

**California Environmental Protection Agency
Children's Environmental Health Program
Biennial Report
*(2004-2005)***

February 2006



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Secretary
California Environmental Protection Agency**



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*Biennial Report (2004-2005)***

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EXECUTIVE SUMMARY

Infants and children breathe more air, eat more food and drink more water per pound of body weight than adults, thus exposing them to relatively greater quantities of environmental pollutants. They are also more vulnerable to the health impacts of pesticide and toxic substance poisoning because their respiratory and immune systems are in developing stages.

To ensure that its programs remain vigilant in protecting this sensitive population subgroup, the California Environmental Protection Agency (Cal/EPA) has established and maintained an active Children's Environmental Health Program to identify and protect California's children from the harmful effects of environmental pollutants. The Office of the Secretary at Cal/EPA oversees and coordinates the research efforts, studies and remediation efforts relating to children's environmental health that are currently being pursued by the Cal/EPA Boards, Departments and Offices (BDOs).

This report is submitted to the Legislature and the Governor to fulfill the biennial reporting requirements of the Children's Environmental Health Protection Act (Chapter 731, Statutes of 1999 [SB 25]) and to provide information on additional children's health related activities conducted for the past two years at Cal/EPA. The document describes 14 major children's health program activities and their accomplishments in the past two years, planned activities, program benefits, and recommendations for the future. These activities are summarized below:

Review of California Ambient Air Quality Standards

The Air Resources Board (ARB) lowered the annual average PM10 ambient air quality standard to 20 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and established an annual average PM2.5 ambient air quality standard at 12 $\mu\text{g}/\text{m}^3$. The Board also adopted a new 8-hour average standard for ozone of 0.070 parts per million (ppm) in consideration of impacts to children and other vulnerable population subgroups. The new ozone standard will become effective in 2006.

Evaluation of the Adequacy of California's Air Monitoring Network

ARB conducted extensive monitoring at six school sites for fine particulates, ozone, carbon monoxide, and oxides of nitrogen. Results obtained by this effort generally indicate few exceedences of standards and were mostly similar to the results obtained at other monitoring locations in the general proximity of each respective study area. The evaluation led to a monitoring study for dioxins and a method for measuring acrolein, two known toxic chemicals.

Identification and Control of Toxic Air Contaminants

In its January, 2006 public hearing, ARB identified environmental tobacco (second-hand) smoke as a toxic air contaminant in consideration of its effects on asthmatic children and breast cancer in women. ARB staff has proposed eight airborne toxic

control measures to reduce exposures to diesel emission particulates with several of these measures being adopted by ARB. In addition, staff has reviewed the need for new control measures for three other substances (acrolein, lead, and polycyclic organic matter) pursuant to the review. As a result of this review, the Department of Pesticide Regulation (DPR) developed regulations to reduce acceptable levels of worker and public seasonal exposures to the fumigant methyl bromide.

Risk Assessment Methodologies

The Office of Environmental Health Hazard Assessment (OEHHA) initiated the development of guidance concerning early-life exposure to carcinogens and assessment of procedures that could better account for such exposures in assessing lifetime cancer risks. The proposed changes in the risk assessment methodology are expected to be available for public review in 2006.

Development of Children's Cancer Risk Assessment Guidelines

OEHHA also reviewed both the U.S. EPA *Guidelines for Carcinogenic Risk Assessment* and the *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens*. In addition, OEHHA proposed criteria for identifying carcinogens that might have greater impact if exposure occurs early in life. OEHHA staff continues to add information to the Age-Related Cancer Susceptibility (ARCS) database and has presented at a national risk and exposure conference their preliminary analysis of 41 studies contained in the ARCS database.

School Site Multimedia Exposure and Health Risk Assessment Guidance

OEHHA, in collaboration with the Department of Toxic Substances Control (DTSC) released a final report providing guidance for a multimedia, multi-pathway risk assessment for existing and proposed school sites.

Contaminants of Greatest Potential Health Concern at Schools

This activity identifies chemical contaminants commonly found at school sites determined to be of greatest concern based on criteria that identify child-specific exposure and child specific sensitivities. OEHHA has reported the rationale for health guidance values for five contaminants (cadmium, chlordane, heptachlor-heptachlor epoxide, methoxychlor, and nickel). OEHHA also held a public workshop regarding draft health guidance values for pentachlorophenol and manganese, provided a draft health guidance value for lead to external peer reviewers, and drafted guidance values for toluene, delta-methrin and atrazine.

Evaluating Toxic Substance Risks at School Properties

DTSC reviewed 607 school projects in the past two years and is currently developing the *School Evaluation and Assessment Manual* which provides a comprehensive approach for environmental evaluation of proposed new school sites or expansions.

DTSC also completed a study regarding the background concentration of metals at several Los Angeles Unified School District school sites and completed an interim guidance for reducing the impacts of naturally occurring asbestos at school sites. Several other advisory documents related to the evaluation of subsurface vapor intrusion into indoor air, and methane assessment and mitigation measures were released to the public.

Integrated Pest Management (IPM) in California Schools

This pest management strategy focuses on long-term prevention or suppression of pests through a combination of techniques such as monitoring for pest presence and establishing treatment threshold levels using non-chemical practices. DPR continues to maintain and update its school IPM web site and conduct regional school IPM workshops. The department has provided to the schools and public IPM fact sheets for controlling common pests.

Environmental Health Conditions in California's Portable Classrooms

A statewide study recently completed by ARB evaluated ventilation systems and maintenance practices, indoor air quality, and other physical environmental factors in portable and permanent classrooms in public schools. The investigators documented in a report the findings and advisories of inadequate air ventilation, excessive background noise, high levels of indoor formaldehyde, mold problems, and inadequate lighting.

Children's School Bus Exposure Studies

ARB has sponsored a number of research studies on children's exposures to pollutants from diesel-fueled vehicles during their commute to school on a school bus. A recently completed study concluded that there appears to be a few inexpensive, easy to implement and effective mitigation methods for owners and operators of school buses to eliminate the negative impacts of school bus self-pollution. The report recommended several methods to minimize the negative effects to children such as reducing the caravanning of school buses, raising the bus exhaust release location, and reducing children's exposure to idling diesel engine emissions.

Cal/EPA's Children's Environmental Risk Reduction Plan

The Office of the Secretary provides the guidance to the Boards, Departments, and Office (BDOs) in developing new methods to reduce children's environmental risk as part of the Cal/EPA's overall efforts in addressing environmental justice issues through community projects. Cal/EPA hosted a series of workshops to present project goals, and timelines. The ARB, DPR, DTSC, and State Water Resources Control Board have been recently working with the local community groups to initiate a total of six 2-year pilot projects focused on reducing risks to children.

Vulnerable Populations Research Program

This program is designed to identify susceptible subpopulations, quantify the degree to which their health is compromised, and to characterize their exposures to air pollutants. Three projects are being conducted under the program including ARB's Fresno Asthmatic Children's Environment Study and a study of Traffic Related Air Pollution and Asthma in Economically Disadvantaged and High Traffic Density Neighborhoods in Los Angeles County, and OEHHA's East Bay Children's Respiratory Health Study. The East Bay study has shown a correlation between the proximity of a child's school and home to major roadways and the incidence of asthma symptoms and chronic bronchitis.

Southern California Children's Health Study

Sponsored by ARB, this has been a 10-year study of the health effects of children's long-term exposures to Southern California's high concentrations and unique mixtures of air pollutants. The recently-completed final report yielded many important results including a finding that a child's history of a doctor's diagnosis of asthma was found to be associated with nitrogen dioxide exposure and residential distance to a freeway. The study also found that significant decreases in lung function development at the age of 18 could be attributed to air pollutant exposure

INTRODUCTION

The protection of children's health continues to be a high priority for the Legislature and the Administration of Governor Arnold Schwarzenegger. In 1999, the Legislature passed a major initiative entitled "The Children's Environmental Health Protection Act". The act created the Children's Environmental Health Initiative within the Office of the Secretary at the California Environmental Protection Agency (Cal/EPA). Since that time many programs have been initiated to identify and remediate environmental health risks to children and to protect children from these health impacts. The Office of the Secretary coordinates and oversees these activities within Cal/EPA's Boards, Departments, and Office (BDO).

Upon taking office in 2003, Governor Schwarzenegger, as part of his Environmental Action Plan, made the protection of children's health one of the top priorities for the Administration. The Governor directed Cal/EPA to:

"...submit an inventory of projects that will immediately improve air quality along freeways adjacent to residential areas, improve aging plumbing in inner-city neighborhoods (that now cause contamination of drinking water for families), and identify other pollution threatening children's health. Agencies managing recently approved water and park bond funds will be directed to give priorities to these projects. Special emphasis will be placed on projects that measurably reduce childhood asthma by improving both indoor and outdoor air quality."

Additionally, the Governor stated his desire to:

"...promote integrated pest management to reduce pesticide use in our schools, hospitals, and homes."

These laws and initiatives have enabled the Administration and the Legislature to collectively address issues relating to the protection of California children's environmental health. California has taken important steps to protect children with unprecedented funding to support clean-ups of hazardous substances at school sites, to evaluate air quality in portable classrooms, and to ensure our environmental standards safeguard infants, children, and other sensitive people.

This report is presented in two parts. Part 1, entitled *Biennial Report to the Legislature and the Governor Regarding the Revisions and Modifications made by Cal/EPA to Cancer Potency Values and other Numerical Health Guidance Values Relating to Children's Health* is provided to meet the reporting requirements contained in Section 901(h) of the California Health and Safety Code (added by SB 25).

Part 2, entitled *A Report on the Activities of the Cal/EPA Children's Environmental Health Initiative* provides an update on all additional activities to protect children's health conducted by Cal/EPA for the past two years.

Part 1: Biennial Report to the Legislature and the Governor regarding the Revisions and Modification made by CAL/EPA to Cancer Potency Values and other Numerical Health Guidance Values Relating to Children's Health (Pursuant to the Children's Environmental Health Protection Act)

A. Review of California Ambient Air Quality Standards

1. Purpose and Requirements of the Legislation

The Children's Environmental Health Protection Act requires the California Air Resources Board, in consultation with the Office of Environmental Health Hazard Assessment, to review California's health-based ambient air quality standards (AAQS) by no later than December 31, 2000. The purpose of the review was to determine whether the standards, based on public health, scientific literature, and exposure pattern data, adequately protect the health of the public, including infants and children, with an adequate margin of safety. This initial review was also intended to set priorities for more extensive reviews and possible revisions of those standards not considered sufficiently protective of public health, especially with respect to infants and children. ARB was required to publish a report summarizing the findings of the initial review. Within two years of completing the prioritization of the standards for review, OEHHA was required to recommend to ARB revisions to the health-based standard for the highest priority criteria air pollutant determined to be inadequate to protect public health. OEHHA and ARB are additionally required to subsequently review one standard per year until all California AAQS have been reviewed.

The statute (Health and Safety Code Section 39606 [b]) also requires OEHHA to assess, to the extent that information is available: (1) exposure patterns among infants and children that are likely to result in disproportionately high exposure to ambient air pollutants in comparison to the general population; (2) special susceptibility of infants and children to ambient air pollutants; (3) the effects on infants and children of exposure to ambient air pollutants and other substances that have a common mechanism of toxicity, and; (4) the interaction of multiple air pollutants on infants and children, including the interaction between criteria air pollutants and toxic air contaminants.

2. Accomplishments from January 1, 2004 – December 31, 2005

a. Background

California has ten criteria air pollutants (ozone, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, visibility reducing particles, sulfates, hydrogen sulfide, and vinyl chloride), and 15 AAQS. ARB and OEHHA staff reviewed each standard's adequacy in protecting health, and then prioritized them for a more extensive review and revision, if necessary. The findings of the staff review were published in a report entitled *Adequacy of California Ambient Air Quality Standards: Children's Environmental Health Protection Act* (December 2000, available at <http://www.oehha.ca.gov/air/pdf/sb25.pdf>.) This report was reviewed by the Air Quality

Advisory Committee (AQAC), which consists chiefly of scientists in California academic institutions who conduct research in the field. The report found that health effects may occur in infants, children, and other potentially susceptible subgroups exposed to pollutants at or near levels corresponding to several existing California ambient air quality standards. Based on these factors, the pollutants were placed into two tiers, with the first representing greater potential risks to public health at the concentrations of the current air quality standards. ARB approved the staff report on December 7, 2000.

The first tier of pollutants included particulate matter with a mean aerometric diameter of 10 or 2.5 microns or less (PM10 and PM2.5, respectively), sulfates, ozone, and nitrogen dioxide. The AAQS for these pollutants are being re-evaluated first. The standard for PM10 was found to have the highest priority for revision. California also has a separate standard for sulfates, but since this class of pollutants represented a subset of particulate matter, the sulfates standard was reviewed in conjunction with the PM10 standard. The second tier of pollutants included lead, carbon monoxide, hydrogen sulfide, and sulfur dioxide. In 2003, ARB had completed its review of PM10/PM2.5 standards. The information on the review can be found at: <http://www.arb.ca.gov/research/aaqs/std-rs/std-rs.htm>.

b. Revision to the Ozone Standard

ARB and OEHHA staff conducted an extensive review of the scientific literature on public exposure, atmospheric chemistry, and health effects of exposure to ozone and published the findings in June 2004. This public review draft *Review of the California Ambient Air Quality Standard for Ozone* (June 2004) can be found at: <http://www.arb.ca.gov/research/aaqs/ozone-rs/ozone-draft-rpt.htm>.

The staff review and findings were peer-reviewed by the AQAC in January 2005. The Committee approved staff's recommendations, which were subsequently presented to ARB on April 28, 2005. ARB approved staff's recommendations to revise the ozone standard by establishing a new 8-hour average standard of 0.070 ppm. ARB also retained the current 1-hour standard for ozone at 0.09 ppm. The new standards are expected to become effective in 2006. The final report, *Review of the California Ambient Air Quality Standard for Ozone* (October 2005) can be found on the ARB website at: <http://www.arb.ca.gov/research/aaqs/ozone-rs/ozone-final/ozone-final.htm>.

Staff's recommendations are based primarily on human exposure studies that show reduced lung function and increased respiratory symptoms following either a 1-hour exposure to 0.12 ppm of ozone or a 6.6 to 8-hour exposure to 0.08 ppm of ozone. Evidence from epidemiological studies pointed to an association between ozone exposure and premature death and disease at current ambient concentrations of ozone.

