ICF CONSULTING

South Coast Air Quality Management District (SCAQMD)

Air Quality Issues in School Site Selection

Guidance Document

June 2005

(revised May 2007)

05-044

powered by perspective

This page intentionally left blank.

South Coast Air Quality Management District (SCAQMD)

Air Quality Issues in School Site Selection

Guidance Document

June 2005

(revised May 2007)

Prepared for:
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765
(909) 396-2000

Prepared by:
ICF Consulting
60 Broadway
San Francisco, CA 94111
(415) 677-7100

Reviewed by:
Jean Ospital
Health Effects Officer
South Coast Air Quality Management District
(909) 396-2582

05-044

Preface

This guidance document is a reference for school districts within SCAQMD's jurisdiction. It provides suggested policies that school districts can use to prevent or reduce potential air pollution impacts and protect the health of their students and staff. The objective of the guidance document is to facilitate stronger collaboration between school districts and the SCAQMD to reduce exposure to source-specific air pollution impacts. Contacts for further information: for California Environmental Quality Act (CEQA): (909) 396-3109; for facilities within the vicinity of potential school sites: (909) 396-2430. This document will be updated periodically based on new information or latest science.

Executive Summary

Background

The South Coast Air Quality Management District's (SCAQMD) Governing Board has recently addressed several cases of school children being exposed to relatively high levels of air pollution at school sites. Many of these schools are located near heavy diesel traffic and industries and are home to low-income communities. In view of the Board's environmental justice priorities and commitment to children's air quality issues, it is important to provide appropriate guidance for selection of new school sites.

Furthermore, although the primary authority for siting public schools rests with local school districts, which are the designated "lead agencies" for the California Environmental Quality Act (CEQA) environmental analyses, both the California Education Code (CEC) Section 17213 and the California Public Resources Code (PRC) Section 21151.8 require school districts to consult with the SCAQMD and hazardous material/waste regulatory agencies when preparing the environmental assessment. The SCAQMD verifies all permitted and non-permitted sources of air pollution that might significantly affect health for lead agency's consideration.

Purpose

There are several important factors to consider in the selection of a location for a new school. One of these is local air quality. Because children spend so much of their time at the school site, and they are often more sensitive than adults to the health effects of air pollution, it is important to avoid locations with poor air quality. Several documents have been prepared elsewhere to assist in various aspects of school site selection and planning. This document is intended to supplement information available from other sources by providing guidance to site selection personnel specifically related to local air quality issues.

It is important to note that the recommendations given in this document generally are suggestions, not requirements or regulations. The SCAQMD and the California Air Resources Board (CARB) have strong, comprehensive regulatory programs in place for new and existing sources of air pollution. However, local emissions may still cause "hot spots" of air pollution that can adversely affect the health of students, should schools be placed near these sources. The suggestions included here are intended to guide school site selection personnel in selecting locations that reduce exposure to source-specific air pollution and lower the associated health risk by providing information on the types of nearby facilities that may be of concern.

Why Air Quality is Important to School Site Selection

Air contaminants pose health risks to those that are exposed to them. Students, along with the elderly, pregnant women, and persons with existing health problems, are particularly susceptible to health effects from toxic emissions that may occur from certain types of sources. These emissions sources may emit compounds that can cause a variety of health effects, including neurological, respiratory, and developmental effects as well as cancer. Several studies have shown that risk decreases dramatically with increased distance from sources of emissions.

How to Use This Document

As discussed above, this document is intended primarily to serve personnel involved in selecting proper sites for new school construction or expansion by providing a set of guidelines that will help in selecting locations that mitigate the deleterious effects of airborne pollution on students and staff at the school. It is recommended that site selection personnel use the information in this document to help them first understand the hazards of air pollution to students and school faculty and, second, to use current best practices to recognize and mitigate these risks when selecting new school sites. Several references to other documents are provided to allow better understanding of the environmental, policy, and legal aspects of air pollution issues, as they arise in the site selection process.

Contacts for further information on:

- California Environmental Quality Act (CEQA) (909) 396-3109
- Facilities within the vicinity of potential school sites (909) 396-2430

Pollutants of Concern

Criteria pollutants are those for which either the federal government and/or the California state government have established ambient air quality standards based on short- and/or long-term human health effects associated with exposure to these pollutants. The federal government, via the U.S. Environmental Protection Agency (U.S. EPA) has established ambient air quality standards for the following six pollutants:

ground-level ozone (O_3)	carbon monoxide (CO)	lead (Pb)	nitrogen dioxide (NO_2)	sulfur dioxide (SO_2)	Particulate Matter (PM_{10}, $PM_{2.5}$)

The California EPA has also established ambient air quality standards for these six pollutants, some of which are more stringent than the national ambient air quality standards (NAAQS). In addition to the six national criteria pollutants, California has also established ambient air quality standards for three other pollutants:

hydrogen sulfide (H_2S)	sulfates	vinyl chloride

Air toxics, also known as hazardous air pollutants (HAPs), toxic air contaminants (TACs), or non-criteria air pollutants, are contaminants found in the ambient air that are known or suspected to cause cancer, reproductive effects, or birth defects, other health effects, or adverse environmental effects, but do not have established ambient air quality standards. HAPs include such pollutants as benzene in gasoline, perchloroethlyene from some dry cleaning facilities, methylene chloride, an industrial solvent and paint stripper, dioxin, asbestos, toluene, and toxic metals such as cadmium, mercury, hexavalent chromium, and lead compounds. HAPs may have short-term and/or long-term exposure effects. Diesel particulate matter is the toxic air contaminant of primary concern in the South Coast Air Basin (SCAB). Additionally, under Rule 301, the SCAQMD takes inventory of toxic emissions, and assesses fees based on the emissions of 23 HAPs:

ammonia	ethylene oxide	beryllium
asbestos	formaldehyde	polynuclear aromatic hydrocarbons (PAHs)
benzene	hexavalent chromium	vinyl chloride
cadmium	methylene chloride	1,4-dioxane
carbon tetrachloride	nickel	lead
chlorinated dioxins/dibenzofurans	perchloroethylene	trichloroethylene
ethylene dibromide	1,3-butadiene	1,1,1-trichloroethane
ethylene dichloride	inorganic arsenic	

Odors can be associated with toxic or non-toxic emissions often of ammonia, sulfur compounds and organic compounds from activities such as auto body shops, livestock operations, and waste treatment and disposal. The non-toxic emissions are generally not federally regulated but are a nuisance for surrounding communities and are regulated in California at the state and local levels, particularly near schools and other sensitive receptors.

Emission Sources of Concern

CARB identifies specific sources of air pollution that should be considered when siting new sensitive land uses, such as schools in the "Proposed Air Quality and Land Use Handbook: A Community Health Perspective." These are:

high traffic roadways	rail yards	refineries
distribution centers	ports	chrome platers
perc dry cleaners	gasoline dispensing facilities	hazardous waste treatment/storage
gas turbines		

Recommendations for minimum distances from these sources are based primarily on data showing that these localized air pollution exposures can be reduced as much as 80% with the recommended separation. Other types of air pollution emission sources that should also be considered when siting a new facility are:

airports	power plants	wood refinishing facilities
backup power generators	auto body shops	agricultural sources

The SCAQMD also identifies the following operations as likely to produce offensive odors:

agriculture (farming and livestock)	reinforced plastic composite manufacturing	wastewater treatment
chemical plants	landfills	graphic arts
composting operations	rail yards	dairies
oil field production	refineries	roofing/re-roofing operations
painting operations	rendering plants	

Recommendations

In addition to CARB's "Proposed Air Quality and Land Use Handbook: A Community Health Perspective," several other guidance documents, studies, and legislative mandates are available to school personnel to assist them in the selection of sites for new schools. Several concerns, including air quality, are addressed in these documents. This section provides a summary of mandates and recommendations pertaining to air quality and proximity to emission sources.

1. Distance Criteria for Mobile Sources

Siting of school and child care facilities should include consideration of proximity to roads with heavy traffic and other sources of air pollution. New schools should be located to avoid "hot spots" of localized pollution. As demonstrated through the various subsections of the PRC § 21151 and in SB352, California law is very clear about separating sources of hazardous emissions, particularly those from mobile sources, from sensitive receptors at school sites. Other recommendations for appropriate distances between schools and other sensitive receptors and various mobile source emissions from relevant documents include:

- PRC § 21151.8 essentially requires assessment of hazardous pollutants within ¼ mile (400 m) of any public school.
- California Senate Bill (SB) 352 requires specific responses assessing health risk for schools within 500 feet (150 m) of busy roadways.
- SCAQMD's Health Risk Assessment (HRA) CEQA guidance for diesel idling establishes a 300 m (1,000 ft) buffer between sensitive receptor locations and sources of truck traffic emissions as a mitigation measure.
- CARB's Air Quality and Land Use Handbook recommends 500 feet (150 m) between busy roadways and sensitive receptor locations, 1,000 feet (300 m) from busy distribution centers and rail yards, and generally downwind of busy ports.
- California's Office of Environmental Health Hazard Assessment (OEHHA) study on schools and busy roads used a threshold of 500 feet (150 m) to define close proximity to roadways.
- Based on safety considerations, the California Department of Education (CDE) Site Selection and Approval Guide recommends distances of two nautical miles between schools and airport runways, as high as 2,500 feet (760 m) from railways and major roadways.

Based on the recommendations from the above documents, a general buffer zone of no less than 500 feet (150 m), and possibly as much as 1,000 feet (300 m), between major roadways and school sites should be considered to protect the health of students and school employees and meet state guidelines on location of mobile source emissions. New school sites should not be located closer than 1,000 feet (300 m) from other major mobile sources, and possibly further, depending on the source.

2. Distance Criteria for Stationary Sources

Major and minor stationary sources of air emissions within the immediate vicinity of proposed school sites are also likely to be issues of concern for site selection personnel, particularly in urban areas. As discussed above, California law (e.g., PRC § 21151.8 and SB352) has direct regulations regarding separation of stationary sources of hazardous emissions and sensitive receptor locations (e.g., schools). Specific recommendations for appropriate minimum distances between sensitive receptors and various stationary sources of criteria and toxic air emissions from relevant documents include:

- Based on safety considerations, the CDE School Site Selection and Approval Guide recommends not siting on or near a variety of known or potential stationary sources of hazardous material emissions, such as landfills, dump areas, chemical plants, oil fields, refineries, natural sources of asbestos, unless the site has been sufficiently cleaned and documented. Also, the document recommends against siting within ¼ mile (400 m) of any stationary source of toxic air contaminants and prohibits siting on any location containing pipelines transferring hazardous materials.
- California's Department of Toxic Substance Control (DTSC) documents indicate that naturally occurring or constructed sites containing asbestos or lead, and sites where the soil may be contaminated from past pesticide, oil development, or other toxic use must be adequately documented and remediated before construction, and are best avoided if possible.
- CARB's "Air Quality and Land Use Handbook" recommends consulting with local air quality districts to determine an adequate separation distance from refineries, a minimum separation of 1,000 feet (305 m) between metal plating operations and sensitive receptor locations, and 300 feet (90 m) between sensitive receptors and dry cleaners using perchloroethylene or large gasoline dispensing operations. A minimum distance of 50 feet (15 m) is recommended between sensitive receptor

locations and small gasoline facilities. Separation distances for other significant stationary sources, including commercial, industrial, public, and transportation facilities emitting toxic air contaminants should be determined by consulting with local air quality control districts.

- SCAQMD's guidance for stationary sources is consistent with CARB's for consulting the air quality district, as given above, and indicates the availability of emissions inventories within the Air Basin under SCAQMD Rule 1402 and AB2588.
- CEC Section 17213 dictates that *all* permitted and non-permitted facilities within ¼ mile (400 m) of potential school site must be surveyed and assessed for health risks from toxic air emissions.

Based on the recommendations in these documents, new school sites separated from all stationary sources of toxic and hazardous emissions by ¼ mile (400 m) should be adequately conservative to protect the health of students and employees. Depending on the strength of the source and the pollutants emitted, the threshold distance may be significantly less (e.g., in the case of natural asbestos properly mitigated) or more (e.g., for large sources like active port complexes). In these cases, the local air quality agency should be consulted to obtain relevant data on emissions and associated health risks.

3. Distance Criteria for Agricultural Sources

In some areas, current and former agricultural lands may be investigated for potential new school locations. Several of the documents listed above discuss possible sources of contaminants and emissions from previous agricultural uses on the site or current uses near proposed sites. Specific recommendations from relevant documents include:

- Based on safety considerations, the CDE's "School Site Selection and Approval Guide" recommends not siting within sufficient proximity to abandoned farms or dairies or agricultural areas where pesticides have been heavily used, such that emissions of air toxics may pose a substantial health risk to students or employees, unless the site has been sufficiently cleaned and documented.
- The DTSC's Phase I Environmental Site Assessment Advisory for school properties specifically warns against selecting sites where residual pesticide contamination in soils, particularly arsenical herbicides, organo-chlorine pesticides, and/or other sources of PAHs, dioxins, and sources of PCBs are present.
- The DTSC's "Interim Guidance for Sampling Agricultural Fields for School Sites" provides specific techniques for evaluating certain agricultural areas for pesticides such as DDT and derivatives that must be documented in the Environmental Analysis Section (EAS).
- CARB's "Air Quality and Land Use Handbook" recommends consulting with local air quality districts to determine an adequate separation distance from agricultural operations, such as farming, dairy, and livestock operations that may be sources of diesel PM and other air toxics and criteria pollutants.
- Proximity to emissions from current agricultural operations will also be regulated by SB352 and PRC § 21151 to beyond ¼ mile for certain levels of emissions.
- The California Department of Pesticide Regulation (DPR) specifies the size and duration of buffer zones around agricultural application of fumigants, depending on the application method, the magnitude of the application, and the fumigant; and requires notice to schools within 300 feet of a buffer zone. DPR regulations also specify that fumigation injection must be completed at least 36 hours prior to the start of a school session, when the outer buffer zone is within 300 feet of a school property. However, use of school facilities for recreation or other activities on weekends is not considered a school session.

Based on the recommendations, new school siting should generally be separated from significant sources of emissions from agricultural operations by ¼ mile (1,320 feet or 400 m) and cannot occur on sites where the soil is contaminated from previous pesticide or other toxic chemical usage. Other considerations may be required to ensure safety from nearby pesticide use. The County Agricultural Commissioner can provide information on past pesticide application methods and rates for nearby agricultural operations to determine the likely size of any fumigant buffer zones.

4. Consideration of Traffic Generation and Other Emission Sources by the Proposed Site

In October, 2003 the U.S. EPA's Office of Policy, Economics, and Innovation (OPEI) published a study on the environmental and health effects of school site characteristics, "Travel and Environmental Implications of School Siting." School locations can significantly affect air emissions and quality in their communities, as well as affecting community character and neighborhood vitality.

This study finds that there are two primary factors related to the use of automobiles to arrive at schools versus non-polluting methods like walking or riding bicycles: proximity of schools to students' homes and the quality of the built environment along the route to schools. The built environment involves increased sidewalks on all arterials and collectors feeding the school, as well as the character, such as amount of trees and degree of mixed-use, along the route. Proximity involves greater neighborhood access to school sites.

In addition, in siting and testing of diesel backup generators, consideration should be given to minimize potential exposures to diesel exhaust. Use of low emitting and energy efficient boilers for heating can also reduce potential exposures.

Table of Contents

List of Figures

List of Tables

1. Introduction

Background

The South Coast Air Quality Management District's (SCAQMD) Governing Board has recently addressed several cases of school children being exposed to air pollution at school sites. Many of these schools are located near heavy diesel traffic and industries and are in low-income communities. In view of the SCAQMD Board's environmental justice priorities and commitment to children's air quality issues, it is important to provide appropriate guidance for selection of new school sites. Such guidance will help avoid adverse air quality situations in the future.

Furthermore, although the primary authority for siting public schools rests with local school districts, which are the designated "lead agencies" for the California Environmental Quality Act (CEQA) environmental analyses, both the California Education Code Section 17213 and the California Public Resources Code Section 21151.8 require school districts to consult with the SCAQMD and hazardous material/waste regulatory agencies when preparing the environmental assessment. The SCAQMD provides information about sources of air pollution that might significantly affect health for lead agency's consideration.

Purpose

There are several important factors to consider in the selection of a location for a new school. One of these is local air quality. Because children spend so much of their time at the school site, and they are often more sensitive than adults to the health effects of air pollution, it is important to avoid locations with poor air quality. Several documents have been prepared elsewhere to assist in various aspects of school site selection and planning. This document is intended to supplement information available from other sources by providing guidance to site selection personnel specifically related to local air quality issues.

It is important to note that the recommendations given in this document generally are suggestions, not requirements or regulations. The SCAQMD and the California Air Resources Board (CARB) have strong, comprehensive regulatory programs in place for new and existing sources of air pollution. However, local emissions may still cause "hot spots" of air pollution that can adversely affect the health of students, should schools be placed near these sources. The suggestions included here are intended to guide school site selection personnel in selecting locations that reduce exposure to source-specific air pollution and lower the associated health risk by providing information on the types of nearby facilities that may be of concern.

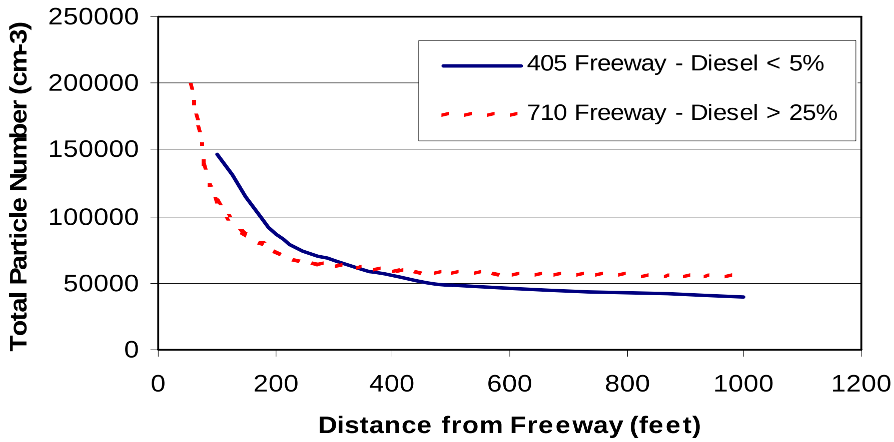
Why Air Quality Is Important to School Site Selection

Air contaminants pose health risks to those that are exposed to them. Students, along with the elderly, pregnant women, and persons with existing health problems, are particularly susceptible to health effects from toxic emissions that may occur from certain types of sources, including busy roads, refineries, metal plating operations, dry cleaners, contaminated soils, and other sources of emissions that can be found at and near potential school locations. These populations, known as sensitive receptors, deserve special attention when planning the facilities in which they will spend large amounts of time. These emissions sources, which are discussed in more detail below, may emit compounds that can cause a variety of health effects, including neurological, respiratory, and developmental effects as well as cancer. The risk from each of these compounds increases with concentration of the pollutant and the duration of exposure. Overall risk may be compounded by having multiple sources emitting different pollutants in any one area.

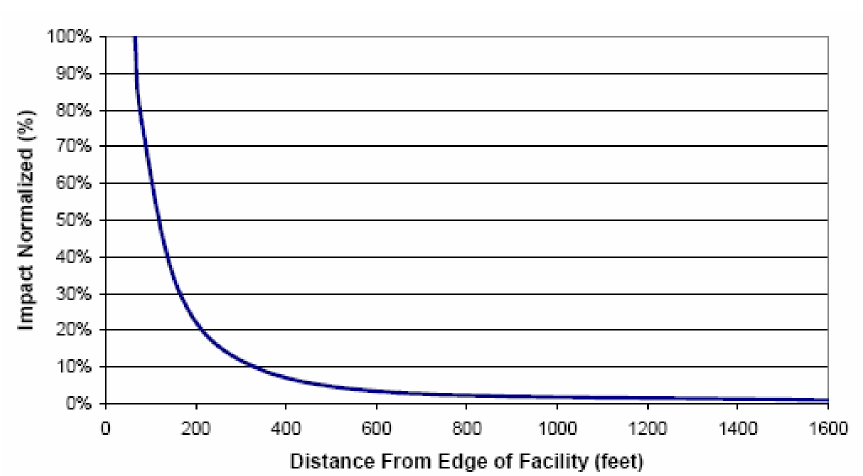
It is important for school site selection personnel to consider each of the types of sources discussed in this document and their locations relative to potential school sites when assessing new school locations to reduce the health risks to students and faculty. Several studies have shown that risk decreases dramatically with increased distance from sources of emissions. Figure 1.1, below, shows several examples of this for different types of sources of concern. Note that while risk is proportional to concentration, the risk can vary dramatically by species emitted by the facility. Hence, these curves should be taken as general examples of decreasing risk by increasing distance to the source.

