DIRTY, DANGEROUS AND DEADLY DIESELS

Diesel exhausts from both on-road and off-road engines are a significant source of some of the most deadly kinds of air pollution in Texas. Diesel exhaust is a mixture of over 450 different components including toxic gases and fine particles. Over 40 chemicals in diesel exhaust are considered toxic and have been linked to cancer and the disruption of the reproductive system.[1]

Diesel engines are used in both light duty cars and trucks and heavy-duty applications such as buses, ships, trains, and construction equipment. They are also used in stationary sources such as generators, drilling equipment, pumps and compressor stations. For the same load and engine conditions diesel engines spew out 100 times more sooty particles than gasoline engines and 50 times more NOx .[2] Across the country diesel engines produce nearly 20% of the total nitrogen oxides in outdoor air and 26% of the total NOx from on-road sources. Nitrogen oxides are a major contributor to the formation of ozone or smog.[3]

Nationally, diesel engines account for an estimated 26% of the total hazardous particulate pollution from fuel combustion sources and 66% of the particulate pollution from on-road sources.[4] Pollution from diesel engines causes health problem primarily in children and the elderly who are the most susceptible to the effects of air pollution. Lung irritation that is mild in the case of an adult can significantly impact a child. For those over 65 years of age, studies have shown a direct correlation between emergency room visits and higher levels of particulate pollution. [5]

This report will examine different kinds of pollution from diesel engines and their effect on human health, as well as identify successful solutions and control strategies.

DIESELS AND NOx

Nitrogen oxides are one of the pre-cursors to ground level ozone formation. Ozone forms when NOx is mixed with volatile organic chemicals and sunlight, and it is commonly referred to as “smog.” The American Lung Association has compiled a number of health effects associated with ozone pollution. The effects include increased respiratory symptoms, damage to cells of the respiratory tract, decline in lung function, increased susceptibility to respiratory infections, and increased risk of hospitalization and early death.

- ***Short-term exposures to ozone can cause a decline in lung function, including rapid breathing, decreased lung volumes and flow, and increased twitchiness of the airways. Exposure early in life may lead to acceleration in the decline of lung function that is a normal process of aging.***

- ***Respiratory symptoms can include coughing, throat irritation, shortness of breath, and pain on taking a deep breath. Asthmatics can experience wheezing, a hallmark of an asthma attack.***

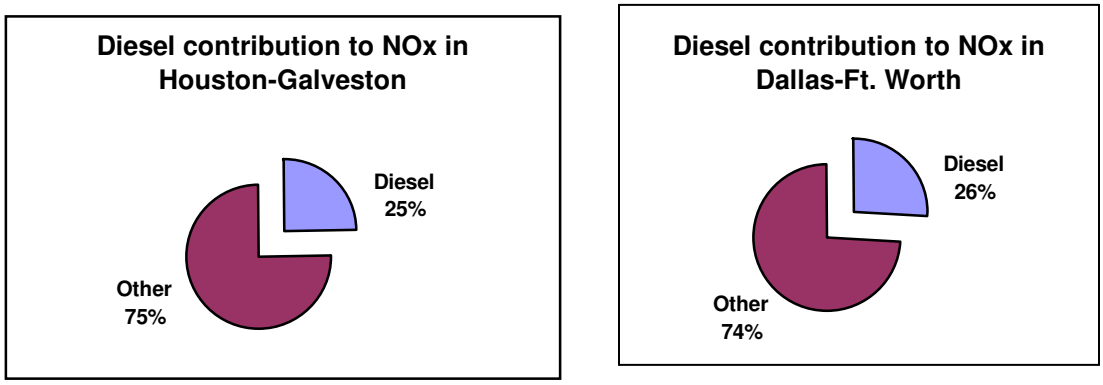
- ***When children with allergies and asthma are exposed to ozone, they can be more responsive to allergens that trigger an asthma attack.***

- ***Ozone triggers an inflammation response in the cells lining the lungs, causing them to rupture and leak. Repeated exposures may lead to structural changes in the respiratory tract including increased production of fibrous tissue associated with lung scarring.***