Staff estimated that the annual health impact of exposure to ozone at current levels, compared to attainment of the proposed State 8-hour ozone standard throughout California includes:

- 630 (310 – 950 probable range) premature deaths for all ages;

- 4,200 (2,400 - 5,800, 95% confidence interval (CI)) hospitalizations due to respiratory diseases for all ages;
- 660 (400 – 920, 95% CI) emergency room visits for asthma by children under 18 years of age;
- 3.1 million (1.3 million – 5.0 million, 95% CI) minor restricted activity days for adults above 18 years of age, and;
- 4.7 million (1,200,000 – 8,600,000, 95% CI) school absences for children 5 to 17 years of age.

Children are at greater risk than adults of experiencing adverse responses to ozone by virtue of their higher level of outdoor activity, which increases their breathing rate and consequently their total exposure. Also, infants and children inhale more air per unit body weight than adults, even at rest. Thus, young children and infants experience a greater exposure per lung surface area than adults.

3. Planned Activities for the Next Two Years

The staffs of ARB and OEHHA are currently reviewing the scientific literature regarding the health effects of nitrogen dioxide exposure. A draft staff report is expected to be released in Winter 2006. Staff expects to take the findings of the review to ARB in late 2006.

4. Program Benefits to Children’s Environmental Health

Ambient air quality standards define “clean air” and are established with the intent to protect the health of the sensitive subsets of the general population in our communities, such as infants and children. To this end, California’s air quality standards include a margin of safety for adequate health protection.

B. Evaluating the Adequacy of California’s Air Monitoring Network

1. Purposes and Requirements of the Legislation

The overall goal of this element of the California Children’s Environmental Health Protection Program is to evaluate and improve the data available to estimate children’s exposures to air pollutants. Insufficient information on the exposures of infants and children poses a significant challenge to assessing the health impacts of air pollution on this vulnerable population. To accomplish this goal, SB 25 requires ARB to evaluate the adequacy of its ambient air quality monitoring network and assess its ability to provide information on infants’ and children’s exposures to air pollution. This effort will support a major objective of the Program, which is “to ensure that the state’s air quality standards and airborne toxic control measures adequately protect the health of infants and children.”

The occurrence, nature, and severity of air-pollution related health effects that children experience are dependent on how much of a given pollutant they breathe, which in turn is dependent on the level of a pollutant in the outdoor and indoor air. Although pollution

levels tend to be similar throughout a region, there may be pockets of higher air pollutant concentrations located in close proximity to pollution sources such as heavily traveled freeways and industrial facilities. Harmful exposures can occur when children live in homes, attend schools, and play at recreational areas located downwind of these sources.

California's extensive ambient air quality monitoring network was designed to measure regional levels of pollutant concentrations in the air. Its primary purpose is for determining which areas of the State are in attainment or in nonattainment with the health-based State and federal air quality standards for criteria pollutants such as ozone, particulate matter, oxides of nitrogen, oxides of sulfur, and carbon monoxide. The network provides information to help determine what air pollution control programs and strategies are needed, and to evaluate the success of our air pollution reduction programs. In addition, there are monitors that support the identification of toxic air contaminants (TACs) in the air and help identify locations in the State where there are high levels of TACs. There are also many special purpose monitors throughout the State established to support specific programs. The ambient air global monitoring network has been a useful and necessary tool for assessing the regional level of air pollution in California. However, it may not adequately represent the localized environments where children spend most of their time.

Legislative Requirements for Outdoor and Indoor Monitoring. To enhance our understanding of infant's and children's exposures to air pollution and the health effects associated with those exposures, SB 25 added Section 39617.5 to the Health and Safety Code. This addition specified the following:

By no later than January 1, 2003, ARB is to:

- Evaluate the adequacy of the current outdoor air quality monitoring network for its ability to gather the data necessary to determine the exposure of infants and children to air pollutants including criteria air pollutants and toxic air contaminants.
- Identify areas where the exposure of infants and children to air pollutants is not adequately measured by the current monitoring network.
- Recommend changes to improve air pollution monitoring networks and data collection to more accurately reflect the exposure of infants and children to air pollutants.

For the purpose of sampling air pollution in locations where children spend time, ARB, in cooperation with local air quality districts, is to expand its existing monitoring program in six communities around the state in non-attainment areas. This expansion is to include:

- Special monitoring of children's exposures to air pollutants and toxic air contaminants.
- Placement of air pollution monitors near schools, daycare centers, and outdoor recreational facilities that are in close proximity to, or downwind from, major industrial sources of air pollutants and toxic air contaminants, including, freeways and major traffic areas.

- Monitoring during multiple seasons and at multiple locations within each community at schools, daycare centers, recreational facilities, and other locations where children spend most of their time.
- A combination of approaches to provide the most comprehensive data possible on the levels of children's exposure to air pollutants and toxic air contaminants. These approaches include:
 - Upgrades to existing fixed monitoring sites.
 - Establishment of new fixed monitoring sites.
 - Conducting indoor and outdoor sampling and personal exposure measurements in each community.

The legislation also stipulates that data collected from expanded air quality monitoring activities may be used for any purpose, if the monitoring devices used to collect the data meet federal and State regulations pertaining to pollutant measurement methods.

2. Accomplishments for January 1, 2004 – December 31, 2005

a. Community Monitoring Studies

SB 25 required ARB to evaluate the adequacy of the statewide ambient monitoring network for determining infant's and children's exposure to air pollutants and, as part of that review, to expand monitoring activities to six communities in areas where children live and play near major industrial sources and traffic areas. In evaluating the monitoring network, ARB compared the SB 25 monitoring results with routine network data. ARB also used a combination of network monitoring data and statistical analyses as another method to evaluate the ability of the network to characterize the air pollution exposure of children. Based on the analyses, ARB found that the statewide monitoring network provides the fundamental data needed to determine typical outdoor exposures of children to air pollution in California communities. At the same time, ARB found that additional methods are needed to assess localized exposures that may occur near specific air pollution sources. The *Report of the Assessment of the Statewide Air Monitoring Network* can be found on the ARB website at: http://www.arb.ca.gov/ch/programs/SB_25/adequacy.htm.

Reports on the special monitoring in communities of Barrio Logan, Wilmington, Boyle Heights, Crockett, Fruitvale and Fresno were completed in 2004 and 2005 and can be found on the ARB website at: http://www.arb.ca.gov/ch/programs/SB_25/SB_25.htm. Table 1 provides a summary of average measurements of Nitrogen Oxides (NO_x), Carbon Monoxide (CO), PM₁₀, and Ozone at these communities:

Table 1. Community Monitoring Study Results

Monitoring Location		Average Results from a Minimum 12 - Month Period			
		NOx (ppb) ¹	CO (ppm) ²	PM-10 (Micro-grams per cubic meter) ³	Ozone (ppb) ⁴
Barrio Logan	Memorial Academy Charter	61	1.0	35	42
Boyle Heights	Hollenbeck Middle	188	2.0	44	46
Wilmington	Wilmington Park Elementary	128	1.1	40	43
Crockett	John Swett High	43	0.5	19	40
Fruitvale	Lockwood Elementary	117	1.2	24	34
Fresno	Fremont Elementary	103	1.0	45 ⁵	65

¹ No State or federal standards have been associated with oxides of nitrogen. The State standard for NO₂ is 250 ppb for a one-hour average. The federal annual average standard for NO₂ is 53 ppb.

² The State CO standard is 9 ppm for an 8-hour average.

³ The State PM10 standard is 50 micrograms per cubic meter.

⁴ The State ozone standard is 90 ppb for a one-hour average.

⁵ Derived utilizing the BAM-10 method.

Listed below are brief discussions of the results from the community monitoring studies:

- Barrio Logan
Based on 17 months of outdoor air measurements collected at the Memorial Academy Charter School, ARB found overall air quality levels at Barrio Logan to be similar to the San Diego region and to statewide averages.
- Boyle Heights
Average criteria air pollutant levels were similar at the Hollenbeck Middle School site and the two long-term monitoring sites at downtown Los Angeles and Burbank.
- Wilmington
The study did not find large differences between most pollutants measured at the Wilmington Park Elementary School site, downtown Los Angeles, and North Long Beach monitoring sites.

- Crockett
The overall air quality measured at John Swett High School in Crockett was comparable and in some cases better than what was measured at monitoring sites in other nearby cities in the Bay Area.
- Fruitvale
Average levels of criteria air pollutants at the Lockwood Elementary School site were comparable to measurements from the nearest long-term monitoring sites in the Bay Area. Fruitvale, like many other areas in the Bay Area, exceeds the State standard for PM10. Even though Fruitvale exceeded the State PM10 standard a few times, maximum PM10 levels at the nearest monitoring sites in the San Francisco Bay Area were higher. Fruitvale did not exceed the State standards for carbon monoxide or ozone.
- Fresno
Data from Fremont Elementary School was compared to data from the nearest long-term monitoring site (Fresno 1st Street). Like many other areas in the San Joaquin Valley Air Basin, both the Fremont School and Fresno 1st Street sites exceeded the State 24-hour PM10 standard. In addition, both sites measured several exceedances of federal and state ozone standards. Overall ozone values at the Fremont site were lower than those measured at the Fresno 1st Street site.

Two other activities associated with the community monitoring studies were conducted in 2004 - 2005:

- Dioxins Monitoring Study
ARB conducted a special ambient dioxins monitoring study to provide information on ambient levels of dioxins and dioxin-like compounds. Ten sampling sites were selected, five in the San Francisco Bay Area, four in the Los Angeles basin, and one in Sacramento. Monitoring was conducted over a three year period (2002-2004) at the ten sites with over 400 samples analyzed. Data are currently available for the 2002 and 2003 on ARB's website at: <http://www.arb.ca.gov/aqa/cadamp.html>.
- Acrolein Ambient Methodology and Monitoring
As a result of SB 25, ARB developed a test method for analyzing acrolein in ambient air. This method was finalized in 2003, and collection of data began at that time. Previous to this, ARB had no reliable ambient data for acrolein. This information is currently being used in preparing the draft needs assessment for acrolein.

b. Indoor Air Monitoring

Dr. Steven Colome of the University of California, Los Angeles conducted an indoor and personal pollutant monitoring study for this project under contract to ARB. Measured pollutants include particulate matter (PM2.5 and PM10), organic carbon and elemental carbon, aldehydes, carbon dioxide (CO2), and ten volatile organic compounds (VOCs). A total of thirteen weeks of sampling data were collected. Sampling was conducted

inside three classrooms at each school, at one outside location on the grounds of each school, and inside one student's residence near each school.

Dr. Colome submitted a draft final report which was reviewed by ARB's Research Screening Committee (RSC) as required. The RSC found that the draft report needed improvement to clearly communicate the work that was completed, the results, and an understanding of indoor sources and the relationship between exposure to indoor air pollutants and children's health. ARB is working with the RSC and a contractor to complete the report.

3. Planned Activities for the Next Two Years

a. Community Monitoring Studies: Outdoors

ARB has completed the community monitoring required as part of SB 25 but will continue to conduct special purpose monitoring studies that will add to an understanding of community level air pollution and how it affects the health of children.

b. Indoor Air

ARB is continuing to pursue suitable completion of this project.

4. Program Benefits to Children's Environmental Health

a. Community Monitoring Studies: Outdoors

The additional information gathered through ARB's monitoring efforts was critical for the evaluation of the existing air quality monitoring network's adequacy for assessing children's exposures. The information has enhanced ARB's understanding of how well the measurements made at existing sites within a community relate to specific locations where children spend time. This additional data can provide guidance on whether certain measurements need to be strategically added to the existing monitoring network. The insights provided by the monitoring efforts, described above, can be used to guide public health policy that relates to assessing children's exposures to air pollution and to mitigating those exposures.

b. Indoor Air Monitoring

The intent of the indoor air monitoring study was to provide information that would help ARB identify differences between pollutant levels measured at network monitoring sites and locations where children spend a substantial amount of time. The personal monitoring data would provide insight to children's actual exposures to toxic air pollutants. This information would be useful in identifying additional pollutant sources that may require emission reductions in the future.

5. Recommendations

a. Community Monitoring Studies: Outdoors

ARB developed three recommendations designed to supplement the air pollution exposure information provided by the statewide monitoring network. These recommendations are being implemented as part of ARB's community health and environmental justice programs. The recommendations are to:

- Use the mobile monitoring capability for short-term special purpose assessments to supplement the statewide monitoring data.
- Improve emission estimates and air quality modeling methods to assess localized exposures near air pollution sources.
- Fund development of lower-cost monitoring methods.

b. Indoor Air Monitoring

Preliminary results from this study for aldehydes indicate that measured values were relatively low compared to those found in other studies, but that classroom concentrations were higher than or equal to the corresponding outdoor concentrations at the schools. This result is consistent with the statewide study of *Environmental Health Conditions in California's Portable Classrooms*, which found elevated levels of formaldehyde in most classrooms. Elevated indoor concentrations generally indicate that there are indoor sources of formaldehyde and other aldehyde and that they should be reduced. Further recommendations will be developed after the submission and acceptance of a final report.

C. Review of Toxic Air Contaminants

1. Purpose and Requirements of the Legislation

a. Identification of Additional Chemicals as Toxic Air Contaminants

SB 25 modified the portion of the Health and Safety Code describing the identification of toxic air contaminants. Specifically, the bill requires that OEHHA, when assessing the health effects of candidate toxic air contaminants, consider: 1) the exposure patterns among infants and children that are likely to result in disproportionately high exposure, and; 2) special susceptibility of infants and children in comparison to the general population.

b. Air Toxic Control Measures

The goal of the air toxics program is to reduce to the maximum extent feasible, or eliminate when possible, exposure to toxic air pollutants to all Californians, including infants and children. With regards to the control of air toxics, SB 25 requires ARB to take two actions within specified timeframes:

- 1.) Prepare a needs assessment report and adopt control measures, as appropriate, for the toxic air contaminants (TACs) identified on the list as making infants and children more susceptible to illness and that have no existing control measures, and;
- 2.) Review and revise, if necessary, any control measures that had been adopted for the TACs identified by OEHHA.

The initial list that OEHHA produced in 2001 contained five TACs that may cause infants and children to be especially susceptible to illness. These TACs are: polycyclic organic matter, lead, dioxins (formally known as polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs)), particulate emissions from diesel-fueled engines, and acrolein.

