted from these facilities. Refineries are also a source of non-routine emissions and odors.

<sup>5</sup>A typical GDF in California dispenses under 3.6 million gallons of gasoline per year. The cancer risk for this size facility is likely to be less than 10 in a million at the fence line under urban air dispersion conditions.

A large GDF has fuel throughputs that can range from 3.6 to 19 million gallons of gasoline per year. The upper end of the risk range (i.e., 120 in a million) represents a hypothetical worst case scenario for an extremely large GDF under rural air dispersion conditions.

## **Freeways and High Traffic Roads**

Air pollution studies indicate that living close to high traffic and the associated emissions may lead to adverse health effects beyond those associated with regional air pollution in urban areas. Many of these epidemiological studies have focused on children. A number of studies identify an association between adverse non-cancer health effects and living or attending school near heavily traveled roadways (see findings below). These studies have reported associations between residential proximity to high traffic roadways and a variety of respiratory symptoms, asthma exacerbations, and decreases in lung function in children.

One such study that found an association between traffic and respiratory symptoms in children was conducted in the San Francisco Bay Area. Measurements of traffic-related pollutants showed concentrations within 300 meters (approximately 1,000 feet) downwind of freeways were higher than regional values. Most other studies have assessed exposure based on proximity factors such as distance to freeways or traffic density.

These studies linking traffic emissions with health impacts build on a wealth of data on the adverse health effects of ambient air pollution. The data on the effects of proximity to traffic-related emissions provides additional information that can be used in land use siting and regulatory actions by air agencies. The key observation in these studies is that close proximity increases both exposure and the potential for adverse health effects. Other effects associated with traffic emissions include premature death in elderly individuals with heart disease.

### **Key Health Findings**

- Reduced lung function in children was associated with traffic density, especially trucks, within 1,000 feet and the association was strongest within 300 feet. (Brunekreef, 1997)
- Increased asthma hospitalizations were associated with living within 650 feet of heavy traffic and heavy truck volume. (Lin, 2000)
- Asthma symptoms increased with proximity to roadways and the risk was greatest within 300 feet. (Venn, 2001)
- Asthma and bronchitis symptoms in children were associated with proximity to high traffic in a San Francisco Bay Area community with good overall regional air quality. (Kim, 2004)
- A San Diego study found increased medical visits in children living within 550 feet of heavy traffic. (English, 1999)

In these and other proximity studies, the distance from the roadway and truck traffic densities were key factors affecting the strength of the association with adverse health effects. In the above health studies, the association of traffic-related emissions with adverse health effects was seen within 1,000 feet and was

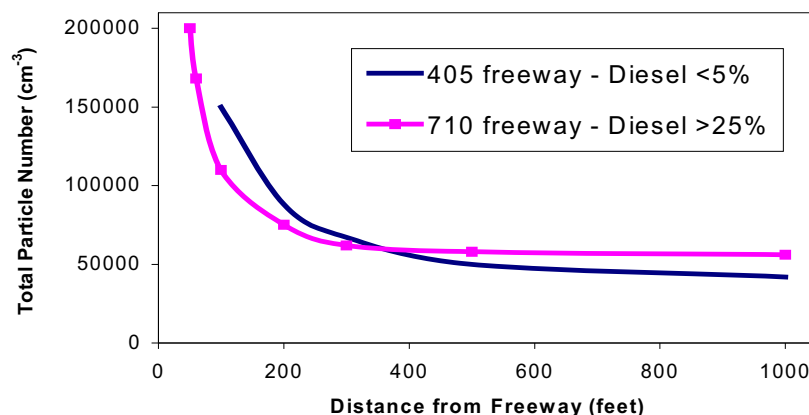
strongest within 300 feet. This demonstrates that the adverse effects diminished with distance.

In addition to the respiratory health effects in children, proximity to freeways increases potential cancer risk and contributes to total particulate matter exposure. There are three carcinogenic toxic air contaminants that constitute the majority of the known health risk from motor vehicle traffic – diesel particulate matter (diesel PM) from trucks, and benzene and 1,3-butadiene from passenger vehicles. On a typical urban freeway (truck traffic of 10,000-20,000/day), diesel PM represents about 70 percent of the potential cancer risk from the vehicle traffic. Diesel particulate emissions are also of special concern because health studies show an association between particulate matter and premature mortality in those with existing cardiovascular disease.