- ***Ozone compromises the lungs' natural defense mechanisms, increasing susceptibility to respiratory infections such as colds, flu, and pneumonia.***

- ***Short-term exposures are also associated with an increase in daily mortality, and increased hospital admissions and emergency department visits for respiratory causes.***

Diesel engines are notorious for their contribution of NOx to the air. In 1996, 26% of all NOx in the air was a result of diesel exhaust. One 225 horsepower diesel engine emits as much NOx as 50 cars. In Texas, pollution related to diesel engines is a significant problem, particularly in our two dirtiest metropolitan areas, Houston-Galveston and Dallas-Fort Worth.



Source: TNRCC

- Diesel engines contribute 25.38% of NOx, or 266.96 TPD in the HG region (from 2007 base case of 1052 TPD).

- Diesel engines contribute 26% of NOx or 129.44 TPD in the DFW region (from 2007 base case of 484 TPD).

To comply with federal health based air standards; Houston-Galveston must reduce its NOx emissions by 704 tons per day and Dallas-Fort Worth must reduce 230 TPD of NOx emissions by 2007.[1]

DIESEL EMISSIONS AND FINE PARTICLE POLLUTION

Fine particles are one of the most harmful toxins in diesel emissions. Researchers at Harvard School of Public Health have estimated that approximately 60,000 people each year are killed by fine particle pollution and hundreds of thousands more are made sick. The World Health Organization has estimated that as many as half a million premature deaths each year may be associated with fine particle pollution.

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The EPA defines particles as airborne particles that are less than 10 microns in diameter (PM10). However, there are even smaller particles with a diameter of 2.5 (PM2.5). Larger particles, don't remain in the air for very long, and rapidly settle to the ground. Finer particles remain suspended in air for far longer, sometimes for weeks, and they can travel in winds hundreds of miles from their sources.

The fine particles found in diesel exhaust find their way into the deepest tissues of the lungs. There the particles need to be cleared by the immune system, a process that takes months or years. Fine particles from diesels are particularly dangerous because they are coated with a mixture of chemicals that are toxic. They cause inflammation and the release of natural chemicals that coagulate the blood.

Effects of fine particle pollution include reduced lung function, damage to tissue and an increased susceptibility to bacterial or viral respiratory infections, especially among vulnerable groups in the population. These factors have been shown to increase hospital and emergency room admissions in places where the presence of fine particle concentrations are above acceptable standards. **Scientists in the United Kingdom have concluded that long-term exposure to fine particle pollution is likely to be as dangerous as second hand smoke.**[7] Asthma is a very common childhood disease and the presence of fine particles exacerbates it. **As levels of fine particles rise, so does the occurrence of asthma.**

A recent study by the American Lung Association found that childhood asthma rates in Houston were twice as high as the national average, and that asthmatic children would each experience more than 50 fewer days a year of chest symptoms, on average if the air were cleaned up to meet federal standards.[7] ***A recent study conducted for the City of Houston of the health care costs attributable to poor air quality found a price tag of $2.9 -$3 billion for the region. There is also a statistically significant association between absence from school and levels of fine particles. In fact, asthma is the leading cause of absence from school.***

Children are especially at risk for the harmful effects of fine particle pollution, due to the fact that their bodies do not reach full maturation until much after puberty. Thus, children's organs such as the brain, lungs and reproductive organs are in a constant state of development. This leaves children much less able to defend against harmful toxins that penetrate deep into the respiratory tract and then into vital organs. Children also play outside at times when air pollution is at its peak. The fact that children are shorter and lower to the ground increases their exposure to airborne particles. Also, children breathe more air per pound of body weight at a two to three times greater rate than adults do. This coupled with children's tendency to breathe through their mouths, results in children receiving greater amounts of contaminant.