2. Accomplishments from January 1, 2004 – December 31, 2005

a. Identification of Additional Chemicals as Toxic Air Contaminants

Environmental tobacco smoke (ETS) entered the TAC identification process in June 2001 and has undergone a thorough and extensive evaluation. Since then, a public workshop and several meetings were held with the Scientific Review Panel (SRP). The SRP approved the draft report on June 24, 2005, and published its scientific findings. In its findings, the SRP concluded that the report is based on sound scientific knowledge and that ETS should be listed as a TAC by ARB. The SRP further recommended that OEHHA also add ETS to the list of TACs that may disproportionately impact children. This was the first assessment of a candidate TAC that included the specific evaluation of effects on children and infants as required under SB 25. Exposure to ETS is associated with a number of adverse health impacts on infants and children, including induction and exacerbation of asthma, low birth weight and pre-term delivery, sudden infant death syndrome, and upper respiratory and middle ear infections. ARB adopted ETS as a TAC during its January 2006 public hearing.

The California Department of Pesticide Regulation has developed a public process for selecting and prioritizing active ingredients for risk assessment initiation, including consideration for potential Toxic Air Contaminants and children's exposure and provided opportunity for public comment on process through public meetings of the Pesticide Registration Evaluation Committee and through the Department of Pesticide Regulation web site. DPR finalized the public process and published a final prioritized list.

DPR completed a risk assessment for sulfuryl fluoride as a potential Toxic Air Contaminant and presented its findings to the Scientific Review Panel. Additionally, DPR initiated consultation with the SRP regarding the next candidate ingredients.

b. Air Toxic Control Measures

ARB adopted or considered for adoption eight airborne toxic control measures (ATCMs) to reduce exposures for diesel PM and one ATCM to reduce dioxins from cruise ships between January 1, 2004 and December 31, 2005. Significant resources have been

focused on reducing levels of diesel PM because it is estimated to contribute about 70 percent of the potential cancer risk from air toxics statewide. As a result, work has continued on activities to review and reduce exposure to the other four TACs identified by OEHHA, but not at the same pace as that for diesel PM. The ATCMs adopted for diesel PM and dioxins are summarized below:

1). Diesel PM ATCMs

Diesel PM was identified as a TAC in 1998. ARB approved a needs assessment report in September 2002, entitled the *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles* (the Diesel Risk Reduction Plan). The Diesel Risk Reduction Plan outlines control measures to be developed over the next several years with the goal to reduce diesel PM emissions by 75% in 2010 and 85% by 2020. Prior to 2004, ARB has taken many actions to reduce diesel PM, such as establishing new heavy-duty diesel engine standards, developing a retrofit verification program, and adopting regulations limiting school bus idling and to lower the sulfur content of diesel fuel. As shown below, in the past two years ARB has continued to accomplish significant reductions through the adoption of numerous measures:

- Stationary Engines (adopted 2004, modified 2005):
There are approximately 26,000 stationary diesel-fueled engines in California. Most are used as emergency backup in the event of a power failure. Others are used to pump water in agricultural areas, to run compressors, cranes and other equipment. New ARB standards for these engines, adopted in February 2004, will bring an approximate 80% diesel PM reduction by 2020 through stricter standards for new engines and requirements to retrofit existing engines. Due to limited availability of complying engines, the ATCM was modified in 2005 to allow replacement of older, dirtier engines with the cleanest new engines available.
- Transport Refrigeration Units (adopted 2004):
Transport Refrigeration Units (TRUs) are diesel-powered refrigeration units that cool temperature-sensitive products while they are being shipped in trucks, trailers, shipping containers and rail cars. Although the diesel engines powering TRUs tend to be relatively small, there are about 40,000 engines operating in California. ARB adopted a regulation to reduce emissions from TRUs in February 2004. Diesel PM emissions will be reduced by 65% by 2010 and by 92% by 2020.
- Portable Engines (adopted 2004):
California has about 33,000 portable diesel engines that are used in pumps, airport ground support equipment, oil drilling rigs, generators, and a variety of other equipment. In February 2004, ARB passed a regulation that requires reductions in emissions from portable engines, reaching a 95% reduction in diesel PM emissions in 2020 with significant cuts in smog-forming emissions.
- CARB Diesel for Locomotives and Marine Harborcraft (adopted 2004):
The ATCM extends the applicability of the California standards for motor vehicle diesel fuel regulations to diesel fuel used in commercial and recreational harborcraft and intrastate diesel-electric locomotives. The ATCM applies to diesel fuel sold for

use in commercial and recreational harborcraft within the boundaries of the South Coast Air Quality Management District (SCAQMD) beginning January 1, 2006. It applies statewide to diesel fuel sold for use in commercial and recreational harborcraft and intrastate locomotives beginning January 1, 2007.

- Heavy Duty Idling (adopted 2004, modified 2005):
ARB adopted a five minute limit on nonessential idling on July 22, 2004. On October 20, 2005, ARB approved a regulation to further reduce emissions of toxics and criteria pollutants by limiting idling of new and in-use sleeper berth equipped diesel trucks. The regulation consists of new engine and in-use truck requirements and emission performance requirements for technologies used as alternatives to the truck's main engine idling.
- Ocean-going Vessel Auxiliary Engines (adopted December 2005):
Air pollution from maritime port activities is a significant and growing concern in California. Emissions from the auxiliary engines of ocean-going vessels are one of the largest contributors of air pollutants to communities near ports. The regulation of ship auxiliary engines is designed to significantly reduce the public's exposures to diesel PM, as well as reduce ambient particulate matter. The proposed regulation will also reduce emissions of nitrogen oxides (NOx), a precursor to PM and ozone pollution, and SOx. The regulation will result in a reduction of diesel PM by 70-80% each year, beginning in 2007.
- Mobile Cargo Handling Equipment (adopted December 2005):
There are approximately 3,700 pieces of cargo handling equipment at California's ports and intermodal rail yards. ARB adopted a regulation to reduce emissions of diesel PM from new and existing (in-use) mobile cargo handling equipment at ports and intermodal rail yards through the application of best available control technology (BACT). Diesel PM emissions from cargo handling equipment will be reduced by approximately 80% by 2020, relative to the 2004 baseline levels.
- On-road Public and Utility Fleets (adopted December 2005):
Diesel vehicles owned and operated by public agencies and utilities are a concern because they often operate in and around residential neighborhoods. The regulation will require public agencies (municipalities) and utilities to reduce the amount of diesel PM from their vehicles by application of best available control technology. The regulation is expected to reduce diesel PM emissions by up to 60% in 2010.

2). Other Diesel PM Actions

ARB has also completed several additional non-regulatory actions that will help to reduce the public's exposure to diesel PM. These actions include:

- Roseville Rail Yard Study (2004):
ARB prepared a risk assessment to determine the potential public health risks from diesel PM emissions related to locomotives and their activity at the J. R. Davis Yard (rail yard or Yard) in Roseville, California. The results of the risk

assessment show a large area impacted by the diesel PM emissions associated with the operations and activities of the Yard. Overall, the emissions from the rail yard impact an area of over 10,000 acres. This information is being used by the local air districts and the railroad companies to develop strategies to reduce emissions from rail yards.

- Railroad MOU (2005):
To achieve the greatest emission reductions through measures that will begin to be implemented immediately across the State, ARB entered into a memorandum of understanding (MOU) with Union Pacific Railroad (UP) and Burlington Northern Santa Fe Railway (BNSF). The MOU is designed to achieve a 20% reduction in locomotive and railroad diesel PM emissions by 2010.
- Port of Los Angeles and Long Beach Risk Assessment (2005):
ARB performed this study to help understand the emission impacts and the potential public health risks from diesel PM emissions due to activities at the Port of Los Angeles and Port of Long Beach (the Ports), approximately 20 miles south of downtown Los Angeles. The results of the draft risk assessment show a very large area impacted by the diesel PM emissions associated with the operations and activities of the Ports. Overall, the emissions from the Ports impact areas extending several miles from the Ports. This study will also help prioritize control actions for the various sources of diesel PM at the Ports.

3). Dioxins ATCM

Dioxins are highly toxic chemicals that are formed during the combustion of materials and the manufacture of certain chlorinated chemicals. Dioxins can be emitted from a variety of sources including cars and trucks, waste incineration, chemical manufacturing plants, and other industrial sources that burn fuel. In 2004, Assembly Bill 471 was passed prohibiting cruise ships from conducting onboard incineration while operating within three (nautical) miles of the California coast. Prohibiting this incineration will reduce the potential for adverse public health impacts for residents and workers. AB 471 states that the Board shall enforce this legislation and may adopt standards, rules, and regulations for this purpose. ARB adopted an ATCM in November 2005 to implement this legislation which will reduce emissions of dioxins and other TACs, such as toxic metals.

4). Field Fumigation Mitigating Measures

The Department of Pesticide Regulation developed regulations to reduce to acceptable levels worker and public seasonal exposures to the field fumigation use of methyl bromide. Implementation of regulatory controls occurs at the county level. DPR also agreed to collaborate with U.S. EPA on the development of mitigation measures for methyl isothiocyanate, a breakdown product of the pesticide metam-sodium. The Department of Pesticide Regulation will coordinate the release of mitigation proposal with U.S. EPA. Interim steps include a review of planned stewardship activities by the currently-established Metam Sodium Task Force.

c. Other Activities for TACs

As mentioned previously, ARB has committed significant resources to diesel PM risk reduction because of the health impacts to children and the majority contribution to statewide cancer risk. ARB has also assessed the need for new control measures for the other three TACs.

1). *Acrolein*

Acrolein is a product of incomplete combustion and is present in motor vehicle exhaust, tobacco smoke, wood smoke and some industrial emissions. It can also be formed in the atmosphere from chemical reactions involving 1,3-butadiene, another pollutant present in motor vehicle and industrial emissions. As mentioned previously, ARB developed an ambient monitoring method in 2003 and began collecting ambient data for acrolein. At this time, available information does not indicate any significant sources of uncontrolled emissions. This information is being used in the development of a draft needs assessment.

2). *Lead*

Airborne lead levels have decreased dramatically in recent decades, primarily due to the ban on leaded gasoline. Inorganic lead was identified as a toxic air contaminant in 1997. The 1993 ATCM to reduce toxic metal emissions, including lead, from metal smelting operations, was reviewed and no revisions were found to be necessary. Data are being gathered to ensure that no significant sources of lead remain that need control.

3). *Polycyclic Organic Matter*

Polycyclic Organic Matter (POM) consists of a family of more than 100 chemicals containing more than one benzene ring and a boiling point of greater than 100°C. POM can be divided into the subgroups of polycyclic aromatic hydrocarbons (PAHs) and PAH-derivatives. They are produced by the combustion of fossil fuels, vegetable matter and other carbon-based materials. POM is present in exhaust from diesel- and gasoline-powered motor vehicles, fireplace smoke, tobacco smoke, and emissions from paper mills, industrial machinery manufacturing plants, and petroleum refineries. Regulations reducing combustion sources (like burn barrels and agricultural burning) and diesel PM also reduce PAHs. Currently, ARB has limited ambient data on gaseous PAHs due to monitoring limitations. No significant sources of uncontrolled emissions are apparent.

3. *Planned Activities over the Next Two Years*

a. *Identification of Additional Chemicals as Toxic Air Contaminants*

In the future, ARB plans to identify additional candidate substances as TACs, especially those with disproportionate impacts to children. Under Health and Safety Code requirements, ARB performs an evaluation to establish the list of substances which will be evaluated next as potential TACs. ARB is currently updating the prioritization process to include a category for health information on infants and children.

OEHHA plans to update the list of TACs after finalizing the revised risk assessment methods (see next section) to more specifically include infants and children. The updating of the list will be based on reviews of up to 15 TACs over the next two years.

DPR will continue to initiate risk assessments on additional pesticide active ingredients as other ongoing assessments are completed and continue to present risk assessments for potential Toxic Air Contaminants to the Scientific Review Panel. Several active ingredients in prioritized list pose air concerns and are potential TACs. Children's exposure will be addressed.

Finally, DPR will initiate mitigation on completed risk assessments as directed by the Risk Management Directive.

b. Air Toxic Control Measures

The Diesel Risk Reduction Program continues to be a high priority and ARB is evaluating several additional control measures to further reduce the public's exposure to diesel PM over the next two years. Health risks from diesel PM are highest in areas of concentrated emissions, such as near ports, rail yards, freeways, or warehouse distribution centers. The diesel PM measures planned for evaluation include:

- Off-road public and private fleets
- Harbor craft engines
- Oceangoing vessel main engines
- In-use agricultural engines
- On-road private fleets

In addition to the planned control measures listed above, ARB is an active partner in the Governor's Goods Movement Action Plan being jointly carried out by Cal/EPA and the Business, Transportation & Housing Agency (BT&H). As part of that effort, ARB has developed and released a draft Emissions Reduction Plan for Ports and Goods Movement that lists strategies for further reducing diesel PM and other pollutants from the transportation sectors involved. The basic strategies to reduce emissions include regulatory actions, incentive programs, lease agreements, careful land use decisions, and voluntary actions. The measures address all significant emission sources involved in goods movement including marine vessels, harbor craft, cargo handling equipment, locomotives, and trucks.

ARB will also be developing a control measure to further reduce dioxin emissions from incineration by oceangoing ships to implement Senate Bill 771, which was passed in 2005. This legislation will extend the ban on incineration from cruise ships to other types of marine vessels.

Since Environmental tobacco Smoke has been identified as a TAC and is likely to be added to the SB 25 list, ARB is required to prepare a needs assessment report and develop control measures, as appropriate, within three years of identification. Health and Safety Code section 39665 has specific requirements for issues to be addressed, to the extent that data are available, in a needs assessment report.

DPR will develop and implement mitigation measures for the fumigant sulfuryl fluoride. This fumigant is used for structural pest control and as a commodity fumigant. DPR will also work collaboratively with U.S. EPA to develop and implement mitigation measures for other fumigant pesticides.

4. Program Benefits to Children's Environmental Health

While the identification of ETS as a TAC has no direct effect on public exposure, it is still anticipated to have some benefits. Given the comprehensive technical report produced by ARB and OEHHA, much has been learned regarding children's exposure and health effects. The Cal/EPA report serves as an excellent reference document, which will likely form the basis for future educational materials. The report will also likely serve as an important reference for future anti-smoking policies and breast cancer research.

A benefit of the review and adoption of ATCMs is reduced exposure to toxic air contaminants that adversely impact children. Airborne toxic control measures are adopted based on reducing the level of emissions to the lowest level achievable through the application of best available control technology (BACT) or a more effective method.

