

SCHOOL DIESEL BUS EMISSIONS YOU TAKE MY BREATH AWAY

SUMMARY

Diesel engines emit a dangerously high level of pollutants. The older the engine the more nitrous oxides, particulate matter and non-methane hydrocarbons are sent into the atmosphere which can cause or complicate serious health problems. Exposure to diesel engine exhaust can aggravate symptoms of asthma, bronchitis, emphysema, pneumonia and possibly cause some types of cancer. Diesel school bus emissions have an adverse affect on all of us, but in particular, they pose an increased health risk for those children who must ride diesel buses every school day. Prolonged exposure to these pollutants can affect some children's development of respiratory, nervous, endocrine and immune system problems. As a result, the 2006-2007 San Diego County Grand Jury commenced a study of the San Diego County Air Pollution Control District (APCD) and school districts ability to protect our children from harmful diesel bus emissions.

Heavy duty trucks and buses that weigh more than 6000 lbs require an annual opacity (smoke) check as specified by California Air Resource Board (CARB) regulations. CARB opacity compliance is determined by the year the vehicle was manufactured and penalties are enforced for noncompliance. Idling regulations require school bus drivers to turn off their engines upon arrival or when parking within 100 feet of a school. In 2006, school buses began using reduced sulfur content fuel which in turn reduces sulfur oxide emissions.

Other voluntary measures, besides diesel engine manufacturing standards to control school bus emissions, are underway. The first priority is replacing all pre-1977 diesel school buses. Currently, five pre-1977 school buses remain in use in San Diego County. The next priority is replacement of 1977-1986 school buses. For buses built in or after 1987 particulate trap retrofits are recommended. Level-three particulate traps are appropriate for 1994 and newer buses requiring the use of low level sulfur diesel fuel. Engine modifications in use to control nitrous oxides (NO_x) emission, use electronic to control air fuel ratios and valve/piston timing, recycling exhaust gas for a second burn and turbo-charging.

Purchasing new buses and retrofitting older buses is an expensive proposition. A new diesel school bus can cost \$100,000 or more, depending on its size and desired options. Retrofitting an older school bus with a particulate trap can cost \$4000 or more for the hardware alone. Non-catalytic traps require cleaning. The device needed to clean these traps can cost up to \$15,000, which some school districts cannot afford. Beginning in 2000, the San Diego County APCD administered state funding to reduce school bus emissions following CARB guidelines for bus replacement or retrofit. In addition to state funding, San Diego County APCD receives funding from other sources such as county

vehicle registration fees. Since 2000, APCD has allocated more than \$8 million for school bus replacement or retrofit. From these funds, 110 buses were replaced and 467 were retrofitted.

PURPOSE

Media coverage, TV documentaries and medical reports all confirm the adverse affects of diesel engine emissions on health. Everyone is affected, although children in particular suffer more harm from these noxious fumes, especially children who ride to school in diesel school buses. Therefore, we must ensure that steps are underway to replace or retrofit the older diesel school buses that are emitting the most pollutants in San Diego County.

PROCEDURES

VISITS

- San Diego Unified School District bus maintenance facility
- Cajon Valley Union School District bus maintenance facility
- Sweetwater Union High School District bus maintenance facility

INTERVIEWS

- San Diego County Air Pollution Control District management

REVIEWS

- Diesel truck/bus inspection documents from California Highway Patrol
- Emission questionnaires sent and responses received from Santee, Cajon Valley and La Mesa-Spring Valley School Districts
- EPA Milestones in Auto Emissions Control report (EPA 400-F-92-014)
- Air Quality in San Diego County (APCD 2005 Annual Report)

WEB SITES EXAMINED

- www.arb.ca.gov Lower-Emissions School Bus Program
- www.ucsusa.org/clean-vehicles Sick of Soot
- www.nrdc.org what parents need to know about school buses
- www.cleanairfleets.org Advances in diesel engine technology
- www.fcmat.org/newsheadlines Maintenance, Operations and Transportation
- www.dieselforum.org/meet-clean-diesel Particulate Traps
- www.eesi.org/briefings/2006/transp&smartgrowth/6.22.06
- www.keikaventures.com/s-smokemeters

DISCUSSION

THE DANGER: Diesel engine emissions are a serious health risk. Particulate matter (PM) specifically contributes to several respiratory and cardiovascular illnesses. The possibility of cancer, chronic bronchitis, asthma, emphysema, pneumonia and heart disease can result from prolonged exposure to diesel exhaust particulates. These particulates are measured in microns (millionth of a meter). One micron is approximately equal to 1/7 the diameter of a human hair. PM measuring 10 microns is labeled PM₁₀ and those at or less than 2.5 microns are labeled PM_{2.5}. PM contains nitrates, sulfates, organic chemicals, metals and dust. These are produced by cars, trucks, buses, factories, construction sites, stone crushing and burning wood.