DIESEL SCHOOL BUSES: A THREAT TO OUR CHILDREN

Each school day in Houston more than 32,000 children ride a diesel bus. This simple act may be threatening our children's health, because children are more susceptible to the health risks associated with diesel exhaust. A January 2001 study by the Natural

Resources Defense Council of diesel exhaust levels measured **inside** school buses showed that:

- ***A child riding inside of a diesel school bus may be exposed to as much as 4 times the level of toxic diesel exhaust as someone riding in a car immediately in front of that bus.***
- ***A child riding in a school bus is being exposed to as much as 46 times the cancer risk considered "significant" by EPA and under federal law.***
- ***While children make up only 25 percent of the population, they represent 40 percent of all asthma cases. Research indicates that diesel exhaust may increase the frequency and severity of asthma attacks and may lead to inflammation of the airways that can cause or worsen asthma.***

DIESEL AND CANCER

Diesel exhaust is a known human carcinogen. The EPA has already identified at least 40 individual components of diesel as carcinogens. Diesel exhaust is a complex combination of vapors, particles and gases, and exists in a vapor and fine particle phase. The vapor phase is made up of different gases, including carbon dioxide, carbon monoxide, sulfur oxides and various polycyclic aromatic hydrocarbons. These toxins in diesel emission cause genetic mutations to chromosomes and damage to DNA. This process is believed to contribute to the onset of cancer.

Cancer Risk Assessments of Diesel Exhaust

ORGANIZATION	YEAR	CONCLUSION
National Institute for Occupational Safety and Health	1988	Potential Occupational Carcinogen
International Agency for Research On Cancer (WHO)	1989	Probable Human Carcinogen
State of California	1990	Known to Cause Cancer
U.S. Environmental Protection Agency	2000	Likely to be Carcinogenic
National Toxicology Program	1998	Diesel exhaust particulate is reasonably anticipated to be a human carcinogen

- ***There have been several well-documented scientific studies that support the causal link between diesel emission and cancer, and studies done specifically for California reveal that more than 70% of the risk of cancer from air pollution comes from diesel exhaust alone.***[8]

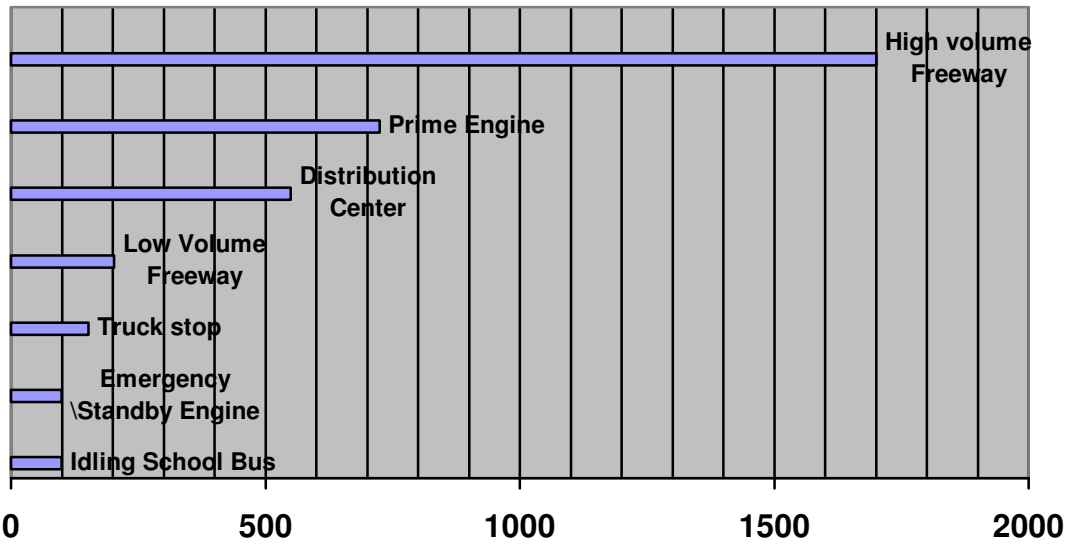
Some of the most compelling evidence for the diesel-cancer link comes from occupational studies. Such studies examine the cancer rate of people (such as truck drivers and railroad workers) who are consistently exposed to elevated levels of diesel exhaust.

