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**Breathe At Your Own Risk: Dirty Diesels, Environmental Health & Justice
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Breathe At Your Own Risk: Dirty Diesels, Environmental Health & Justice).¹

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Abstract

This paper will review the health impacts of diesel exhaust, and analyze how people of color, the poor, children, and the elderly are disproportionately exposed to and affected by toxic diesel fumes (primarily from on-road sources). I will summarize the Federal regulations related to reducing exposure to diesel exhaust, assess available and emerging clean fuel alternatives and technologies for reducing diesel emissions, and make recommendations for improvements in policy. Finally, I will review the major challenges and opportunities to systematically clean up or replace diesel fuel in our nation's fleets of trucks and buses, and propose organizing and coalitional strategies to effectively advance this issue on both a local and national scale.

Diesel in America: Environmental Justice Concerns

The clouds of toxic black smoke that billow from the tailpipes of diesel-fueled trucks, buses, and shipping cranes are a familiar sight and smell for many environmental justice activists. Diesel fumes, which can trigger asthma attacks and increase lung cancer risk, are a pervasive source of air pollution in many low-income communities of color, particularly in urban areas.

Background

Diesel engines were invented in 1892 by Rudolph Diesel in his search to develop an engine that provided greater energy output than the gasoline-fueled car engine. Diesel fuel, like gasoline, is derived from oil, but because it is less refined than gasoline, it is cheaper to use. Diesel engines also outlast gasoline engines, remaining on the road long after their gas-fueled counterparts have been retired. Initially diesel engines were only used in large stationary sources that required huge engines, such as power plants, but in the 1920's and 30's these engines were also developed for vehicle and locomotive use. (HEI p.13). Sales of diesel trucks and buses have exploded since 1960, while sales of diesel fuel continues to rise. In 1996 29 billion gallons of diesel fuel was consumed in the U.S; by 2000 this number was up to 35.5 billion (EHP p.A460). Today diesel engines continue to provide a power and fuel efficiency advantage over the gasoline engine.

The vast majority of heavy-duty trucks and buses rely on diesel fuel. These include long-haul tractor trailers ("18-wheelers"), school buses, public and commercial buses, garbage trucks, and street cleaning trucks. Heavy-duty diesel trucks are the primary means of domestic transport of goods, outpacing trains, planes, and ships. There are also other, non-road sources of diesel emissions that also introduce a significant dose of diesel into our air. These include cranes, forklifts, and other construction equipment; farming equipment such as tractors; boats and ships; and airport equipment and tarmac vehicles. Additionally, back-up generators used by various institutions in case of a power outage are generally fueled with diesel.

Not surprisingly, emissions from diesel engines have skyrocketed over the years, stubbornly resisting the trend of decreased air pollution that has characterized other sources. Emissions have increased both in absolute terms as well as relative contribution of diesel exhaust to ambient air pollution. The power advantage provided by diesel engines comes at the cost of substantially greater emissions than those generated by gas-burning engines. Although improvements in diesel engine design and emission control technology has resulted in decreased emissions from individual diesel vehicles over the years, this decrease in emissions has been offset by a trend of rising vehicle miles traveled (VMT) of diesel-fueled vehicles. Because diesel engines have such a long life, there are still many older and dirtier engines still on the road today, despite the fact that newer engines burn more cleanly. Nationally, heavy-

¹ With thanks to the following individuals for their feedback and help: Cecil Corbin Mark, Sheila Foster, Dave Park, Amnon Bar-Ilan, and Kizzy Charles-Guzman.

duty diesel trucks and buses are believed to contribute 80% of all the particulate matter generated by on-road vehicles in the United States (HEI p.68). These emissions gravely affect the health and quality of life of communities of color, who disproportionately bear the burden of our increasing dependence on diesel fuel.

Why diesel is a problem for communities of color

Asthma, one of the health problems associated with diesel exposure, is a major public health crisis in this nation, hitting low-income communities and communities of color the hardest. Farming, shipping, construction and other non-road sources, as well as major highway sources of diesel ensure that not even rural or suburban communities are immune to diesel exposures. However, urban areas are home to both high concentrations of diesel sources, a large population, as well as the most rapid increase in asthma rates and morbidity. The racial/ethnic and socioeconomic groups that have the greatest prevalence of asthma also have the highest exposures to diesel exhaust. Furthermore, while other types of ambient air pollution have decreased in the past 20-30 years, mobile source pollution and diesel exhaust in particular have remained constant or increased.