#### Distance Related Findings

A southern California study (Zhu, 2002) showed measured concentrations of vehicle-related pollutants, including ultra-fine particles, decreased dramatically within approximately 300 feet of the 710 and 405 freeways. Another study looked at the validity of using distance from a roadway as a measure of exposure

**Figure 1-1**  
**Decrease In Concentration of Freeway Diesel PM Emissions**  
**With Distance**



to traffic related air pollution (Knape, 1999). This study showed that concentrations of traffic related pollutants declined with distance from the road, primarily in the first 500 feet.

These findings are consistent with air quality modeling and risk analyses done by ARB staff that show an estimated range of potential cancer risk that decreases with distance from freeways. The estimated risk varies with the local meteorology, including wind pattern. As an example, at 300 feet downwind from a freeway (Interstate 80) with truck traffic of 10,000 trucks per day, the potential cancer risk was as high as 100 in one million (ARB Roseville Rail Yard Study). The cancer health risk at 300 feet on the upwind side of the freeway was much

less. The risk at that distance for other freeways will vary based on local conditions – it may be higher or lower. However, in all these analyses the relative exposure and health risk dropped substantially within the first 300 feet. This phenomenon is illustrated in Figure 1-1.

State law restricts the siting of new schools within 500 feet of a freeway, urban roadways with 100,000 vehicles/day, or rural roadways with 50,000 vehicles with some exceptions.<sup>2</sup> However, no such requirements apply to the siting of residences, day care centers, playgrounds, or medical facilities. The available data show that exposure is greatly reduced at approximately 300 feet. In the traffic-related studies the additional health risk attributable to the proximity effect was strongest within 1,000 feet.

The combination of the children's health studies and the distance related findings suggests that it is important to avoid exposing children to elevated air pollution levels immediately downwind of freeways and high traffic roadways. These studies suggest a substantial benefit to a 500-foot separation.

The impact of traffic emissions is on a gradient that at some point becomes indistinguishable from the regional air pollution problem. As air agencies work to reduce the underlying regional health risk from diesel PM and other pollutants, the impact of proximity will also be reduced. In the meantime, as a preventative measure, we hope to avoid exposing more children and other vulnerable individuals to the highest concentrations of traffic-related emissions.

### Recommendation

- Avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day.

### References

- Brunekreef, B. et al. "Air pollution from truck traffic and lung function in children living near motorways." Epidemiology. 1997; 8:298-303
- Lin, S. et al. "Childhood asthma hospitalization and residential exposure to state route traffic." Environ Res. 2002;88:73-81
- Venn. et al. "Living near a main road and the risk of wheezing illness in children." American Journal of Respiratory and Critical Care Medicine. 2001; Vol.164, pp. 2177-2180
- Kim, J. et al. "Traffic-related air pollution and respiratory health: East Bay Children's Respiratory Health Study." American Journal of Respiratory and Critical Care Medicine 2004; Vol. 170. pp. 520-526

---

<sup>2</sup> Section 17213 of the California Education Code and section 21151.8 of the California Public Resources Code. See also Appendix E for a description of special processes that apply to school siting.

- Zhu, Y et al. "Study of Ultra-Fine Particles Near A Major Highway With Heavy-Duty Diesel Traffic." Atmospheric Environment. 2002 ; 36:4323-4335
- Knape, M. "Traffic related air pollution in city districts near motorways." The Science of the Total Environment. 1999; 235:339-341
- *Roseville Rail Yard Study*. ARB (October 2004)
- *ARB Diesel Risk Reduction Plan*. (2000)
- Delfino RJ "Epidemiologic Evidence for Asthma and Exposure to Air Toxics: Linkages Between Occupational, Indoor, and Community Air Pollution Research." Environmental Health Perspectives. (2002) 110 (supplement 4): 573-589
- English P., Neutra R., Scalf R. Sullivan M. Waller L. Zhu L. "Examining Associations Between Childhood Asthma and Traffic Flow Using a Geographic Information System." (1999) Environmental Health Perspectives 107(9): 761-767