Figure 1-1. Relative concentration and/or risk associated with distance to sources of concern

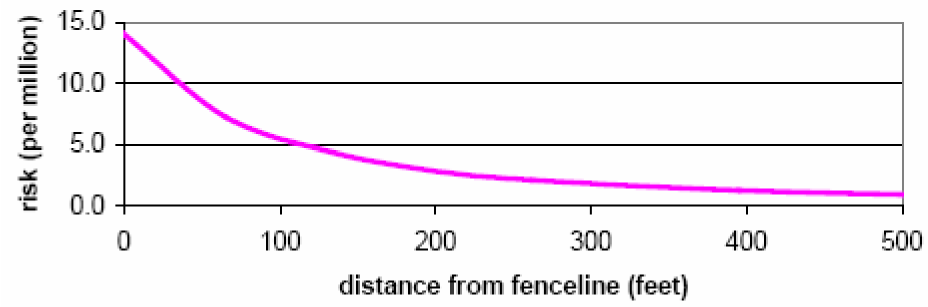
(a) PM Concentration vs. Distance from Freeway
Note the sharp drop off in concentration within 300 to 500 feet from the freeway edge.



(b) Relative Risk from Chrome Plating Operations vs. Distance from Facility
Note the steep drop in risk between the facility edge and 500 to 700 feet.



(c) Cancer Risk from a typical-to-large Gasoline Dispensing Facility vs. Distance from Facility Edge
Cancer risk shown is for a station with throughput of 3.6 million gallons per year.



Source: Air Quality and Land Use Handbook: A Community Health Perspective, CARB, March 2005.

These and other types of sources, categories and risks from different pollutants, as well as specific distance recommendations that may be followed to reduce the risk at school sites, are considered in greater detail throughout the remainder of this document. The central point, however, is to illustrate the importance of sources of air pollution to site selection personnel and the general ability to reduce health risks from exposure by increasing distance between these sources and selected school sites. Risk from multiple sources in an area should also be considered when selecting sites.

Contents

This document is divided into six sections and two appendices. This first section provides site selection personnel an introduction to the need for considering environment and sources of airborne pollutants when making site location decisions and guidance on how to employ this information. The next section contains details of air quality issues that are important for school site selection, particularly air pollutant species and emissions sources of concern. The third section provides summaries of other guidance documents and recommendations that have been prepared to assist site selection personnel. These documents provide information upon which much of this document is based, and many focus on issues other than air quality. The fourth section provides a summary of recommendations based on the documents discussed in the preceding section, as well as discussing the potential for increased pollution caused by operations at the site. The fifth section summarizes mitigation measures that may be considered to improve air quality at a site. The sixth section provides references to other sources of data for site selection personnel. Appendix A provides a checklist that site selection personnel may use to help evaluate and compare potential school sites from an air quality perspective, as well as generally outlining the complete site selection and approval process. Appendix B provides a more thorough discussion of specific pollutants of concern than is given in the body of the document.

How to Use This Document

As discussed above, this document is intended primarily to serve as an information source for personnel involved in selecting proper sites for new school construction or expansion by providing a set of guidelines that will help in selecting locations that minimize the potential for deleterious effects of airborne pollution on students and staff at the school. It is recommended that site selection personnel use the information in this document to help them first understand the hazards of air pollution to students and school faculty and, second, to use current best practices to recognize and mitigate any risks when selecting new school sites. Several references to other documents are provided to allow better understanding of the environmental, policy, and legal aspects of air pollution issues, as they arise in the site selection process.

Contacts for further information on:

- California Environmental Quality Act (CEQA) (909) 396-3109
- Facilities within the vicinity of potential school sites (909) 396-3332

2. Air Quality Issues

This section details various air quality issues that should be considered when selecting a site for new school construction. It begins with a general discussion of the pollutants to be considered, then provides a discussion of the sources of these pollutants. A detailed description of all pollutants of concern appears in Appendix B.

Pollutants of Concern

Air pollutants are solid, liquid, or gaseous substances that occur in the atmosphere and are capable of harming humans, animals, vegetation, or the built environment. They may emanate directly from natural or anthropogenic sources (i.e., primary pollutants), or may be formed through chemical reactions in the atmosphere (i.e., secondary pollutants).

In the following, we have divided the pollutants that should be considered when making school site location decisions into three groups, based on federal and California regulatory practices. Each of these is discussed briefly below. Specific issues, including associated health and other concerns related to pollutant exposure, are provided in Appendix B.

1. Criteria Air Pollutants

Criteria pollutants are those for which either the federal government and/or the California state government have established ambient air quality standards. These are typically not-to-exceed levels, based on short- and/or long-term human health effects associated with exposure to these pollutants (primary standards). Because there are also negative environmental effects associated with some criteria pollutants, secondary standards may also be set for environmental preservation. The federal government, via the U.S. Environmental Protection Agency (U.S. EPA) has established ambient air quality standards for the following six pollutants: ground-level ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb), and particulate matter (PM) with diameters less than 10 μm (PM_{10}) and less than 2.5 μm ($PM_{2.5}$). CARB has also established ambient air quality standards for these six pollutants, some of which are more stringent than the national standards (NAAQS). In addition to the six national criteria pollutants, California has also established ambient air quality standards for three other pollutants: hydrogen sulfide (H_2S), sulfates, and vinyl chloride. Each of these nine pollutants is discussed more fully in Appendix B-1. A summary of both the federal and state criteria pollutant standards is given in Table 2-1.

Table 2-1. Summary of criteria air pollutant standards

		Ambient Air Quality Standards		
	Averaging	California Standards	Federal Standards	
Pollutant	Time	Concentration	Primary	Secondary
Ozone (O_3)	1 Hour	0.09 ppm (180 µg/m^3)	0.12 ppm (235 µg/m^3)	Same as Primary Standard
	8 Hour	-	0.08 ppm (157 µg/m^3)	
Particulate Matter (PM_{10})	24 Hour	50 µg/m^3	150 µg/m^3	Same as Primary Standard
	Annual Arithmetic Mean	20 µg/m^3	50 µg/m^3	
Fine Particulate Matter ($PM_{2.5}$)	24 Hour	No Separate Standard	35 µg/m^3	Same as Primary Standard
	Annual Arithmetic Mean	12 µg/m^3	15 µg/m^3	
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10mg/m^3)	9 ppm (10 mg/m^3)	None
	1 Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)	-	
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	-	0.053 ppm (100 µg/m^3)	Same as Primary Standard
	1 Hour	0.25 ppm (470 µg/m^3)	-	
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	-	0.030 ppm (80 µg/m^3)	-
	24 Hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3)	-
	3 Hour	-	-	0.5 ppm (1300 µg/m^3)
	1 Hour	0.25 ppm (655 µg/m^3)	-	-
Lead	30 Day Average	1.5 µg/m^3	-	-
	Calendar Quarter	-	1.5 µg/m^3	Same as Primary Standard
Sulfates	24 Hour	25 µg/m^3	No Federal Standards	
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)		
Vinyl Chloride	24 Hour	0.01 ppm (26 µg/m^3)		

Source: California Air Resources Board

2. Air Toxics

Air toxics, also known as toxic air contaminants (TACs), hazardous air pollutants (HAPs), or non-criteria air pollutants, are contaminants found in the ambient air that are known or suspected to cause cancer, reproductive effects, or birth defects, other health effects, or adverse environmental effects, but do not have established ambient air quality standards. TACs include such pollutants as benzene in gasoline; perchloroethylene from dry cleaning facilities, methylene chloride used as an industrial solvent and paint stripper, dioxin, asbestos, toluene, toxic metals such as cadmium, mercury, hexavalent chromium, nickel, and lead compounds, as well as diesel exhaust. TACs may have short-term and/or long-term exposure effects.

The U.S. EPA currently has identified and implemented programs to reduce or eliminate the release of 188 TACs. CARB, in conjunction with Office of Environmental Health Hazard Assessment (OEHHA), identifies TACs for the state of California. 243 toxic substances are currently included on CARB's Toxic Air Contaminant Identification List. For overlapping pollutants, CARB standards must be at least as stringent as U.S. EPA standards. Regulation is typically focused on emissions reductions, often under the jurisdiction of the local air quality control agency.

In California, emissions of and health risk from TACs have been addressed by two major Assembly Bills, AB1807 and AB2588, which resulted in creation of the California Air Toxics (CAT) Program. Another California Assembly Bill, AB2588, requires facilities emitting TACs to submit an inventory of those chemicals to the local air district. The Toxic Release Inventory (TRI) is the parallel effort by the federal government. The databases created under these two programs are intended to provide information on the location and emission strength of various TACs.

The Multiple Air Toxics Exposure Study (MATES-II), conducted by the SCAQMD, included monitoring of TACs at fixed sites to characterize neighborhood-scale conditions and a complementary microscale study to monitor potential localized influences of toxic-emitting sources near residential neighborhoods. Inventories of TACs were utilized in computer simulation models to depict toxic risks for the entire South Coast Air Basin (SCAB). The MATES-II project represents one of the most comprehensive TAC monitoring and modeling programs ever conducted in a major urban area in the country. Findings from the study revealed the following:[1]

- Average cancer risk from TACs in the SCAB was found to be about 1400 in a million.
- Diesel exhaust is responsible for about 70 percent of the total cancer risk from air pollution.
- Emissions from mobile sources—including cars and trucks as well as ships, trains and planes—account for about 90 percent of the cancer risk. Emissions from businesses and industry are responsible for the remaining 10 percent.
- The highest cancer risk occurs in south Los Angeles County—including the port area—and along major freeways.

Rule 301 (Permitting and Associated Fees), requires that the SCAQMD take inventory of toxic and ozone depleting emissions, and assesses fees based on the emissions of several species. Table 2-2 details several specific TACs of concern to SCAQMD under Rule 301 and the annual emission threshold for each. (Under Rule 301 provisions, annual fees are assessed on sources emitting more than these amounts.)

Diesel particulate matter, as discussed above, is the primary TAC of concern in the South Coast area, although there are no specific annual thresholds. Each of the pollutants in Table 2-2 is described more thoroughly, along with associated health and other concerns related to pollutant exposure, in Appendix B-2.

[1] There is debate as to the appropriate levels of carcinogenic risk ascribed to diesel particulates. The California EPA, in recommending a cancer risk level of 300 in a million per microgram per cubic meter ($\mu g/m^3$) of diesel particulates, considered evidence that suggested diesel risks as low as 150 in a million to as high as 2,400 in a million per $\mu g/m^3$. The U.S. EPA has concluded that diesel exhaust is likely to be carcinogenic to humans at environmental exposure levels that the public faces, but believe that the available data are insufficient to quantify the risk level. The selection of a risk factor for diesel particulates can have a substantial effect in assessing overall risks; however, even using the lowest bound of the California EPA recommended risk factor (150 in a million) does not change diesel's domination in the overall risks.

Table 2-2. Selected Air Toxics and SCAQMD reporting thresholds

Toxic Compounds	Annual Emission Thresholds	
	(lbs)	(kg)
Ammonia	200	91
Asbestos	0.0001	0.00005
Benzene	2	0.9
Cadmium	0.01	0.005
Carbon tetrachloride	1	0.5
Chlorinated dioxins and dibenzofurans (26 species)	0.00002	0.00001
Ethylene dibromide	0.5	0.2
Ethylene dichloride	2	0.9
Ethylene oxide	0.5	0.2
Formaldehyde	5	2
Hexavalent chromium	0.0001	0.00005
Methylene chloride	50	23
Nickel	0.1	0.05
Perchloroethylene	5	2
1,3-Butadiene	0.1	0.05
Inorganic arsenic	0.01	0.005
Beryllium	0.001	0.0005
Polynuclear aromatic hydrocarbons (PAHs)	0.2	0.09
Vinyl chloride	0.5	0.2
Lead	0.5	0.2
1,4-Dioxane	5	2
Trichloroethylene	20	9

Source: SCAQMD Rule 301, Table IV (p. 301-81)

In addition to the 23 toxic air contaminants listed above (and discussed in Appendix B-2), there are several other species that pose either/both cancer or/and non-cancer health effects when released into the air. In some cases, emissions of these species are regulated under SCAQMD Rules 1401 (New Source Review of Toxic Air

Contaminants) and 1402 (Control of Toxic Air Contaminants from Existing Sources). The additional species regulated under the most recent version of Rule 1401 not included above are listed in Table 2-3.

Table 2-3. Additional Toxic Air Contaminants

Acetaldehyde	Carbon Disulfide	2,4-Diaminotoluene	Ethylene glycol and associated compounds	Manganese and manganese compounds	Phenol	1,1,2, 2-Tetrachloroethane
Acetamide	Chlorine	1,2-Dibromo-3-chloropropane (DBCP)	Ethylene Thiourea	Mercury and mercury compounds (inorganic)	Phosgene	Thioacetamide
Acrolein	Chlorine Dioxide	1,4-Dichlorobenzene (or p-dichlorobenzene)	Glutaraldehyde	Methanol	Phosphine	Toluene
Acrylamide (or propenamide)	Chlorobenzene	3,3-Dichlorobenzidine	Hexachlorobenzene	Methyl Bromide	Phosphoric Acid	Toluene diisocyanate
Acrylic Acid	4-Chloro-o-phenylenediamine	1-1, Dichloroethane	Hexachlorocyclohexane	Methyl Ethyl Ketone	Phthalic Anhydride	1,1,2-Trichloroethane
Acrylonitrile (or vinyl chloride)	P-Chloro-o-toluidine	1,1-Dichloroethylene	(n)Hexane	Methyl Isocynate	Polychlorinated Biphenyls (PCBs)	Triethylamine
Allyl Chloride	Chloroform	Diethanolamine	Hydrazine	Methylene	Potassium bromate	Urethane (or ethyl carbamate)
				bis(2-chloroaniline), 4,4-		
2-Aminoanthraquinone	Chlorophenols	(p-) Dimethylaminoazobenzene	Hydrogen chloride (hydrochloric acid)	Methylene dianiline 4,4'-(and its dichloride)	1,3-Propane sultone	Vanadium pentoxide
Aniline	Chloropicrin	Dimethylformamide N,N-	Hydrogen cyanide (hydrocyanic acid)	Methylene phenyl diisocyanate	Propylene	Vinyl acetate
Arsine	Chromic trioxide (as chromic mist)	2,4-Dinitrololuene	Hydrogen Flouride (hydrofluoric acid)	Methyl tert-butyl ether	Propylene glycol monomethyl ether	Xylenes (isomers and mixtures)
Benzidine (and its salts)	Copper and copper compounds	Diphenylhydrazine (or hydrazobenzene)	Hydrogen selenide	Michler's ketone	Propylene oxide (or 1,2-epoxy propane)	
Benzyl Chloride	Cresidine, p-	Epichlorohydrin	Hydrogen sulfide	Naphthalene	Selenium and selenium compounds, other than hydrogen selenide	
Bis (2-chloroethyl) ether (DCEE)	Cresol mixtures	(1,2-) Epoxybutane	Isophorone	Nitric acid	Sodium hydroxide	
Bis (chloromethyl) ether	Cupferron	Ethyl benzene	Isopropyl alcohol	N-Nitroso-Compoundss	Styrene	
Bis (2-ethylhexyl) Phthalate (DEHP)	2,4-Diaminoanisole (sulfate)	Ethy l chloride	Maleic anhydride	Paraffins, chlorinated	Sulfuric acid and oleum	

Note: More information on air toxics is available from CARB's Air Toxics Program at http://www.arb.ca.gov/toxics/toxics.htm and from the USEPA at http://www.epa.gov/ttn/atw/.

3. Odors

Odors can be associated with toxic or non-toxic emissions often of ammonia, sulfur compounds and organic compounds from activities such as auto body shops, livestock operations, and waste treatment and disposal. The non-toxic emissions are generally not federally regulated but are a nuisance for surrounding communities and are regulated in California at the state and local levels, particularly near schools and other sensitive receptors.

CEQA guidelines specify a significance threshold for odors that "create objectionable odors affecting a substantial number of people."

SCAQMD compiled a list of facilities and operations that tend to produce offensive odors. These are listed in Table 2-4, below.

Table 2-4. Common Sources of Odor Emissions

Emissions Source
Agriculture (Farming and Livestock)
Chemical Plants
Coating Operations
Composting Operations
Dairies
Reinforced Plastic Composite Mfg.
Landfills
Refineries
Rendering Plants
Rail Yards
Wastewater/Sewage Treatment Plants

Source: Guidance Document for Addressing Air Quality Issues in General Plans and Local Planning" SCAQMD, 2005.

Emission Sources of Concern

CARB identifies eight specific sources of air pollution that should be considered when siting new sensitive land uses, such as schools, in the "Air Quality and Land Use Handbook: A Community Health Perspective" (accepted April, 2005, available at http://www.arb.ca.gov/ch/landuse.htm). Where possible, CARB recommends a minimum separation between new sensitive land uses and these eight categories of existing sources. Recommendations are based primarily on data showing that these localized air pollution exposures can be reduced as much as 80% with the recommended separation and tailored such that exposures are minimized for each source category independently. Much of the concern from these sources is due to increased cancer risk from exposure to the toxic emissions from these facilities. Table 2-5, below, provides an overview of the recommended distance criteria for the eight types of sources identified by CARB, the estimated increase in cancer risk from 70-year lifetime near the facility, and CARB's basis for increased cancer risk assessment. It should be noted that risk typically decreases with increased distance from the source, that the risk numbers are expressed as chances in one million, that the recommendations listed are intended to be general—more site-specific information should be used if available, and that these risks are above the background risk from all other regional sources.

Table 2-5. CARB Distance Recommendations for Siting Sensitive Receptors near Eight Existing Source Categories, Relative Increased Cancer Risk, and Justifications

Source Category	CARB Advisory Recommendations	Increased Cancer Risk Over 70 Year Exposure to (chances in a million)	Summary of Basis for Recommendatations
Freeways and High-Traffic Roadways	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.	300-1700	In traffic-related studies, the additional non-cancer health risk attributable to proximity to the roadway was strongest between 300 and 1,000 feet. California freeway studies show about a 70% drop off in particulate pollution levels at 500 feet.
Distribution Centers	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.	Up to 500	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. 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.
Rail Yards	Avoid siting new sensitive land uses within 1,000 feet of a major service and maintenance rail yard. Within one mile of a rail yard, consider possible siting limitations and mitigation approaches.	Up to 500	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.
Ports	Avoid the 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.	Studies Underway	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.
Refineries	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.	Under 10	Risk assessments conducted at California refineries show risks from air toxics to be under 10 chances of cancer per million.4 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.
Chrome Platers	Avoid siting new sensitive land uses within 1,000 feet of a chrome plater.	10-100	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 1000 feet was used as a precautionary measure.
Dry Cleaners Using PCE	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. Do not site new sensitive land uses in the same building with perc dry cleaning operations.	15-150	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.
Gasoline Dispensing Facilities	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.	Typical: < 10 Large: 10-120	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.

Source: Air Quality and Land Use Handbook: A Community Health Perspective, CARB, April 2005.

In Table 2-5, gasoline-dispensing facilities are divided between large and typical facilities, where a typical facility in California dispenses about 3.6 million gallons per year. A large facility dispenses between about 3.6 and 19 million gallons per year.

In this document, we detail 14 source types that should be considered when selecting sites for new school construction. These include the eight described by CARB and detailed in Table 2-5, as well as six others: airports, backup power generators, power plants, coating operations, wood refinishing facilities, and agricultural sources. These 14 sources are grouped into five classes: mobile sources, major and minor stationary sources, agricultural sources, and geologic and natural sources. The remainder of this section describes each of these in greater detail.

1. Mobile Sources

Mobile sources are vehicles, engines, and equipment that generate air pollution and that either move under their own power or are commonly moved as part of their operation. Mobile sources are traditionally classified as either on-road or off-road. On-road and off-road mobile sources have very different emissions characteristics, and are regulated separately. However, both are significant contributors to air pollution for both criteria and toxic air pollutants.

On-road sources include vehicles typically licensed for use on public roadways for transportation of passengers or freight. On-road mobile emissions are released from light-duty gas, diesel, and alternative-fueled passenger vehicles, heavy-duty vehicles such as eighteen-wheelers, and motorcycles used for transportation on roadways. Off-road (also known as nonroad) mobile sources include recreational and commercial vehicles, engines, and equipment not intended to be operated on public roadways. Off-road mobile emissions are released from equipment and vehicles, such as diesel fueled locomotives, propane or natural gas-fueled forklifts and support equipment, and other equipment not licensed for highway use. Off-road equipment is common in the recreational vehicle, construction and mining, industrial, agricultural, and air, marine, and rail freight sectors.