OEHHA's review of the literature on TACs helps ensure that ARB implements control strategies for those contaminants with the most potential to harm infants and children.

5. Recommendations

Continued support of this program is recommended because it provides new information to regulatory agencies and better protects infants and children from exposures to air pollutants. Cal/EPA recommends the continuation of efforts to identify substances which pose a significant public health threat, especially those with disproportionate impacts to children. Where a needs assessment shows that additional control measures can be taken to further reduce exposures, adoption of those measures is also recommended.

Continued support of this program is recommended to determine which TACs pose the most harm to infants and children, and consequently which TACs should be the focus of ARB control measures.

D. Risk Assessment Methodologies

1. Purpose and Requirements of the Legislation

SB 25 requires OEHHA to evaluate the effects of TACs on infants and children. Under existing risk assessment methodologies, OEHHA uses various assumptions when evaluating and quantifying risk from exposure to chemicals to ensure that the evaluation does not underestimate risks to children. For example, in calculating levels of exposure to TACs that do not pose a health risk, OEHHA typically uses statistical and mathematical methods that assume children and infants are more sensitive to TACs

than adults. These assumptions generally are necessary because there often is little or no actual data of the effect of the contaminants on children and infants. Risk assessors have always known that such assumptions are less than ideal, but data have generally been lacking to use anything other than assumptions for most chemicals. As part of the TAC evaluation process for SB 25, OEHHA is evaluating available information to assess the adequacy of these assumptions in protecting infants and children from toxic air contaminants. These evaluations will be used to modify OEHHA's risk assessment methods where appropriate and necessary to ensure adequate protection of infants and children. OEHHA finds that refinement of its risk assessment methodologies is critical to accomplishing SB 25's objective of evaluating the risks that TACs may pose to children and infants.

2. Accomplishments from January 1, 2004 – December 31, 2005

OEHHA has continued its revision of the risk assessment guidelines used in the Toxic Air Contaminant programs (including the Air Toxics Hot Spots program) to provide more specific measures to address early life exposure to TACs. These guidelines will help OEHHA to adequately assess the 15 TACs per year as required under SB 25. OEHHA has also continued its review of factors that influence response to toxicants and how those factors may differ by age. This information will help OEHHA determine whether the methods it uses to identify safe levels of exposure to TACs adequately account for differences between children and adults.

OEHHA has initiated the development of guidance concerning early-life exposure to carcinogens and an assessment of procedures that could better account for the influence such exposures may have on lifetime cancer risk. In addition, OEHHA organized an offsite in May 2005 to enable staff scientists involved in children's health activities to discuss in-depth issues concerning the assessment of health risks that children may face from environmental contaminants.

3. Planned Activities for the Next Two Years

OEHHA plans to take its proposal for revised risk assessment methods through the public review process and review by the state's Scientific Review Panel on Toxic Air Contaminants. OEHHA will use these updated methods in evaluating TACs for inclusion on the list of TACs that may disproportionately impact infants and children.

4. Program Benefits to Children's Environmental Health

Addressing the specific exposures and susceptibilities of infants and children in OEHHA's risk assessment methods helps ensure adequate protection of children when the assessments are used as the scientific basis for airborne toxic control measures.

Part 2: A Report on the Activities of the Cal/EPA Children's Environmental Health Initiative

I. THE HEALTHY SCHOOLS ACT OF 2000 (ASSEMBLY BILL 2260)

A. California School Integrated Pest Management (IPM) Program

1. Purpose and Requirements of the Legislation

The Healthy Schools Act established IPM as the state's preferred method of pest control for schools. The law put the Department of Pesticide Regulation's existing voluntary California School IPM Program into code and added new right-to-know requirements regarding pesticide applications, such as notification, posting, and record keeping for schools; and enhanced pesticide use reporting for licensed pest control businesses. The Act defined this approach as "a pest management strategy that focuses on long-term prevention or suppression of pest problems through a combination of techniques such as monitoring for pest presence and establishing treatment threshold levels, using nonchemical practices to make the habitat less conducive to pest development, improving sanitation, and employing mechanical and physical controls. Pesticides that pose the least possible hazard and are effective in a manner that minimizes risks to people, property, and the environment, are used only after careful monitoring indicates they are needed according to pre-established guidelines and treatment thresholds" (Food and Agricultural Code section 13181). The law (Education Code sections 17608-17613) also requires that public school districts do the following right-to-know activities:

- Provide notification of pesticide applications.
- Maintain a registry of persons requesting notification of each pesticide application.
- Post warning signs at site of pesticide applications.
- Keep records of pesticide applications at each school.
- Designate an IPM coordinator.

The law mandates (Food and Agricultural Code sections 13180-13188) pesticide use reporting by licensed pest control businesses and requires (Food and Agricultural Code sections 13180-13188) that DPR:

- Prepare a school pesticide use reporting form to be used by licensed pest control businesses when they apply any pesticides at a school. Licensed pest control businesses must submit the form to DPR at least annually.
- Establish a school IPM Web site with information on pesticide products; a comprehensive directory of resources describing and promoting least-hazardous pest management practices at schools; a model program guidebook; and ways to reduce the use of pesticides at school facilities.
- Promote and facilitate the voluntary adoption of IPM programs for school districts, while it assists their compliance with the provisions of the Education Code.

- Train school districts' IPM coordinators so that those who carry out the IPM program can better understand principles of IPM and can in turn train their staff.

2. Accomplishments from January 1, 2004 — December 31, 2005

During the two-year time period, DPR continued to maintain and update its school IPM Web site and created IPM factsheets for schools regarding the control of several common pests, such as ants and cockroaches. Several publications were completed, including:

- DPR. 2005. *Don't Grow Your Own Mosquitoes! Coalition for Adequate School Housing* CASH Register 16(9): 11
- Geiger, C. and D. Tootelian. 2005. *The Healthy Schools Act Spurs Integrated Pest Management in California Public Schools*. California Agriculture 59(4): 235-241
- Simmons. S. 2005. *Pest Prevention—Construction Guidelines and Practices*. California Association of School Business Officials Journal of School Business Management 70(4): 10-16
- Simmons, S. 2005. *Pest Prevention—Facility Design*. Coalition for Adequate School Housing CASH Register 26(6): 4,8-9

The department has solicited input and suggestions for improving the California School IPM program by various methods such as the completion of the third survey of IPM adoption in California school districts and the commencement of several meetings of the School IPM Advisory Group.

DPR conducted 10 regional school IPM training workshops attended by 395 people representing 37 districts in Butte, Humboldt, Kern, Placer, Riverside, San Luis Obispo, Santa Clara, Stanislaus, Tulare, and Ventura counties. Since the beginning of the program, DPR has trained 541 people representing 435 districts (44 percent of districts statewide), in 15 regional school IPM workshops.

School IPM coordinators who participated in the training workshops were provided with information necessary for them to practice alternative management practices. For example, in cooperation with the UC Statewide IPM Program, DPR developed an interactive school IPM training DVD on ants. This is modeled after a successful UC Master Gardener pilot project and is intended to supplement the training workshops by providing IPM coordinators with an additional tool to use for their localized intra-district training efforts.

DPR revised its Program Overview (entitled *How IPM Can Help Schools*) and *The Healthy Schools Act Frequently Asked Questions* documents. Staff published four articles to assist school districts to implement IPM and to promote the adoption of IPM. DPR periodically provided IPM coordinators information about school IPM and conducted 17 presentations. Staff responded to numerous questions and requests for information from school districts and other stakeholders.

3. *Planned Activities for the Next Two Years*

Several activities conducted in previous years, such as the maintenance of the school IPM Web site, the commencement of meetings with the School IPM Advisory Group, and the solicitation of input and suggestions for improving the California School IPM program will continue for the next two years. DPR will continue to collect pesticide use information reported by licensed pest control businesses

New initiatives include plans to conduct four regional IPM training workshops statewide each year and the scheduled release and distribution of two interactive school IPM training DVDs on weeds and cockroaches. In addition, DPR plans to develop and implement regional seminars and district-level school IPM training workshops, will finalize pest-specific IPM fact sheets on rats, mice and on turf weeds, and complete a poster that reminds teachers not to use pesticides in classrooms and provides information on what they can do to prevent pests.

DPR plans to complete its calendar of IPM activities for IPM coordinators that will highlight preventive practices, monitoring, and other IPM activities to consider each month. The calendar will be distributed to schools statewide.

DPR staff will continue to make presentations to provide information about the Healthy Schools Act and components of DPR's California School IPM Program. DPR also plans to publish articles about its California School IPM Program and the Healthy Schools Act in key school publications. These efforts will target IPM coordinators, school boards and school district superintendents, business managers, and risk managers to publicize DPR's training program and to promote and facilitate the voluntary adoption of an IPM program.

4. *Program Benefits to Children's Environmental Health*

DPR has a legal mandate to encourage the use of more environmentally sound pest management systems, including IPM. DPR emphasizes a reduced-risk approach to pest management by promoting and facilitating adoption of IPM programs by school districts. The Department encourages the development and adoption of pest management practices that reduce the overall risk to human health and the environment.

The Healthy Schools Act increases information to parents and guardians of students and to staff about pesticide use at their schools. DPR school IPM training workshops allow school district staff to learn more about IPM and implement an IPM program at their schools. Staff more knowledgeable about IPM will successfully implement an effective program. In addition, the Healthy Schools Act establishes IPM as the state's preferred method of school pest control to reduce children's exposure to pesticides.

II. STUDY AND REVIEW OF ENVIRONMENTAL HEALTH CONDITIONS AT SCHOOLS

A. Contaminants of Greatest Potential Health Concern at Schools

1. Purpose and Requirements of the Legislation

SB 25 requires OEHHA to identify those chemical contaminants commonly found at school sites and determined by OEHHA to be of greatest concern based on criteria that identify child-specific exposure and child specific physiological sensitivities.

The child-specific health guidance values that are being prepared by OEHHA are for use by the Department of Toxic Substances Control and other state and local environmental and public health agencies, to assess exposures and health risks at existing and proposed school sites.

2. Accomplishments from January 1, 2004 – December 31, 2005

OEHHA produced a list of the school-site contaminants of greatest health concern in 2002. In early 2002, OEHHA began to evaluate chemicals on this list to determine if there are adequate data to support the development of child-specific numerical guidance values. OEHHA attempts to evaluate over 20 chemicals annually. Only those chemicals that met the data requirements can advance to the guidance value development stage. Because of the internal, public, and external peer review requirements, each guidance value development cycle typically takes more than one year to complete. Activities of the development process are summarized below:

- OEHHA documented the rationale for health guidance values for five contaminants – cadmium, chlordane, heptachlor-heptachlor epoxide, methoxychlor, and nickel in a 2003 draft report. OEHHA has addressed comments received on the draft and posted a final draft report containing health guidance values on its web site in November 2005. OEHHA reviewed comments from an external peer review panel assembled by the Office of the President of the University of California prior to developing the final draft document. OEHHA solicited additional public comments on this document.
- OEHHA held a public workshop on the draft health guidance values for pentachlorophenol and manganese in January 2005. The basis of the health guidance values was presented in a draft report that was released for public review in December 2004. Public comments were considered in re-drafting the document, which has been submitted for external peer review.
- A draft health guidance value for lead has been sent to three external peer reviewers and also to DTSC for intra-agency review. Two reviews have been received to date.
- A draft health guidance value for toluene is being readied for public review.

- A draft health guidance values for deltamethrin and atrazine have undergone internal staff review, as well as a review by DPR staff. These draft health guidance values will be released for public comment.

3. *Planned Activities for the Next Two Years*

a. Refinement of the List

OEHHA plans to review the list of chemical contaminants of concern at school sites with respect to recent monitoring data by other Cal/EPA agencies and new research pertaining to chemicals found at schools. In particular, OEHHA will consider additional candidates that DTSC has identified in its continuing Preliminary Endangerment Assessment reviews and that DPR has identified from pesticide use notifications made by school districts.

b. Development of Numerical Health Guidance Values

Early in 2006, OEHHA will be addressing public comments on cadmium, chlordane, heptachlor-heptachlor epoxide, methoxychlor, and nickel, and finalize their health guidance values.

Also in 2006, OEHHA will be addressing public and external peer review comments on pentachlorophenol, manganese, lead, and endosulfan, and work on developing final health guidance values for those contaminants. The office will be addressing internal review comments on toluene, deltamethrin and atrazine, and develop draft health guidance values for initial public review. OEHHA will continue to gather data on xylene and DDT to support the development of health guidance values for those chemicals. OEHHA staff will solicit input from the scientific community by presenting information on these values at the 2006 Society of Toxicology meeting.

4. *Program Benefits to Children's Environmental Health*

By identifying chemicals of concern to children at school sites and developing guidance values for those contaminants, OEHHA will assist DTSC in preventing exposures to hazardous levels of contaminants in schools. DTSC will be able to make better-informed decisions for siting new schools to avoid exposures to toxic chemicals present in the environment.

B. School Site Multimedia Exposure and Health Risk Assessment Guidance

1. Purpose and Requirements of the Legislation

AB 2872 (Chapter 144, Statutes of 2000) requires OEHHA to publish a guidance document, for use by DTSC and other state and local environmental and public health agencies, on the assessment exposures and health risks at existing and proposed school sites.

2. Accomplishments from January 1, 2004 – December 31, 2005

In collaboration with DTSC, OEHHA in February 2004 released a final report containing guidance for multimedia, multi-pathway, risk assessment for existing and proposed school sites. The guidance has been through external peer review and public review and comment. Comments and their responses have been appended to the document. The equations in the guidance were incorporated into an Excel spreadsheet in order to facilitate compliance with the guidance. The guidance considers exposures that could occur from these sources:

- Direct and indirect exposure at school to contaminants originating in soil.
- Vapors emitted from contaminated soil at the school site can be inhaled indoors and outdoors.
- Exposure to soil contaminants by direct contact with contaminated outdoor soil or with soil particles transported into school buildings via aerosols or by tracking of soil particles into buildings on shoes and other vectors.
- Entrainment of soil particles into aerosols that can be inhaled indoors and outdoors.
- Contaminated shallow aquifers underneath school property that can release volatile chemicals into the air.
- Chemicals absorbed by nursing mothers that migrate into their milk.

3. Planned Activities over the Next Two Years

While there is no specific update planned at this time, OEHHA will monitor progress in the field to ensure the guidance can be updated when appropriate. The Excel spreadsheet will be modified for ease of use as time allows.