The prevalence of asthma nationwide increased 59% between 1982 and 1996 (NCHS, 2000). The burden of asthma is borne disproportionately by African-Americans and persons under the age of 18. In 2000 the rates of asthma hospitalizations for African-Americans were 35.5 per 10,000, compared to 10.4 for whites (American Lung Association 2002). In 1996 the estimated prevalence of asthma among African-Americans was 69.6 per 1000, compared to 53.5 per 1000 for whites, and 55.2 for the general population. Similarly, among all the age groups asthma prevalence is highest in those under age 18, 62 per 1000. The greatest increase in the prevalence and severity of asthma has been among children and young adults living in poor inner-city neighborhoods (Eggleston *et al.*, 1999). For example, in New York City the communities with the highest rates of childhood asthma hospitalization are all low-income communities of color. East Harlem heads the list at 170.2 hospitalizations per 10,000 population for children aged 0-14 in the year 2000, compared to a citywide average of 64 and a national average of 31.5 childhood asthma hospitalizations per 10,000 people in 1999. (NYC Department of Health 2000).

Bus depots and other concentrated sources of diesel exhaust are frequently found in low-income communities. For example, in New York City six out of eight of the Metropolitan Transit Authority's diesel bus depots in Manhattan are located in Northern Manhattan, a low-income community of color, while citywide twelve of twenty depots are in communities of color. In addition, five of the depots in Northern Manhattan are in residential communities, within 200 feet of people's homes.

Another vulnerable population facing high exposures to diesel exhaust are schoolchildren who ride yellow school buses, which are among the dirtiest vehicles on the road today. A recent NRDC study found that children on school buses are exposed to levels of diesel exhaust up to 4 times higher than a child riding a car besides that school bus, with on-bus exposures averaging 19 micrograms (μg) per cubic meter (m^3), (Solomon *et al.*, 2001). Another highly exposed group are people who encounter diesel on the job on a daily basis, including bus and truck drivers, railroad workers, and airport workers who work on the tarmac, many of whom are people of color.

The Environmental and Health Effects of Diesel Exhaust

The characteristic clouds of black smoke emitted by diesel engines are comprised of thousands of substances, including gaseous pollutants and solid particulate matter. The gaseous pollutants include carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen oxides, and organic chemicals or hydrocarbons. Of these, nitrogen oxides (NO_x) are especially problematic because they are precursors to ozone. In fact, the EPA estimates that diesel trucks are responsible for one-third of the smog-forming NO_x emissions coming from all vehicles in the United States. Diesel exhaust contains over 40 organic chemicals identified by the EPA as Hazardous Air Pollutants (HAPs), also called air toxics, which are either suspected to cause cancer or create other serious health risks. The organic chemicals that are of special concern include aldehydes, benzene, 1,3-butadiene, and polycyclic aromatic hydrocarbons (PAHs). It is the PAH's that are believed to create much of the cancer risk posed by diesel exhaust. In fact, because diesel exhaust contains so many substances that contribute to both a cancer and noncancer health risks in humans, the EPA considers diesel exhaust to be a mobile source air toxic.

Ground-level ozone, also known as smog, is formed when nitrogen oxides from motor vehicles reacts with volatile organic chemicals (VOC's) in the presence of sunlight. This highly oxidizing pollutant irritates the respiratory

system and can cause wheezing and coughing, and trigger asthma attacks (USEPA d). Long-term exposure to ozone can cause lung damage, and one recent study showed that children in Los Angeles who played three or more sports were at higher risk of developing asthma later in life, possibly as a result of their ozone exposure (McConnell *et al*, 2002). Ozone also increases susceptibility to respiratory illnesses and can reduce lung capacity in both the long-run and the short-run.