We consider six major categories of facilities associated with on-road and off-road mobile sources of importance to new school siting here, the pollutants they emit, and associated health risks.

Freeways and Other High-Traffic Roadways

Motor vehicle exhaust is a major contributor to both criteria and toxic air pollution. Pollutants emitted from busy roadways include NO_x, CO, particulate matter, especially $PM_{2.5}$ emitted in diesel exhaust and PM_{10} emitted from brake and re-entrained road dust, as well as a range of air toxics emitted in exhaust.

Multiple air pollution studies both within and outside of California have indicated that living, working, and/or attending school within close proximity to high traffic roadways and the exposure to associated emissions may lead to exacerbation of adverse health effects beyond those associated with regional air pollution levels, particularly for sensitive receptors such as children [see, e.g., several sources cited in "Freeways and High Traffic Roads" in CARB's Air Quality and Land Use Handbook (2005)]. These health effects include a variety of respiratory symptoms, asthma exacerbations, and decreases in lung function in children. There are also significant concerns with diesel PM, formaldehyde, benzene, PAHs, 1,3-butadiene, and other known carcinogens found in motor vehicle exhaust near busy roadways. A key observation of several near-roadway studies is that increased proximity increases exposure and enhances the potential for adverse health effects from inhalation of roadway pollutants.[2]

[2] Information based on CARB's "Air Quality and Land Use Handbook: A Community Health Perspective" (2005) and other sources.

Airports

Aircraft emit pollutants during flight that, due to atmospheric mixing, affect ground level pollutant concentrations. This mixing zone extends to 3,000 vertical feet on average. The aircraft operations of interest within the mixing zone are defined as those in the landing and takeoff (LTO) cycle. Jet fuel used in many aircraft is a kerosene-based compound with emissions of all the same species of concern from other fossil-fueled mobile sources. Of particular concern is NO_x, which is relatively high from aircraft emissions, but is targeted with new engine designs and modified flight plans. Major components of aircraft exhaust include CO, VOCs, NO_x, SO_x, and PM, as well as various air toxics. Like on-road diesel fuel, however, ultra-low sulfur jet fuel is expected to become common, reducing PM and SO_x emissions near airports. [3]

In addition to aircraft emissions, the exhaust from cargo handling and other ground support equipment (GSE) at airports can be important sources of pollution. Many airports nationwide are moving from using traditional fossil-fueled (commonly diesel) GSE to either electrified or alternative fueled (e.g., LNG, CNG, propane) GSE. Emissions from alternatively fueled GSE are significantly reduced relative to traditionally fueled GSE, while electrified GSE are virtually emissions free. By comparison, diesel-fueled GSE are considered nonroad mobile emissions and consequently are not required to meet on-road diesel emissions standards. Hence, they can be relatively high emitters of NO_x, CO, and diesel PM, in particular. [4]

Railway Lines and Railway Yards

Diesel-powered locomotives operating along railway lines can be major sources of pollution, particularly NO_x and diesel PM. In addition to emissions from locomotives, railway yards attract heavy-duty truck traffic, which is also a major source of diesel PM, and other pollutants. Since these facilities are often sited in mixed industrial and residential areas, these facilities may represent significant pollutant hot spots. Although other pollutants are also commonly emitted from these facilities, the major pollutant of concern is diesel PM, which has been designated as a carcinogen in California. Exposure to elevated concentrations of PM is also associated with increased risk of premature death due to cardiovascular disease and other noncancer health effects such as asthma and other respiratory illnesses.

CARB, the Placer County Air District, and Union Pacific Railroad recently completed a study of the Roseville Rail Yard in northern California—one of the largest service and maintenance rail yards in the West—that focused on the health risk from diesel PM. Some key findings of the study were:

- Annual diesel PM emissions were about 25 tons per year.
- Air quality modeling predicts potential cancer risks greater than 500 in a million (based on 70 years of exposure) in a 10-40 acre area immediately adjacent to the rail yard's maintenance operations.
- The risk assessment also showed elevated cancer risk impacting a larger area covering about a 10-by-10 mile area around the yard. [5]

---

[3] See, e.g., "Crackdown on diesel engines, vehicles, ships, jet fuel, aircraft key to California emissions 'SIP' - state implementation plan,"Diesel Fuel News, Oct 27, 2003.

[4] Information based on "Impact on Air Quality of Intermodal Freight Movement, Freight Transportation Emissions Estimates (Task 4)," ICF Consulting technical memorandum to the FHWA (October 2004) and other sources.

[5] Information based on CARB's "Air Quality and Land Use Handbook: A Community Health Perspective" (2005).

Ports

Marine freight sector emissions in and near ports are a growing area of concern for surrounding communities. Port emissions are generated by ships in the commercial marine sector, including freight and nonfreight marine vessels, such as large ocean going vessels, tugboats, cruise ships, ferries, and fishing boats. Military ships and recreational watercraft may also contribute to emissions at many ports. Emissions at ports are released from the engines used to power these vessels and their ancillary equipment, as well as from the engines powering the land-based equipment at ports that are used for handling marine cargo. Other mobile emission sources may also operate within port boundaries, such as locomotives, forklifts, cranes, and heavy-duty trucks.

The primary air pollutant associated with port operations is diesel PM and other toxic air pollutants associated with diesel exhaust. The size and number of these diesel engines makes the ports one of the largest sources of diesel PM in the state. International, national, state, and local governments are all working to reduce emissions from the ports through a combination of technological and operational approaches. Another pollutant of major concern at the Ports of Los Angeles and Long Beach is fugitive particulate matter emissions associated with petroleum coke storage and transport. Other heavy industrial sources include refineries and power generating plants.

Health risks from port emissions of diesel PM and emissions from heavy industry located in proximity to those ports are the same as those expected from diesel particulate matter emissions from other sectors, including cancer and non-cancer effects, as well as exceedances of ambient air quality standards.[6]

Distribution Facilities

Warehouses and distribution centers serve as a distribution point for the transfer of goods by truck or other modes, such as rail, or between modes. Such facilities include cold storage warehouses, goods transfer facilities, and inter-modal facilities such as ports. Sources of pollution at these facilities are engines operating in trucks, trailers and shipping containers, particularly transport refrigeration units (TRUs), and other equipment with diesel engines. Distribution centers may consist of multiple centers or warehouses within an area that may span hundreds of acres, involve several different transfer operations. The large number of vehicles accessing these facilities often experience long waiting periods during which the vehicles and/or their associated equipment may be idling. Thus, distribution facilities can be significant sources of emissions, particularly of diesel PM and other air toxics associated with diesel exhaust.

There are a variety of programs either currently being implemented or planned to reduce PM emissions from distribution facilities. These include limiting nonessential idling of diesel-fueled commercial vehicles to no more than five minutes at any one location, and tightening regulations on TRUs operating emissions over time.

Health risks from emissions associated with operations at distribution facilities are the same as those expected from diesel particulate matter emissions from other sectors, including cancer and non-cancer effects, as well as exceedances of ambient air quality standards. [7]

---

[6] Information based on “Impact on Air Quality of Intermodal Freight Movement, Freight Transportation Emissions Estimates (Task 4)”, ICF Consulting technical memorandum to the FHWA (October 2004) and CARB’s “Air Quality and Land Use Handbook: A Community Health Perspective” (2005).

[7] Information based on CARB’s “Air Quality and Land Use Handbook: A Community Health Perspective” (2005).

Other Sources

Similar to the case of distribution facilities, there are other types of facilities that can attract large numbers of motor vehicles to them and, thus, become an indirect source of pollutant emissions. Examples are office complexes, residential development, schools, or sports arenas. There are state and local regulations that consider mitigation measures for these types of sources in their construction plans. The case of schools is discussed in Section 4, below. Health concerns from these emissions are the same as other mobile source emissions, as well as any specific emissions associated with the facilities themselves.

2. Major Stationary Sources

Major stationary sources of emissions are fixed sources that produce large amounts of pollutants as by-products of their operational activities, defined in this case by the Federal Clean Air Act as amended in 1990. Here Section 302[j] defines a major source as "any stationary facility or source of air pollution which directly emits, or has the potential to emit, 100 tons per year or more of any air pollutant (including any major emitting facility or source of fugitive emissions of any such pollutant, as determined by rule by the Administrator" while Section 70.2 applies a threshold of 10 tons per year of any hazardous air pollutant and 25 tons per year of any combination of hazardous pollutants in its definition of "major". Because of our extreme non-attainment status, SCAQMD defines a major source at lower levels for various criteria air contaminants than those specified under the Federal Clean Air Act. NO_x emissions from stationary sources of fossil fuel combustion are a major concern as they account for roughly one half of the total NO_x emissions nationwide, although this fraction is much smaller in the South Coast region. Stationary sources may also be significant sources of odor emissions.

This section examines two categories of major stationary sources of air pollution in California. Should more specific information than presented here on the sources and their respective emissions in the SCAB be needed, it can be obtained from SCAQMD's Department of Engineering and Compliance and from the 2003 Air Quality Management Plan, available at http://www.aqmd.gov/aqmp/AQMD03AQMP.htm.

Petroleum Refineries

Petroleum refineries are complex facilities where crude oil is converted into petroleum products, including gasoline, diesel, and jet fuel. These products are then transported through a system of pipelines and storage tanks for final distribution by delivery truck to fueling facilities. At the refinery, crude oil is passed through many complex chemical and physical processes, including distillation, catalytic cracking, reforming, and finishing, each of which has the potential to emit air contaminants. Over the past decade emissions from refineries in California have been reduced significantly. However, emissions can still be significant. These emissions may be of particular concern for communities that are directly downwind of the refinery.

Four of the ten largest stationary sources of NO_x in California are petroleum refineries. Petroleum refineries are also large stationary sources of both PM_{10} and $PM_{2.5}$. In addition to criteria pollutants, refineries also may emit toxic air pollutants, which vary by facility and process operation. Compounds of greatest concern include: acetaldehyde, arsenic, antimony, benzene, beryllium, 1,3-butadiene, cadmium compounds, carbonyl sulfide, carbon disulfide, chlorine, dibenzofurans, diesel PM, formaldehyde, hexane, hydrogen chloride, lead compounds, mercury compounds, nickel compounds, phenol, 2,3,7,8 tetrachlorodibenzo-p-dioxin, toluene, and xylenes. The potential health effects associated with enhanced exposure to these air toxics include cancer, respiratory irritation, and damage to the central nervous system.

In addition, odor emissions from refineries can cause health symptoms such as nausea and headache. Exposure to PM exacerbates a number of respiratory illnesses, including asthma, and is associated with premature mortality in people with existing cardiac and respiratory disease. Other toxic air contaminants occasionally released from refineries can potentially result in acute health effects to exposed individuals. [8]

Power Plants

Power generating facilities, too, can be very complex operations. Generally, these produce electricity by rotating a turbine. This may be accomplished either by utilizing some form of thermal energy (e.g., fossil-fuel combustion, nuclear reaction, geothermal) or a natural form of mechanical energy (e.g., hydroelectric, wind turbine). The source of energy, as well as the treatment of the exhaust stream, determines the types of air pollutants that may be expected from these facilities. Nuclear facilities are essentially emission free, as are geothermal, hydroelectric, and wind facilities. Many newer power plants are fueled by natural gas, which generates all the compounds associated with fossil fuel combustion, (e.g., NO_x, CO, and PM), but at relatively low levels. In California, the other major fossil-fuel used in power plants is oil which is not used in the South Coast region. [9] Generally, NO_x and other emissions related to power production from oil combustion are about double those from natural gas. Other combustion sources are used in relatively small amounts throughout the state to generate power, including landfill gas and solid waste. Each of these can emit some toxic air contaminants specific to the fuel used, as well as the typical combustion pollutants (e.g., NO_x and PM).

Health effects from NO_x, PM, CO, and other criteria pollutants emitted from power plants have been noted in Appendix B. Specific health effects from air toxic emissions will vary by type of facility and fuel source. [10]

Other Fuel Combustion Sources

Another major stationary source of air pollution in California is fuel combustion at manufacturing and industrial facilities. This sector accounts for about 33% of fuel combustion NO_x emissions, 20% of fuel combustion CO emissions, and 19% of all fuel combustion PM_{10} emissions in California. These emissions are associated with on-site burning of fossil fuels for power generation for manufacturing process. Commonly used fuels include natural gas, diesel fuel, residual or distillate oils, coal or coke, as well as wood products. Unlike power plants, the energy generated by these facilities is typically used to drive one or more specific processes or pieces of equipment rather than being widely distributed.

Agricultural facilities in California also often rely on their own combustion sources rather than power received from the electrical grid to power specific processes. Depending on the amount of power generated, these facilities may be considered major or minor emitters on an individual basis. However, in the aggregate, they are major contributors to statewide emissions and associated health risks. [11]

---

[8] Information based on CARB's Air Quality and Land Use Handbook: A Community Health Perspective (2005).

[9] Coal combustion is a very common form of power generation throughout the United States, and is a very significant emitter of NO_x, SO_x, PM, mercury, and other pollutants; however, very little power generation within California is coal fired.

[10] Based on Air Pollution Its Origin and Control, 3rd Ed., Wark, Warner, and Davis (1998) and other sources. More information on California emissions may be had from CARB's stationary emissions inventory website: http://www.arb.ca.gov/app/emsinv/emssumcat_query.php?F_YR=2004&F_DIV=-4&F_SEASON=A&SP=2005&F_AREA=CA#stationary.

[11] Based on information from CARB's stationary emissions inventory. See previous note for address.

Health effects from the emissions from these other stationary sources are the same as those associated with combustion from other sources, including NO_x, PM, CO, and various air toxics. Specific health effects from each of these pollutants are discussed above.

3. Small Stationary Sources

Small stationary sources are those sources that have smaller emissions overall than major sources, but may be significant emitters of air pollutants, particularly air toxics. By nature, small stationary sources such as dry cleaners, auto repair shops and metal plating facilities, tend to be distributed throughout communities and can therefore be an issue to school siting. Under the 1990 Federal Clean Air Act Amendments, a minor source is one that emits less than 10 tons of a single toxic air pollutant or 25 tons of a combination of toxic air pollutants annually. [12]

This section discusses five important examples of small stationary sources of air emissions.

Alternative and Backup Power Generators

Alternative and backup power generators may include alternative power units (APUs) that provide heat and electrical power to trucks, locomotives, and marine vessels when the main engines are turned off, generators that provide backup power to hospitals and other facilities, or other generators. These may be diesel or gasoline powered and have pollutant emissions such as those associated with other fossil fueled engines, including NO_x, CO, PM, and various air toxics. Other fuel sources include ovens, kilns, boilers, turbines, and standby generators.

Health effects from emissions emanating from generators are similar to those from other fossil fuel combustion sources, including respiratory effects, increased cancer risk, and exceedance of ambient air quality standards. However, because these units vary greatly in size and fuel consumption, it is difficult to generalize a risk associated with the group as a whole.

Dry Cleaners

Dry cleaners can be major sources of perchloroethylene (also known as PCE, Perc, or tetrachloroethylene). Some dry cleaning operations use Perc as a solvent chemical in the cleaning operation. Emissions from those facilities that use Perc are common during operation. Emissions are controlled through the use of condensers, carbon adsorbers, room enclosures, as well as through improved operation and maintenance of equipment.

Beginning in 1996, the U.S. EPA implemented regulations for the dry cleaning industry. Components of the rule for small dry cleaning operations include installation of leak detection and repair equipment, storage of all PCE solvent and waste in sealed containers, and prohibiting any new transfer machine systems. Since 1990, PCE emissions have dropped by more than 70% in California due to regulation and use of PCE alternatives. The SCAQMD has passed rules mandating that all new dry cleaning operations use alternatives to PCE, and prohibiting use of PCE in existing dry cleaning operations by 2020. The health effects of PCE include both cancer and non-cancer effects, as discussed in Appendix B. [13]

[12] For more information on air toxics in Southern California, see http://www.ioe.ucla.edu/reportCard/report00/html/toxics.html.

[13] Information based on the EPA dry cleaning rule. Fact sheet available at http://www.epa.gov/ttn/atw/dryperc/htm_fact.html.

Coating Operations

Automotive refinishing includes the use of paints or coatings that may emit toxic air contaminants, and auto body paint and repair shops can be significant sources of odors and air toxics. Sanding and grinding operations at auto body shops can be emitters of metal compounds, including chromium and nickel.

The health risks from these compounds include both cancer and non-cancer effects, as discussed in Appendix B.

Metal Plating Facilities

Chrome plating operations convert hexavalent chromium in solution to a chromium metal layer by electroplating to enhance appearance and provide greater protection against corrosion and wear. Nickel is also commonly placed on the material before the chromium is applied. Cadmium is also commonly emitted from metal plating facilities. Hexavalent chromium is emitted into the air when an electric current is applied to the plating bath. The magnitude of emissions from the operation are dependent upon the volume of electroplating at the facility and the emissions control requirements implemented, which vary by size and type of the operation. Facilities install add-on pollution control equipment, such as filters and scrubbers, and/or in-tank controls, such as fume suppressants and polyballs. Combinations of controls have reduced hexavalent chromium emissions by approximately 99% in the South Coast Basin.

Health information on hexavalent chromium, cadmium, and nickel exposure is provided in Appendix B.[14]

Wood Processing and Wood Refinishing Facilities

Adhesive binding systems used to manufacture composite wood products such as particle board, medium density fiberboard, hardwood plywood, and composite veneer contain urea-formaldehyde resins. Emissions from facilities that produce and/or use these products expose the public to formaldehyde emissions. Processing wood that has been treated with arsenic may release inorganic arsenic compounds into the air. Furniture refinishing shops strip and refinish furniture, antiques, and other wood products. Old coatings are commonly stripped from wood products using a system where stripping agents that may contain about 80% methylene chloride is flowed, brushed or sprayed on and the excess flows into a catch tray for re-use.

Methylene chloride is a suspected human carcinogen. Formaldehyde is known to have cancer effects and to exacerbate asthma. Arsenic is a known human carcinogen, and is also related to a variety of non-cancerous health effects.

Gasoline Stations

Motor vehicles and motor vehicle-related activity, including refueling at gasoline dispensing facilities, account for more than 90 percent of anthropogenic benzene emissions in California. While gasoline-dispensing facilities account for a small part of total benzene emissions, near source exposures for large facilities can be significant. Ambient benzene concentrations have been reduced by over 75% in California since 1990, due to emissions controls and vapor recovery equipment at gas stations, as well as reduction in benzene levels in gasoline. However, benzene concentrations are still of concern, particularly in urban areas. Gasoline dispensing facilities tend to be located in areas close to residential

---

[14] Based on CARB's "Air Quality and Land Use Handbook: A Community Health Perspective" (2005).

and shopping areas. Benzene emissions from gas stations may result in near-source health risks beyond the regional background threshold, particularly near large retail or wholesale outlets.

Benzene is a potent carcinogen and one of the highest risk toxic air pollutants, although in the South Coast, risk associated with diesel exhaust is much higher. [15]

4. Agricultural Sources

Agricultural operations can be significant sources of air toxics, criteria pollutants, and odors. Pesticide use in agricultural areas are of particular concern because many of these compounds are regulated as air toxics or are otherwise known to have adverse health effects. It is noteworthy that the pesticide emissions from agricultural operations are exempt from the inventory requirements of AB2588. Hence, there could be significant emissions of toxics into the environment from the use of agricultural pesticides would not be reported in any state or local "hot spot" inventory program. Emissions of other toxic or hazardous air pollutants from agricultural operations are still subject to AB2588. Additionally, after implementation of SB700 in January of 2004 and new Title V regulations, for the first time several agricultural sources, such as certain engines, will be required to obtain a permit in order to operate. [16] Emissions data for these sources may be available from the SCAQMD.

However, California requires a permit from the County Agricultural Commissioner for agricultural application of any regulated pesticide. These Pesticide Usage Reports (PURs) are then forwarded to DPR by the County Commissioner. DPR maintains a database of all agricultural applications of pesticides by township section (approximately one square mile). Information of past pesticide usage patterns for particular fields may be obtained from the County Agricultural Commissioner.

Criteria air pollutants and air toxics emitted from agricultural operations are those typically associated with use of gasoline or diesel-fueled equipment; e.g., NO_x, SO_x, CO, PM_{10}, $PM_{2.5}$, diesel PM, formaldehyde, benzene, PAHs, and 1,3-butadiene. Examples of agricultural equipment are on-road heavy- and light-duty vehicles, diesel- and gasoline-powered generators, tractors, and other off-road equipment.