- ***In an evaluation of 29 published occupational studies, the results are conclusive: increased exposure to diesel exhaust leads to a greater occurrence of lung cancer.***

Researchers found an increase of approximately 30% in the chance of lung cancer for occupational workers who are exposed to diesel exhaust. This result is sustained when research controlled for factors such as cigarette smoking. In addition, animal studies have reported the same results. Animals that were exposed to diesel emissions developed tumors on their lungs, but tumors also appeared on other parts of their bodies. It must be noted, however, that these tests were performed using higher levels of diesel exposure than what occupational workers would experience.

While there is copious research that shows that diesel exhaust contributes to cancer, the potency of diesel as carcinogen is still being debated. The National Resources Defense Council reports that for people exposed to 1 microgram per cubic meter of diesel exhaust, anywhere from 34 to 650 people may be expected to develop lung cancer. The average estimated is 230 cases of lung cancer per million people exposed. However, the reality is that people are chronically exposed to more diesel than 1 microgram. In fact, people in urban areas may be exposed to about 23 micrograms of diesel exhaust. This significantly raises the probability of developing lung cancer. The likelihood is elevated for vulnerable groups of people such as children, the elderly, occupational workers who are exposed to diesel exhaust as well as people living next to large roads and other diesel "hot spots." Furthermore, lung cancer is a disease that acts quickly and fatally. Fewer than 14% of lung cancer patients live longer than five years once they have the disease.

Estimated Potential Cancer Risks for Diesel- Related Activities



Source: California Air Resources Board

NAFTA's IMPACT ON TEXAS AIR QUALITY

While current diesel emission levels need to be reduced in Texas, the projected increase in emissions due to NAFTA and the growing number of trucks on Texas highways give the issue added urgency. In the past ten years, northbound truck crossings at the Texas-Mexico border have increased by 215% and southbound crossings by 278%. Future estimates indicate that there will be an 85% increase in truck traffic in the next 30 years.[9]

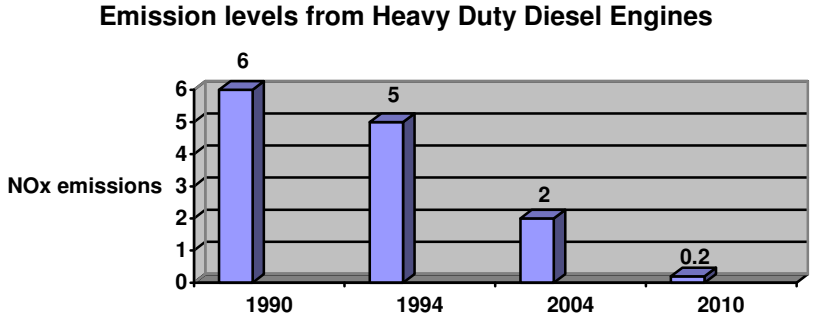
Since the passage of NAFTA, Texas has already seen a significant rise in truck traffic. According to TXDOT;

- Nearly 80% of all United States-Mexico truck traffic goes through Texas Border crossing.
- Based on the first eight months of year 2000 traffic, it is projected that truck crossings from Mexico to Texas will have surged to 2,798,839 by the end of 2000 -- a 324% increase over the pre-NAFTA traffic.
- In comparison, rail car crossing to Texas increased 173% between 1990 and 1994, but grew at a more modest 158% rate between 1994 and 2000. [10]
- DOT estimates that an additional 3 million Mexican trucks would cross yearly with the opening of the border.

Today, no one checks to assure that trucks driven from Mexico aren't heavy polluters. Once across the border the trucks will travel the heavily polluted I-35 and I-10 corridors thus contributing to Texas' pollution problem.

SOLUTIONS

It is evident that to protect public health we must clean up diesels. Fortunately, there are many successful options to choose from including the use of new alternative fueled engines, retrofits, after-treatments, repowering with a cleaner engine, emission controls involving advanced technologies and new, less polluting engines. One of the most promising involves installing a PM trap that filters the exhaust stream and over time burns the collected particles. This technology requires the use of low sulfur gasoline, which will not be widely available, until 2006, yet can reduce PM emissions by 90 %.