Diesel exhaust is also made up of millions of tiny solid particles, ranging in size from 5 nanometers (a billionth of a meter) to slightly larger than 10 micrometers ($10\ \mu\text{m}$, also known as or microns, which are a millionth of a meter.). Although the vast majority of particles are smaller than 2.5 μm , and most are smaller than 1 μm . As a point of reference, the period at the end of this sentence is about 200 μm in diameter. These particles are made up of an inorganic carbon core, to which organic compounds can adhere. Inorganic carbon is also referred to as black carbon or elemental carbon.

It is this elemental carbon core that distinguishes diesel exhaust particles from other types of fine particles in ambient air. Elemental carbon serves as a great surface for other types of chemical pollutants to cling to². For example, volatile organic chemicals, allergens, and other elements in the air adhere to the surface of diesel exhaust particles. These are pollutants that could not normally get deep into our lungs because they would be “caught” by the body’s natural defenses. However, since fine diesel particulate matter can bypass these defenses, these pollutants are essentially able to hitch a ride into the lungs where they would not otherwise get access. Furthermore, because diesel exhaust particles are so small, they collectively have a lot of surface area to which other substances can adhere.

Diesel particulate matter also contributes to ambient levels of fine particulate matter, or $\text{PM}_{2.5}$, which is defined by the EPA as particles with a diameter of 2.5 μm or less. $\text{PM}_{2.5}$ are tiny particles in the air that are of special concern because they are so small that they are able to bypass our respiratory defense systems and penetrate deep into the lungs. In a typical city, diesel particulate matter contributes between 10% and 30% of the fine PM in the air of the city. The other PM in the air is comprised of sulfates, which come from sulfur dioxide emissions, and nitrates, from nitrogen oxide emissions. Sulfur dioxide primarily comes from coal-burning power plants, while nitrogen oxides come from both power plants and motor vehicles.

The haze that characterizes many urban skylines is largely a result of fine particulate, or $\text{PM}_{2.5}$ pollution. Particles in the air have long been known to pose severe health risks. In 1952 London experienced its famous “Killer London Fog” episode caused by particulate pollution. This episode, which killed dozens of people a day, galvanized public awareness of the acutely toxic effects of particulate pollution. Today fine particulate matter is well known to be associated with early mortality, largely from cardiac effects, hastening at least 30,000 deaths annually. Additionally, recent studies have shown that fine PM pollution is also associated with lung cancer, and that living in the most polluted cities in the U.S. can increase a nonsmoker’s risk of dying of lung cancer by 20% -- about the same increase in lung cancer risk faced by a nonsmoker living with a smoker (Pope *et al*. 2002). $\text{PM}_{2.5}$ also exerts other chronic respiratory, immunological, and neurological effects.³

Because diesel exhaust is composed of thousands of different substances in varying proportions, exposure to this combination of multiple substances exemplifies the kind of poorly understood risk associated with exposure to multiple substances, a common phenomenon in many communities of color. In addition to each of these substances exerting its own potential health effect, they may be interacting with each other to modify their health effects in a way that remains poorly understood. Below is a brief review of the health effects of diesel exhaust, many of which are of particular concern to communities of color.

Diesel exhaust: health effects

The two major health effects associated with diesel exhaust particles (DEP) that are independent of its contribution to ambient $\text{PM}_{2.5}$ and smog production are asthma attacks and lung cancer. Diesel exacerbates asthma and contributes to respiratory symptoms. In September 2002 the Environmental Protection Agency finally released its

² For example, water filters and other pollution-trapping devices are frequently made out of charcoal or “activated carbon,” which traps pollution by making it stick to a carbon bed.

³ In 1997 the Environmental Protection Agency, recognizing the severe health problems created by fine PM, promulgated a National Ambient Air Quality Standard for $\text{PM}_{2.5}$ of 15 $\mu\text{g}/\text{m}^3$ annually averaged.

“Health Assessment Document for Diesel Exhaust,” in which it concluded that “short-term exposures can cause irritation and inflammatory symptoms,” (US EPA c). Dozens of laboratory and human studies demonstrate that diesel particles essentially acts to “prime” the respiratory system for an asthma attack. They exert an inflammatory and irritant effect on the lungs.⁴ One way they do this is by enhancing the production of the cytokines, or chemical messengers, that cause inflammation.⁵ Recent epidemiological studies also show an association between experiencing respiratory symptoms and living near major highways and other sources of truck traffic.⁶

While diesel exhaust is fairly well characterized as contributing to asthma exacerbation, little is known about the potential impact that diesel exhaust might have on the development or onset of asthma. There have been cases of newly developed asthma reported in workers exposed to very high levels of diesel exhaust (CARB ES-16), but these levels are much higher than is seen in community settings. However, considering that diesel does impact the immune system, and the onset of asthma is essentially governed by alterations in immune function, it is plausible that exposure to diesel in early childhood, especially for fetuses and very young children, could contribute to development of asthma. This is a research question that needs to be further explored by researchers.