Emissions of PM from agricultural burning, such as crop burning at the end of the growing cycle, may also be of concern in the SCAB. Agricultural burning also emits CO, NO_x, and SO_x, benzene, and 1,3-butadiene into the air. Agricultural soil tilling, sowing, and planting are also major contributors to PM_{10}, as well as dairies and feedlots. [17,18]

Toxic air emissions can also be associated with other agricultural operations. Emissions of ammonia from large agricultural operations (such as chicken farms, dairies, and feedlots) have drawn recent attention and lawsuits. Animal agriculture may account for as much as 85% of total ammonia release. [19]

The most common concern for agricultural operation emissions are odor nuisance complaints. Odorous gases are generated by the organic decomposition of animal wastes and typically contain ammonia or hydrogen sulfide compounds which are regulated under CEQA.

---

[15] Based on CARB's "Air Quality and Land Use Handbook: A Community Health Perspective" (2005).

[16] See, e.g., http://www.arb.ca.gov/diesel/ag/inuseag.htm.

[17] See, e.g., http://www.sarep.ucdavis.edu/NEWSLTR/v5n2/sa-8.htm.

[18] Information on the increasing role of agricultural regulation in meeting criteria pollutant standards given by, e.g., http://farmmanagement.aers.psu.edu/pubs/AirEmissionsfromAganno.pdf.

[19] http://www.dasc.vt.edu/faculty/knowlton/EnvironmentalIssues.pdf.

5. Geologic and Other Sources

Geologic and other natural processes may be sources of concern for some air toxics as well as odors. Some examples are naturally occurring asbestos and soil gas flux.

In some areas of California, asbestos occurs naturally in stone deposits. Forty-five of California's 58 counties contain naturally occurring asbestos (NOA) deposits, although less than 2% of the state's area is known to be in an NOA region. If inhaled, this asbestos can be a potent carcinogen. Asbestos-containing dust may be a public health concern in areas where asbestos-containing rock is mined, crushed, processed, or used. There is no use of asbestos containing gravel in road paving materials in the South Coast region. According to the California Department of Conservation, the SCAQMD does not contain NOA, except for Catalina Island where small ultramafic rock occurrences are present.

In some areas, the soil naturally emits gases that may be hazardous to people. Radon gas emanating from soil is a concern in many areas. Other examples of outgassing soil may be related to previous uses of the land, such as oil fields or waste depositories (i.e., landfills). Some hazardous pollutants that may outgas from soils due to previous activity include benzene, toluene, and hexane. Soil outgassing can be a serious concern because it can dramatically affect indoor air quality. Tar pits are another natural source of odors and emissions.

3. Relevant Guidance Documents

This section provides brief descriptions and references to other guidance documents focused on issues of properly identifying and addressing environmental and other concerns affecting new school construction. They are provided here as reference for the user of this document, since many of them illustrate topics beyond the air quality focus of the present document. For each document, a summary of siting issues addressed in the document is first given, followed by a highlighting of topics related to air quality in the document, particularly sources of concern and potential mitigation measures. A summary table is also given of air quality issues related to school siting from each document.

California Department of Education's School Site Selection and Approval Guide

Under the California Code of Regulations and the Education Code, school site approval from the California Department of Education (CDE) must be granted before the State Allocation Board (SAB) will apportion funds to a school district. The requirements for approval include the local educational agency consulting with the local air quality management district to identify facilities within a quarter mile of the proposed site that might reasonably be anticipated to emit hazardous air emissions. If any such facilities exist, they must be investigated to determine whether they constitute an actual or potential endangerment of public health at the site or whether corrective measures can be taken that will result in emissions mitigation to levels that will not constitute endangerment. This document was developed by the CDE to help school districts to select sites that provide students with safe environments to enhance the students' learning process and to facilitate gaining state approval for the selected sites.

The guide includes a set of selection criteria that have been helpful in previous site selection endeavors and contains specific information about safety factors to be considered when evaluating potential sites for new schools and for additions of land to existing school sites. The primary focus of site screening and ranking criteria presented in the document is safety at the site. Other major considerations, including location, environmental concerns, availability of public services, and cost are mentioned as important criteria for site selection. Detailed discussions of safety factors, including distance criteria are given for 15 issues of concern to safety. These are:

- proximity to airports,
- proximity to high-voltage power transmission lines,
- presence of toxic and hazardous substances,
- hazardous air emissions and facilities within a quarter mile,
- other health hazards,
- proximity to railroads,
- proximity to pressurized gas, gasoline, or sewer lines
- proximity to high-pressure water pipelines, reservoirs, water storage tanks,
- proximity to propane tanks,
- noise,
- proximity to major roadways,
- results of geological studies and soils analyses,
- traffic and school bus safety conditions,
- safe routes to school, and

- safety issues for joint-use projects.

Although the focus of this document is safety, some of the recommendations for these elements relate, either directly or indirectly, to air quality. These are summarized in Table 3-1. Note that many of the recommendations are based on safety concerns other than exposure to air contaminants.

Table 3-1. Concerns and Recommendations Related to Air Quality from California Department of Education's *School Site Selection and Approval Guide*

Issues of Concern	Proposed Solution	Relation to Air Quality
Proximity to Airports	School sites should not be located within two nautical miles of existing or proposed runways based on safety concerns. Otherwise specific actions must be taken to deem the site accessible.	Additionally, airports are significant emitters of air pollutants.
Presence of Toxic or Hazardous Substances	Do not site on or within sufficient proximity to landfills, current or former dump areas, chemical plants, oil fields, refineries, fuel storage facilities, nuclear generating plants, abandoned farms or dairies, agricultural areas where pesticides have been heavily used, or areas where naturally occurring asbestos or other naturally occurring hazardous materials are or have been present unless the site has been sufficiently cleared by appropriate procedures, including preparation and approval of an Environmental Site Assessment (ESA).	Air toxics may be released from soil or underground deposits where toxic substances have been present.
Hazardous Air Emissions and Facilities	Do not site within ¼ mile of any facility identified as a source of toxic air emissions known to the local air quality board unless the risks do/will not endanger public health or that sufficient mitigation measures will be taken.	Air toxic emissions may endanger public health.
Proximity to Railroads	Any site within 1500 feet of a railroad track easement requires a safety study to address pedestrian and vehicle safety. Regions up to 2500 feet from railways have been evacuated due to accidents involving toxic gases and explosives.	Additionally, railways can be significant emitters of diesel PM.
Proximity to Pressurized Gas, Gasoline, or Sewer Pipelines	Under the CEC, no school may be sited on property that "contains one or more pipelines, situated underground or aboveground, which carries hazardous substances, acutely hazardous materials, or hazardous wastes, unless the pipeline is a natural gas line which is used only to supply natural gas to that school or neighborhood."	Should they leak, pressurized gas, gasoline, and sewer pipelines can be sources of hazardous air emissions and odors.
Proximity to Propane Tanks	To avoid explosions, school districts should contact state agencies to evaluate the safety risk of on-site propane tanks.	Additionally, leaking propane tanks can be a source of odors and hazardous air pollutants.
Proximity to Major Roadways	Distances of at least 1500 feet are recommended from roadways on which pesticides, fuels, poisons, or other dangerous materials are transmitted. Distances of 2500 feet are recommended from roadways on which explosives are carried. Also, adequate distance should be included to protect populations from traffic accidents and noise pollution.	Additionally, roadways are significant sources of criteria pollutants, diesel PM, and several other air districts.

Source: The document is available at http://www.cde.ca.gov/ls/fa/sf/schoolsiteguide.asp and was most recently modified June 19, 2006.

California Department of Toxic Substance Control

Under AB387 and SB162, effective January 2000, the California Department of Toxic Substance Control (DTSC) must be involved in the environmental review process for the proposed acquisition and/or construction of school properties utilizing state funding. To address their responsibilities dictated by these rules, DTSC has promulgated several guidance documents and advisories for school site selection. A summary of each of these follows, including its relevance to air quality concerns.

1. Phase I Environmental Site Assessment Advisory: School Property Evaluations

In order to obtain State funding for school property acquisition or new construction, the CEC requires school districts to conduct a comprehensive Phase I Environmental Site Assessment (ESA) for each proposed school site to assess if there has been either a release of hazardous materials or a presence of naturally occurring hazardous materials at the site. If so, a Preliminary Endangerment Assessment (PEA) must be made to evaluate the threat posed to public health or the environment. The California DTSC reviews all Phase I ESAs and PEAs and determines any need for further action. DTSC created this document to advise personnel responsible for preparing Phase I ESAs for potential school locations on proper guidelines on evaluating relevant environmental conditions.

This document provides a list of 13 past practices that may have occurred at the site that may be current sources of contamination. These include:

- agricultural use
- mines,
- former U.S. Government use or ownership,
- current or prior residential usage,
- lead-based paint,
- easements (including pipelines and railroads),
- asbestos
- naturally occurring hazardous materials,
- PCBs,
- petroleum,
- fill material,
- debris dumping, and
- illegal drug manufacturing.

Rather than recommending solutions for possible sources of contamination, this document only lists areas of concern. Those uses of concern listed in the document that are relevant to air quality at the proposed site, along with the reason for concern, are summarized in Table 3-2.

Table 3-2. Concerns Related to Air Quality from

Phase I Environmental Site Assessment Advisory: School Property Evaluations

Issues of Concern	**Relation to Air Quality**
Agricultural Use	Some pesticides may reside in the soil for long periods of time and eventually outgas to the air or may be released by soil disturbance as toxics contaminants. Some classes of concern include arsenical herbicides and organo-chlorine pesticides. Other previous uses that might lead to current air quality issues include burn areas as sources of PAHs and dioxins, cattle dip pits as sources of PAHs, and electrical transformers as sources of PCBs.
Mining	Abandoned or inactive mines may be sources of toxic metals such as chromium, mercury, and nickel, metal compounds of arsenic or selenium and asbestos which may be released to the air.
Residential Use	Pesticide contamination from extensive gardening, lead- or asbestos-containing material usage, and use or storage of hazardous wastes from automobile repair, painting, or other activities may contaminate the soil and groundwater and could be released into the air.
Easements	Pipelines used to transmit petroleum products could contaminate soils and eventually release these compounds into the air. Railroads could have released or spilled fuel or other contaminants into the soil.
Naturally Occurring Hazardous Materials	Asbestos, toxic metals, and compounds (nickel, mercury, chromium, arsenic, selenium) may occur naturally at sites and be released into the air by disturbing the soil. Some naturally occurring gases are toxic, such as radon, methane, and hydrogen sulfide.
Petroleum Storage or Production	Compounds from previous oil fields, oil and gas wells, natural gas production, and natural reserves of petroleum may lead to elevated air concentrations of these compounds.
Fill Material, including "Clean Fill"	Fill material, particularly from off-site sources, may contain hazardous substances that can be released to the air, including organic gases, heavy metals, asbestos, pesticides, PCBs and petroleum products.
Clandestine Drug Manufacturing	Illegal drug manufacturing can produce areas contaminated with chemicals that may be released into the air, including phosphine, iodine, hydrogen chloride, various acids, methamphetamine, and organic solvents.

This document is available at http://www.dtsc.ca.gov/Schools/upload/SMP_REP_Schools_Phase1Advisory.pdf.

The most recent update is September 5, 2001.

2. Interim Guidance on Naturally Occurring Asbestos at School Sites

Asbestos consists of six naturally occurring minerals, all of which are hazardous to humans if released into the air resulting from soil disturbing activities. DTSC prepared this document to assist school site selection personnel with identifying and mitigating exposure to naturally occurring asbestos at potential sites. It follows a four-step process for identifying and resolving issues with NOA at potential sites, including the Phase I Environmental Site Assessment (ESA), the Preliminary Environmental Analysis (PEA), mitigation actions, and long-term monitoring.

The general problem and proposed mitigation approach for school site selection in areas of naturally occurring asbestos from this document are summarized in Table 3-3.

Table 3-3. Concerns and Recommendations Related to Air Quality from *Interim Guidance on Naturally Occurring Asbestos at School Sites*

Issues of Concern	Relation to Air Quality	Proposed Solution
Naturally Occurring Asbestos (NOA)	Asbestos released from disturbed soil is a known carcinogen.	Proposed school sites must go through an ESA and possibly a PEA. If the PEA shows NOA levels above acceptable concentrations and the school district decides to proceed with the site development, the district must instigate a removal action workplan (RAW) that may include site grading, backfill, and paving or other final surface finishing to minimize exposure to NOA at the site. The district is also likely to have to engage in long-term monitoring and maintenance of the site.

Source: This document is available at
http://www.dtsc.ca.gov/Schools/upload/SMBRP_POL_Guidance_Schools_NOA.pdf

The most recent update is September 24, 2004.

3. Interim Guidance for Evaluating Lead-Based Paint and Asbestos-Containing Materials at Proposed School Sites

Current law requires the California DTSC to assume responsibility for evaluating environmental assessments for proposed state-funded sites for new schools for acquisition and/or construction, particularly to ensure that selected sites either do not contain hazardous materials or that, if they once did, these sites have been appropriately remediated and are safe for use. DTSC prepared this guidance document to allow proper assessment of new and existing school sites where the only contaminant present is lead-based paint and/or asbestos-containing materials (ACM). It details specific actions that must be taken by the environmental assessor and by DTSC to assess the safety of a school site containing these materials.

Lead based paint can occur in or on residential structures constructed before 1978. Sites constructed before 1976 may contain asbestos (NOTE: SCAQMD believes that the buildings constructed after 1976 can contain asbestos, even though the incidence is less frequent for those built after 1984). The general problems and proposed mitigation approach for school site selection using existing structures that contain lead-based paint (LBP) on interior or exterior structures, as discussed in this document, are summarized in Table 3-4.

Table 3-4. Concerns and Recommendations Related to Air Quality from *Interim Guidance for Evaluating Lead-Based Paint and Asbestos-Containing Materials at Proposed School Sites*

Issues of Concern	Relation to Air Quality	Proposed Solution
Lead Based Paint (LBP)	LBP chips may contaminate soil from construction/demolition, and may be resuspended from soil disturbing activities or released into the air by burning painted surfaces. Lead exposure is toxic, particularly for children.	The ESA must report if LBP is present or suspected and may be supported by chemical or X-ray analysis. If present, the structures must either be removed or managed in place. Site selection may also require soil monitoring for lead contamination.
Asbestos Containing Materials (ACM)	ACM can release asbestos fibers into the air, where they may be inhaled and cause permanent lung damage and cancer.	The ESA must identify if ACM is present. If so, it must either be appropriately removed or managed in place and documented in accordance with all pertinent regulations (NOTE: As an example, SCAQMD Rule 1403 regulates asbestos removal, demolition, and renovation activities to limit asbestos emissions).

Source: This document is available at http://www.dtsc.ca.gov/Schools/upload/Schools_FS_lead-based-paint.pdf.

The most recent update is June 2006.

4. Advisory—Active Soil Gas Investigations

Outgassing from contaminated soil can adversely affect both indoor and outdoor air quality at impacted sites. Active soil gas investigations may be used to obtain vapor phase data on soil at sites potentially contaminated by volatile organic compounds (VOCs), including chlorinated and aromatic hydrocarbons, methane, hydrogen sulfide, or to measure fixed and biogenic gases such as oxygen, carbon dioxide, or carbon monoxide. These data may be used to identify sources and determine the spatial distributions of VOC contamination, or to estimate indoor air concentrations for risk assessment purposes. The California DTSC and Los Angeles Regional Water Quality Control Board (LARWQCB) prepared this document as a guideline for active soil gas sampling investigations for regulatory and land use purposes. It details the steps that should be followed by site selection personnel before and during active soil gas investigations, should they be needed for soil contamination studies. Although this document is not intended solely for school site selection projects, its contents may be relevant for specific selection projects. Table 3-5 summarizes this document.

Table 3-5. Concerns and Recommendations Related to Air Quality from *Advisory—Active Soil Gas Investigations*

Issues of Concern	Relation to Air Quality	Proposed Solution
Soil contaminated with and/or emitting VOCs, methane, hydrogen sulfide, or fixed or biogenic gases.	Vapor intrusion from soils can contaminate indoor air with a variety of pollutants.	Soil gas studies provide the recommended data set for assessing impacted indoor air quality. This document details appropriate methods for these tests.

Source: This document is available at http://www.dtsc.ca.gov/LawsRegsPolicies/Policies/SiteCleanup/upload/SMBR_ADV_activesoilgasinvst.pdf

The most recent update is January 28, 2003.

5. Interim Guidance for Sampling Agricultural Fields for School Sites

All new proposed school sites and school construction projects must be evaluated by the California DTSC to help avoid potential environmental hazards. The DTSC prepared this guidance document to address selection of lands currently or previously used for agricultural purposes. This consideration is important because some chemicals used may have contaminated the soil and pose a threat to the public health. The most commonly detected pesticides that have required special remediation by soil removal have been toxaphene, dieldrin, and aldrin. This document is intended to provide guidance to site selection personnel on a uniform approach to evaluating former agricultural properties for pesticide use. It applies to the PEA or other initial sampling investigations, but does not apply to disturbed land, such as land that has been graded for construction, areas where soil has been imported, land used for animal facilities, land that has been developed, or uses where the application of fertilizer would not be uniform. The document details identifying potentially applicable sites, sampling strategies, important foci of analyses, and proper reporting methodology. Table 3-6 summarizes the relevant air quality implications of the document.

Table 3-6. Concerns and Recommendations Related to Air Quality from *Interim Guidance for Sampling Agricultural Fields for School Sites*

Issues of Concern	Relation to Air Quality	Proposed Solution
Soil contaminated with agricultural chemicals	Pesticides or other toxic substances may be present in the soil and can evaporate into the air or be transported by soil disturbances.	Soil studies must be done as part of EAS to assess risk from contamination. This document details appropriate methods for sampling agricultural fields for contamination.

Source: This document is available at http://www.dtsc.ca.gov/Schools/upload/interim-ag-soils-guidance.pdf.

The most recent update is August 26, 2002.

OEHHA Study on Schools Near Busy Roads

Traffic-related pollutants have been associated with adverse health effects, which are exacerbated by increased proximity to busy roads. School locations are particularly important due to increased exposure of children to these pollutants. This study examined public schools in California, various socioeconomic factors, and their proximity to major roads. The study found that about two percent of all the public schools in California, incorporating about 150,000 students, are within 500 feet (150 m) of a very busy roadway. The study also provided recommendations on ways to mitigate exposure of students to traffic-related pollutants in the event that a school is located near busy roadways.

The results provide guidance to parents and schools on exposure to mobile source pollution, methods to reduce exposure, and a list of resources. Table 3-7 summarizes these recommended actions to reduce exposure at schools.

Table 3-7. Summary of Recommendations to Reduce Exposure at Schools from OEHAA Study on Schools Near Busy Roads

Issue of Concern	Relation to Air Quality	Proposed Solutions
Exposure of Children to Air Toxics in Motor Vehicle Exhaust	Exhaust from cars, trucks, and buses contains a variety of criteria and toxic air pollutants related to both cancer and non-cancer health effects. Schools located near busy roadways may expose children to higher levels of these pollutants.	Ensure that California idling reduction plans are implemented near schools.
		Avoid locating air intake systems at schools near locations where idling occurs, such as loading docks.
		Develop plans to minimize idling by cars near the school, particularly at drop-off and pick-up times.
		Retrofit or replace old diesel school buses with cleaner, lower emitting technologies such as diesel particulate filters.
		Maintain healthy indoor air quality by having a properly functioning, routinely maintained HVAC system.
		Purchase HVAC filters with higher efficiency ratings (60-90%).
		Close windows and doors during peak traffic periods.
		Fix building leaks.
		Limit truck traffic near schools during operating hours.

Source: The study abstract, as well as fact sheets for parents and schools are available at http://www.oehha.ca.gov/public_info/public/kids/airkidshome.html. Both were last updated on October 7, 2004. The full article from the study, published in January 2004, is available at http://ehp.niehs.nih.gov/members/2003/6566/6566.pdf.

CARB's Air Quality and Land Use Handbook

CARB produced the Air Quality and Land Use Handbook to help address important air quality concerns to be considered when siting new sensitive land uses, such as residences, schools, day care centers, playgrounds, and medical facilities. Sensitive land uses require special attention because children, pregnant women, the elderly, and those with existing health problems are especially vulnerable to the effects of air pollution. A primary focus is the association between health effects and proximity to pollution sources, especially sources of diesel particulate matter.

The document provides CARB's recommended best practices for siting new sensitive land uses near sources of air pollution. This includes various sources of pollution and recommended threshold distances for each. An additional intention is to highlight potential health impacts associated with proximity to major sources of air pollution (data shows that localized exposures may be reduced as much as 80% from increasing separation distances to at least those recommended in the document). Mobile sources, chrome plating operations, refineries, fueling facilities, and odor and dust sources are considered explicitly. For many sources, recommended minimum distances are determined for proximity to sensitive land uses, based on generalized increased health from the source. Each of the eight major source categories considered in the document, along with CARB's recommendations, are summarized in Table 3-8.