4. Program Benefits to Children's Environmental Health

The OEHHA guidelines will enable DTSC and other state and local agencies to conduct consistent assessments of potential risks posed by exposures to toxic chemicals in the school environment, thereby improving the ability of regulators to make better decisions for siting new schools to avoid or reduce such exposures.

5. Recommendations

OEHHA recommends that the guidelines be reviewed every five years to ensure that they remain consistent with new scientific developments.

C. Development of Children's Cancer Risk Assessment Guidelines

1. Purpose and Requirements of the Legislation

The purpose of this provision of AB 2872 is to review existing state and federal cancer risk assessment guidelines, along with new information on cancer formation, to determine if existing guidelines are producing assessments that adequately identify cancer risks to the fetus, infants and children. The legislation also requires OEHHA to develop and publish children's cancer risk assessment guidelines that will ensure that these assessments identify children's cancer risks.

a. Review of Cancer Risk Assessment Guidelines

OEHHA is required to review existing state and federal cancer risk assessment guidelines as well as new information on cancer formation, and to consider the extent to which those guidelines address cancer risks from exposures occurring early in life (Health and Safety Code (HSC) § 901 (c)).

b. Development of Criteria for Carcinogens, Method Assessment and Guideline Publication

OEHHA is to develop criteria for identifying carcinogens likely to have greater impact if exposures occur early in life (HSC § 901 (d)(1)); construct a database of animal studies to evaluate increases in risk from early-life exposure (HSC § 901 (d)(2)), and to finalize and publish children's cancer risk assessment guidelines that shall be protective of children's health (HSC § 901 (e)).

2. Accomplishments from January 1, 2004 – December 31, 2005

OEHHA has reviewed both the U.S. EPA *Guidelines for Carcinogenic Risk Assessment* and the *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* that were released in final form in March 2005. OEHHA also presented proposed criteria for identifying carcinogens that might have greater impact if exposure occurs early in life at the annual meeting of the Society for Risk Analysis in December 2005. This national meeting featured several sessions devoted to discussion of issues directly related to children's environmental health. Response from session attendees to OEHHA's proposed criteria was positive.

OEHHA continued to add information to the Age-Related Cancer Susceptibility (ARCS) database, which contains data from cancer studies that exposed animals to carcinogens during different life stages, including early life periods. To date, there are 143 studies in the ARCS database on 72 distinct chemicals.

At the annual meeting of the Society for Risk Analysis, OEHHA presented data from the preliminary analysis of 41 studies contained in the ARCS database in which the differential susceptibility of early life exposure as compared to adult exposure was

quantified. Response from session attendees to this work was positive. The results of this work will directly impact the development of the children's cancer guidelines.

3. *Planned Activities for the Next Two Years*

- Continue review of scientific literature on studies of cancer resulting from exposures at different stages of life.
- Continue updating of the ARCS database with studies that meet OEHHA's selection criteria.
- Submission of a manuscript for publication in the scientific literature regarding criteria for identifying carcinogens likely to have a greater impact from early life exposure.
- Continue biostatistical analysis of the studies mentioned above to further characterize the effect of age at exposure on cancer risk, and in particular, to characterize the variability in these effects across chemicals.
- Submission of a manuscript for publication in the scientific literature presenting the studies' analyses.
- Development of an analytic approach for analyzing large datasets containing cancer incidence data. This approach will be used to generate chemical-specific age sensitivity factors for exposures during early life stages.
- Continue efforts to develop guidance and new methodologies related to specific aspects of children's cancer risk assessment.
- Continue incorporation of OEHHA's findings in the draft proposed guidelines for children's cancer risk assessment.

4. *Program Benefits to Children's Environmental Health*

It is well recognized that early life exposure to certain carcinogens can lead to an increased risk of cancer during one's lifetime. Cancer is a complex multi-step process wherein many variables may interact to produce the disease. The systematic approach taken by OEHHA in developing criteria for use in identifying carcinogens likely to have a greater impact with early life exposure, and in analyzing early life exposure studies, will provide a solid foundation for use in developing California's children's cancer risk assessment guidelines.

Implementation of these guidelines will result in greater certainty that the ensuing cancer risk assessments and newly adopted numerical health guidance values are protective of the fetus, infants and children.

D. Evaluating Toxic Substance Risks at School Properties

1. Purpose and Requirements of the Legislation

Since January 1, 2000 the Department of Toxic Substances Control's School and Property Evaluation and Cleanup Division (Schools Program) has successfully supported the statewide effort to increase the number of schools and classrooms in California, while protecting children and staff from the potential effects of exposure to hazardous substances. In January 2000, two new laws on school construction became effective: Assembly Bill (AB) 387 and Senate Bill (SB) 162, which added Sections 17072.13, 17210, 17210.1, 17213.1 - 17213.3 and amended Sections 17070.50 and 17268 of the Education Code. These statutes require the oversight of DTSC in the environmental review process for the proposed acquisition and/or construction of school properties, including expansions and additions, where state funding is utilized. These new laws address concerns raised by parents, teachers, local communities, and the Legislature over school properties that are or may have been contaminated by hazardous materials and thereby pose a potential health threat to children and staff. Initially, the concerns were focused on several school projects in the Los Angeles Unified School District, including the Belmont Learning Center (now known as Central Los Angeles High School #11/Vista Hermosa) and Jefferson New Middle School (now known as Los Angeles Academy). Discussions were expanded to include the apparent lack of proper site assessments by all school districts and lack of assessment review and approval by environmental agencies. The new laws codified the process for environmental assessment and named DTSC as the lead agency for evaluating proposed new school properties and school expansions.

In addition to the evaluation of the presence of hazardous materials on the proposed school properties, the legislation expanded DTSC's authority to evaluate naturally occurring hazards, such as petroleum deposits and naturally occurring asbestos. DTSC also evaluates other hazards not traditionally considered hazardous materials, such as methane generation from oil fields, former dairy properties and landfills. All of these considerations have been incorporated into a comprehensive approach developed by DTSC for evaluation, mitigation and approval of new school sites.

2. Accomplishments from January 1, 2004 - December 31, 2005

To facilitate the implementation of this new program, the Schools Program and DTSC Human and Ecological Risk Division (HERD) managers have participated in regular coordination meetings with representatives from the Department of Education (CDE) and the Coalition for Adequate School House (CASH). CASH is a lobbying group representing over 1000 school districts, architects, attorneys, construction managers, consultant and facility planners, contractors and developers, and financial institutions. Topics of discussion have included sampling guidance and protocols prepared by DTSC, timeframes and costs for environmental reviews, structure and content of the Environmental Oversight Agreements, pending legislation, and other issues of concern to local school districts. These meetings have resulted in improved coordination, cooperation, and communication between school districts, CDE and DTSC providing an

avenue for school districts to work with state agencies to resolve any issues of concern. To facilitate outreach to school districts, DTSC has participated in over twelve workshops and conferences in both Northern and Southern California during 2004 and 2005, giving presentations on DTSC's site evaluation, risk assessment and cleanup process.

a. Summary of Projects

DTSC has reviewed over 1700 school projects since the legislation was implemented in January 2000. Since January 2004, DTSC has reviewed 607 school projects. During the past two year period, a number of projects went directly into the Preliminary Environmental Assessment (PEA) phase, by-passing the Phase I Assessment. This strategy provided a cost and time savings to school districts for projects that a PEA was clearly needed. Table 2 is a summary of school projects for the 2000-2001, 2002-2003 and 2004-2005 time periods.

Table 2. Summary of Completed School Projects

Project Phase	January 2000 – December 2001	January 2002 December 2003	January 2004- December 2005
Phase 1	473	240	226
Phase I Addendum	0	5	30
Preliminary Environmental Assessment	267	220	299
Removal Actions	12	58	52
Total Number of School Projects	852	523	607
Number of School Districts	280	366	303

The following are examples of school projects which DTSC has been involved. These projects include new school and additions, as well as existing schools where contamination was suspected or found.

- Central Los Angeles High School #11 - Vista Hermosa (formerly Belmont Learning Center), Los Angeles
Since 1999, DTSC has overseen a comprehensive environmental investigation of this large high-profile project in downtown Los Angeles. Over the years, the site has been thoroughly investigated to address its location in the Los Angeles Oil Field.

The original school site has been divided into a joint use park and the proposed high school site. DTSC approved the Remedial Action Plan for the park on June 10, 2004 and for the school on March 10, 2005. The Remedial Action Plan outlines mitigation measures to address the presence of methane and hydrogen sulfide at the school and park sites. The selected remedial alternative requires installation of a gas mitigation system that consists of redundant measures to protect human health and the environment. These measures include a gas barrier system; passive venting systems; sand dispersion layer; air sweep systems; enhanced building ventilation; performance monitoring system; access controls; dewatering system; and the subsurface gas monitoring network, which will continually monitor gas concentrations under the school buildings.

DTSC is currently reviewing a detailed Remedial Design for the site to ensure it meets the remedial action objectives. Concurrently, DTSC is reviewing an Operation and Maintenance (O&M) Plan that sets forth a comprehensive and rigorous set of on-going requirements to ensure the gas mitigation systems are operating effectively. Included in the O&M Plan is the Construction Quality Assurance Plan, which outlines a detailed list of testing requirements that must be met during construction of each component of the gas mitigation systems. Finally, DTSC is preparing an enforceable Operation and Maintenance Agreement with the Los Angeles Unified School District, setting forth the roles and responsibilities of both parties in carrying out ongoing operation and maintenance activities required for the site.

- Los Angeles Academy (formerly Jefferson New Middle School), Los Angeles
This is an operating middle school, with significant contamination in deep soil and groundwater. The school has been in operation since 1998. DTSC became aware of the school construction in 1995, during an investigation of a contaminated industrial property located across the street from the school site. Historically, the site was occupied by industrial and commercial properties. Due to an incomplete investigation and an inadequate remediation system installed by the school district, the community and parents requested that DTSC oversee additional investigations of the school property. DTSC and the responsible parties, including the school district and former owners and operators of the site, signed a Consent Order in January 2001 to proceed with investigation and remediation as necessary. A large, new soil vapor extraction system was permitted and began operation in August 2002. Two recent Remedial Investigations have been conducted at the school site, focusing on the shallow vadose zone between ground surface and 40 feet below ground surface, and the deep vadose zone between 40 and 145 feet below ground surface (bgs). The results indicate the presence of volatile organic compounds in the deep vadose zone. The deep vadose zone (40-145 feet bgs) is currently being remediated by the soil vapor extraction systems. In addition, the Final Remedial Investigation for the groundwater has been initiated. Preliminary data from the groundwater investigation indicates that VOC-contaminated soil vapor and groundwater have potentially migrated from offsite sources onto the school site. DTSC has initiated coordination meetings with the Los Angeles Regional Water

Quality Control Board to accelerate the remedial strategies for the school site and regional impacts.

- Ramblewood Elementary School, San Jose

In September 2003, the Franklin-McKinley Unified School District proposed to build Ramblewood Elementary School on five acres of an 8.5 acres site in San Jose where a city park was located. A PEA was conducted and, while the school site was free of other contamination, the investigation identified the presence of naturally occurring asbestos (NOA). NOA in chrysotile form was found in concentrations ranging from 0.25 to 6.25 percent across the school site. Because asbestos is a known human carcinogen, DTSC required that mitigation be conducted prior to site use as a school. To prevent or minimize exposure of humans to NOA in soil through inhalation, the Removal Action Workplan required placement of a three-foot cap of clean imported fill over NOA-containing soils. In addition, a geotextile fabric was placed in-between native soils and clean fill to provide a visual marker and show locations of NOA-containing soils. The response action was implemented during school construction, which occurred between November 2003 and August 2005. During construction, air monitoring and dust minimization were conducted to minimize exposures. DTSC is currently working with the district to develop an Operations and Maintenance Plan to ensure that the cap is properly maintained and appropriately repaired, thereby preventing future exposures to NOA in soils.

- Burlingame High School, Burlingame

Burlingame High School started a project in 2000 to renovate and modernize existing buildings on campus. The modernization project did not require DTSC involvement, but the School District opted to voluntarily enter into an agreement for DTSC oversight. A Preliminary Environmental Assessment conducted in 2001 found elevated levels of arsenic, lead and polychlorinated biphenyls (PCBs). DTSC approved a removal action work plan to mitigate the lead and PCB impacted soil. The lead and PCB clean-ups are expected to be completed in January 2006.

Additionally, during the PEA investigation, significant levels of arsenic were found at various locations on the campus. Very high concentrations of arsenic were found in an open grassy area in front of the main building where many of the students ate lunch and gathered. In consultation with DTSC, the School District erected a fence to eliminate public access to the arsenic contaminated grassy area. One of the challenging aspects to the remediation of the arsenic is the approximately 50 mature trees in the grassy area. DTSC is working with the School District and the City of Burlingame to develop a strategy to remediate the elevated arsenic without disturbing the trees. The cleanup actions are anticipated to be completed in the summer of 2006.

- Rancho Vista Elementary School, Rolling Hills Estates

DTSC was contacted in October 2003 to evaluate the possible presence of contaminants at Rancho Vista Elementary School due to results from a 2002 air monitoring survey conducted by the South Coast Air Quality Management District (SCAQMD). The SCAQMD conducted the study to address community concerns

about offsite impacts to the school from the Palos Verdes Landfill, located about 400 feet east of the school site. The study showed elevated levels of vanadium and nickel particulates in air samples. To determine whether or not the elevated metals were caused by surface soils, DTSC conducted soil sampling and took radiation readings at the school site in December 2003, and determined that metals identified in soils were naturally occurring, intrinsic to the Valmonte Diatomite formation, common in the Palos Verdes Hills. Most metals were within background ranges observed in Southern California. Radiation readings were generally consistent with background readings. However, because barium concentrations at the school site were slightly elevated, a risk assessment was conducted. The risk assessment concluded that there were no potential significant risks to students, staff, or community from metals detected in soils at the school. Analysis of sampling results did not yield evidence of onsite contamination or offsite impacts. Therefore, no further action was required by DTSC.

- Helms Middle School Reconstruction, San Pablo

The school district proposed construction of a new school to replace an existing school that does not meet seismic hazards standards. The new school will be located on approximately 10 acres of what is now a play field connected to the existing school site. The proposed new school project was not subject to the provisions of CEQA, and therefore not required to obtain DTSC review and approval. However, the site was brought to DTSC's attention by the school district after petroleum odors were noted by the school district contractors performing geotechnical borehole drilling for the new construction. Initial investigation results show that five of the nine borings had moderate levels of organic vapors including toluene, ethylbenzene and degraded gasoline. The preliminary data indicates a possible on-site source of contamination. A gas station located northeast of the proposed site is currently under investigation by the Regional Water Quality Control Board, and is also being evaluated as a possible source. DTSC will continue to be closely involved in the review and oversight of the investigation and possible response actions at the proposed school.