Cancer and other health effects

Diesel exhaust is known to exert a genotoxic effect, meaning that it can damage DNA, a necessary (but not sufficient) step in the development of cancer. There is a substantial body of evidence of an association between long-term exposure to high levels of diesel exhaust (generally at the level of occupational exposure,) and increased risk of developing lung cancer. (US EPA c, HEI). A study by the South Coast Air Quality Management District (AQMD) estimates that exposure to diesel exhaust in the Los Angeles basin is responsible for 71% of the cancer risk from all sources of air pollution in that region. Another study conducted by state and local air pollution officials concluded that nationwide, based on lifetime risk, diesel particulate matter contributes to 125,000 cancers in the United States, (STAPPA / ALAPCO).

The Environmental Protection Agency has concluded that “long-term inhalation exposure is likely to pose a lung cancer hazard to humans, as well as damage the lung in other ways.” The EPA’s health assessment document is by far the most comprehensive review of the available literature on the overall health effects of diesel exhaust. Unlike the state of California, the EPA has not developed a benchmark number that is used to determine acceptable levels of exposure. (US EPA c).

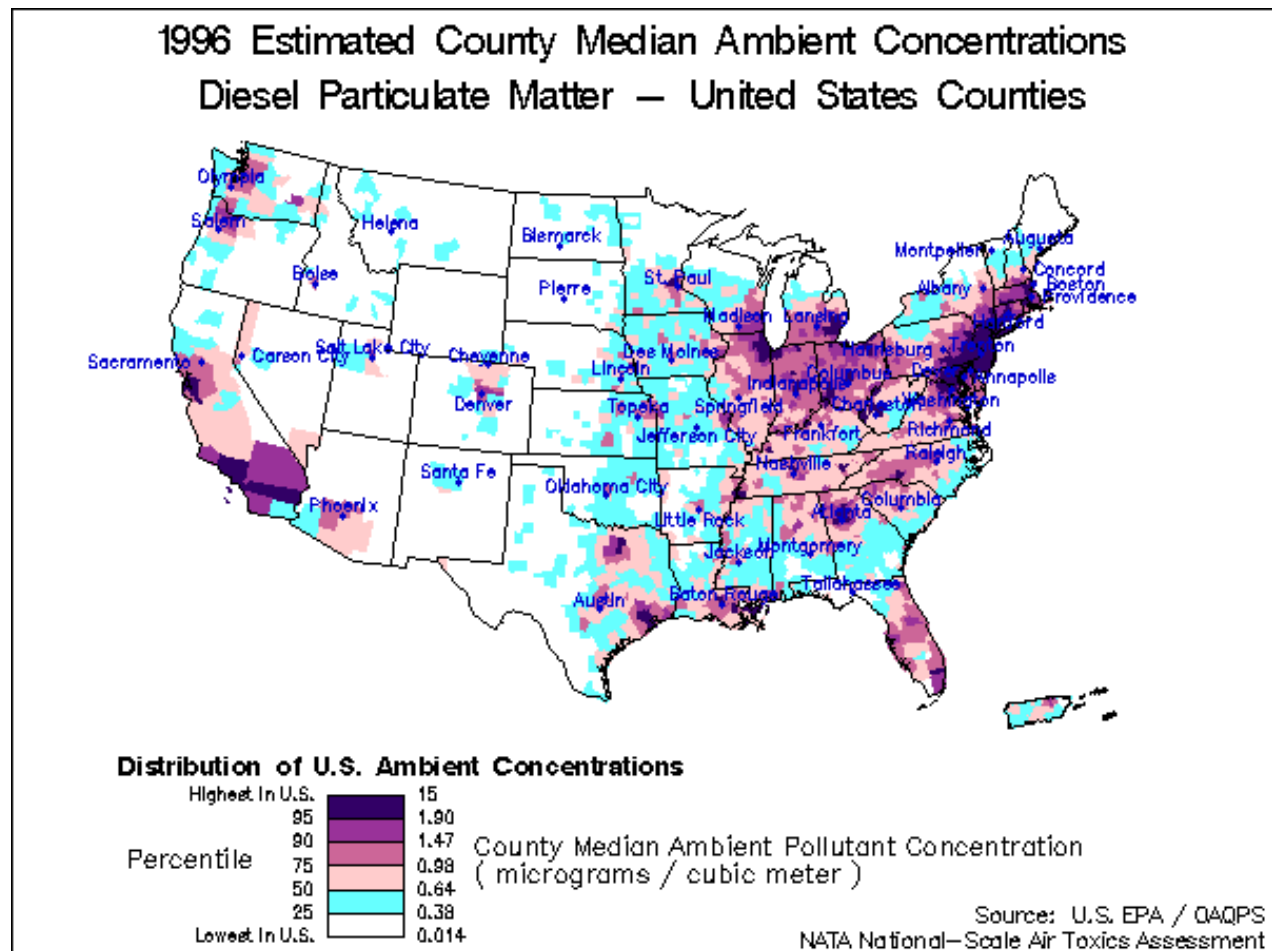
In 1998 the state of California Air Resources Board (ARB) declared diesel exhaust to be a Toxic Air Contaminant (TAC), defined as “an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health,” (CARB 1998). The state recommended a Reference Exposure Level of 5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) as the non-cancer health benchmark.