Table 3-8. Major Sources of Air Pollutant Emissions and Recommendations from CARB's *Air Quality and Land Use Handbook*

Issues of Concern	Relation to Air Quality	Proposed Solution
Freeways and High-Traffic Roadways	Roadways are significant sources of diesel PM and other mobile-source air toxics.	Avoid siting new sensitive land uses within 500 feet of freeways, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day.
Distribution Centers	Traffic into and out of distribution centers, and use of transport refrigeration units (TRUs) are significant emitters of diesel PM and other air toxics.	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.
Rail Yards	Train and associated traffic can be large emitters of diesel PM and other air toxics.	Avoid siting new sensitive land uses within 1,000 feet of a major service and maintenance rail yard.
		Within one mile of a rail yard, consider possible siting limitations and mitigation approaches.
Ports	Activity at ports from ships, cargo handling equipment, trucks, and locomotives can cause large emissions of diesel PM and other air toxics.	Avoid the siting of new sensitive land uses immediately downwind of ports in the most heavily impacted zones. Consult local air districts or the CARB on the status of pending analyses of health risks.
Refineries	Petroleum refineries are large emitters of VOCs, NO_x, PM_{10}, $PM_{2.5}$, and a variety of air toxics.	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.
Chrome Platers	Metal plating operations can be significant emitters of highly toxic hexavalent chromium as well as other heavy metals.	Avoid siting new sensitive land uses within 1,000 feet of a chrome plater.
Dry Cleaners Using Perc	Perc is a toxic air pollutant that is related to both cancer and non-cancer health effects and is directly emitted by dry cleaning operations.	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 three or more machines, consult with the local air district.
		Do not site new sensitive land uses in the same building with Perc dry cleaning operations.
Gasoline Dispensing Facilities	Gasoline facilities may be significant emitters of benzene, a toxic air contaminant.	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.

In addition to the eight source categories listed in Table 3-8, the Handbook lists five other industrial source categories that should be considered when siting sensitive land uses. Specific recommendations are not provided for these general categories, as the level of risk is too variable to estimate a standard distance threshold. The factors affecting risk include species emitted and strength of emissions, which may be obtained from local air districts. Adequate distances may then be determined from site-specific analysis. Table 3-9 summarizes these source categories.

Table 3-9. Other Industrial Sources of Air Pollution

Sources of Concern		Relation to Air Quality	Proposed Solution
Commercial	Autobody Shops, Furniture Repair, Film Processing, Distribution Centers, Printing Shops, Diesel Engines	May be significant emitters of metals, solvents, methylene chloride, PCE, and/or diesel PM	Site specific: Obtain guidance from local air quality districts
Industrial	Construction, Manufacturers, Metal Platers, Welders, Metal (Thermal) Spray Operations, Chemical Producers, Furniture Manufacturers, Shipbuilding and Repair, Rock Quarries, Cement Manufacturers, Hazardous Waste Incinerators, Power Plants, Research and Development Facilities	PM, asbestos, solvents, hexavalent chromium, nickel, and/or other metals	
Public	Landfills, Waste Water Treatment Facilities, Waste Incinerators, Recycling Facilities, Garbage Transfer Stations	Benzene, vinyl chloride, diesel PM, hydrogen sulfide, dioxin, PAHs, PCBs, and/or 1,3-butadiene	
Transportation	Truck Stops	Diesel PM	
Agricultural Operations	Farming, Dairy, and Livestock Operations	Diesel PM, VOCs, NO_x, PM_{10}, ammonia, CO, SO_x, and/or pesticides	

Source: CARB's Air Quality and Land Use Handbook: A Community Perspective (March 2005)

The document is available at http://www.arb.ca.gov/ch/landuse.htm in its proposed, final format. The most recent update of the document is dated March 2005. Several aspects of this document are undergoing change as more studies are performed. Updates to the information presented in the document will be posted on the above website when available.

SCAQMD's Guidance Document for Addressing Air Quality Issues in General Plans and Local Planning

The SCAQMD prepared this guidance document primarily to help local governments better understand and incorporate air quality issues in their general and local plans. SCAQMD expects that, while an air quality element is not legally required by law, local governments in SCAQMD's jurisdiction will strive to address environmental justice issues and better incorporate air quality concerns into their local plans. This document intends to provide local governments the information they need to help develop or update an air quality element into their general plan and planning policies.

The fairly comprehensive document includes a discussion of basic air quality considerations, including pollutants of concern, environmental justice, the role of government agencies in maintaining air quality for its citizens, the basics of air quality elements, the interplay between land use planning and air quality, mobile and stationary sources of air pollution, fugitive dust, energy conservation, and methods for enhancing community involvement in reducing air pollution. Of particular importance for school siting is the discussion of land use. These recommendations are included in Table 3-10.

Table 3-10. Summary of Recommendations to Reduce Exposure at Schools, from these Documents

Issues of Concern to School Siting	Relation to Air Quality	Proposed Solution
Freeways and High-Traffic Roadways, Distribution Centers, Rail Yards, Ports, Refineries, Metal Plating Facilities, PCE Dry Cleaners, Large Gasoline Stations	Significant emitters of both criteria pollutants and toxic air contaminants.	Follow CARBs recommended minimum threshold distances, as described in the *Air Quality and Land Use Handbook: A Community Perspective* (March 2005).
Sources of Idling Emissions	Can be large emitters of diesel PM and other air toxics.	Idling of primary diesel engines near schools for more than five minutes is prohibited by California law. Use of other diesel engines is limited within 100 feet of homes and schools. Anti-idling initiatives should be enforced by local jurisdictions for schools and other areas.
Other Stationary Sources of Toxic Air Contaminants (TACs)	Emissions of TACs.	Consult SCAQMD for current inventories of emissions from sources surrounding a proposed sensitive site, as well as other publicly available information including health risks (compiled by law under SCAQMD Rule 301 and AB2588).
Energy and Efficiency	Regional emissions and operational cost.	All new projects must meet minimum energy efficiency standards (under Title 24, part 6 of the CA Code of Regulations). Voluntary measures to go beyond these are encouraged.

Source: This document is available at http://www.aqmd.gov/prdas/aqguide/doc/aq_guidance.pdf
The most recent update is dated May 6, 2005.

SCAQMD's Health Risk Assessment Guidance for Analyzing Cancer Risks from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis

CARB has identified particulate matter in exhaust from diesel engines (diesel PM) as a toxic air contaminant and, as discussed above, recognized it as the primary contributor to elevated cancer risk in the SCAB. This document was prepared by SCAQMD to provide technical guidance in estimating potential diesel PM impacts and recommended procedures for performing diesel PM risk analysis from diesel truck idling and movement, ship hotelling, and train idling. It provides specific guidance on project description, project emissions, dispersion modeling, estimation of health risks, and potential mitigation measures for diesel PM that are needed for preparing CEQA documents.

Although intended to meet CEQA requirements for emitting sources, the document also provides information useful for the new school siting process. This includes detailed information about the types of data available for specific sources under the permitting process (such as location, emissions rates, and types of pollutants), activity profiles for diesel idling emissions, port emissions, estimated health risks for nearby communities, and potential mitigation measures. Specific mitigation measures included in the document that could be relevant for school site selection are given in Table 3-11. Other recommendations mentioned are beyond the control of school siting personnel.

Table 3-11. Summary of Recommendations to Reduce Exposure from Idling

Issues of Concern	Proposed Solution
Diesel Truck/Bus Idling	Establish minimum buffer of 300 meters (980 feet) between truck traffic and sensitive receptor locations
	Reroute truck traffic around sensitive locations
	Improve traffic flow by adding signal synchronization near sensitive receptors
	Increase mass transit and carpooling options
	Restrict idling times or require alternate idling technologies be used
	Conduct air quality monitoring at sensitive receptor locations

Source: This document is available at the SCAQMD's CEQA Air Quality Analysis Guidance Handbook website at http://www.aqmd.gov/ceqa/oldhdbk.html. The most recent update was August, 2003.

CARB's Air Toxic Control Measures for School Bus Idling

As of July 2003, CARB has implemented an air toxic control measure (ATCM) to limit the amount of time that heavy-duty diesel vehicles, including school and transit buses, school pupil activity buses, youth buses, general public paratransit vehicles, and other commercial motor vehicles may operate with engines idling. The ATCM to limit idling is intended to reduce emissions of diesel PM and other toxic air pollutants from heavy-duty motor vehicle exhaust at schools or other locations where children are found.

Specifically, the ATCM dictates that idling should not occur near schools or students to minimize exposure, as shown in Table 3-12.

Table 3-12. Summary of California's Diesel Idling Rule

Issues of Concern	Required Action Under the Law*
Diesel School Bus and Other Applicable Vehicle Idling	Vehicles must turn off their engines upon stopping at or within 100 feet of a school and must not restart the vehicle more than 30 seconds before leaving the school.
	Vehicles may not idle at any location greater than 100 feet from a school for more than five consecutive minutes or more than five minutes in any one hour.

* Except under specific conditions, such as during testing or in traffic.

Source: More information on the rule is available from the California ARB's website at: http://www.arb.ca.gov/toxics/sbidling/sbidling.htm.

California Department of Pesticide Regulation's (DPR) Fumigant Buffer Zone Regulations

Methyl bromide (MeBr) is one of the most common agricultural fumigants used in California. This toxic compound may pose significant health hazards to workers and nearby communities. Consideration of MeBr use may be relevant to site selection at some locations. Further, mitigation measures for MeBr may be generalized to other similar pesticides. Some key findings from relevant studies are detailed below.

California Department of Pesticide Regulation (DPR's) document "Evaluating the Effectiveness of Methyl Bromide Soil Buffer Zones in Maintaining Acute Exposures Below a Reference Air Concentration" (2001) [20] describes a study conducted to evaluate the effectiveness of the MeBr buffer zones established by DPR in 2001. A buffer zone is an area surrounding an application block where activities are limited to those that are approved by the County Agricultural Commissioner, typically transit and performance of fumigation activities only. The study used the ISCST3 dispersion model to simulate emissions of MeBr over a period of time following fumigation of the field for several scenarios involving real meteorology, a range of field sizes for application, and a given emissions rate for the chemical. The ambient concentrations output from the model was used to derive effective buffer zones, beyond which concentrations are expected to be below harmful levels (understood to be DPR's reference concentration for MeBr of 210 ppb). The study concluded that the buffer zone approach was generally effective in protecting the public from exposure to MeBr.

The size of the buffer zone depends on the application method, the magnitude of the application, and the fumigant. Current California regulations for the MeBr buffer zone range from a minimum of 30 feet to 2,400 feet (inner zone) and 60 feet to 4,600 feet (outer zone) from the area of fumigation and last for a minimum of 36 hours from time of application. The outer buffer zone may not contain occupied residences and must not extend into properties that contain schools, convalescent homes, homes, hospitals, or other similar sites identified by the Commissioner.

Regulations require that the following types of properties located within 300 feet of the outer buffer zone receive notification information:

1. Schools
2. Residences

[20] Available at http://www.cdpr.ca.gov/docs/dprdocs/methbrom/rafnl/attach_h6.pdf

3. Hospitals
4. Convalescent homes
5. On-site employee housing
6. Similar sites identified by the commissioner.

DPR regulations also provide additional protection for schools, and specify that fumigation injection must be completed at least 36 hours prior to the start of a school session, when the outer buffer zone is within 300 feet of a school property. In most cases, this limits fumigations to Saturdays. Use of school facilities for recreation or other activities on weekends is not considered a school session. However, commissioners have the option of providing additional protections for these activities. [21]

California Legislative Documents

1. SB352

Senate Bill 352 (Chapter 668, Statutes of 2003) became effective in January, 2004, making significant changes to existing rules on school site selection where new property is acquired. In particular, it expanded requirements for identifying and reviewing the impacts of facilities emitting hazardous air pollution or handling hazardous material or wastes within a ¼ mile (400 meter) radius of a new school site and created new requirements for sites within 500 feet (150 meters) of busy roadways.

If a proposed site boundary is within 500 feet of a busy roadway, the district must determine if air quality at the site poses a significant health risk to pupils. Another important element of the SB352 is the redefinition of "facilities within 1/4 mile" to mean "both permitted and non-permitted facilities, including but not limited to freeways, busy traffic corridors, large agricultural operations, and rail yards." This essentially requires not only contact with administering agencies, such as the air quality district, to obtain emissions data for permitted sources, but a survey of the area to identify any non-permitted sources within ¼ mile of the proposed site for risk analysis. Some important elements of the bill for school site selection are summarized in Table 3-13.

Table 3-13. Summary of Primary Changes to School Site Selection under SB352

Issues of Concern	Required Action Under the Law
Exposure of Students to Toxic and Criteria Air Pollutants	All potential sources (permitted and non-permitted) within 1/4 mile (400 m) of site must be surveyed and included in the risk assessment.
	Any school site within 500 feet (150 m) of a busy roadway must be assessed to show that neither short- nor long-term exposure poses a significant health risk.
	Non-permitted sources of air contaminants, such as large agricultural operations, roadways, and rail yards must be considered.

Source: More information is available from the California Department of Education at http://www.cde.ca.gov/ls/fa/sf/sb352.asp. The official bill is available at the California Senate website at http://info.sen.ca.gov/pub/03-04/bill/sen/sb_0351-0400/sb_352_bill_20031003_chaptered.html.

[21] Information based on *Guidance Manual Methyl Bromide (in Combination with Chloropicrin)Field Soil Fumigation*, CAL/EPA Department of Pesticide Regulation, December 8, 2004 at http://www.cdpr.ca.gov/docs/county/training/methbrom/mebrman.pdf

2. PRC Sections 21151.2, 21151.4, and 21151.8

The California Public Resources Code (PRC) includes several rules related to air quality and emissions that affect the new school site selection process for projects that receive state funding. In particular, PRC Section 21151 entails subsections dealing with the preparation of impact reports by local agencies at various stages of the site acquisition process. These are summarized in Table 3-14 below.

Table 3-14. Summary of CEQA Sections Applied to Site Selection

PRC Subsection	Summary
§ 21151.2	A school board cannot acquire the title to a new site or addition to an existing site until it has notified the local planning commission and received their recommendation, which must occur within 30 days. If the planning commission does not recommend the site, the school district must wait an additional 30 days before it can acquire the site.
§ 21151.4	No new or modified projects that produce enough hazardous air emissions or handle enough hazardous or acutely hazardous material to pose a threat to students or employees may be approved within 1/4 mile (400 m) of any school unless the school has been consulted and given written notification at least 30 days in advance.
§ 21151.8	No new public primary or secondary school site purchase or construction can be approved unless four criteria are satisfied:
	1) The site report (EIR or negative declaration) contains enough information to determine that no previous hazardous uses occurred or have been remediated.
	2) Administering and local air quality agencies have been consulted to determine if any possible emitters or handlers of hazardous materials exist within 1/4 mile (400 m) of the proposed site.
	3) If such facilities exist, either they do not pose a potential adverse public health impact or any impact will be mitigated before the school is occupied.
	4) All administering agencies provide the necessary information and written notification to the lead agency within 30 days.

Source: More information and the specific text of the rule is available at http://ceres.ca.gov/ceqa/stat/chap4.html.

This page deliberately left blank.

4. Summary of Recommendations

There is a strong connection between health risk and the proximity of the source of air pollution. Previous sections of this document have detailed recommendations or regulations suggested or required in specific documents related to air quality. In this section we first synthesize recommended threshold distances from three primary classifications of sources of air emissions expected to be of concern during the site selection process. The brief summaries presented here represent key, relevant results only; more detail from each of the cited documents is provided in the previous section, along with links to the full documents. Each of these general recommendations presented here is tailored to sensitive receptors.

This section also includes a discussion of the possible feedback mechanism of school construction generating traffic and, hence, emissions in an area, and how it may be addressed in planning.

The section concludes with some examples of evaluating the distance criteria.

Distance Criteria for Mobile Sources

Siting of school and child care facilities should include consideration of proximity to roads with heavy traffic and other sources of air pollution. New schools should be located to avoid "hot spots" of localized pollution.[22] As demonstrated through the various subsections of PRC § 21151 and in SB352, both discussed above, California law is very clear about separating sources of hazardous emissions, particularly those from mobile sources, from sensitive receptors at school sites. Other recommendations for appropriate distances between schools and other sensitive receptors and various mobile source emissions from relevant documents include:

- PRC § 21151.8 requires assessment of hazardous pollutants within ¼ mile (400 m) of any public school.
- SB352 requires specific responses assessing health risk for schools within 500 feet (150 m) of busy roadways.
- CARB's ATCM regarding diesel school bus idling limits idling emissions in a school or within 100 feet (30 m) of a school boundary.
- SCAQMD's HRA CEQA guidance for diesel idling recommends a 1,000 ft (300 m) buffer between sensitive receptor locations and sources of truck traffic emissions as a mitigation measure.
- CARB's Air Quality and Land Use Handbook recommends 500 feet (150 m) between busy roadways and sensitive receptor locations, 1,000 feet (300 m) from busy distribution centers and rail yards, and generally avoid siting immediately downwind of busy ports.
- The OEHHA study on schools and busy roads used a threshold of 500 feet (150 m) to define close proximity to roadways.
- Based on safety considerations, the CDE site selection guide recommends distances of two nautical miles between schools and airport runways, and as much as 2,500 feet (760 m) from railways and major roadways.

[22] American Academy of Pediatrics, Committee on Environmental Health, Policy Statement, Ambient Air Pollution: Health Hazards to Children, PEDIATRICS Vol. 114 No. 6 December 2004, pp. 1699-1707 (doi:10.1542/peds.2004-2166), http://aappolicy.aappublications.org/cgi/content/full/pediatrics;114/6/1699

Based on the recommendations from the above documents, a general buffer zone of no less than 500 feet (150 m), and possibly as much as 1,000 feet (300 m), between major roadways and school sites should be considered to protect the health of students and employees and meet state guidelines on location of mobile source emissions. New school sites should not be located closer than 1,000 feet (300 m) from other major mobile sources, and possibly further, depending on the source.

Distance Criteria for Stationary Sources

Major and minor stationary sources of air emissions within the immediate vicinity of proposed school sites are also likely to be issues of concern for site selection personnel, particularly in urban areas. As discussed above, California law (e.g., PRC § 21151 and SB352) has direct regulations regarding separation of stationary sources of hazardous emissions and sensitive receptor locations (e.g., schools). Specific recommendations for appropriate minimum distances between sensitive receptors and various stationary sources of criteria and toxic air emissions from relevant documents include:

- Based on safety considerations, the CDE School Site Selection Guide recommends not siting on or near a variety of known or potential stationary sources of hazardous material emissions, such as landfills, dump areas, chemical plants, oil fields, refineries, natural sources of asbestos, unless the site has been sufficiently cleaned and documented. Also, the document recommends against siting within ¼ mile (400 m) of any stationary source of toxic air contaminants and disallows siting on any location containing pipelines transferring hazardous materials.
- DTSC documents indicate that naturally occurring or constructed sites containing asbestos or lead, and sites where the soil may be contaminated from past pesticide, oil development, or other toxic use must be adequately documented and remediated before construction, and are best avoided if possible.
- CARB's "Air Quality and Land Use Handbook" recommends consulting with local air quality districts to determine an adequate separation distance from refineries, a minimum separation of 1,000 feet (300 m) between metal plating operations and sensitive receptor locations, and 300 feet (90 m) between sensitive receptors and dry cleaners using PCE (Perc) or large gasoline dispensing operations. A minimum distance of 50 feet (15 m) is recommended between sensitive receptor locations and small gasoline facilities. Separation distances for other significant stationary sources, including commercial, industrial, public, and transportation facilities emitting toxic air contaminants should be determined by consulting with local air quality control districts.
- SCAQMD's guidance for stationary sources is consistent with CARB's for consulting the air quality district, as given above, but indicates the availability of some emissions inventories within the Air Basin under AB2588 and annual emissions reporting under Rule 301.
- SB352 dictates that *all* potential stationary sources within ¼ mile (400 m) must be surveyed and assessed for health risks from toxic air emissions.
- PRC § 21151.8 essentially requires assessment of hazardous pollutants within ¼ mile (400 m) of any public school.

Based on the recommendations in these documents, new school sites separated from all stationary sources of toxic and hazardous emissions, including natural sources (e.g., asbestos), by ¼ mile (400 m) should be adequately conservative to protect the health of students and employees. Depending on the pollutants and the amount emitted, the threshold distance may be significantly less (e.g., in the case of natural asbestos properly mitigated) or more (e.g., for large sources like active port complexes). In these cases, the local air quality agency should be consulted to obtain relevant data on emissions and associated health risks.