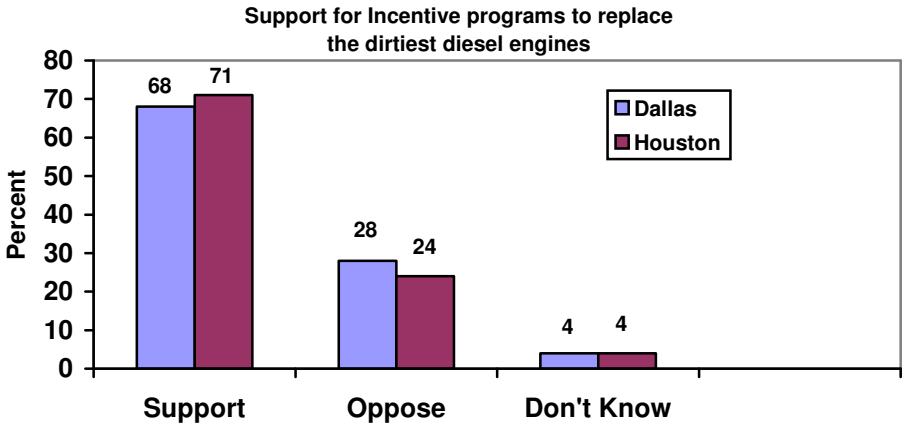


Source: EPA/CARB

Repowering or replacing old engines with newer cleaner ones is a viable strategy. A 1987 or newer engine emits just 50% of the NOx from an 86 model engine. A 1997 engine emits 20% less NOx than a 1996. Federal law requires significant reductions beginning in the 2004 model year but because manufacturers are allowed to average

their emissions the majority of the reductions in emissions don't come until 2010. If we encourage the use of cleaner diesels today we have the opportunity to get the benefits of the emission reductions for our SIP plans today.

Cleaning up diesel emissions is important to the public. In a recent poll (conducted on behalf of the American Lung Association in December 2000), nearly 9 out of 10 people believe that big diesel trucks and buses should be required to use the best available pollution control technology. Furthermore, American voters want changes to be implemented quickly. The same poll found that 69% want cleaner diesel fuel and tighter regulations for trucks to be phased in within the next five years. In Texas, there is widespread support to clean up diesels.



In Dallas and Houston, approximately 70% of people polled said they would support a state-funded program to replace the dirtiest diesel engines on the road today.

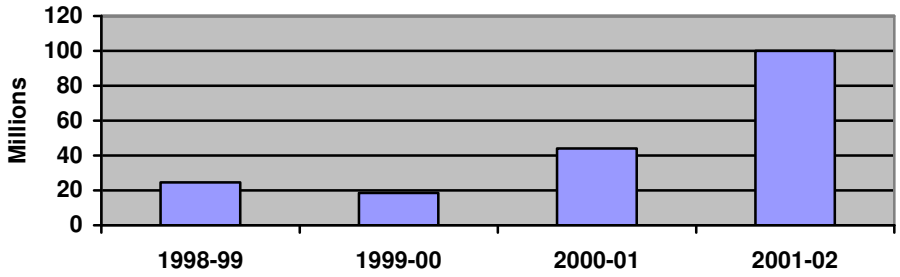
CARL MOYER PROGRAM

In California, the Carl Moyer Program has been successful and it could be used as a model for Texas. One of the main advantages of the program is that it is one of the cheapest ways to reduce NOx. In California, the cost-effectiveness statewide is about $5,000 per ton of NOx reduced, well below the $58,000 per ton for additional industrial controls or the $78,000 for accelerating Tier 2&3 standards for new diesel engines that these emission reductions are projected to cost Texans.[12]

The goal of this program is to reduce NOx emissions beyond what laws, agreements and regulations call for in an effort to meet federally mandated pollution limits. The program is built around providing money that can be offered as an incentive to cover the costs of replacing or retrofitting a wide variety of older diesel engines with newer ones as well as providing incentives to purchasers of low emissions technologies.