### **Distribution Centers**

Distribution centers or warehouses are facilities that serve as a distribution point for the transfer of goods. Such facilities include cold storage warehouses, goods transfer facilities, and inter-modal facilities such as ports. These operations involve trucks, trailers, shipping containers, and other equipment with diesel engines. A distribution center can be comprised of multiple centers or warehouses within an area. The size can range from several to hundreds of acres, involving a number of different transfer operations and long waiting periods. A distribution center can accommodate hundreds of diesel trucks a day that deliver, load, and/or unload goods up to seven days a week. To the extent that these trucks are transporting perishable goods, they are equipped with diesel-powered transport refrigeration units (TRUs) or TRU generator sets.

The activities associated with delivering, storing, and loading freight produces diesel PM emissions. Although TRUs have relatively small diesel-powered engines, in the normal course of business, their emissions can pose a significant health risk to those nearby. In addition to onsite emissions, truck travel in and out of distribution centers contributes to the local pollution impact.

ARB is working to reduce diesel PM emissions through regulations, financial incentives, and enforcement programs. In 2004, ARB adopted two airborne toxic control measures that will reduce diesel PM emissions associated with distribution centers. The first will limit nonessential (or unnecessary) idling of diesel-fueled commercial vehicles, including those entering from other states or countries. This statewide measure, effective in 2005, prohibits idling of a vehicle more than five minutes at any one location.<sup>3</sup> The elimination of unnecessary idling will reduce the localized impacts caused by diesel PM and other air toxics

---

<sup>3</sup> For further information on the Anti-Idling ATCM, please click on:  
<http://www.arb.ca.gov/toxics/idling/outreach/factsheet.pdf>

in diesel vehicle exhaust. This should be a very effective new strategy for reducing diesel PM emissions at distribution centers as well as other locations.

The second measure requires that TRUs operating in California become cleaner over time. The measure establishes in-use performance standards for existing TRU engines that operate in California, including out-of-state TRUs. The requirements are phased-in beginning in 2008, and extend to 2019.<sup>4</sup>

ARB also operates a smoke inspection program for heavy-duty diesel trucks that focuses on reducing truck emissions in California communities. Areas with large numbers of distribution centers are a high priority.

### Key Health Findings

Diesel PM has been identified by ARB as a toxic air contaminant and represents 70 percent of the known potential cancer risk from air toxics in California. Diesel PM is an important contributor to particulate matter air pollution. Particulate matter exposure is associated with premature mortality and health effects such as asthma exacerbation and hospitalization due to aggravating heart and lung disease.

### Distance Related Findings

Although distribution centers are located throughout the state, they are usually clustered near transportation corridors, and are often located in or near population centers. Diesel PM emissions from associated delivery truck traffic and TRUs at these facilities may result in elevated diesel PM concentrations in neighborhoods surrounding those sites. Because ARB regulations will restrict truck idling at distribution centers, the largest continuing onsite diesel PM emission source is the operation of TRUs. Truck travel in and out of distribution centers also contributes to localized exposures, but specific travel patterns and truck volumes would be needed to identify the exact locations of the highest concentrations.

As part of the development of ARB's regulation for TRUs, ARB staff performed air quality modeling to estimate exposure and the associated potential cancer risk of onsite TRUs for a typical distribution center. For an individual person, cancer risk estimates for air pollution are commonly expressed as a probability of developing cancer from a lifetime (i.e., 70 years) of exposure. These risks were calculated independent of regional risk. For example, the estimated regional cancer risk from air toxics in the Los Angeles region (South Coast Air Basin) is approximately 1,000 additional cancer cases per one million population.