Distance Criteria for Agricultural Sources

In some areas, current and former agricultural lands may be investigated for potential new school locations. Several of the documents listed above discuss possible sources of contaminants and emissions from previous agricultural uses on the site or current uses near proposed sites. Specific recommendations from relevant documents include:

- Based on safety considerations, the CDE's "School Site Selection Guide" recommends not siting within sufficient proximity to abandoned farms or dairies or agricultural areas where pesticides have been heavily used such that emissions of air toxics may pose a substantial health risk to students or employees, unless the site has been sufficiently cleaned and documented.
- The DTSC's Phase I Environmental Site Assessment Advisory for school properties specifically warns against selecting sites where residual pesticide contamination in soils, particularly arsenical herbicides, organo-chlorine pesticides, and/or other sources of PAHs, dioxins, and sources of PCBs are present.
- The DTSC's "Interim Guidance for Sampling Agricultural Fields for School Sites" provides specific techniques for evaluating certain agricultural areas for pesticides such as DDT and derivatives that must be documented in the EAS.
- CARB's "Air Quality and Land Use Handbook" recommends consulting with local air quality districts to determine an adequate separation distance from agricultural operations, such as farming, dairy, and livestock operations that may be sources of diesel PM and other air toxics and criteria pollutants.
- Proximity to emissions from current agricultural operations will also be regulated by SB352 and PRC § 21151 to beyond ¼ mile for certain levels of emissions.
- California DPR regulations specify the size and duration of buffer zones around agricultural application of fumigants, depending on the application method, the magnitude of the application, and the fumigant; and require notice to schools within 300 feet of a buffer zone. DPR regulations also specify that fumigation injection must be completed at least 36 hours prior to the start of a school session, when the outer buffer zone is within 300 feet of a school property, but use of school facilities for recreation or other activities on weekends is not considered a school session.

Based on the recommendations in the specific documents discussed in Section 3 and summarized above, new school siting should generally be separated from sources of harmful emissions from agricultural operations by ¼ mile (1,320 feet, 400 m) and cannot occur on sites where the soil is contaminated from previous pesticide or other toxic chemical usage. This distance should generally be adequately conservative to protect the health of students and employees from agricultural emissions including fumigants. The SCAQMD should be consulted, however, to obtain relevant data on emissions and associated health risks.

Other considerations may be required to ensure safety from nearby pesticide use. The County Agricultural Commissioner can provide information on past pesticide application methods and rates for nearby agricultural operations to determine the likely size of any fumigant buffer zones.

Consideration of Traffic Generation and Other Emission Sources by the Proposed Site

In October, 2003 the U.S. EPA's Office of Policy, Economics, and Innovation (OPEI) published a study on the environmental and health effects of school site characteristics, "Travel and Environmental Implications of School Siting."[23] It found that as the number of students is increasing dramatically nationwide and thousands of new schools are planned, the fraction of students who arrive at schools by car is also increasing dramatically. This has raised health and safety concerns associated with increased automobile traffic and associated emissions in communities, particularly at school sites. School locations can significantly affect air emissions and quality in their communities, as well as affecting community character and neighborhood vitality.

In 1969, 48% of students walked or rode bicycles to school, compared to less than 15% of students aged 5 to 15 walking and about 1% biking in 2001. Further, of those students living within one mile of school, about 31% walked or biked to school in 2001, versus about 90% in 1969. Increased use of automobiles in school trips may be related to increased rates of childhood obesity, diabetes, and respiratory problems, including asthma. It may also be related to increased traffic congestion and degraded air quality community-wide.

This study finds that there are two primary factors related to the use of automobiles to arrive at schools versus non-polluting methods like walking or riding bicycles: proximity of schools to students and the quality of the built environment along the route to schools. The built environment involves increased sidewalks on all arterials and collectors feeding the school, as well as the character, such as amount of trees and degree of mixed-use, along the route. Proximity involves greater neighborhood access to school sites. [24]

Specifically, the study concludes that schools constructed closer to their students and in walkable neighborhoods can reduce traffic and may result in a 13% increase in walking and biking as well as a reduction of at least 15% in traffic-related emissions. School siting projects that improve the walking environment to school and successfully incorporate the school into the community will result in decreased traffic and related health concerns.

Examples

Figure 4-1 shows a sample CHAPIS (Community Health Air Pollution Information System) map of Long Beach, CA. In this figure, schools are shown as blue boxes with flags. Metal plating operations are shown as silver crosses (e.g., near the intersection of E. Anaheim St. and Santa Fe Ave.). Other emitting facilities in the database are indicated by black triangles. Two schools near the center of the map are depicted with surrounding perimeters of ¼ mile (400 m) and 1,000 feet (300 m), respectively.

---

[23] U.S. EPA, EPA231-R-03-004, available at http://www.epa.gov/smartgrowth/pdf/school_travel.pdf.

[24] The importance of proximity on travel mode choice has been confirmed by other studies, as has the built environment. However, which elements of the built environment are most important for travel mode choice are under study. See, e.g., "School Location and Student Travel: Analysis of Factors Affecting Mode Choice", Ewing, Schroeer, and Greene, Transportation Research Record: Journal of the Transportation Research Board, 2004; and "Neighborhood Schools and Sidewalk Connections: What Are the Impacts on Travel Mode Choice and Vehicle Emissions?" Ewing, Forinash, and Schroeer, Transportation Research News, Mar/Apr 2005.

Figure 4-1. Sample CHAPIS Map for School Site Selection

Based on the discussions of mobile sources and stationary sources above, best practice indicates that school sites should be selected with a buffer of no less than 500 feet and probably as much as 1,000 feet from major roadways and about ¼ mile from stationary sources. It is also emphasized that no school should be placed within 1,000 feet of a metal plating operation, and generally they should avoid being placed downwind of major ports. It is clear from the figure that these two sites meet the distance criteria from metal plating and other stationary sources. The upper school meets all distance criteria from major roadways, while the lower school meets the minimum 500 feet criteria from the 710 Freeway, it does not meet the 1,000 feet criteria. However, both of these schools, and several others, have relatively close proximity to the Ports of Los Angeles and Long Beach.

These two schools serve only as examples. Selecting sites for new schools should consider distances from existing major and minor stationary sources, mobile sources, and any agricultural sources, as discussed in Section 2 to help assess if the location is appropriate for a new school site.

This page deliberately left blank.

5. Mitigation Measures

This section presents a discussion of mitigating measures that can be undertaken to minimize exposure of sensitive receptors at school sites to sources of air pollution and a discussion of actions that should be taken during the site selection process.

As part of the OEHHA Study on Schools Near Busy Roads (see Section 3), the Cal/EPA prepared a fact sheet intended for use by schools that details information about exposure of students to traffic-related air pollutants and potential mitigation measures. The following list, which was based on the findings of this study, details mitigation measures that can be taken at schools to reduce exposure of students to air pollution from nearby traffic sources. The lists are separated into three sections, designating design and maintenance, operational, and potential technological measures that may be implemented to reduce exposure.

Operational

- Ensure that vehicle operators follow the new, state-wide idling rule. This includes requiring drivers of buses and other commercial heavy-duty vehicles to minimize idling near public and private schools.
- Limit idling by trucks, buses, and cars at loading docks and parking areas.
- Develop and maintain a policy that minimizes idling of cars at the school, especially during drop-off and pick-up times when many children are congregated nearby.
- Maintain good indoor air quality by being aware of sources inside the classroom that may also contribute to respiratory symptoms. For example, the use of chemicals can affect indoor air quality, and the painting of walls and the installation of new carpeting are potential sources of odors and VOC. (The U.S. EPA has a simple, free kit, "Indoor Air Quality Tools for Schools," to help school officials prevent and resolve indoor air quality problems.)
- Close windows and doors during peak traffic hours.
- Conduct outdoor school activities as far from high traffic roadways as possible, especially during peak traffic hours.
- Maintain heating, ventilation, and air conditioning (HVAC) system operation during peak episodes of outdoor air pollution. Turning off the HVAC system will increase levels of indoor air pollutants.

Design and Maintenance

- Design schools such that air-intake vents are not located near outdoor pollution sources, such as loading docks, parking areas, and waste sites.
- A properly maintained, working HVAC system can decrease exposure to outdoor pollution indoors. The HVAC system should receive routine maintenance, especially changing filters. The best performance is usually achieved when windows and outside doors remain closed.
- Upgrade current HVAC filters to ones with a higher efficiency rating (e.g., 60-90% efficiency compared to the 10-30% standard filter). Gymnasiums or indoor areas where children exercise and play should be the first priority for placement of good efficiency air filtration systems.
- Fix building leaks that allow outdoor air to flow indoors.
- Work with officials to limit truck traffic near schools during school hours if the nearby roads are under local jurisdiction.

- Installing sound walls and tree plantings near a busy road may help decrease noise pollution. They may also be effective in lowering traffic emissions, although this has not been proven.

Technological

- Purchase clean, low-emitting buses to replacing old diesel school buses.
- Where possible, operate buses on low-sulfur fuels to reduce emissions.
- Equip existing buses with exhaust particle filters.
  (U.S. EPA and CARB have programs to help with purchasing cleaner buses and cleaning-up existing buses.)

In addition to the OEHHA document discussed above, the U.S. EPA has also prepared a comprehensive guide on preparing and constructing schools that control indoor air quality. This includes discussion of building materials, HVAC, sources of indoor pollution, and outdoor pollution that can affect indoor air quality, portions of which are relevant to school site selection. This document is available at http://www.epa.gov/iaq/schooldesign.

Odors are commonly associated with biological decomposition of organic materials, such as animal and human waste. These may be of concern to school sites near agricultural areas. There are several methods of mitigation for odor emissions, such as containment, increased dilution, modification of operations, and chemical treatment, which may be applied, depending on the source. Generally, distance from the source is an effective mitigation strategy.

6. Other Sources of Data for School Site Selection

We conclude this document with a listing of what air quality-related data is publicly available and where agencies may obtain data helpful for the school site selection process. This includes several other documents not discussed in detail in Section 3. In addition, we present an appendix following this document that includes a checklist of items that should be considered when siting a new school as well as a general outline of the site selection and approval process.

Health Risk Assessments

During site selection and acquisition, there may be times when a Health Risk Assessment is required. Under the California Health and Safety Code § 901(f) OEHHA prepared guidance on how to assess exposure to hazardous chemicals and associated health risks of populations at existing and proposed school sites. The full methodology, including a conceptual site model, exposure media and pathways, and guidance on risk assessment and sensitivity and uncertainty analysis are included in the guidance document. This is available at: http://www.oehha.ca.gov/public_info/public/kids/pdf/SchoolscreenFinal.pdf.

Publicly Available Emissions Data

To perform an HRA, or possibly for other siting purposes, specific information on the emissions from sources near the proposed site will need to be collected. Under AB2588, and Rule 301 in the SCAB many facilities are required to report their emissions and are assessed fees based on their level of emissions. Emissions inventories of all facilities in the SCAB subject to Rule 301 from fiscal year 2000-2001 and beyond are publicly available. These data may be accessed from http://www.aqmd.gov/aer/DataInquiry.html.

State-wide emissions in California are collected by CARB and are generally available to the public at: http://www.arb.ca.gov/ei/emissiondata.htm. Here emissions are inventoried state-wide by source category and by region. Relevant here for site selection is the ability to estimate emissions by neighborhood using the CARB's CHAPIS software. However, it should be noted that the information presented in and derived from CHAPIS is not necessarily the most recent data available for specific facilities, and CHAPIS does not necessarily contain all sources or air pollutants in a given neighborhood. It can serve as an effective screening tool for school site selection, although CARB or local air quality districts should be contacted to verify results and possibly provide more complete information. The most recent version of CHAPIS is available at http://www.arb.ca.gov/gismo/chapis_v01_6_1_04/.

CARB's Hot spots Analysis and Reporting Program (HARP), a tool developed under the Air Toxics "Hot Spots" Program, is a software package that combines an emission inventory database, facility prioritization calculations, air dispersion modeling tools, and risk assessment analyses into a single database. HARP is intended to allow engineers, air quality managers, and other parties to evaluate emissions data and potential health impacts. HARP is intended to promote consistency and efficiency in developing facility health risk assessments. More information, data, and software downloads are available at the CARB's HARP website at http://www.arb.ca.gov/toxics/harp/harp.htm.

While not all sources of emissions may be publicly available, seven categories of facilities are grouped together under AB2588, based on the ubiquity of these typically small businesses and the economic hardships assessed fees would cause to them individually. These categories are:

- retail gasoline dispensing facilities,
- perchloroethylene dry cleaning,
- auto body shops,
- reinforced plastic composite manufacturing,
- printing,
- metal plating, and
- wood stripping and refinishing operations.

The California Air Pollution Control Officers Association's (CAPCOA) Toxics Committee is currently preparing guidelines for local air districts to use to estimate emissions inventories from these facilities. Although the individual emissions may not be currently available, the guidelines are available at http://www.arb.ca.gov/ab2588/riskassess.htm#list.

Publicly Available Health Risk Assessments

Under AB2588, facilities are required to report criteria and toxic emissions. The results of these reports are then compiled and ranked, such that the largest emitting facilities are identified. Only the largest emitters—that is, any facility receiving a score of greater than a certain threshold—are required to perform an HRA. All facilities required to perform an HRA, and the cancer and non-cancer (acute and chronic) risks from each, are listed in the AB2588 "Hot Spots" Program annual reports, which are publicly available. The 2005 report is located at http://www.aqmd.gov/prdas/AB2588/pdf/Annual_Report_2005.pdf.

Other Relevant Websites for School Siting Information

The U.S. EPA has prepared a list of relevant websites addressing school site selection and evaluation criteria. Among the important information presented there is a list of links helpful for school siting personnel available on the Internet. These cover the subjects of contaminated environments, good practices for site assessments, recognizing potential hazards in site selection, and other relevant items for school site selection. Some of the documents included in the review have been discussed in this document and are not repeated here. Others deal with siting outside of the state of California. The remaining list is presented in Table 6-1, below.

Table 6-1. List of Other School Siting Related Information Available on the Internet

Document	Description	Link
ENVIROFACTS. EPA.	EPA's single point of access to a wide range of databases that provide mapping capabilities for specific locations throughout the country.	http://www.epa.gov/enviro/html/qmr.html
ASTM Standard Practice E-1527-00 Phase I Environmental Site Assessment.	American Society for Testing and Materials. Brief summary and link to ordering this guide, which defines good customary practice for conducting an environmental site assessment of commercial real estate with respect to petroleum products and contaminants within the scope of the Comprehensive Environmental Response, Compensation and Liability Act.	http://www.astm.org
ASTM Standard Practice E-1903-97 (2002) Phase II Environmental Site Assessment.	American Society for Testing and Materials. Brief summary and link to ordering this guide, which defines good customary practice for conducting a Phase II environmental site assessment of commercial real estate with respect to petroleum products and contaminants within the scope of the Comprehensive Environmental Response, Compensation and Liability Act.	http://www.astm.org
Site Selection Resource List. National Clearinghouse for Educational Facilities.	NCEF's resource list of links, books, and journal articles on school siting, including examples of state selection criteria and resources on environmental issues and site organization.	http://www.edfacilities.org/rl/site_selection.cfm
Brownfields Cleanup and Redevelopment. EPA.	Portal for topics on Brownfields, including pilot projects, grants, liability, cleanup, partnerships, outreach, resources, news, events, laws, and regulations.	http://www.epa.gov/swerosps/bf
Creating Safe Learning Zones: Invisible Threats, Visible Actions. Center for Health, Environment, and Justice.	This report addresses the need for protective laws around building new schools; it includes guidance for acquiring property and for evaluating existing sites, model school siting legislation, references, community stories, and actions for parents and community leaders.	http://www.childproofing.org/cslzindex.html
Evaluating and Cleaning Up School Sites. California Department of Toxic Substance Control.	Website provides information about the Schools Property Evaluation and Cleanup Division, including school sites, fact sheets, general information, environmental advisories, guidance, regulatory background, and the registered environmental assessor program.	http://www.dtsc.ca.gov/Schools/index.cfm
Guide to School Site Analysis and Development 2000 Edition. California Department of Education.	This document assists school districts in determining the amount of land needed to support their educational programs in accordance with their stated goals and with recommendations of the California Department of Education. (This is the parent document of the CDE's School Site Selection and Approval Guide discussed in Section 3.)	http://www.cde.ca.gov/ls/fa/sf/sitereview.asp
Sensitive Environments and the Siting of Hazardous Waste Management Facilities. EPA.	This publication discusses sensitive types of environments that pose special challenges to the siting, expansion, and operation of RCRA hazardous waste management facilities.	http://www.epa.gov/epaoswer/hazwaste/tsds/site/sites.pdf

Source: EPA IAQ Design Tools for Schools. Available at http://www.epa.gov/iaq/schooldesign/recommended_actions_checklist.html

Other Generally Relevant Documents

When a school district is planning to acquire land for a school, it must consider many factors about each site. The School Facilities Planning Division (SFPD) developed three worksheets to assist districts in assessing potential sites, making preliminary selections, and comparing between sites. The worksheets outline a set of 12 primary criteria in three components of the site selection process: the site selection criteria helps to evaluate sites to determine strengths and weaknesses; the site selection evaluation allows a ranking of each site; and the comparative evaluation of candidate sites provides a comparison of sites by the rating factors and total scoring. These sheets, while not all inclusive, are intended to be useful in evaluating various sites, identifying at least three acceptable sites from which to make a final choice, and explaining the site selection process to interested parties. The three worksheets may be obtained from http://www.cde.ca.gov/ls/fa/sf/schoolsiteguide.asp#site.

The American School Board Journal has published an article by a specialist in facilities planning that covers specific details of and contains suggestions for the site selection process. Located at http://www.asbj.com/lbd/2001/inprint/Carey.html, it is a worthwhile read for site selection personnel.

California Legal Information

There may be instances where site selection personnel will need to consult the California Education Code (CEC) directly. Information on legislation relevant to school site selection, based on the CEC, is cited in Table 6-2, below. Further information on each of the relevant regulations listed here can be found at http://www.leginfo.ca.gov/calaw.html.

Table 6-2. Sections of the California Education Code relevant to School Site Selection

Code Section	Subject
17072.12	Assistance in site development and acquisition
17072.13	Evaluation of hazardous materials at a site
17210	Definitions in environmental assessment of school sites
17210.1	Application of state act; hazardous materials; risk assessments; compliance with other laws
17211	Public hearing for evaluation before acquisition in accordance with site selection standards
17212	Investigation of prospective school site; inclusion of geological engineering studies
17212.5	Geological and soils engineering studies
17213	Approval of site acquisition; hazardous air emissions; findings (See also Public Resources Code Section 21151.8.)
17213.1	Environmental assessment of proposed school site; preliminary endangerment assessment; costs; liability
17213.2	Hazardous materials present at school site; response action
17213.3	Education Department; monitoring performance of Toxic Substance Control Department; reports on amount of fees and charges
17215	Site near airport; requirements as amended by Assembly Bill 727
17217	Manner of acquisition; school site on property contiguous to district
17251	Power and duties concerning buildings and sites
35275	New school planning and design

Source: CDE, available at http://www.cde.ca.gov/ls/fa/sf/schoolsiteguide.asp#site

Checklists

Input from all the information collected and presented in the present document has been collected and synthesized into a single checklist of items related to air quality that school site selection personnel in California should be aware of during the process. This is intended to highlight the process that must be followed and known pitfalls to be avoided when selecting and approving a site for new school construction or expansion. It is not intended to substitute for all the relevant information on air quality and school site selection presented in this document and elsewhere. This checklist appears in Appendix A.

Another helpful checklist of items to consider for school site selection was prepared by the legal firm of Atkinson, Andelson, Loya, Ruud & Romo, who have worked with several California school districts. Their checklist is available at: http://www.pcassoc.com/PDF/checklist_school.pdf.

This page deliberately left blank.

Appendix A.
Air Quality and School Site Selection Checklist

In this appendix we developed a checklist of items, either directly or indirectly related to air quality, which should be considered during the site selection process. These items should be a part of the initial survey for appropriate sites from a list of potential sites. Initial selection of a potential school site is just one phase of a many phased acquisition process, and air quality is just one element of the many criteria that should be assessed for safety and suitability of the site. The general outline of the site selection process is given below. The air quality checklist, which follows the general outline, fits into steps I and II in the outline below.

General School Site Selection Process

I. Survey for Appropriate Site

Include all relevant safety and health considerations for all sites considered. Air quality issues are one element of this. A comprehensive list of air quality considerations for site selection is given in the subsequent checklist.

II. Make Preliminary Selection

Based on air quality and other site-specific criteria, evaluate all properties initially selected. Comparative evaluations from the air quality checklist included here and other evaluation criteria, such as safety (recommend the Site Selection Criteria, Parts 1, 2, and 3, worksheets considered in the California Department of Education's "Site Selection and Approval Guide" discussed in Section 3 of this document).