- Jordan High School, Los Angeles

Jordan High School is an existing school located adjacent to the Atlas Metals recycling facility. In March 2004, a discarded Navy bomb shell, thought to be a "dud" bomb, exploded while being disassembled, and shot over the fence into a playfield at the school. The school district requested in March 2004 that DTSC investigate both the recycling facility and the school site to determine if soil contamination had migrated from the Atlas Metals facility.

DTSC hired contractors to conduct an investigation during April and May 2004. The investigation revealed that elevated levels of heavy metals, primarily lead and arsenic, and polychlorinated biphenyls (PCBs) were present in the baseball field immediately adjacent to Atlas Metals. As a result, DTSC determined that a removal action was required to excavate and dispose of approximately 2000 tons of contaminated soil offsite. As a year-round school, Jordan High was scheduled for a summer break between June 21 and July 5, 2004. DTSC's contractors successfully

completed a removal action during this two-week timeframe, and the school opened for the summer session on time. DTSC staff met with faculty and parents to explain the removal action and to respond to questions that they had about school safety. DTSC continues to be involved with the investigation of the adjacent Atlas Metals Recycling facility.

- New Bessie Carmichael School Site, San Francisco
The proposed school site occupied a 1.4 acre site in a San Francisco district that historically consisted of commercial and industrial activities. Chemicals of concern were heavy metals (arsenic, copper, cadmium, zinc, mercury and lead), polyaromatic hydrocarbons (PAHs), and PCBs in soil, and elevated levels of VOCs in shallow groundwater. In October 2002, about 2000 cubic yards or 100 truckloads of contaminated soils were excavated, and the site was backfilled with clean clay fill soil. A liner/vapor barrier beneath the building foundation was installed to further prevent intrusion of vapor into indoor air.
- Midland Elementary School, Poway
The 8.7-acre site was in use as an elementary school since the 1920s. The School District proposed demolition of existing buildings and construction of a new elementary school. During the PEA, DTSC identified organochlorine pesticides (OCPs) that had been applied to soils surrounding the school buildings in the 1960s for termite control. High levels of OCPs, including chlordane and dieldrin, were found in areas around foundations of several buildings. A group of faculty and staff members expressed concerns to DTSC staff about the health effects and possible past exposures to these potentially carcinogenic chlorinated pesticides; DTSC staff met with the group members, and assisted them in contacting local public health officials to address their individual health issues. DTSC oversaw completion of a soil removal action in 2005 for the pesticide contaminated soils.
- Norco High School, Norco
Norco High School is located adjacent to the western boundary of the former Wyle Laboratories site in the City of Norco, California. DTSC began the Wyle site Remedial Investigation at the property boundaries to determine if site contamination was migrating off-site into the surrounding community. Elevated levels of trichloroethylene (TCE) were detected in both groundwater and soil gas offsite at the northwestern boundary. During investigation of the offsite contamination, it was shown that TCE in soil gas and groundwater was migrating toward both Norco High School and Norco Middle School. DTSC required Wyle to conduct an indoor air quality investigation at all three schools. No Wyle-related contaminants were found at the Elementary or Middle School, but elevated levels of TCE were found in shallow groundwater and trace levels of vinyl chloride were found in soil gas at the High School. More importantly, vinyl chloride, a breakdown product of TCE, was detected in indoor air at the Science Building at the High School.

Additional indoor air sampling showed repeated detections of vinyl chloride in the Science Building. Using a residential risk assessment model, the levels detected indoors do not pose a risk to students, but they do pose a slightly elevated lifetime

cancer risk for faculty, who are assumed to teach at the Science Building for 40 years. DTSC has required Wyle to conduct a comprehensive indoor air study to identify potential preferential pathways from the groundwater contamination into the building, as well as develop a mitigation workplan to reduce indoor levels of vinyl chloride. DTSC will continue to oversee the investigation and possible response actions at this site.

- Acquistapace Elementary School, Santa Maria

The proposed Acquistapace Elementary School Site is a 19-acre portion of a larger 80.54-acre farm parcel. The site is currently used for agricultural production of strawberries and has been actively farmed for the past 15 years. The site is located within the Santa Maria Valley Oil field and 10 oil wells are located adjacent to the site. The drilling pit/oil sumps for two of the wells were located within the school site boundaries. During the Preliminary Environmental Assessment investigation, the organochlorine pesticides DDE, dieldrin and toxaphene were detected in shallow soil throughout the site. These pesticides were found to not pose a significant risk to human health under an unrestricted, residential land use scenario. However, soil gas samples collected at the former wells revealed high methane concentrations. Because the highest methane concentration was above the lower explosive limit (LEL of 5 percent), a Supplemental Site Investigation was conducted to determine 1) the lateral and vertical extent of methane contamination, and; 2) if the source of methane is biogenic or petrogenic. The investigation found elevated methane concentrations in fill material ranging from 94,000 ppmv (9.4 percent) to 429,000 (42.9 percent), and identified that the source of methane was biogenic, associated with bacterial fermentation. DTSC has required a removal action to excavate the localized fill material and backfill it with clean fill. DTSC will continue to oversee the response action at this site.

b. School-Based Exposure Scenario

The Office of Environmental Health Hazard Assessment released the *Guidance for Assessing Exposures and Health Risks at Existing and Proposed Schools Sites, February 2004*. This school child-specific exposure scenario was developed by OEHHA with input from the DTSC Human and Ecological Risk Division. The school-based exposure assessment is one of the risk assessment approaches available to school districts for evaluating potential risks to children and staff. The school-based exposure assessment evaluates children at a school on a year by year basis and is consistent with the actual daily hours spent at the school site. The health of school employees are also evaluated based on actual number of hours they are on site and assuming a 40 year job duration. Consequently, the estimated exposures using the school-based exposure assessment are less than what would be estimated using an unrestricted land use scenario, and the corresponding risks for the school-based exposure assessment will be lower. The overall conclusion may be that greater amounts of contamination may be left on a school site using this approach than using the default unrestricted land use scenario. When DTSC bases its risk management decision on the results from the school-based exposure assessment, DTSC may require

a land-use covenant on the school property to prevent the use of the property for residential development.

In addition, child-specific toxicity factors are being developed for limited number of chemicals by OEHHA starting in 2002. These values will be used by DTSC in risk assessments for schools.

c. School Evaluation and Assessment Manual (SEAM)

DTSC is currently developing the *School Evaluation and Assessment Manual* which will be a comprehensive approach for the environmental evaluation of proposed new school sites or expansions. The SEAM will include the Phase I, Phase I Addendum, a revised and updated Preliminary Environmental Assessment, Supplemental Site Investigation protocol, and an outline of the Removal Action Workplan process. In addition, the SEAM will have a section on a tiered approach for evaluating existing school sites.

d. Indoor Air

Volatile organic compounds (VOCs) are commonly found on sites in urban areas. The source of VOCs can be from leaking underground and aboveground fuel tanks, solvent tanks and sumps, and contaminated groundwater from sources either on or off-site. Evaluation of VOCs is conducted using the Johnson and Ettinger Vapor Intrusion Model approved by U.S. EPA and modified by DTSC. This model provides a conservative estimate of potential vapor intrusion and concentration in building interiors. VOC contamination can be found in the soil and in groundwater. Both of these potential sources for vapor migration are evaluated as an addendum to the PEA guidance at proposed school sites. Input source concentrations can be used from soil gas, soil matrix, or groundwater data.

DTSC has also developed guidance to assist in evaluating indoor air contamination from vapor intrusion. The DTSC *Guidance for Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air, December 15, 2004 (revised February 7, 2005)* is used to determine appropriate sampling strategies and mitigation options, where necessary for school sites.

e. Agricultural Properties

Many new schools have been proposed on properties that were formerly used for agricultural purposes. In most cases, these properties had legally-applied pesticides used in the process of crop production. DTSC developed a modified sampling strategy for evaluating properties with uniform pesticide application. The original guidance, *Interim Guidance for Sampling Agricultural Soils (June 28, 2000)*, has been updated and reissued on August 26, 2002. The revision incorporated data and information that had been gathered over the previous two years and the experience learned from the several hundred former agricultural properties that had been evaluated in the Schools Program. The revised guidance is a useful tool for school districts to focus and expedite their evaluation of potential school sites. The strategy maximizes the sampling

coverage with a cost effective approach utilizing selective composite sampling in crop areas. Focused, discrete sampling is applied in areas of pesticide mixing, loading, storage, or other areas of concern. Approximately 5% of the former agricultural sites have required some remediation of the soil because of pesticide residues. Most of these pesticides were organochlorine pesticides, with elevated levels of toxaphene being the most common pesticide requiring remediation. Arsenic contamination, associated with the use of arsenical pesticides, has also been frequently identified at these sites.

f. Arsenic

Arsenic concentrations in background soils are particularly problematic, since background levels in many areas are above a lifetime cancer risk screening level of one in one million (1×10^{-6}). Because of this, it is particularly important to determine if the observed arsenic levels on a site are naturally occurring background or if they are from an industrial or anthropogenic source. To help address this issue in the Los Angeles area, where many new schools are being proposed by Los Angeles Unified School District (LAUSD), HERD evaluated data from fifteen proposed LAUSD school sites that had been reviewed and approved by DTSC. From these sites, HERD compiled a data set of 589 soil samples of arsenic and then conducted a statistical evaluation. The upper tolerance limit (UTL) of the distribution is 5.9 parts per million (ppm) of arsenic. This approach is being used by DTSC to determine whether arsenic is a contaminant on other LAUSD sites. The document, *Background Metals at Los Angeles Unified School Sites—Arsenic, June 6, 2005* is available on the DTSC website.

In addition to the background analyses for determining whether arsenic is a potential chemical of concern at proposed school sites in the Los Angeles area, a strategy for developing clean-up goals is also being developed with the document. This strategy would combine overall distributions on a site, statistical analyses, including the upper 95% confidence limit, and lateral and vertical extent of any areas identified with arsenic values exceeding background levels. This draft document, *Arsenic Strategies: Determination of Arsenic Remediation and Development of Arsenic Cleanup Goals For Proposed and Existing School Sites* will be finalized in 2006.

g. Naturally Occurring Asbestos

Asbestos, a known human carcinogen, occurs naturally in several rock formations throughout California. Recent attention has been focused on the Sierra foothill area east of Sacramento, where several forms of naturally occurring asbestos have been found in the soil and rock outcroppings. DTSC is also involved in NOA issues with schools in other areas, including San Jose, King City, and Lake County. DTSC is currently evaluating 27 proposed schools for NOA, and is working on NOA mitigation at 11 school sites. Because NOA exposures are ubiquitous in many areas, DTSC cannot eliminate all NOA exposures at school sites. The remedial solution used by DTSC for school sites requiring mitigation is the reduction of exposure to soils containing NOA on site by hardscape, landscape and in some instances importation of clean (non-NOA impacted) fill.

DTSC developed the *Interim Guidance for Naturally Occurring Asbestos (NOA) at School Sites, September 24, 2004* for the investigation and evaluation of naturally occurring asbestos. DTSC is working closely with school districts, Cal/EPA, and U.S. EPA as knowledge and information concerning NOA expands. In 2006, DTSC will release a revised guidance document incorporating the most current information on NOA.

DTSC has also developed guidance to assist school districts when an Operation and Maintenance agreement is required because of the presence of NOA. This document, *Draft Operation and Maintenance (O&M) Plan Template for Naturally Occurring Asbestos Response Actions at Schools* will be completed in 2006. This Guidance provides a standardized approach and language for the development of O&M Plans.

h. Organochlorine Pesticides around Residential Structures

Using federal grant funds acquired from U.S. EPA, DTSC completed an investigation for residual organochlorine pesticide contamination around buildings where pesticides may have been used for the control of termites (*Final Report Residential Pesticide Study, September 20, 2004*). Chlordane and dieldrin were commonly used as termiticides until they were banned in the late 1980's. These and other organochlorine pesticides are considered to be possible human carcinogens and they are persistent in the environment. When older buildings are scheduled to be demolished for new or expanding school construction, the question of possible residual pesticide contamination was raised. To determine if this was a potential problem in California, DTSC conducted evaluations of three prospective school sites. Each of these sites consisted of many residential buildings, and due to the age of the buildings, the presence of organochlorine pesticides was suspected. Chlordane was found in 95% of all of the surface soil samples, and other organochlorine pesticides were found in over half of the samples. In many cases, the levels of chlordane were high, and removal actions were required at all of the proposed school sites investigated in the study. The findings of the investigation support the need for testing soils around older structures for organochlorine pesticides.

DTSC is currently completing guidance and proposed new regulations to address this potential problem. The *Interim Guidance for Screening School Sites with Potential Soil Contamination from Lead from Lead-Based Paint, Organochlorine Pesticides from Termiticide Application, and Polychlorinated Biphenyls from Electrical Transformers* will be completed in 2006.

i. Special Pilot PEA Projects to Assist Financially Disadvantaged School Districts

Using funds available through the U.S. EPA Preliminary Assessment/Site Inspection (PA/SI) Grant Program, DTSC completed Preliminary Environmental Assessments for four proposed school sites. DTSC's pilot program benefited these school districts in several ways. The pilot program assisted financial hardship school districts which otherwise would not have been able to evaluate these sites. In addition, it demonstrated that through direct contractor oversight, DTSC can assist school districts

in controlling investigation costs and improving project efficiency. The following is a summary of the pilot projects.