⁴ Emerging experimental evidence supports an irritant and/or immunologic effects of diesel exhaust on the respiratory system may have special relevance in inner city neighborhoods, effects that are consistently proinflammatory and allergy enhancing (Salvi et al., 1999; Diaz-Sanchez, 1997; Nel et al., 1998; Peterson et al, 1996; Ohta et al., 1999; Abe et al. 2000).

⁵ In particular, lab studies show that exposure to diesel exhaust increases the production of IgE, immunoglobulin E, which is the chemical messenger that is released during an asthma attack. This enhanced production is most visible when the exposed lab animal is then exposed to another allergen.

⁶ A few researchers have conducted cross-sectional studies examining the relationship between children’s acute and chronic experiences of respiratory distress and their proximity to motor vehicles from highways. Wjst et al (1993). showed a small but significant decrease in peak expiratory flow (PEF) among 10-year old children in school districts in Munich with higher flow of car traffic, as well as increased self-reports of respiratory symptoms. Other analyses found that decreases in lung function and parental report of chronic respiratory symptoms were associated with truck traffic density and with concentration of black smoke measured in schools in the Netherlands (Van Vliet et al., 1997; Brunekreef et al., 1997). One case-control study found a linear trend between hospital admissions for asthma and traffic flow (Edwards et al., 1994), while another found a positive association between wheezing and symptoms of allergic rhinitis and self-reported frequency of truck traffic (Duhme et al., 1996).

The Environmental Protection Agency, through its National Air Toxics Assessment (NATA), has modeled and estimated ambient concentrations of 32 hazardous air pollutants (HAPs), also known as air toxics, including diesel particulate matter. This information, available directly through the EPA web page at <http://www.epa.gov/ttn/atw/nata/>, estimates that ambient diesel exhaust particles vary as high as 15 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$) in some counties. The highest modeled concentrations are in southern California, Chicago, New York City, and the northeast corridor from Washington DC to Boston MA, (US EPA e).



Existing Laws, Regulations and Policies

In December 2000 the EPA announced ground-breaking regulations limiting emissions of particulate matter, NO_x, and hydrocarbons from new on-highway heavy-duty diesel vehicles, and limiting the amount of sulfur in diesel fuel, (US EPA b). The emission standards, which take effect in 2007, are given in terms of a grams of a pollutant that can be emitted, per brake-horsepower-hour (bhp-hr), which is a measure of constantly-changing power output of an engine. The “Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements” rule limits PM emissions to .01 grams per brake-horsepower-hour (g/bhp-hr), down from the previous standard of 0.1 g/bhp-hr. The rule also limits NO_x emissions to 0.20 g/bhp-hr and non-methane hydrocarbons to 0.14 g/bhp-hr. Emissions standards are stated in terms of grams of a pollutant that can be emitted by an engine operating at a particular engine load, per unit of time. Hence, engines that operate with a higher power output are permitted to emit more pollution.