III. Initial Contact with CDE Field Staff

This is the first step in the site review process. A list of staff within the School Facilities Planning Division (SFPD) who address school plan and site reviews for new construction modernization projects is available by region at http://www.cde.ca.gov/ls/fa/sf/fieldstaff.asp. . More information on details of the Site Review Process is available at http://www.cde.ca.gov/ls/fa/sf/sitereview.asp.

IV. Official Actions

A Phase I Preliminary ESA must be prepared for the proposed site by the lead educational agency and submitted to the DTSC. If the Phase I ESA indicates that further investigation of the site through a Preliminary Endangerment Assessment (PEA) is necessary, the school board or relevant educational agency must prepare this under DTSC oversight.

V. Request (Possibly Contingent) and Approval

All required documents must be submitted to the SFPD along with a letter requesting approval of the site. In certain situation, the educational agency may request a contingent site approval. More information on this process, including a list of all required documentation, is available from the CDE in its "School Site Approval Procedures" document (SFPD 4.01) available at http://www.cde.ca.gov/ls/fa/sf/schoolsiteguide.asp.

Table A-1. Air Quality Checklist for School Site Selection

Category	Issue	Important Notes	OK	Potential Problem
Proximity to	Major Roadways	Any school site within 500 feet of a busy roadway **must** be assessed to show that neither short- nor long-term exposure poses a significant health risk.		
		Roadway Mitigation:		
		Can develop plans to minimize idling by cars near the school, particularly at drop-off and pick-up times.		
		Can maintain healthy indoor air quality by having a properly functioning, routinely maintained HVAC system.		
		Able to limit truck traffic near schools during operating hours.		
		Sufficient buffer zone to sources of idling emissions.		
	Distribution Centers			
	Rail Yards and Railroads			
	Major Ports			
	Refineries			
	Chrome Platers			
	Dry Cleaners Using PCE			
	Gasoline Dispensing Facilities			
	Other Commercial Facilities with Emissions	Including Autobody Shops, Furniture Repair, Film Processing, Distribution Centers, Printing Shops, Diesel Engines		
	Other Industrial Facilities with Emissions	Including Construction, Manufacturers, Metal Platers, Welders, Metal (Flame) Spray Operations, Chemical Producers, Furniture Manufacturers, Shipbuilding and Repair, Rock Quarries, Cement Manufacturers, Hazardous Waste Incinerators, Power Plants, Research and Development Facilities		
	Other Public Facilities with Emissions	Including Landfills, Waste Water Treatment Facilities, Waste Incinerators, Recycling Facilities, Garbage Transfer Stations		

Category	Issue	Important Notes	OK	Potential Problem
Proximity to (continued)	Other Transportation Facilities with Emissions	Including Truck Stops		
	Agricultural Operations	Including Farming, Dairy, and Livestock Operations		
	Airports			
	Future plans for land use for possible industrial and commercial conflicts			
	Future plans for roads, sewers, railroads, recreation, and industrial developments			
		All potential sources (permitted and non-permitted) within 1/4 mile of site must be surveyed and included in the risk assessment.		
		Non-permitted sources of air contaminants, such as large agricultural operations, roadways, and rail yards must be considered.		
Onsite	Presence of Toxic or Hazardous Substances			
	Propane Tanks			
	Pressurized Gas, Gasoline, or Sewer Pipelines (Not allowed onsite, hazardous nearby)			
	Previous or Current Agricultural Use			
	Previous or Current Mining			
	Residential Use			
	Previous or Current Easements			
	Naturally Occurring Hazardous Materials			
	Petroleum Storage or Production			
	Use of Fill Material, including "Clean Fill"			
	Previous Clandestine Drug Manufacturing			
	Naturally Occurring Asbestos (NOA)			
	Lead Based Paint (LBP)			
	Asbestos Containing Materials (ACM)			

Category	Issue	Important Notes	OK	Potential Problem
Onsite (continued)	Soil contaminated with and/or emitting VOCs, methane, hydrogen sulfide, or fixed or biogenic gases			
	Soil contaminated with agricultural chemicals			
	Free from smoke, dust, odors, and pesticide spray			
	Adequate percolation for septic system and drainage			
	Landfill Site			
Location & Ability for Mitigation of Induced Traffic	Safe walking areas			
	Centrally located to avoid extensive transporting and to minimize student travel distance			
	Compatible with current and probable future zoning regulations			
	Close to libraries, parks, museums, and other community services			
	Favorable orientation to wind and natural light			
	Obstacles such as crossings on major streets and intersections, narrow or winding streets, heavy traffic patterns			
	Access and dispersal roads			
	Routing patterns for foot traffic			
	Distance to centers of student demographics, now and in the future, including relative travel burden upon majority and minority children			
	Travel times to those demographic centers			
Public Services	Available public transportation			
	Trash and garbage disposal readily available	To reduce odor exposure at site		
Size and Shape	Sufficient open play area and open space away from traffic			
	Area for adequate and separate bus loading and parking isolated from students			
	Acreage to support school and possible future expansion and buffer from nearby traffic			

Category	Issue	Important Notes	OK	Potential Problem
Soils	Toxic cleanup beyond the owner's obligation			
	Environmental mitigation			
	Zoned for prime agriculture or industrial use			
	Negative environmental impact report			
Other AQ & Safety	Contaminants/toxics in the soil or groundwater, such as from landfills, dumps, chemical plants, refineries, fuel tanks, nuclear plants, or agricultural use of pesticides or fertilizer, etc.			
	Close to open-pit mining			
	Proximity to geologic features, such as faults, springs, sources of emissions			
	Possible zoning for changes in compatibility			

This page deliberately left blank.

Appendix B. Specific Pollutants of Concern

1. Criteria Air Pollutants

Carbon Monoxide (CO)

Carbon monoxide is an odorless, colorless, poisonous gas formed during the incomplete combustion of carbon-containing fuels. EPA estimates show that as much as 95% of the CO in U.S. cities emanates from mobile sources, such as motor vehicles. Nationwide, about 50% of the CO in ambient air comes from on-road mobile sources. Although CO is still a serious concern for human health, particularly in certain settings where its removal from the atmosphere is limited, such as parking garages and roadway tunnels, its concentrations have decreased steadily over the past few decades. This is due primarily to tightened emissions controls on motor vehicles, particularly through the use of catalytic converters. However, in spite of these reductions, as of April 2005, parts of Riverside, San Bernardino, and Los Angeles Counties, as well as all of Orange County, were designated as serious non-attainment for CO. [25] All other regions in California are currently designated as in attainment for CO.

Carbon monoxide affects the body by binding with hemoglobin in the blood and replacing oxygen. This starves the body of oxygen and can result in headaches, fatigue, drowsiness, and, in extreme cases, death. Fetuses are at elevated risk of CO poisoning due to the additional affinity of their blood to CO. The Federal primary standard for CO is 35 ppm over one hour and 9 ppm averaged over eight hours. The California standard maintains the Federal 8-hour standard, but tightens the 1-hour standard to 20 ppm. These levels are set to protect portions of the population who already suffer from medical conditions that impair the body's ability to deliver oxygen. There are no secondary standards for CO.

Hydrogen Sulfide (H_2S)

Hydrogen sulfide is a colorless gas with a strong smell of rotten eggs. It is naturally formed during bacterial decomposition of organic substances that contain sulfur, may be present in sewer gas and some natural gas, and can be emitted as the result of geothermal energy use.

High concentrations of H_2S result in very disagreeable odors and headaches. Hence the standard for hydrogen sulfide is designed both to protect public health and to reduce odor annoyance. The current California standard for hydrogen sulfide is 30 ppb, averaged over one hour. There is no federal standard for H_2S.

Lead (Pb)

Lead is a toxic metal found naturally in the environment that has had manufacturing and industrial uses for centuries. Historically, the major sources of lead emissions were motor vehicles, due to the use of leaded fuels, and industrial sources. Since the phase out of leaded gasoline, metals processing, particularly lead smelters, has become the major source of lead emissions into the atmosphere. Other sources include waste incinerators, utilities, and lead-acid battery manufacturers. Humans and animals are primarily exposed to lead by breathing and ingesting it through food, water, soil, or dust. Lead accumulates in the blood, bones, muscles, and fat. It is recognized by the State of California to pose

[25] Because there have been no recent violations of the standard in the South Coast Air Basin, the Air Quality Management District is currently formally petitioning the U.S. EPA to consider redesignation of the area for this standard.

significant cancer and non-cancer health risks, including systemic and developmental toxicity. Infants and young children are especially sensitive, even at low levels of exposure.

All of California has been designated as complying with the lead standards since 1996.

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is one of the two main nitrogen-containing pollutants formed when some of the nitrogen in air reacts with oxygen during high-temperature fuel combustion, such as in automobiles, power plants, and waste disposal systems. The other main pollutant is nitric oxide (NO). Together with the inert gas nitrous oxide (N_2O) they are referred to as NO_x. Although NO is produced in greater abundance during combustion, it is quickly oxidized to NO_2, which is a greater threat to health than NO.

NO_x is a threat to health and welfare for several reasons, including ozone formation, and formation and growth of secondary PM species. However, because the secondary formation takes several hours, enhanced concentrations of ozone and/or PM typically occur at substantial distances from the release point of the NO_x. Therefore, these effects are not important considerations for school site selection. The primary concern about NO_2 for the purpose of selecting a school site is that it is a pulmonary irritant that can reduce lung function.

The federal not-to-exceed standard for NO_2 is 0.053 ppm (53 ppb) averaged over one year, with a secondary standard equal to the primary standard. The CARB standard is 0.25 ppm (250 ppb) averaged over one hour. There are currently no counties in California in exceedance of the federal or state NO_2 standard.

Ozone (O_3)

Ground-level ozone is the primary component of the photochemical smog that commonly occurs in Southern California. Ozone is a secondary pollutant formed in the atmosphere from chemical reactions involving volatile organic compounds (VOC) and nitrogen oxides (NO_x) in the presence of sunlight. VOCs are emitted from a variety of natural and anthropogenic sources, while NO_x is a product of fuel combustion. Ozone is a potent irritant with a noxious odor that can cause damage to the lung tissue and mucous membranes of the respiratory system and is linked to a variety of respiratory problems, including asthma. Even healthy people have been shown to exhibit reduced lung function in the presence of elevated ozone concentrations, particularly during exercise. This is often accompanied by chest pain, congestion, coughing, nausea, increased susceptibility to infections, and some immunological changes. Ozone is also known to attack rubber compounds, retard tree growth, and damage crops.

Currently, both U.S. EPA and CARB have primary standards for ambient ozone concentrations. The federal standard is a concentration not to exceed 0.12 ppm (120 ppb) in a one-hour period, and 0.08 ppm (80 ppb) averaged over an eight-hour period.[26] However, the less-stringent one-hour federal standard is set to expire for many regions around June 2005. There are currently 35 counties in California in violation of the eight-hour ozone standard. All of the counties in the SCAB are designated as severe non-attainment areas for the eight-hour standard. The CARB standard for ozone is a concentration of 0.09 ppm (90 ppb) averaged over one hour. CARB has also recently adopted a more stringent standard of 0.07

[26] The one-hour Federal standard is defined such that the expected number of days in each calendar year with a maximum hourly-average concentration of greater than 120 ppb must be less than or equal to one. For the eight-hour standard, the three-year average of the fourth-highest daily maximum eight-hour average ozone concentration cannot exceed 80 ppb at any monitor within the region.

ppm (70 ppb) averaged over eight hours. The secondary standards for ozone are the same as the primary standards.

It is important to note that because ozone is formed in the atmosphere over a period of several hours, enhanced concentrations typically occur at substantial distances from the release point of the precursor compounds, where the compounds have been carried by the wind.

Particulate Matter (PM)

Particulate matter (PM) refers to a group of inhalable solid particle and liquid droplet which are small enough to remain suspended in the atmosphere for some time. PM has both natural and anthropogenic sources. It can be composed of a wide variety of substances, some of which can be non-poisonous irritants (e.g., dust and pollen) or potentially carcinogenic (e.g., diesel particulate matter, asbestos, and some pesticides). Because PM is inhalable, it can acutely affect the human respiratory system, making breathing difficult and leading to aggravated asthma, decreased lung capacity, chronic bronchitis, and even premature death.

PM is currently regulated in two classes: particles with diameters less than 10 µm (PM_{10}) and the more recent classification of particles with diameters less than 2.5 µm ($PM_{2.5}$), which is a subset of PM_{10}. The second designation was prompted by findings that smaller particles become more deeply lodged in the respiratory system, and thus are potentially more damaging. Current federal standards for PM_{10} are not-to-exceed concentrations of 50 $\mu g/m^3$ arithmetically averaged over one year at any monitor in a region, and 150 $\mu g/m^3$ in one hour more than once per year. Federal standards for $PM_{2.5}$ are not-to-exceed concentrations of 65 $\mu g/m^3$ in an hour or 15 $\mu g/m^3$ arithmetically averaged over a year.[27] California standards for PM_{10} are 20 $\mu g/m^3$ per year, computed as an annual geometric mean, and 50 $\mu g/m^3$ as a 24-hour average. California has also adopted an annual $PM_{2.5}$ standard of 12 $\mu g/m^3$. Federal secondary PM standards are the same as the primary standards.

Currently in California there are 15 counties designated as nonattainment for PM_{10} and 12 counties designated as nonattainment for $PM_{2.5}$. All of the South Coast counties are partially or wholly designated as nonattainment for $PM_{2.5}$ and as serious nonattainment for PM_{10}.

Sulfates ($SO_4^{=}$)

Sulfates are the fully oxidized, ionic form of sulfur, and always occur in combination with other ions, such as ammonium, metal or hydrogen. They are formed from the atmospheric oxidation of sulfur dioxide (SO_2), and, hence, share sources with that pollutant. The conversion of SO_2 to sulfates is rapid and typically occurs in all urban areas of California. Sulfates cause aggravation of respiratory symptoms, including decreased lung function, aggravation of asthma, and an increased risk of cardio-pulmonary disease.

CARB adopted an ambient sulfate standard of 25 $\mu g/m^3$, averaged over a 24-hour period. There is no federal standard for sulfates beyond those for PM and SO_2.

[27] The actual definition of the Federal $PM_{2.5}$ 24-hour standard is set such that the three-year average of the 98th percentile of 24-hour concentration values at each population-oriented monitor within an area must not exceed 65 $\mu g/m^3$. The Federal $PM_{2.5}$ annual standard is computed such that the three-year average of annual arithmetic mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$.

Sulfur Dioxide (SO_2)

Sulfur dioxide is a highly odorous, colorless gas in the family of gases of oxides of sulfur, known as SO_x, all of which are highly soluble in water. Sulfur is common in many raw materials, particularly fossil fuels, such as oil and coal, and metal ore. When these fuels are burned or refined, or when metals are extracted from ore, SO_x species are released. A natural source of SO_2 in the atmosphere is sea spray. Electric utilities, petroleum refineries, cement manufacturing, and metal processing facilities are major emitters of SO_2. Off-road mobile sources, such as locomotives, large ships, and diesel construction equipment are currently important sources as well, although new EPA and CARB rules regulating the sulfur content of these fuels will reduce emissions from some of these sources. Although also related to acid rain and a contributor to PM formation, the primary concern about SO_2 for the purpose of selecting a school site is that it is a pulmonary irritant that can reduce lung function.

Current primary federal standards for SO_2 are 30 ppb for an annual, arithmetic mean concentration and 140 ppb for a 24-hour average, not to be exceeded more than once per year. There is also a secondary federal standard of 500 ppb averaged over three hours, also not to be exceeded more than once in a calendar year. CARB standards are 40 ppb averaged over 24 hours and 250 ppb averaged over one hour. California currently has no SO_2 nonattainment areas.

Vinyl Chlorides

Vinyl chloride, also known as chloroethene, is a colorless gas with a mildly sweet smell. Vinyl chloride is used in industry to produce polyvinyl chloride (PVC) plastic and other vinyl products. Common emission sources of vinyl chloride in the environment are landfills, sewage plants, and hazardous waste sites where microbial breakdown of chlorinated solvents releases the compound into the ambient air. Chlorinated hydrocarbons combusted in an incinerator is another example of a potential source of vinyl chloride. Short-term exposure to high levels of vinyl chloride through inhalation has been shown to cause dizziness, drowsiness, and headaches. Long-term exposure to vinyl chloride through inhalation and ingestion has been related to liver damage. Vinyl chloride exposure through inhalation has also been shown to increase the risk of liver cancer in humans.

CARB has established ambient air quality levels for vinyl chloride to reduce the risk of animal and human cancer from exposure. Because it is a known carcinogen, there is no safe level of exposure. Hence, CARB set the standard at the lowest detectable level, 0.01 ppm, averaged over 24 hours. There is no federal standard for Chloroethene.

2. Air Toxics

Ammonia (NH_3)

Ammonia is a colorless liquid or gas that has a pungent, irritating odor. It is commonly found in household cleaners and other chemical products. In California, the primary stationary sources are electric generation, steam and air conditioning supply services, and petroleum refining. NH_3 is also emitted by vehicles with three-way catalytic converters; in urban regions this source can be of comparable strength to biological decomposition in agricultural areas. As of 1997, statewide emissions of NH_3 were estimated at more than 20 million pounds per year.

As a relatively strong base, in significant concentrations, ammonia vapors and liquids are corrosive and may cause severe burns and irritation to the skin, eyes, and lungs. High concentrations cause conjunctivitis, laryngitis, and pulmonary edema, possibly accompanied by a feeling of suffocation. Persons with asthma may be particularly sensitive to exposure. [28]

Arsenic (As) [Inorganic]

Arsenic is a common, naturally occurring, semi-metallic element. Inorganic arsenic is released into the air by volcanoes and the weathering of arsenic-containing minerals and ores. The primary stationary sources that have reported inorganic arsenic emissions in California are electrical services and metal mining.

Inhalation of high levels of inorganic arsenic can cause sore throat and irritated lungs. Acute exposure to low levels of arsenic can cause nausea and vomiting, decreased production of both red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a stinging sensations in the extremities. Chronic exposure to low levels of inorganic arsenic, either by ingestion or inhalation, can cause a darkening of the skin and the appearance of small wart-like growths on the palms, soles, and torso. Inorganic arsenic can increase the risk of lung, skin, bladder, liver, kidney, and prostate cancer. The World Health Organization (WHO), the DHHS, the EPA, and the State of California have all determined that inorganic arsenic is a human carcinogen. [29]

Asbestos

Asbestos is the name given to a family of mineral species used throughout the world for its chemical stability and thermal insulation properties. It was commonly used to enhance acoustic isolation in structures, as well as a fire retardant and in roofing and flooring materials. The crystalline structure of asbestos is unique in the mineral world. Only when these fibers are released into the air, do they become a health hazard. The primary sources of asbestos emissions in California are metal mining (gold and silver ores), industrial sand and gravel mining, and crushed and broken stone mining. Other sources of emissions are landfills, renovation and demolition of buildings, roads surfaced with gravel containing asbestos, and natural weathering or human disturbance of serpentine rock deposits.

Asbestos fibers may be inhaled into the lungs, where they act as an irritant and a carcinogen. The fibers may become trapped in the lung tissue, which can secrete an acid to try and dissolve the fibers. Although the fibers do not dissolve, the fibers can damage the lungs and eventually induce a condition known as asbestosis. Mesothelioma is a rare cancer of the abdominal cavity and surrounding organs. Its only known cause is asbestos exposure. Asbestos exposure is also known to increase the likelihood of lung cancer, particularly in cigarette smokers. The State of California considers all forms of asbestos carcinogenic. [30]

Benzene (C_6H_6)

Benzene is a volatile, colorless, highly flammable liquid that has a sweet odor and readily dissolves in water. Inhalation exposure to benzene commonly occurs as a result of burning fossil fuels, vehicle

---

[28] Based on Fact Sheet, available at http://www.oehha.ca.gov/air/acute_rels/pdf/7664417A.pdf.

[29] Based on the ATSDR Fact Sheet, available at http://www.atsdr.cdc.gov/tfacts2.html.

[30] Based on EPA assessment, http://www.epa.gov/asbestos.

exhaust, and evaporation from gasoline service stations and industrial solvents. Mobile sources contribute 85% and industry-related stationary sources 15% of state-wide emissions.

Atmospheric exposure to benzene has both acute (short-term) and chronic (long-term) effects. Acute exposure may result in drowsiness, dizziness, headaches, irritation of the eyes, skin, and respiratory tract, and unconsciousness. Chronic inhalation has been related to blood disorders, reproductive effects, adverse effects on developing fetuses, leukemia, and a variety of other cancers. Benzene has been classified as a known human carcinogen by both the State of California and the U.S. EPA. [31]

Beryllium (Be)

Beryllium is a naturally occurring, hard, grey metal found in rocks, coal, and soil. The primary stationary sources that have reported emissions of beryllium compounds in California are transportation equipment, electrical services, and cement and hydraulic products.