California has appropriated a total of $98 million for the Carl Moyer Program over the last three fiscal years. The program has proved so successful at reducing diesel emissions in a cost-effective manner that the Governor has increased the budget for the program to $100 million for the next fiscal year including $50 million targeted specifically at diesel reductions from school buses.

Funding Levels for Carl Moyer Program



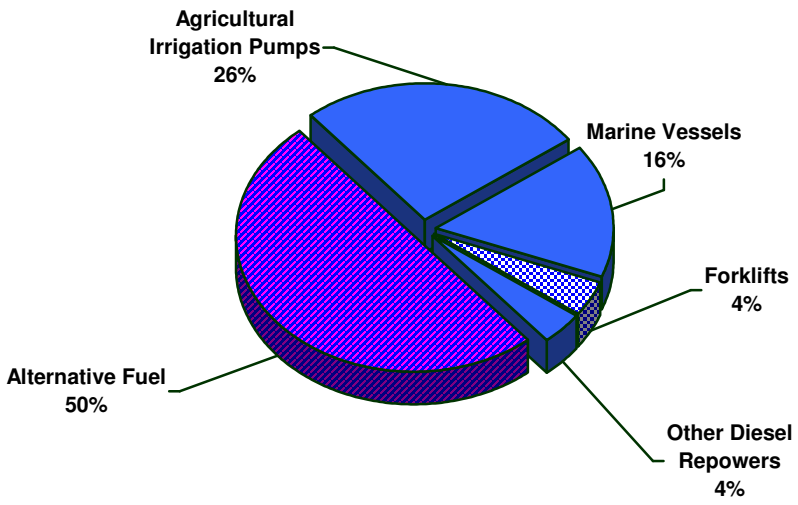
The program's emission reductions are achieved by funding the incremental cost of cleaning up diesel engines NOx and PM emissions below the levels called for by current standards, agreements or regulations. In California estimated emission reductions from the program's first two years are about 2200 tons per year (TPY) of NOx. When third-year projects are implemented, it is anticipated that annual NOx reductions will reach about 4400 TPY.

Carl Moyer Program Benefits by Project Category Year I & II - California

Source Category/ Equipment Type	NOx (tons/year)	Cost-Effectiveness ($/ton)
On-Road:		
Heavy-Duty Line Haul	41	$ 2,570
Refuse Haulers	303	$ 5,127
Urban Transit Buses	130	$ 6,546
School Buses	3	$10,818
Other	5	$ 6,162
Off-Road:		
Farm Equipment	18	$ 4,260
Construction	0.09	$ 7,194
Other	36	$ 8,722
Locomotives:	22	$ 2,322
Marine Vessels:	386	$ 4,291
Agricultural Irrigation Pumps:	1092	$ 2,348
Forklifts (electric):	129	$ 3,016

Average cost = $5,281

Source: Carl Moyer Program Status Report, April 16, 2001[6]