Particle size can determine the potential for eventual health problems. Sizes at or below 2.5 microns often penetrate deeper and damage lung tissue. Children are at a greater risk than adults for health problems due to exposure to diesel emissions, since they breathe faster than adults, breathe through their mouths more, spend more time outdoors and their immune system and internal organs are still developing.

Concern for our children is multiplied since many must ride diesel school buses. The Union of Concerned Scientists (USC) (www.ucsusa.org/clean-vehicles) found that the nation's 505,000 school buses were some of the oldest and dirtiest vehicles on the road. They found that one school bus can produce between two and ten times as much PM as a big rig. USC also determined that diesel emissions inside the bus can be eight times stronger than outside (www.fcmat.org/newsheadlines).

Diesel school bus emissions contain contaminants other than PM that also pose health risks for our children who ride these vehicles. One contaminant is ozone or smog which, in the stratosphere protects us from the sun's ultraviolet radiation, but at ground level is unhealthy to breathe. Ozone can restrict airways forcing the respiratory and cardiovascular systems to accelerate activity to provide adequate oxygen. Ozone can also damage the lining of the lungs. Diesel exhaust also contains oxides of nitrogen (main ingredient of smog), carbon monoxide, sulfur oxides, volatile hydrocarbons, benzene, formaldehyde and arsenic (Air Quality in San Diego County APCD 2005 Annual Report).

Since these by products all contribute negatively to our children's health, ***WHAT CAN WE DO?***

THE SOLUTION: The best of all possible plans to reduce or eliminate the harmful effects of diesel school bus emissions would be to replace all San Diego County school buses manufactured before 1988 with alternate fuel buses or diesel buses built to 2007 standards. In addition, it would be beneficial to modify engines and install particulate traps in diesel buses manufactured from 1988 to 2004. To accomplish this plan in one giant step is, of course too expensive. But a plan is currently underway for replacement that will progress in a step by step procedure through 2010.

Concerns about vehicle exhaust began in the 1950s with laws and regulations that required engine modification and inspections that evolved over the next several decades. Pollution concerns in those early years were primarily with gasoline powered vehicles and little was done about diesel exhaust emissions from heavy duty trucks and buses. In 1977, initial diesel emission standards were adopted by the Environmental Protection Agency (EPA), but not until 1985 were stringent emission standards adopted for heavy duty trucks and buses. Those standards were not implemented until 1991 and 1994 (EPA Milestones in Auto Emissions Control EPA400-F-92-014).

Additional delays arose as diesel engine manufacturers objected to many EPA mandated diesel emission standards, resulting in litigation prior to legislation. Following the standards set in 1994, diesel engine manufacturing progress was made with engine redesign, and included exhaust gas recirculation, common-rail fuel injection (fuel injection pressure regulation), combustion chamber design, turbo charging, electronic engine controls and cleaner diesel fuel. Each year progress has been made to reduce diesel emissions from heavy duty trucks and buses. The table below illustrates the EPA emission requirements for grams per horsepower hour (a one hour measurement for a particular size diesel engine) for new heavy duty diesel trucks and buses since 1984.

EPA EMISSIONS REQUIREMENTS

NO_x: THE X= OXIGEN CONTENT WITHIN THE COMPUND

PM_{2.5}: THE 2.5 = THE SIZE OF THE PARTICULATE IN MICRONS

YEAR	NO_x	PM_{2.5}
1984	10.7	0.60
1991	5.0	0.25
1998	4.0	0.10
2004	2.0	0.10
2007	0.2	0.01

Current regulations to test and control diesel emissions for buses manufactured prior to 1984 are minimal at best. To achieve some control, the California Air Resource Board (CARB) implemented the Fleet Periodic Smoke Inspection Program (PSIP) in 1998. This program required California fleet diesel vehicles with a Gross Vehicle Weight Rating (GVWR) greater than 6000 lbs to undergo an annual smoke opacity test that complied with Society of Automotive Engineers snap acceleration smoke test procedure (SAE J1667), (www.arb.ca.gov).

Opacity testing includes hardware, software and a procedure that measures the smoke/exhaust density emitted from a diesel truck or bus. There are several types and manufactures of opacity meters. One type uses hardware and software listed below (www.keikaventures.com/s-smokemeters). The tailpipe or stack device looks like an upper case T. The T crosspiece has a light transmitter on one end and a receiver on the other. The bottom part fits in the tail pipe or stack of a diesel truck or bus which allows smoke to access the crosspiece. Circuitry within the device converts the analog smoke

measurement to a digital equivalent. The digital signal is connected by a cable to a laptop computer where, with appropriate software, a pass or fail result will be displayed depending on truck or bus year and size. A complete package required for SAE J1667 testing could cost as much as \$4000. Testing stations are available throughout the county for school districts that cannot afford the opacity test package.