Acute inhalation exposure to very high concentrations may result in acute beryllium disease, a condition resembling pneumonia. A small fraction of the population may become sensitive to beryllium. Chronic exposure to high levels of beryllium can result in an inflammatory reaction in the respiratory system called chronic beryllium disease (CBD), which results in feelings of weakness or tiredness, difficulty breathing, anorexia, weight loss, and possibly right-side heart enlargement and heart disease in advanced cases. Chronic inhalation exposure is also linked to increased risk of lung cancer in people. The DHHS and the International Agency for Research on Cancer (IARC) have determined that beryllium is a human carcinogen. The EPA has determined that beryllium is a probable human carcinogen. The State of California has determined that beryllium and its compounds are carcinogens. [32]

1,3-Butadiene

1,3-Butadiene is a colorless gas with a mild gasoline-like odor. In California, the majority of 1,3-butadiene emissions are from incomplete combustion of gasoline and diesel fuels. Mobile sources account for approximately 96 percent of the total annual emissions state-wide for quantified sources. Vehicles that are not equipped with functioning exhaust catalysts emit greater amounts of 1,3-butadiene than vehicles with functioning catalysts. The primary stationary sources that have reported emissions of 1,3-butadiene are petroleum refining, manufacturing of synthetics and man-made materials, and oil and gas extraction.

Exposure to 1,3-butadiene affects the nervous system and irritates the eyes, nose, and throat. Acute exposure to very high levels of 1,3-butadiene can cause central nervous system damage, blurred vision, nausea, fatigue, headache, decreased blood pressure and pulse rate, and unconsciousness. There are no recorded cases of accidental exposures at high levels that caused death in humans. At lower levels, acute exposure may cause irritation of the eyes, nose, and throat. Chronic low levels exposure has been linked to an increase in heart and lung damage, increased risk of birth defects, kidney and liver disease, and damaged lungs. The US Department of Health and Human Services (DHHS) has determined that 1,3-

[31] Based on the EPA Technology Transfer Network, http://www.epa.gov/ttn/atw/hlthef/benzene.html .

[32] Based on the ATSDR Fact Sheet, http://www.atsdr.cdc.gov/tfacts28.html.

butadiene may reasonably be anticipated to be a carcinogen. The State of California has determined that 1,3-butadiene is a carcinogen. [33]

Cadmium (Cd)

Cadmium is a naturally occurring element in the Earth's crust. Mobile sources of cadmium include diesel fuel, gasoline, lubricating oil, and particles resulting from vehicle tire wear. The primary stationary sources that have reported emissions of cadmium in California are electrical services, gold and silver ore mining, structural clay products manufacturing, and metal plating operations.

High concentrations of cadmium can cause severe damage to lung tissue or even death. Chronic exposure to low levels of cadmium in air may lead to kidney disease from cadmium accumulation in the kidneys, lung damage, and fragile bones. The State of California has determined that cadmium and cadmium compounds are carcinogens. [34]

Carbon Tetrachloride (CCl_4)

Carbon tetrachloride is a clear liquid with a strong, sweet smell and no natural sources. CCl_4 is most commonly present in air as a colorless, non-flammable gas. Historically, it was used in the production of refrigeration fluid and propellants for aerosol cans, as a pesticide, as a cleaning fluid and degreasing agent, in fire extinguishers, and in spot removers. It has now been recognized as a toxic contaminant, and these uses have been banned. The primary sources in California are chemical and allied product manufacturers, and petroleum refineries.

Exposure to high concentrations of CCl_4 in the air can cause liver, kidney, and central nervous system damage. Human livers and kidneys are particularly susceptible to CCl_4 damage. Damage from acute, low levels of exposure may be repairable, although effects are more severe in heavy drinkers of alcohol. Acute exposure to high concentrations may cause feelings of intoxication, headaches, dizziness, sleepiness, nausea, vomiting, and coma and death in severe circumstances. The U.S. EPA has declared CCl_4 vapors are a probable human carcinogen, while several studies have indicated links between CCl_4 exposure and birth defects and early fetal deaths. The State of California has identified carbon tetrachloride as a carcinogen. [35]

Chlorinated Dioxins and Dibenzofurans (CDD, Polychlorinated dibenzo-p-dioxins (PCDDs), and Polychlorinated Dibenzofurans (PCDFs) including 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)

Chlorinated dioxins and dibenzofurans are unwanted chemical by-products emitted from various combustion and chemical processes, including the incomplete combustion of waste materials such as municipal solid waste, sewage sludge, hospital, and hazardous wastes that contain chlorine. Dioxin in very small concentrations is ubiquitous in the environment and it is likely that many of the primary sources are not yet known. Dioxins have been found worldwide, even in remote areas. The primary stationary sources that have reported emissions of dioxins in California are sanitary services, manufacturers of medical instruments and supplies, and cement and hydraulics products. The primary

[33] Based on the ATSDR Fact Sheet, available at http://www.atsdr.cdc.gov/tfacts28.html and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

[34] Based on the ATSDR Public Health Statement, http://www.atsdr.cdc.gov/toxprofiles/phs5.html

[35] Based on ATSDR description, http://www.atsdr.cdc.gov/tfacts30.html.

stationary sources that have reported emissions of dibenzofurans in California are manufacturers of miscellaneous plastics products, sanitary services, sawmills and planing mills.

Exposure has been linked to chloracne, a severe and possibly disfiguring skin disease characterized by acne-like lesions, generally occurring on the face and upper body, and other effects to the skin. Changes in blood and urine that may indicate liver damage have been observed in people. Alterations in the ability of the liver to metabolize hemoglobin, lipids, sugar, and protein have also been reported in people exposed to relatively high concentrations of dioxins. In addition, the State of California has determined that TCDD is a developmental toxicant. Several studies have indicated that exposure to high levels of dioxins may increase the risk of cancer in people; the U.S. EPA has determined that 2,3,7,8-TCDD is a possible human carcinogen when considered alone and a probable human carcinogen when considered in association with phenoxy herbicides and/or chlorophenols. The U.S. EPA has also determined that a mixture of dioxins with six chlorine atoms is a probable human carcinogen. The State of California has determined that TCDD is a carcinogen. [36]

Diesel Particulate Matter (DPM)

Diesel exhaust is a complex mixture of gases, vapors, and fine particles. Some of the exhaust components, like arsenic, benzene and nickel, are known to cause cancer in humans. At least 40 other components, including human carcinogens benzo[a]pyrene, 1,3-butadiene and formaldehyde, are listed by U.S. EPA as hazardous air pollutants and the CARB as toxic air contaminants.

Because of the ubiquitous nature of diesel engines in industry and transportation, diesel exhaust PM emissions can be emitted from mobile sources (on-road vehicles and off-road mobile sources), small stationary sources, and major stationary sources. On-road diesel vehicles contribute approximately 59 percent of California's diesel exhaust PM. Other mobile sources contribute about 36 percent, and stationary sources contribute the remaining amount. Stationary sources of diesel exhaust include shipyards, warehouses, heavy equipment repair yards, and oil and gas production operations, as well as heavy construction and electrical services.

Non-cancer effects of diesel exhaust are likely due to the presence of particles in the exhaust, which are associated with increased morbidity and mortality including respiratory symptoms, changes in lung function, and increased hospitalizations for respiratory and cardiovascular disease.

The State of California has determined under Proposition 65 that diesel engine exhaust is a carcinogen, and CARB has identified particulate matter from diesel-fueled engines as a toxic air contaminant. The U.S. EPA has also concluded that diesel exhaust is likely to be carcinogenic to humans at environmental exposure levels that the public faces. However, U.S. EPA believes that the available data are insufficient to quantify the risk level.

1,4-Dioxane (Dioxane, $C_4H_8O_2$)

Dioxane is colorless liquid with a faint, pleasant odor. 1,4-dioxane is primarily used as a solvent in products such as paints, varnishes, lacquers, paint and varnish removers, cosmetics, and deodorants. Significant non-occupational exposure to dioxane is likely to occur primarily through the use of paint removers without adequate ventilation. The primary stationary sources that have reported emissions of

[36] Based on the OEHHA Chronic Toxicity Summary, http://www.oehha.ca.gov/air/chronic_rels/pdf/chlordibenz.pdf, the ATSDR Public Health Statement, http://www.atsdr.cdc.gov/toxprofiles/phs104.html,.

1,4-dioxane in California are coating, engraving, and allied metal services manufacturing, manufacturers of aircraft and parts, and sanitary services.

Chronic dioxane exposure may be related to liver changes, increased urinary protein, and increased white blood cell counts. Kidney, liver, brain, and respiratory lesions may be associated with high acute exposure. The U.S. EPA has classified 1,4-dioxane as a probable human carcinogen, while the State of California has determined that 1,4-dioxane is a carcinogen. [37]

Ethylene Dibromide ($C_2H_4Br_2$)

Ethylene dibromide, also known as 1,2-dibromomethane, is a colorless liquid with a mild sweet odor. In the past, ethylene dibromide was used as an additive to leaded gasoline, but was phased out along with leaded fuel. It was used as a fumigant insecticide in citrus, vegetable, and grain crops, and for turf on golf courses, but these purposes have been banned nationwide since 1984. The primary stationary sources that have reported emissions of ethylene dibromide in California are airports and airport services, hydraulic cement manufacturers, and petroleum refining.

Acute exposure to very high concentrations of ethylene dibromide may lead to depression and physical collapse, skin blistering, and even death. Animal testing has shown moderate acute toxicity resulted from inhalation exposure. Chronic inhalation exposure to ethylene dibromide may be linked to bronchitis, headache, and depression, as well as toxic effects to the liver, kidney, and the testis, as well as possible birth defects. EPA has classified ethylene dibromide as a probable human carcinogen. The State of California has determined that ethylene dibromide is a carcinogen. [38]

Ethylene Dichloride ($C_2H_4Cl_2$)

Ethylene dichloride, also known as 1,2-dichloroethane, often occurs as a colorless, oily, heavy liquid. It has a pleasant, chloroform-like odor. Ethylene dichloride is primarily used in the production of vinyl chloride as well as other chemicals. The primary stationary source emissions of ethylene dichloride in California are manufacturers of chemicals, aircraft and parts, and medical instrument and supplies.

Acute exposure to very high concentrations of ethylene dichloride by inhalation can affect the nervous system and may lead to narcosis, nausea, vomiting, and even death. Vapor contact with the eyes may cause clouding of the cornea and eye irritation. Chronic inhalation exposure may produce effects on the liver and kidneys. EPA has classified ethylene dichloride as a probable human carcinogen. The State of California has determined that ethylene dichloride is a carcinogen. [39]

Formaldehyde (CH_2O)

Formaldehyde is a colorless gas with a pungent, suffocating odor at room temperature and has many commercial and industrial applications. While not directly related to school siting, secondary formation may account for the majority of formaldehyde pollution in California. A primary source of directly emitted formaldehyde is vehicular exhaust (about 9% of direct emissions). The primary stationary

---

[37] Based on the OEHHA Chronic Toxicity Summary, available at http://www.oehha.ca.gov/air/chronic_rels/pdf/123911.pdf.

[38] Based on the EPA Air Toxics website, http://www.epa.gov/ttn/atw/hlthef/ethyl-di.html and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

[39] Based on the EPA Air Toxics website, http://www.epa.gov/ttn/atw/hlthef/di-ethan.html, and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

sources that have reported emissions of formaldehyde in California are crude petroleum and natural gas extraction, manufacturers of miscellaneous nonmetallic mineral products, and gas production and distribution services. Cigarette smoking is also a source of formaldehyde exposure.

Acute effects of formaldehyde inhalation exposure are eye, nose, throat, and nasal cavity irritation. At high concentrations, formaldehyde exposure may cause coughing, wheezing, chest pains, and bronchitis. EPA considers formaldehyde to be a probable human carcinogen. The State of California has determined that formaldehyde is a carcinogen. [40]

Hexavalent Chromium (Cr VI)

Chromium occurs in the environment primarily as trivalent chromium (Cr III) and hexavalent chromium (Cr VI). Chromium III is an essential element in the human body, which can detoxify some Cr VI to the much less toxic Cr III form. Inhalation exposure to hexavalent chromium results from ferrochrome production, ore refining, chemical and refractory processing, cement-producing plants, automobile brake lining and catalytic converters, leather tanneries, and chrome pigments. Emissions of Cr VI from stationary sources in California have been reported by electrical services, aircraft and parts manufacturing, and steam and air conditioning supply services. However, the primary source of concern for school siting is chrome-plating operations.

Exposure to chromium may occur from natural or industrial sources of chromium. Acute exposure to high levels of chromium trioxide is associated with shortness of breath, coughing, and wheezing, as well as gastrointestinal and neurological effects. Chronic Cr VI inhalation exposure may result in respiratory effects, including perforations and ulcerations of the septum, bronchitis, decreased pulmonary function, pneumonia, asthma, and nasal itching and soreness, as well as possible complications during pregnancy and childbirth. Cr VI inhalation is known to cause increased risk of lung cancer in humans. EPA has classified Cr VI as a known human carcinogen by the inhalation route of exposure. The State of California has determined that hexavalent chromium compounds are carcinogenic. [41]

Lead (Pb)

Lead is regulated nation-wide as a criteria pollutant, and is discussed more fully above.

Methylene Chloride (CH_2Cl_2)

Methylene chloride, also known as dichloromethane, is a synthetic, colorless liquid with a mild, sweet odor. Methylene chloride is used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film. Paint removers account for the largest use of methylene chloride in California, in industrial, commercial, military, and domestic applications. California's primary stationary sources with reported emissions of methylene chloride are manufacturers of plastic products, synthetics, and aircraft and parts.

Exposure to high levels of methylene chloride may cause feelings of unsteadiness, dizziness, nausea, and tingling sensations or numbness in the fingers and toes. Exposure to moderate amounts of methylene

---

[40] Based on the EPA Air Toxics website, http://www.epa.gov/ttn/atw/hlthef/formalde.html, and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

[41] Based on the EPA Air Toxics website, http://www.epa.gov/ttn/atw/hlthef/chromium.html
and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

chloride may cause loss of attentiveness and accuracy in tasks requiring hand-eye coordination. Methylene chloride may cause birth defects at high concentrations. The EPA has determined that methylene chloride is a probable human carcinogen. The State of California has listed methylene chloride (dichloromethane) as a carcinogen and as a TAC. [42]

Nickel (Ni)

Nickel is a naturally occurring element that may be essential for human nutrition. Fuel combustion (residential oil, distillate oil, coke and coal) is responsible for the majority of the total statewide emissions of nickel, as small particles. Electrical services and defense operations are also emitters of nickel in California.

Inhalation exposure to nickel has been shown to induce respiratory effects, including increased risk of lung and nasal cancers from exposure to nickel refinery dusts and nickel subsulfide. Exposure to nickel carbonyl has been reported to cause lung tumors. EPA has classified nickel refinery dust and nickel subsulfide as carcinogens, and nickel carbonyl as a probable human carcinogen. The State of California has determined that nickel and certain nickel compounds (including nickel carbonyl, nickel refinery dust, and nickel subsulfide) are carcinogens. OEHHA has concluded that all nickel compounds should be considered potentially carcinogenic to humans by inhalation. [43]

Perchloroethylene (Tetrachloroethylene, Perc, C_2Cl_4)

Perchloroethylene, also known as tetrachloroethylene, Perc, and PCE, is a nonflammable colorless liquid with a sharp sweet odor. The primary stationary sources that have reported emissions of Perc in California are dry cleaning plants, aircraft parts and equipment manufacturers, and fabricated metal products manufacturers.

Acute inhalation exposure of humans to Perc vapor can cause irritation of the eyes and upper respiratory tract, kidney dysfunction, neurological effects such as reversible mood and behavioral changes, degraded coordination, dizziness, headache, sleepiness, and unconsciousness. Chronic inhalation exposure can result in neurological effects, including sensory symptoms such as headaches, impairments in cognitive and motor functions, color vision decrements, cardiac arrhythmia, liver damage, and possible kidney effects. Adverse reproductive effects may also be related to Perc exposure. Studies have suggested an increased risk from Perc exposure for a variety of cancers, including of the esophagus, kidney, bladder, lung, pancreas, and cervix. A small fraction of Perc absorbed by the body is metabolized to trichloroacetic acid (TCA), which is classified as a possible human carcinogen by EPA. EPA does not

[42] Based on the ATSDR Fact Sheet, available at http://www.atsdr.cdc.gov/tfacts14.html, and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.
[43] Based on the EPA Air Toxics website, http://www.epa.gov/ttn/atw/hlthef/nickel.html. and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

currently have a classification for the carcinogenicity of Perc, although the State of California has listed Perc as a carcinogen. [44]

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a class of complex air pollutant chemicals that are ubiquitous in ambient air. There are more than 100 different PAHs, of which EPA has identified 16 as priority PAH pollutants: naphthalene (C_8H_{10}), acenaphthylene ($C_{12}H_8$), acenaphthene ($C_{12}H_{10}$), flourene ($C_{13}H_{10}$), phenanthrene ($C_{14}H_{10}$), anthracene ($C_{14}H_{10}$), pyrene ($C_{16}H_{10}$), fluoranthene ($C_{16}H_{10}$), benz[*a*]anthracene ($C_{18}H_{12}$), chrysene ($C_{18}H_{12}$), benzo[*a*]pyrene ($C_{20}H_{12}$), benzo[*b*]fluoranthene ($C_{20}H_{12}$), benzo[*k*]fluoranthene ($C_{20}H_{12}$), benzo[*ghi*]perylene ($C_{22}H_{12}$), indeno[*1,2,3-cd*]pyrene ($C_{22}H_{12}$), and dibenz[*a,h*]anthracene ($C_{22}H_{14}$).

PAHs are emitted into the air from biomass burning, including agricultural and forest products, coal, municipal and industrial waste incineration, hazardous waste sites, and diesel and gasoline exhaust. The primary stationary sources that have reported emissions of benzo[*a*]pyrene in California are petroleum refineries, industrial machinery manufacturers, and the wholesale trade in petroleum and petroleum products. The primary stationary sources that have reported emissions of PAHs in California are paper mills, manufacturers of miscellaneous wood products, and petroleum refining.

Chronic exposure to certain PAHs have been linked to tumors, cancer, reproductive effects, birth defects, and decreased body weight. Both acute and chronic exposure has been linked to harmful effects on the skin, body fluids, and the immune system of animals. Several PAHs have been identified by the DHHS as known animal carcinogens, by IARC as probably or possibly carcinogenic to humans, while the EPA has listed several compounds as not classifiable as to human carcinogenicity. The State of California has determined that several PAH compounds (including benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, chrysene, indeno[1,2,3-cd]pyrene, 3,7-dinitrofluoranthene, and 3,9-dinitrofluoranthene) are carcinogens. [45]

Trichloroethylene (TCE)

TCE is a manufactured chemical, occurring as a colorless liquid with a somewhat sweet odor and a sweet, burning taste. Inhalation exposure to TCE may occur from breathing air contaminated with the vapor as it evaporates from contaminated water (e.g., shower water) or from household products containing TCE (e.g., adhesives, paint removers, spot removers and typewriter correction fluid). The primary stationary sources that have reported emissions of trichloroethylene in the past are manufacturers of pens, pencils, art and office supplies; manufacturers of motor vehicles and equipment, and manufacturers of miscellaneous fabricated metal products.

Acute inhalation exposure to small amounts of TCE may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating, while high concentrations can cause impaired heart function, unconsciousness, and death. Chronic exposure to TCE may cause nerve, kidney, and liver damage. The National Toxicology Program (NTP) has determined that TCE is "reasonably anticipated to be a human

[44] Based on the EPA Air Toxics website http://www.epa.gov/ttn/atw/hlthef/tet-ethy.html and http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

[45] Based on the ATSDR Fact Sheet, available at http://www.atsdr.cdc.gov/toxprofiles/phs69.html, Chemistry of the Upper and Lower Atmosphere, Finlayson-Pitts and Pitts, 2000, and the CARB Fact Sheet, http://www.oehha.ca.gov/prop65/prop65_list/files/060906P65single.pdf.

carcinogen." Because of its cancer and non-cancer causing health effects, the State of California has identified trichloroethylene both as a carcinogen and a TAC. [46]

Vinyl Chloride

In California, vinyl chloride is regulated as a criteria pollutant. It is discussed more fully above.

[46] Based on the ATSDR Fact Sheet, available at http://www.atsdr.cdc.gov/tfacts19.html and the CARB fact sheet http://www.arb.ca.gov/toxics/tac/factshts/trichlo.pdf.