- Proposed Community Day School and Ovrom Park, Burbank, Burbank Unified School District and City of Burbank
This 1.4-acre site was used for commercial and industrial operations, including an auto dealership, an auto repair shop and a film processing laboratory. A PEA report was approved with a "Further Action Required" determination in June 2004. Elevated levels of arsenic were detected in surface and subsurface soils. Subsequently, a removal action was completed and the site was certified in May 2005.
- Proposed East Los Angeles High School #1, Los Angeles, Los Angeles Unified School District
This 7.7-acre site was previously used for commercial and industrial operations, including dry cleaners, three service stations and a Southern California Edison maintenance yard. A PEA report was approved with a "Further Action Required" determination in June 2004. Elevated levels of lead and arsenic were found on the school site and a soil removal action is being conducted.
- Proposed Hercules Middle School, Hercules, West Contra Cost Unified School District
This 12-acre site was previously used for industrial operations including a gunpowder and munitions facility, a wastewater treatment facility, a facility with underground storage tanks, and a maintenance yard. A PEA report was approved with a "Further Action Required" determination in June 2005. Several classes of chemicals were found in the soil including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), lead, and arsenic. VOCs were also found in the groundwater. DTSC will oversee additional investigation and possible response actions at this site.
- Proposed Aspire Charter School, Oakland, Aspire Public Schools and Oakland Unified School District
This 2.5-acre site was previously used for industrial operations including an electric motor manufacturer, an iron works and a powder coatings facility. DTSC approved the PEA report with "Further Action Required" in September 2005. PCBs, VOCs, TPH, lead, and arsenic were found in the soil and VOCs and TPH were found in the groundwater. DTSC will oversee additional investigation and a removal action at this site.
- Database
The Schools Program uses the newly developed DTSC Site Mitigation database (EnviroStor) to track and report school site projects. The database has been used by DTSC Schools Program staff since August 2005, and will be accessible to the public through the DTSC website in early 2006 to provide specific information on school projects. The database is updated regularly with the project status as well as which chemicals are of concern for the site.

j. Supplemental Guidance and Reports

Many of the documents cited below can be found at <http://www.dtsc.ca.gov>.

1). Regulations

Final Regulations: Phase I Environmental Site Assessment (Schools) – February 2003

2). Guidance/ Advisories

- *Revised Interim Guidance for Sampling Agricultural Soils*, August 2002
- *Interim Guidance for Evaluating Lead-Based Paint and Asbestos-Containing Materials at Proposed School Sites*, July 2001 (Currently under revision, see below)
- *Guidance for Integration of School Sites Requirements and Site Mitigation Program Activities at Military Facilities*, October 2001
- *Phase I Environmental Site Assessment Advisory: School Property Evaluations*, September 2001
- *PCB Advisory for Schools—How Voluntary Lighting Retrofits Can Address Hidden Dangers and Liabilities*, April 2003
- *Advisory—Active Soil Gas Survey, January 2002. Department of Toxic Substances Control and the Los Angeles Regional Water Quality Control Board*
- *Guidance for Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air*, December 2004 (revised February 2005)
- *Background Metals at Los Angeles Unified School Sites— Arsenic, Department of Toxic Substances Control*, June 2005
- *Interim Guidance for Naturally Occurring Asbestos (NOA) at School Sites*, September 2004
- *DTSC Final Report Residential Pesticide Study*, September 2004
- *Advisory on Methane Assessment and Common Remedies at School Sites – June 2005*

3). Fact Sheets

- *New Environmental Requirements for Proposed School Sites, Assembly Bill 387 and Senate Bill 162 - April 2001*
- *Update on Environmental Requirements for Proposed School Sites/Construction Projects, AB 2644 Summary , February 2001*
- *Update on School Site Environmental Review Process, AB 972 Summary, November 2001*
- *Further Action/Response Actions at School Sites: Supplemental Site Investigation (SSI) and Removal Action Workplan (RAW), June 2003*
- *Proposed Regulations on Preparation of Phase I Environmental Site Assessments , September 2002*
- *SB 633: California's Mercury Reduction Act of 2001, May 2002*

- *Federal Brownfields Grants Available to School Districts* , February 2003
- *Environmental Assessments for Charter School Sites* , February 2003
- *PCBs in Schools—Voluntary Lighting Retrofits Can Address Hidden Dangers and Liabilities* , February 2003
- *Environmental Oversight Agreements, School Property Evaluation and Cleanup Division* , February 2002
- *Information Advisory, Clean Imported Fill Material* , October 2001

4). Guidance in Draft

- *Draft Operation and Maintenance (O&M) Plan Template for Naturally Occurring Asbestos Response Actions at Schools*
- *Draft Guidance on Evaluation and Mitigation of Radon on Proposed School Sites*
- *Draft Guidance on Petroleum Sites and Total Petroleum Hydrocarbons (TPH)*
- *Interim Guidance, Screening of School Sites with Potential Soil Contamination from Lead from Lead-Based Paint, Organochlorine Pesticides from Termiticide Application, and Polychlorinated Biphenyls from Electrical Transformers*

3. Emerging Issues

Because children spend a significant amount of their waking hours in the school environment where they can have contact with potentially contaminated soils, schools can be seen as an extension of their living environment. This is especially true in areas where school facilities include extended day-care units, so potential exposures to contaminants can occur even at the pre-kindergarten level. Ensuring that these school environments are not contaminated with hazardous materials, creates a safe living environment that is protective of childhood development.

Significant environmental contamination, with accompanying health risks, may be present at some of California's existing schools. At this time, however, school districts lack legal and financial incentives and provisions to fund investigations and cleanups, because current laws do not require that environmental assessments be performed at existing schools. There are approximately 9,375 public schools in California. Many of these existing schools were built 30 to 40 years ago, and the California Department of Education has determined that 73% of the state's classrooms are over 25 years old. Although most contaminated schools tend to be situated in urban areas, rural and agricultural areas are not exempt from environmental contamination. The sources of their contamination have varied. Some schools were built on poorly characterized and/or contaminated sites. Numerous school sites had undocumented fill material brought in during prior ownership or school construction. In some cases, even if the original schools were built on clean property, commercial and industrial facilities were built adjacent to schools, and schools were impacted by offsite migration of contaminants. Some existing schools were located next to landfills or on properties requiring ongoing environmental cleanup or monitoring.

Recently, several schools built on burn ash waste disposal sites were brought to the attention of DTSC. Many older schools have lead contaminated soil from previous use of lead-based paint on buildings, and organochlorine pesticide residues, such as chlordane, in the soil around buildings from termite control procedures. DTSC has overseen investigations at existing schools which include dioxin and lead contamination from onsite incinerators; arsenic contamination from use of arsenical herbicides; organochlorine pesticides on the play fields from an adjacent pesticide business; hexavalent chromium from adjacent chrome plating facilities; methane and gas impacts from adjacent landfills; oily wastes from landfills and collection ponds; heavy metal contamination from adjacent industrial businesses; and volatile organic compounds (VOCs) from former underground storage tanks.

Cal/EPA and its BDOs continue to work in areas of California to address concerns about potential effects of naturally occurring asbestos at school sites. It is anticipated that additional sites will be identified in the next several years because of the increased awareness of school administrators of signs indicating the presence of the material.

DTSC has conducted remediation at a number of existing schools where school districts have elected to enter into Voluntary Cleanup Agreements. However, there are no current laws that require a systematic environmental review of existing schools, except in those situations where the school is adding a significant new building addition that would require state funding. Under the current statutes, DTSC oversight is required for such new construction, but not for the existing school adjacent to the new construction. School districts are currently not required to involve DTSC when hazardous materials are discovered during activities such as modernization, installation of portable classrooms or routine maintenance. Furthermore, school districts are not required to involve DTSC when concerns arise about hazardous materials migrating from adjacent properties. Although DTSC will continue to provide assistance to existing schools when requested, DTSC has no authority to provide environmental oversight in situations where hazardous materials may be present at existing school sites.

4. Planned Activities for the Next Two Years

School districts are required to supply education for all students in their districts, and many districts in California are experiencing growing student populations. From close interaction between DTSC and school districts across the state, DTSC projects that there will continue to be a steady flow of proposed new or expanding school sites requiring DTSC's review and approval. DTSC continues to develop guidance documents to assist districts and their consultants in screening and reviewing these properties. Several new documents will be completed and issued in the next calendar year. Additional guidance will be initiated as issues and areas of concern become apparent. "Clean" properties are often difficult to locate and costly to purchase, especially in urban areas. This process may accelerate as school districts continue to acquire "brownfields" or contaminated inner-city properties for development as schools.

5. Program Benefits to Children's Environmental Health

DTSC has evaluated over 1600 new school properties and over 50 existing schools to determine that they are safe from both short- and long-term health risks from contaminated soils. The DTSC environmental overview has helped motivate school districts to become more selective in evaluating potential school properties, and the program has enabled community members and parents a more active participation role in the selection of school properties. Because children spend a significant amount of their waking hours in the school environment as well as important developmental years, the benefits of the DTSC Schools Program are to ensure that school environments are not contaminated with hazardous materials and are a safe living environment which are protective of California's children.

6. Recommendations

As discussed in the section on emerging issues, there is no current systematic assessment or procedure for existing schools that encounter or suspect hazardous materials on their properties that require the involvement of environmental oversight agencies, such as DTSC. There are a number of examples of existing schools with significant environmental contamination that either have required, or will require, remediation. The potential number of these schools throughout California may be in the hundreds. One of the critical issues identified by school districts is the lack of specific funding to address these environmental issues. Further study of existing schools may be appropriate to assess this potential problem.

III. THE GOVERNOR'S CHILDREN'S ENVIRONMENTAL HEALTH INITIATIVE

A. Children's Environmental Exposure Studies

1. Environmental Health Conditions in California's Portable Classrooms

a. Purpose and Requirements of the Legislation

The objectives of the study of environmental health conditions in California's portable classrooms were to assess the statewide environmental health conditions in the rooms and to develop recommendations to remedy or prevent any problems identified. As specified in AB 2872 and Section 39619.6 of the Health and Safety Code, ARB and the California Department of Health Services (DHS) were required to evaluate the school ventilation systems and maintenance practices, assess indoor air quality, and identify any toxic contamination including molds and allergens, in California's classrooms. A smaller number of traditional (site-built) classrooms were also included in the study. ARB and DHS were required to submit a final study report, including recommendations, to the Legislature. Additional information on this study can be found at <http://www.arb.ca.gov/research/indoor/pccs/pccs.htm>.

b. Accomplishments from January 1, 2004 – December 31, 2005

ARB and DHS completed their report to the Legislature in 2003. The Office of the Governor approved the report and it was forwarded to the Legislature in 2004.

The study identified a number of environmental health problems in both portable and traditional classrooms that need improvement. Most, but not all, of these problems were found more often in portable classrooms than in traditional classrooms. A small fraction of the classrooms had severe problems. Some of the specific findings include:

- Inadequate outdoor air ventilation and poor system maintenance in over 40% of daily class time, and severe ventilation problems in about 10% of class time.
- Background noise well above current guideline levels in all classrooms, leading many teachers in portable classrooms to turn off ventilation systems entirely.
- Indoor levels of formaldehyde exceeding OEHHA's guideline levels for irritation in about 4% of all classrooms, and the ten-in-a million excess cancer risk level, in nearly all classrooms.
- Visible mold or evidence of moisture problems (e.g., high moisture content in the building materials, or water stains) in about one-third of the classrooms.
- Temperature and humidity levels outside the acceptable range in many classrooms.
- Inadequate lighting in some classrooms.

c. Planned Activities for the Next Two Years

ARB and DHS will continue to work with school districts, portable classroom manufacturers, other state agencies, and interested parties to implement the study recommendations. With funding from the California Energy Commission, further data analyses are currently being conducted to examine the relationship of classroom indoor environmental quality to classroom ventilation and lighting characteristics. ARB and DHS are working to incorporate the pertinent study recommendations into the *Best Practices Manual of the Collaborative for High Performance Schools*, which is currently being updated.

d. Program Benefits to Children's Environmental Health

The recommendations from this study will be used by the Governor, the Legislature, state agencies, school districts, portable classroom manufacturers, ventilation system manufacturers and others to take effective actions that will improve the learning environment in California schools. Most importantly, actions taken will directly benefit children by reducing health impacts from potentially unhealthful conditions in portable classrooms. By improving the environmental health and comfort conditions in portable classrooms, these actions will also facilitate improved academic achievement of the students as well as improved teacher performance.

e. Recommendations

The report to the Legislature includes 16 recommended actions to resolve the problems identified in the study. Most importantly, ARB and DHS recommend that school districts assure that school buildings fully meet all state regulations, especially those of Cal/OSHA related to ventilation, sanitation, and moisture intrusion. To comply with these regulations and prevent other health and safety problems, it is also recommended that schools routinely undertake a facility self-inspection program similar to that of the Los Angeles Unified School District. The State and school districts should establish a policy of incorporating “Best Practices” into the design, construction, operation, and maintenance of schools. State-level guidelines or standards need to be developed to provide clear benchmarks for indoor air quality and noise levels in schools.

In general, California needs to focus its efforts from remediation (fix-and-repair) to prevention (improved construction, operation and maintenance). To achieve this goal, long-term, stable funding mechanisms should be developed for operation, maintenance, and repair of school buildings. In addition, state review of school plans and training programs should be increased.

2. Children’s School Bus Exposure Studies

a. Purpose and Requirements of the Legislation

In October 2003, ARB completed a research study on children’s exposures to pollutants from diesel-fueled vehicles during their commute to school on a school bus. Based on the high exposures measured in that study, a follow-up study was funded to investigate what can be done to the existing school bus fleet to reduce children’s exposures on buses. In the first study, the investigators found high exposures due to bus “self pollution,” where a fraction of the exhaust re-entered the bus cabin. In the follow-up study, *Evaluation of Mechanisms of Exhaust Intrusion into School Buses and Feasible Mitigation Options*, investigators examined whether ventilation modifications, changes in exhaust release location, tighter sealing of bus windows and other openings, or other bus maintenance measures could offer reductions in bus self-pollution.

b. Accomplishments for January 1, 2004 - December 31, 2005

A pilot study was conducted in the Fall of 2004 and the main study was conducted in the Spring of 2005. Final analyses are still being conducted; however, the study found the following preliminary findings:

- School buses typically have many potential routes of outside air entry into the bus cabin, including the door, between the window frames and the bus body, between the window frame itself and its moving parts, and throughout the bus undercarriage. The number and extent of these openings indicate that sealing a bus to prevent intrusion of exhaust is not feasible.
- Maintaining a positive pressure in the bus cabin appeared to reduce intrusion of exhaust through bus cabin leaks. However, during the occasional times when the air inlet of the positive pressure system was downwind of the bus exhaust,

unacceptably high in-cabin exhaust concentrations occurred, which defeated much of the otherwise reduced exposures. Therefore, this method, although promising, did not appear feasible as a self-pollution mitigation method.