Most San Diego City Schools Districts that have a diesel bus fleet perform opacity tests every 45 days or 3000 miles in conjunction with the required safety check. A well-tuned engine will usually guarantee compliance with smoke opacity percent requirements. However, even a well-tuned engine in an older bus, which complies with smoke opacity, still pollutes at an unacceptable level. As mentioned earlier, corrective measures are in process. Through several governmental and volunteer programs ended in 2005, 110 pre-1987 school buses in San Diego County have been replaced and 467 post-1987 buses were modified with replacement clean engines or equipped with particulate traps. Much more should be done and ***ALL IT TAKES IS MONEY.***

THE PAYMENT: Several federal state and local funding sources can offset the cost of a new bus or the cost to retrofit post 1987 diesel buses. Federal (EPA) funding for school bus replacement and or retrofitting is ongoing. The Clean School Bus Energy Act enacted in 2006 authorized \$55 million over two years to replace pre-1977 and/or to retrofit post-1990 school buses. However, in 2006 only \$7 million was appropriated for school bus replacement/retrofit. These funds were distributed through the EPA's regional networks to school districts, state, recognized Indian tribes and non- profit organizations.

California state programs that provide funding to reduce diesel school bus emissions are doing more than federal replacement/retrofit programs. In 2000-2001 the California Air Resource Board (CARB) established the Lower Emissions School Bus Program. California school districts are not required to take part as participation in the program is voluntary. Budget guidelines were set up to determine how the initial allocation of \$50 million would be distributed throughout the state in December 2000. Follow up guideline changes were made for 2003-2004 budget and again in 2005- 2006. Current guidelines include:

- Replacement of pre-1977 buses exclusively.
- Replacement of buses in the order of the oldest bus first.
- All replaced 1977 and later buses will be crushed or rendered inoperative.
- Retrofit funding exclusively for devices providing the highest percentage PM reductions (level three) also with a priority on funding for devices that produce the lowest NO₂ (Nitrous Dioxide) emissions.

Revisions proposed in 2006 to guidelines were:

- Waive school district matching funds for new bus funding.
- Eliminate requirement that a percentage of replacement buses be alternately fueled.
- Following a retrofit, a California Highway Patrol (CHP) inspection is required prior to return to service.
- Allow funding for maintenance on Particulate Matter (PM) filters.

- Allow funding for data gathering for each bus to be retrofitted.
- Add requirement to use specified local air district funds to replace fuel tanks on compressed natural gas fueled buses.

The California Lower Emissions School bus program funds are distributed to Air Pollution Control Districts (APCD) to fund diesel bus replacement/retrofit throughout California. Each APCD is encouraged to abide by CARB guidelines before deciding how to lower emissions at volunteer school district bus fleets. In 2006 \$1 million was provided to San Diego County APCD. Additional funds are derived from vehicle registration and power plant mitigation fees (fee reduction). For every vehicle registered in the county, \$2 is set aside and a small portion of this money is provided to APCD for school bus replacement/retrofit. Since 2000, the San Diego County APCD has provided \$13 million to county volunteer school districts for school bus replacement/retrofit. Early in 2007 San Diego County APCD received additional mitigation funds from local power companies for selected school districts for pollution control. Additional funding may be available in 2007 from the state for school bus emissions reduction as a result of Proposition 1B passing in Nov 2006. Prop 1B would provide \$200 million for school bus replacement/retrofit state-wide.

As previously pointed out, it is voluntary for San Diego county school districts to participate in the APCD lower emissions school bus program. In fact a number of county school districts do not take part. These districts are usually smaller, with limited dollars available for bus purchases and limited maintenance facilities needed for retrofits. As more funds become available, the smaller districts should be able to purchase new buses and retrofit their existing buses that qualify, but a timeline is not yet available.

FACTS AND FINDINGS

Fact: Several studies by universities and medical facilities confirm that diesel school bus emissions contain particulate matter, nitrous oxide, carbon monoxide, sulfur oxides, volatile hydrocarbons, benzene, formaldehyde and arsenic. These emissions all contribute to cancer, asthma, bronchitis, emphysema and pneumonia. Small children's developing organs and immune systems are particularly susceptible to these school bus emissions. Health problems caused by these particles may not appear until later in life.

Finding: San Diego County school district diesel bus fleets pollute less than other counties in California and in other states. However, many older, polluting school buses are still on the road in San Diego County and pose a health threat for children who ride diesel school buses.

Fact: Harmful emissions can be stopped or controlled by purchasing new cleaner running buses, or retrofitting older fleet buses that qualify.