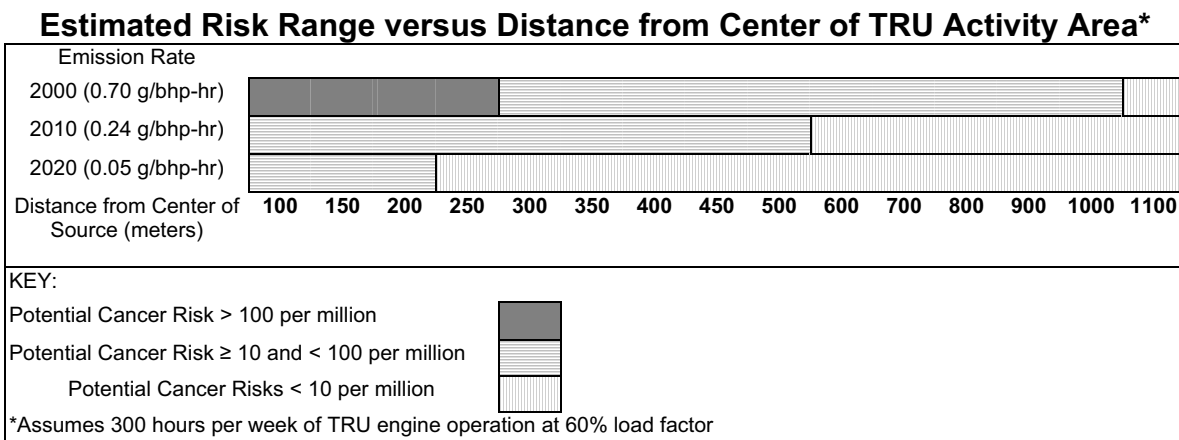
---

<sup>4</sup> For further information on the Transport Refrigeration Unit ATCM, please click on: <http://www.arb.ca.gov/diesel/documents/trufaq.pdf>

The diesel PM emissions from a facility are dependent on the size (horsepower), age, and number of engines, emission rates, the number of hours the truck engines and/or TRUs operate, distance, and meteorological conditions at the site. This assessment assumes a total on-site operating time for all TRUs of 300 hours per week. This would be the equivalent of 40 TRU-equipped trucks a day, each loading or unloading on-site for one hour, 12 hours a day and seven days a week.

As shown in Figure 1-2 below, at this estimated level of activity and assuming a current fleet diesel PM emission rate, the potential cancer risk would be over 100 in a million at 800 feet from the center of the TRU activity. The estimated potential cancer risk would be in the 10 to 100 per million range between 800 to 3,300 feet and fall off to less than 10 per million at approximately 3,600 feet. However with the implementation of ARB's regulation on TRUs, the risk will be significantly reduced.<sup>5</sup> We have not conducted a risk assessment for distribution centers based on truck traffic alone, but on an emissions basis, we would expect similar risks for a facility with truck volumes in the range of 100 per day.

**Figure 1-2**



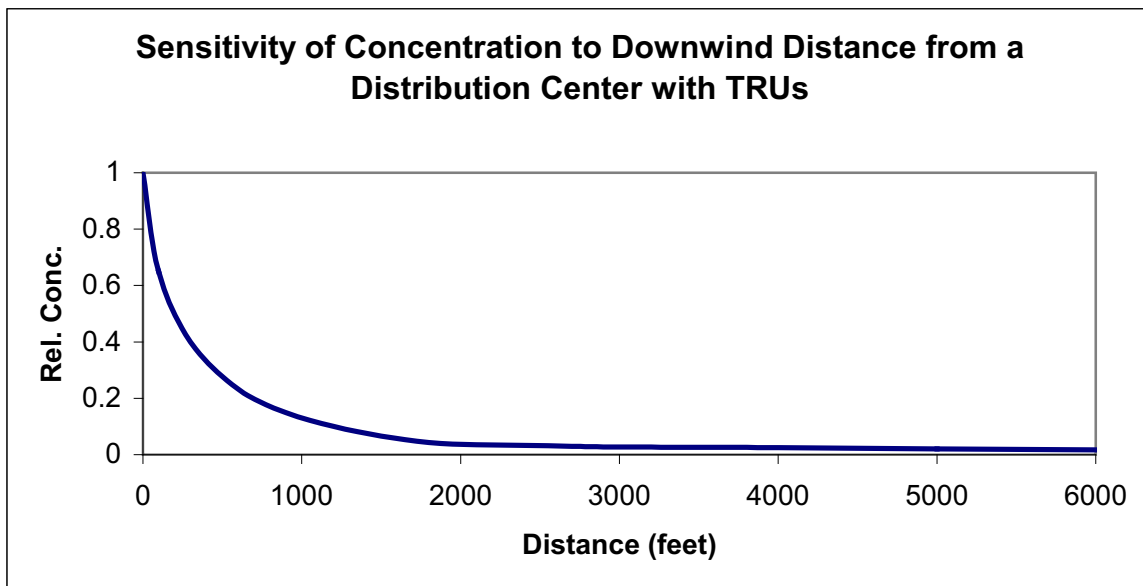
The estimated potential cancer risk level in Figure 1-2 is based on a number of assumptions that may not reflect actual conditions for a specific site. For example, increasing or decreasing the hours of diesel engine operations would change the potential risk levels. Meteorological and other facility specific parameters can also impact the results. Therefore, the results presented here are not directly applicable to any particular facility or operation. Rather, this information is intended to provide an indication as to the potential relative levels of risk that may be observed from operations at distribution centers. As shown in Figure 1-2, the estimated risk levels will decrease over time as lower-emitting diesel engines are used.