- Raising the bus exhaust release location appeared to offer modest reductions in self-pollution, and appeared to be the most effective mitigation method tried, although it was still less effective than hoped. The higher release height appeared to allow less exhaust re-entrainment in the vehicle wake of the bus, and less exhaust “blow back” when winds were from the rear of the bus. It also appeared to somewhat reduce the effect of its exhaust on following buses.

c. Planned Activities for the Next Two Years

Final measurement analyses are being conducted which will quantify the exact benefits achieved by raising a bus’ exhaust location. This will determine whether exhaust height modification is recommended as a mitigation method and/or a school bus design change. The final report is expected to be released in Summer 2006.

d. Program Benefits to Children’s Environmental Health

The results of this follow up study, although disappointing, provide evidence that there do not appear to be inexpensive, easy, and fully-effective mitigation methods for owners or operators of school buses to permanently minimize school bus self-pollution. Therefore, the importance of achieving exposure reductions through particle trap retrofits or new bus purchases has increased urgency. For existing, unaltered buses, exposure reductions will continue to require operator awareness and actions (see recommendations below), further emphasizing the importance of awareness and outreach.

e. Recommendations

Pending the completion of the project final report, recommendations to reduce school bus-related exposures that were developed after the completion of the initial study have not changed. They include:

- Replacing conventional buses with alternate fuel or particulate trap-equipped buses.
- Minimizing bus caravanning by staggered departure times and driver avoidance of other buses.
- Using cleaner buses on longer routes.
- Minimizing idling time at schools (now California law).
- Encouraging children to sit in the front of the bus, if the bus is not full.
- Maintaining school buses to eliminate or reduce visible exhaust.

B. Cal/EPA’s Children’s Environmental Risk Reduction Plan

1. Purpose and Requirements of the Legislation

In 2004, Cal/EPA released the Environmental Justice Action Plan (EJ Action Plan) which provided Cal/EPA and its BDO’s opportunities to take the initial steps toward

addressing complex environmental justice issues such as precautionary approaches and cumulative impacts. As part of this plan, Cal/EPA will develop and conduct pilot projects that incorporate some of the themes in the Governor's Environmental Action Plan and focus on environmental risk factors. Each pilot project will include the development of a Children's Environmental Risk Reduction Plan (ChERRP) to explore application of practical strategies for reducing children's environmental risk.

2. Accomplishments from January 1, 2004 – December 31, 2005

Cal/EPA hosted a series of workshops in October and November 2004 to discuss issues and gather input for activities related to community driven pilot projects in the EJ Action Plan. Issues discussed at these workshops included project goals, processes and timelines, suggested pilot project locations, and definitions for precautionary approaches and cumulative impacts. A total of six 2-years pilot projects have been proposed by ARB, DPR DTSC, and SWRCB and were approved by the Cal/EPA Interagency Working Group for Environmental Justice (IWG) for implementation in 2005. These projects are at the early stage of implementation.

ARB's project will focus on reducing air pollution exposure in urban communities in Southern California and will conduct air monitoring, emission inventory, and health evaluation in the community of Wilmington. The DPR's project will focus on monitoring and evaluating ambient air concentrations of as many as 40 pesticides and breakdown products in the community of Parlier in Fresno County.

DTSC will manage two projects in the San Francisco Bay Area. The first project is designed to collect data for developing guidelines and recommendations for the recognition and remediation of methamphetamine-contaminated residential structures consistent with the requirements of AB 1078 (Keene, Liu) and SB 536(Bowen). The second project will facilitate information sharing between the West Oakland community and government. A better agency understanding of the needs and concerns of the community will help the community to have a stronger role in decision-making process.

One of the two SWRCB projects will address the fish die-offs at the Klamath River basin located in northern California. The project will also increase the amount of productive habitat by restoring historic higher populations of salmon and allow the Native American Tribes, as a primary stakeholder of interest, to enjoy the benefit of increased fishery production. The other project will establish a Regional Advisory Group comprised of community, government and Tribal members impacted by decisions or activities along the New River, from California/Mexico Border at the City of Calexico, through the Imperial Valley and north to the Salton Sea. The project will attempt to establish new long-term strategies to reduce farm runoff contaminants; and to reduce raw sewage flows in the New River by working with the Mexican government.

More information on these pilot projects can be viewed at http://www.Cal/EPA.ca.gov/EnvJustice/ActionPlan/Phase1/#Pilot_Projects

3. *Planned Activities for the Next Two Years*

Working with the local advisory groups, California Environmental Justice Advisory Committee and IWG, the ChERRP will be developed and implemented over the next two years.

4. *Program Benefits to Children's Environmental Health*

The pilot projects developed in the Children's Environmental Risk Reduction Plan will help Cal/EPA identify applications and strategies that can be transferable to other communities throughout the State.

C. Vulnerable Populations Research Program

1. *Purpose and Requirements of the Legislation*

In July 1999, the Vulnerable Populations Research Program (VPRP) was initiated by ARB. The purpose of the VPRP is to provide the scientific support, through research efforts, for ARB's regulatory and non-regulatory programs that aim to protect all of California's citizens, especially those subpopulations considered vulnerable, from the adverse effects of air pollution. The VPRP plan will identify susceptible subpopulations, quantify the degree to which their health is compromised and will characterize their exposures to air pollutants. The VPRP 2003 Progress Report and Research Plan was finalized in August 2003 and provides the framework necessary to guide project sponsorship under the auspices of the VPRP. The plan is available at: <http://www.arb.ca.gov/research/vprp/vprp.htm>.

There are four studies currently considered part of the VPRP: the Fresno Asthmatic Children's Study (FACES), Fresno Asthmatic Children's Study (East Bay Kids), Los Angeles Family and Neighborhood Survey (LA FANS) and the Southern California Children's Health Study.

The Fresno Asthmatic Children's Study is the first project to be funded through ARB's Vulnerable Populations Research Program. FACES is designed to examine the acute and chronic health effects of particulate air pollution on the natural history of asthma in young children. The Fresno area was selected for the study since there is a high prevalence of asthma among the children in Fresno, an ethnically diverse population with high levels of ambient air pollution, especially particulate matter. The study is being conducted by a team of researchers from a number of organizations, led by the University of California, Berkeley. Additional information can be found at <http://www.arb.ca.gov/research/faces/faces.htm>.

OEHHA sought and received funding to conduct studies on health effects related to vehicular fuel usage. A portion of the study, known as the Fresno Asthmatic Children's Study, was used to conduct an epidemiological study of the respiratory health impacts of traffic-related pollutants on children.

In the LA FANS study, the investigators are conducting NOX and NO2 monitoring at 200 locations within the LA FANS study domain for the development of Land Use Regression (LUR) models for the Los Angeles County area. The LUR models will be used to predict traffic pollutant (NOX, NO and NO2) exposures for all of the LA FANS subjects, to evaluate associations between these traffic pollutant exposures and lung function and asthma (prevalence, exacerbation and possibly incidence) in children ages 0-17 years. This study will also use geostatistical models to estimate regional background concentrations of ozone and PM2.5 to evaluate whether concentrations of these more regionally distributed background pollutants confound or modify the effects of exposure to the more heterogeneously distributed traffic-related pollutants of NOX, NO, and NO2 on lung function and asthma. This study will provide information on respiratory impacts of motor vehicle emissions in a low socioeconomic status population and will aid in the development of air pollution exposure models that could be used in future epidemiological studies in Los Angeles County focused on different age groups and different adverse health outcomes.

ARB's recently-completed Children's Health Study, a 10-year study of the effects of long-term exposures of children to air pollution, was initiated prior to the VPRP. Although it is now informally considered part of the program, results are discussed in Section D on Page 52.

2. Accomplishments from January 1, 2004 – December 31, 2005

Approximately 300 children between the ages of 6 and 11 living in the Fresno/Clovis area, who have been diagnosed by a doctor with asthma, have been recruited into the ARB FACES study.

The study is investigating the relationships of air pollutants on acute exacerbations of asthma, the critical exposures leading to the observed acute health effects, the cumulative effects of repeated acute responses to short-term air pollution exposures on the progression of the children's asthma, and the biological or exposure characteristics of groups of children who are more or less responsive to a given exposure. These questions are being addressed by a series of panel studies to assess the short-term effects and a longitudinal study to assess the cumulative effects.

The panel and longitudinal studies began with the initial recruitment of the study participants in 2000 and will continue until the end of the study. The panel studies involve observations of groups of children during three 14-day panel periods per year. During the panel periods the children record the results of twice-daily lung-function tests, asthmatic symptoms, medication usage, and time/location/activity patterns. The longitudinal component involves each subject undergoing detailed health evaluations initially and every six months thereafter.

Parallel to the health studies, the FACES project involves a detailed examination of the air pollution exposure of the children. Ambient pollutant data from the Fresno First Street air monitoring station will be used for the duration of the study. In addition, highly instrumented monitoring trailers were placed at schools for a period of 14 months during

2002 and 2003. One of the trailers continuously monitored the ambient air quality at Fremont School for the entire period, while the other trailer was moved to a different school approximately every six weeks. Models to determine the spatial and temporal patterns of pollution across the Fresno/Clovis area by combining the trailer data and the concurrent First Street data were created in this two year period. These patterns form the basis for modeling individual exposures of the study subjects throughout the study area.

The draft final report is planned for submission in the first quarter of 2006.

OEHHA completed a cross-sectional study of children in the East Bay to examine the association between measurements of traffic and children's respiratory health. Respiratory health surveys were obtained on approximately 1100 children (8-10 years old) recruited from ten schools in three East Bay communities (Oakland, San Leandro, and Hayward). The results of the study indicate a correlation between the proximity of a child's school and home to major roadways and the incidence of asthma symptoms and chronic bronchitis. There was also a correlation between traffic-related pollutant measurements and exacerbation of asthma and chronic bronchitis (Kim, *et al.*, Traffic-related Air Pollution near Busy Roads, *Am J Respir Crit Care Med*, v.170, pp 520-526, 2004.)

ARB-funded continuation of the traffic assessment in the East Bay Children's Respiratory Study will use a database developed from an examination of air pollutants, including particulate matter (PM10 and PM2.5), black carbon (BC), and nitrogen oxides (NOx and NO2) in an epidemiological study to examine respiratory health among children living and attending schools at varying distances from high-traffic roads in Alameda County, California.

The LA FANS study has been initiated and preliminary data have been gathered.

3. Planned Activities for the Next Two Years

The FACES, East Bay Kids, and LA FANS studies will continue into the next two year period. In addition, other studies may be planned to examine other potentially vulnerable populations, including those that may be vulnerable due to their particular air pollution exposures.

4. Program Benefits to Children's Environmental Health

Research initiated and planned under the VPRP and related programs will shed light on some of the environmental factors that influence the behavior of childhood asthma and other respiratory health effects caused or exacerbated by air pollution including traffic effects. The information obtained from research sponsored through this plan will be used in the development and evaluation of ambient air quality standards and other air pollution related public health policies implemented at the State and community level that are designed to protect against the harmful health effects of pollutants.

D. Southern California Children's Health Study

1. Purpose and Requirements of the Legislation

Understanding the adverse health effects of air pollution on children is important since children are especially vulnerable to air pollution. Children's respiratory and immune systems are still developing, and they breathe more rapidly and are more physically active than adults. Little is known about the health effects of long-term air pollution exposure on children. The Children's Health Study, a 10-year study of the health effects of children's long-term exposures to Southern California's high concentrations and unique mixtures of air pollutants, is providing important new information on the health impacts of air pollution on children. This information will be useful in the setting of ambient air quality standards to protect this vulnerable population. More information can be found at <http://www.arb.ca.gov/research/chs/chs.htm>.

2. Accomplishments from January 1, 2004 – December 31, 2005

In the 2004-2005 time period, ARB-funded portion of the Children's Health Study was completed. ARB has received and approved the final report for this 10-year project. The report can be viewed at <http://www.arb.ca.gov/research/abstracts/94-331.htm>. The investigators will continue the project through 2007 with funding from the National Institute of Environmental Health Sciences (NIEHS). The study enrolled a total of over 6,000 children in 12 communities with varying mixtures of air pollutants; 3,600 of them were enrolled as fourth graders and are being followed through high school graduation. The children's pulmonary function was measured annually, and questionnaires ascertained information about respiratory symptoms and illnesses and numerous factors known to affect relationships between air pollution and health. Air pollution monitoring in the 12 communities provided information about exposures to ozone, nitrogen dioxide, nitric oxide, carbon monoxide, acid vapor, particulate matter less than 10 micrometers in diameter (PM10), particulate matter less than 2.5 micrometers in diameter (PM2.5), elemental and organic carbon (both PM10 and PM2.5), and the number of ultra-fine particles (less than 0.1 micrometer in diameter). During this time period the measurements of PM2.5, elemental and organic carbon, and ultra-fine particle exposure were phased out. Measurements and modeling of personal exposures to ambient air pollution related to motor vehicle emissions is ongoing.

The Children's Health Study has yielded many important results. In addition to previously reported results, in this two-year period a child's history of a doctor's diagnosis of asthma was found to be associated with nitrogen dioxide exposure and residential distance to a freeway (Gauderman, *et al.*, *Childhood Asthma and Exposure to Traffic and Nitrogen Dioxide*, *Epidemiology* 16:6, Nov. 2005). It was also found that significant decreases in lung function development at age 18 could be attributed to air pollutant exposure (PM2.5, NO2, acid vapor, and elemental carbon; Gauderman, *et al.*, *The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age*, *New Engl J Med*, 351:11, Sept. 9, 2004). This lung function decrement may be particularly important since the lungs are nearly mature by age 18 and lung function deficits are unlikely to be reversed.

For the NIEHS extension of the project through 2007, the scope of the project has been fine tuned. Sampling and the monitoring of children in Lompoc, Atascadero, and Lancaster has been dropped; these communities were replaced with air sampling and new study groups of children in Santa Barbara, San Bernardino, and Anaheim.

3. Planned Activities for the Next Two Years

ARB's funding support of the Children's Health Study ceased after June 30, 2004. Under the auspices of an NIEHS grant, however, the investigators will continue the monitoring effort and health measurements for an additional three years. ARB has an agreement in place with the investigators to facilitate the usage of the very rich dataset developed for the CHS in new investigations of other potential outcomes that have not been previously studied.

The investigators are expected to continue collecting additional data and performing many more analyses of the study's extensive data base and additional results are anticipated.

4. Program Benefits to Children's Environmental Health

The Children's Health Study is the first large-scale study of children to examine the impacts of long-term air pollution exposures. In addition, the study is able to look at sensitive children such as asthmatics who may be even more vulnerable to the impacts of air pollution. This information will be useful in adjusting ambient air quality standards and guiding health policies to protect children from the harmful effects of air pollution.