Finding: Diesel school buses purchased prior to 1987 can pollute four times as much as a bus purchased in 2006. Purchasing new, cleaner running diesel school buses will reduce emissions by a factor of four. Older diesel school buses purchased between 1990 and

2000 can be retrofitted with particulate traps or have the engine replaced or modified with electronic tune ups, recycling the exhaust, turbo charging and using cleaner diesel fuel. Replaced and retrofitted diesel school buses funded by San Diego County APCD have reduced PM and NO_x emissions by nearly 200 tons.

Fact: The scarcity of San Diego County school district dollars is limiting what can be done about reducing school bus emissions and when they can do it. Federal, state, local and private funds are available, but those dollars are not nearly enough to eradicate the problem.

Finding: Because of federal, state, and local laws momentum is growing in San Diego County to provide more emission reduction funding for the present and future. In 2006 the federal government distributed \$7 million for school bus replacement/retrofitting to school districts and qualified organizations with diesel bus fleets. The state has distributed APCD funds throughout California from the lower emissions school bus program. San Diego county APCD has received and distributed to volunteer school districts \$13 million since 2000. California State Proposition 1B approved in November 2006 will provide \$200 million for state wide school diesel bus replacement/retrofit.

RECOMMENDATIONS

The 2006-2007 San Diego County Grand Jury recommends that the San Diego County Air Pollution Control District:

- 07-15:** Adjust its priorities for distribution of EPA air quality Improvement funds to improve local school district diesel bus fleets.
- 07-16:** Inform school districts in detail about potential district funding and guidelines changes that could assist less affluent school districts to improve fleet emissions levels.
- 07-17:** Advise San Diego County School Districts that older, polluting school buses that were replaced with new low polluting buses should be removed from the road.

The 2006-2007 San Diego County Grand Jury recommends that the San Diego Unified, Sweetwater Union High and Cajon Valley Union School Districts:

- 07-18:** That are currently processing bond issue funds, or will have bond issue funds available in the future, budget a portion of these funds for diesel school bus replacement or retrofit.

COMMENDATIONS

The Grand Jury commends the San Diego Unified School District Transportation Center/Fleet Services, Sweetwater Union High School District Transportation Department and Cajon Valley Union School District Transportation Department for the informative tours of their maintenance/bus facilities and demonstrating for the Grand Jury the efforts being made to decrease bus emissions to protect school children.

REQUIREMENTS AND INSTRUCTIONS

The California Penal Code §933(c) requires any public agency which the Grand Jury has reviewed, and about which it has issued a final report, to comment to the Presiding Judge of the Superior Court on the findings and recommendations pertaining to matters under the control of the agency. Such comment shall be made *no later than 90 days* after the Grand Jury publishes its report (filed with the Clerk of the Court); except that in the case of a report containing findings and recommendations pertaining to a department or agency headed by an elected County official (e.g. District Attorney, Sheriff, etc.), such comment shall be made *within 60 days* to the Presiding Judge with an information copy sent to the Board of Supervisors.

Furthermore, California Penal Code §933.05(a), (b), (c), details, as follows, the manner in which such comment(s) are to be made:

- (a) As to each grand jury finding, the responding person or entity shall indicate one of the following:
 - (1) The respondent agrees with the finding
 - (2) The respondent disagrees wholly or partially with the finding, in which case the response shall specify the portion of the finding that is disputed and shall include an explanation of the reasons therefor.
- (b) As to each grand jury recommendation, the responding person or entity shall report one of the following actions:
 - (1) The recommendation has been implemented, with a summary regarding the implemented action.
 - (2) The recommendation has not yet been implemented, but will be implemented in the future, with a time frame for implementation.
 - (3) The recommendation requires further analysis, with an explanation and the scope and parameters of an analysis or study, and a time frame for the matter to be prepared for discussion by the officer or head of the agency or department being investigated or reviewed, including the governing body of the public agency when applicable. This time frame shall not exceed six months from the date of publication of the grand jury report.

- (4) The recommendation will not be implemented because it is not warranted or is not reasonable, with an explanation therefor.
- (c) If a finding or recommendation of the grand jury addresses budgetary or personnel matters of a county agency or department headed by an elected officer, both the agency or department head and the Board of Supervisors shall respond if requested by the grand jury, but the response of the Board of Supervisors shall address only those budgetary or personnel matters over which it has some decision making authority. The response of the elected agency or department head shall address all aspects of the findings or recommendations affecting his or her agency or department.

Comments to the Presiding Judge of the Superior Court in compliance with the Penal Code §933.05 are required from the:

<u>Responding Agency</u>	<u>Recommendations</u>	<u>Date</u>
San Diego County Air Pollution Control District	07-15 through 07-17	08/08/07
San Diego Unified School District	07-18	08/08/07
Sweetwater Union High School District	07-18	08/08/07
Cajon Valley Union School District	07-18	08/08/07