Carl Moyer Program
Percent Funding By Project Type

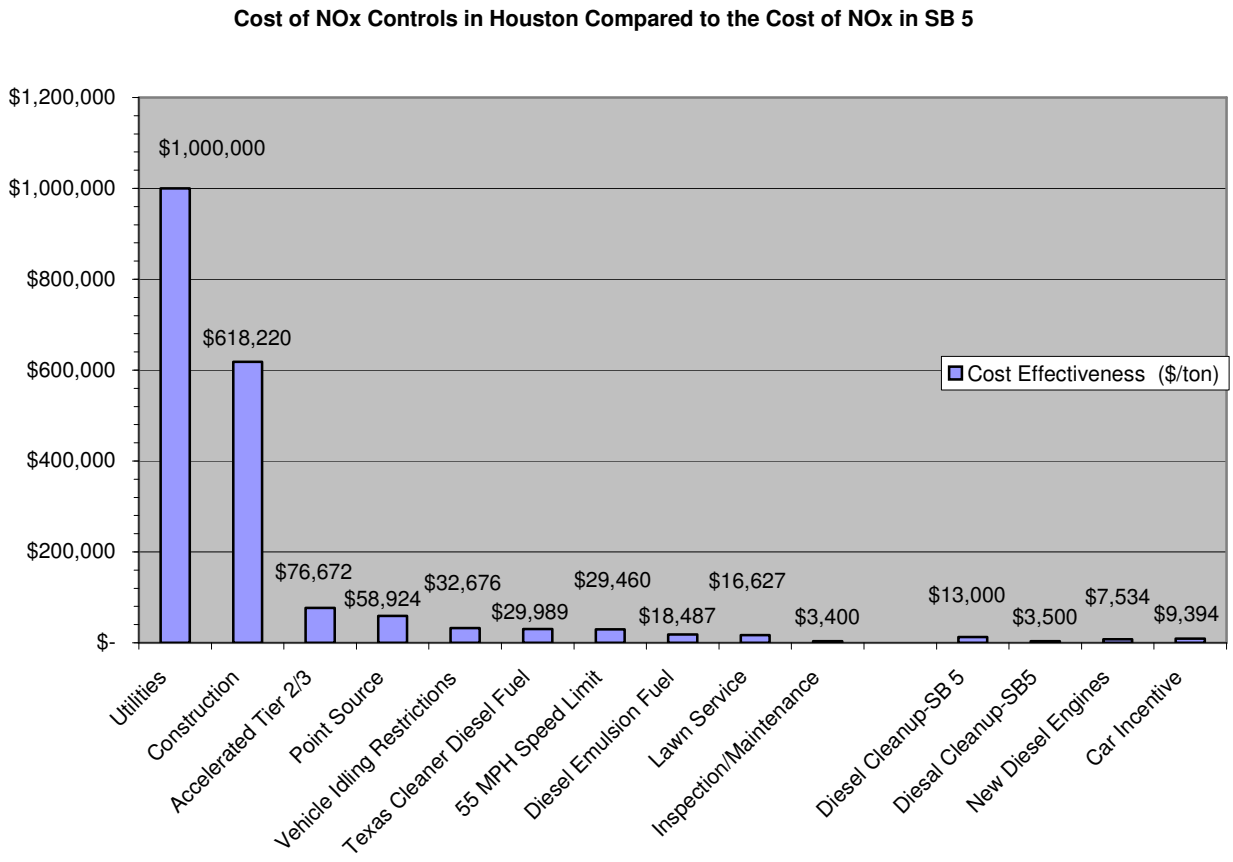
In California, engine replacements were funded for heavy-duty line haul trucks, urban transit buses, school buses, waste haulers, delivery trucks, off-road equipment, agricultural pumps, marine vessels, locomotives, and forklifts. The types of projects ranged from diesel-to-diesel repowers, new diesel engines, new alternative fueled engines and electric motors. Money was also used for emission-reducing add-on equipment. Vehicles and equipment funded must agree to operate for at least five years and required that vehicles and equipment must operate 75% of the time in air basin where the money was awarded.

Estimated emission reductions from the first two years of the California program are about 7 tons per day of NOx and about 400 pounds per day of PM. When third year projects are implemented, it is anticipated that annual NOx reductions will total approximately 14 tons per day, and PM emission reductions will total about 800 pounds per day. The majority of the emission benefits will occur in the first five years (the minimum project life), although some of the lower-emission engines may be in service 20 years or more.

The TNRCC estimates that if Texas adopted the Carl Moyer Program at $100 million levels it would achieve between:

tons per day	cost of reducing each ton of NOx
26	$13,000
68	$5,000
98	$3,500

CLEANING UP DIRTY DIESELS IS COST EFFECTIVE



Cleaning up diesels is a wise investment. Adopting a Carl Moyer type program would be an inexpensive way to reduce NOx.It has been successful because it is one of the cheapest ways to reduce NOx. In California, the cost-effectiveness statewide is about $5,000 per ton of NOx reduced, well below the $58,000 per ton for industrial controls or the $78,000 for accelerating Tier 2 & 3 standards for new diesel engines proposed in Texas.

ALTERNATIVE FUELS

Alternative fuels provide for fewer emissions than diesel because they produce lower amounts of smog-forming chemicals, soot and cancer risk. There are many examples of the successful use of Alt fuels in large fleets around the country and in Texas.