<sup>5</sup> These risk values assume an exposure duration of 70 years for a nearby resident and uses the methodology specified in the 2003 OEHHA health risk assessment guidelines.



Another air modeling analysis, performed by the South Coast Air Quality Management District (South Coast AQMD), evaluated the impact of diesel PM emissions from distribution center operations in the community of Mira Loma in southern California. Based on dispersion of diesel PM emissions from a large distribution center, Figure 1-3 shows the relative pollution concentrations at varying distances downwind. As Figure 1-3 shows, there is about an 80 percent drop off in concentration at approximately 1,000 feet.

**Figure 1-3**  
**Decrease In Relative Concentration of Risk**  
**With Distance**



Both the ARB and the South Coast AQMD analyses indicate that providing a separation of 1,000 feet would substantially reduce diesel PM concentrations and public exposure downwind of a distribution center. While these analyses do not provide specific risk estimates for distribution centers, they provide an indication of the range of risk and the benefits of providing a separation. ARB recommends a separation of 1,000 feet based on the combination of risk analysis done for TRUs and the decrease in exposure predicted with the South Coast AQMD modeling. However, ARB staff plans to provide further information on distribution centers as we collect more data and implement the TRU control measure.

Taking into account the configuration of distribution centers can also reduce population exposure and risk. For example, locating new sensitive land uses away from the main entry and exit points helps to reduce cancer risk and other health impacts.

## Recommendations

- Avoid siting new sensitive land uses within 1,000 feet of a distribution center (that accommodates more than 100 trucks per day, more than 40 trucks with operating TRUs per day, or where TRU unit operations exceed 300 hours per week).
- Take into account the configuration of existing distribution centers and avoid locating residences and other new sensitive land uses near entry and exit points.

## References

- *Airborne Toxic Control Measure To Limit Diesel-Fueled Commercial Motor Vehicle Idling*. ARB (August 20, 2004). Rule effectiveness date awaiting submittal of regulation to the Office of Administration Law.  
<http://www.arb.ca.gov/regact/idling/idling.htm>
- *Revised Staff Report: Initial Statement of Reasons for Proposed Rulemaking. Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate*. ARB (October 28, 2003).  
<http://www.arb.ca.gov/regact/trude03/revisor.doc>
- *Health Risk Assessment Guidance for Analyzing Cancer Risks from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis*. SCAQMD (August 2003) [http://www.aqmd.gov/ceqa/handbook/diesel\\_analysis.doc](http://www.aqmd.gov/ceqa/handbook/diesel_analysis.doc)
- “*Mira Loma Study: Analysis of the Impact of Diesel Particulate Emissions from Warehouse/Distribution Center Operations*”, PowerPoint presentation. SCAQMD (July 31, 2002)

## Rail Yards

Rail yards are a major source of diesel particulate air pollution. They are usually located near inter-modal facilities, which attract heavy truck traffic, and are often sited in mixed industrial and residential areas. ARB, working with the Placer County air district and Union Pacific Railroad, recently completed a study<sup>6</sup> of the Roseville Rail Yard (Yard) in northern California that focused on the health risk from diesel particulate. A comprehensive emissions analysis and air quality modeling were conducted to characterize the estimated potential cancer risk associated with the facility.

---

<sup>6</sup> To review the study, please click on: <http://www.arb.ca.gov/diesel/documents/rstudy.htm>