- In Houston, the HEB grocery store chain has switched 61 trucks-10% of its fleet to run on alternative fuels.

- In San Antonio, the Northside Independent School District (NISD) has a fleet of 472 school buses, which transport 33,000 students to and from school each day. It is the fifth largest school district in Texas and it currently operates 440 of these school buses on propane and the remainder on a propane/gas

combination. NISD switched to propane in 1981, largely because of the high price of gasoline. Currently in their 20th year of operating the largest dedicated propane fleet in the country, NISD has found that maintenance costs are low, and the engines get good mileage.

- A test of commercial buses in Boulder, Colorado demonstrated a 97% reduction in PM and a 58% reduction in NOx

CONCLUSION

Diesel exhausts from both on-road and off-road engines are a significant source of some of the most deadly kind air pollution in Texas. One 225 horsepower diesel engine emits as much NOx as 50 cars and NOx contributes to ozone formation. .It also includes fine particles that are one of the most harmful toxins of diesel emissions. The fine particles found in diesel exhaust find their way into the deepest tissues of the lungs, and are particularly dangerous because they are coated with a mixture of chemicals that are toxic. They then cause inflammation and the release of natural chemicals that coagulate the blood.

In addition, the EPA has already identified at least 40 individual components of diesel as carcinogenic, and diesel exhaust is a known human carcinogen. Studies done specifically for California reveal that more than 70% of the risk of cancer from air pollution comes from diesel exhaust alone.

Diesels are a significant source of air pollution in Texas. They contribute 25.38% of NOx, or 266.96 TPD in the Houston-Galveston region, and 26% of NOx, or 129.44 TPD in the Dallas-Fort Worth region.

NAFTA and the increase in truck traffic will only exacerbate the pollution problems from diesels, but there are solutions. There are many proven options to reduce diesel emissions including: the use of new alternative fueled engines, retrofits, after-treatments, repowers, and emission controls involving advanced technologies.

Texans support statewide efforts to clean up diesels. In Dallas and Houston, approximately 70% of people polled said they would support a state-funded program to replace the dirtiest diesel engines on the road today, while only about 26% said they would oppose such a program.

Cleaning up diesels is a wise investment. The Carl Moyer Program provides incentives to change out older dirtier engines. It has been successful because it is one of the cheapest ways to reduce NOx. In California, the cost-effectiveness statewide is about $5,000 per ton of NOx reduced, well below the $58,000 per ton for industrial controls or the $78,000 for accelerating Tier 2 & 3 standards for new diesel engines.

Alternative fuels also provide cleaner modes of transportation than diesel because they produce lower amounts of smog-forming chemicals; soot and cancer risk, and have been used in many cities in Texas.

[1] EPA and California Air Resources Board
[2] NRDC EXHAUSTED BY DIESEL, May 1999 pg v
[3] American Automobile Manufacturers Association. 1997 Motor Vehicles Facts and Figures, 1997 Detroit Michigan. P. 40
[5] NRDC EXHAUSTED BY DIESEL, May 1999 pg 12
[6] http://www.arb.ca.gov/msprog/moyer/moyer.htm
[7] http://www.doh.gov.uk/comeap/longtermeffects.pdf
[8] South Coast Air Quality Management District, "Multiple Air Toxics Exposure study in the South Coast Basin (MATES-II)," March 2000 p. ES-2. CARB "Risk Reduction Plan to Reduce Particulate Matter Emissions From Diesel-Fueled Engines and Vehicles," September 2000 p. 15
[9] Texas Border Infrastructure Coalition. Transportation Report. Testimony. Border Affairs Committee hearing July 10, 2000
[10] Truck Crossing into Texas from Mexico, 1990-1999; Truck Crossing into Texas from Mexico, 2000 YTD; Rail Car Crossing into Texas from Mexico, 1990-1999, all from Texas Center for Border Economic and Enterprise Development, May 10, 200 & Oct. 23, 2000; projection based on first eight months of 2000 truck entries extrapolated to entire year.
[12] The Carl Moyer Program Status Report, April 13, 2001. California Air Resources Board