Although engine manufacturers are redesigning engines to emit lower levels of NO_x, they will also have to meet the 2007 emissions standards by installing control technologies, also known as aftertreatment technologies. The technology of choice is the diesel particulate filter, sometime called a catalyzed diesel particulate filter, which

captures 85% to 97% of particles (on a mass basis) emitted from the engine. The captured soot is then “burned” or oxidized off the filter with the help of a catalyst. Particle filters are poisoned by sulfur in fuels; therefore their use must be paired with low-sulfur diesel fuel. Diesel particulate filters also reduce carbon monoxide and VOC emissions, but do not alter NOx emissions. NOx standards must be met through other controls such as selective catalytic reduction (SCR) systems or NOx adsorbers, combined with engine modifications.

These 2007 emission standards are preceded by another set of standards, which were announced by the EPA in July of 2000, (US EPA a). These are standards for model year 2004 heavy-duty diesel engines, and focus on the smog-forming combination of NOx and hydrocarbons. The standard states that engines manufactured in 2004 or later must not emit a combination of NOx and non-methane hydrocarbons (NMHC’s) in excess of 2.4 grams per brake-horsepower per hour. This standard exists as a way to help engine manufacturers “phase-in” engines that will eventually meet the 2007 standard for NOx.⁷

The 2007 emissions limits cannot be met without the use of pollution control technologies; consequently the second part of this diesel rule limits the amount of sulfur in diesel fuel. By July 15, 2006, diesel fuel for highway use cannot contain sulfur in quantities higher than 15 parts per million (ppm), a 97% reduction from the current allowable levels of 500 ppm. This limit accomplishes two goals: it reduces the number of sulfate particles that are emitted by diesel engines, and it prevents diesel particulate filters from being “poisoned” by the sulfur in fuel.

The EPA estimates that the Heavy-Duty Diesel Rule will prevent 8300 premature deaths, 5500 cases of chronic bronchitis, and 17,600 cases of acute bronchitis in children each year. They also estimate that over 360,000 asthma attacks, 7100 hospital admissions, and 2400 emergency room visits for asthma will be avoided each year, and that the action will prevent 1.5 million lost work days, (US EPA c).

Effectiveness of Current Environmental Protection Standards

Although the Heavy-Duty Diesel Standards are a critical step in reducing harmful emissions from diesel-fueled vehicles, they are not a comprehensive solution to the environmental justice and public health problems created by diesel exhaust. While ultra low-sulfur diesel fuel is cleaner than current diesel fuel, there is no such thing as “clean” diesel fuel. **The only “clean diesel” is no diesel.**

The 2007 Heavy-Duty Diesel standards do not directly regulate the emissions of air toxics. Emissions reductions may come about incidentally, given that many of these toxics adhere to the fine particles whose emissions will be reduced. Nonetheless, research is needed to assess whether the new engines that meet the 2007 standards do in fact reduce air toxics to an acceptable degree. If the answer is no, as it is likely to be, then additional regulations may be needed to reduce air toxics emissions from diesel engines.

Most tests run on trucks fitted with catalyzed particulate filters are conducted in a lab-like setting rather than on the road. There is some evidence that the efficiency of these filters begins to break down with increased time on the road. One major weakness with the current diesel standards is that they do not require on-road emissions testing. Unlike most cars, trucks do not have to pass annual emissions tests; compliance with emissions standards takes place only when engines are manufactured. In fact, when the EPA calculated the expected benefits of the Heavy-Duty Diesel Rule, they assumed that the emissions control technologies built into the new engines would maintain 100% performance over the life of the engine. There is ample reason to believe that pollution control technologies will in fact malfunction or lose their effectiveness over time. Consequently, a major gap in the regulation of diesel vehicles that must be filled at the national level is requiring that heavy-duty trucks and buses pass annual inspection tests to ensure their emissions stay within acceptable bounds over the long lifespan of the engines.⁸

⁷ Additionally, as part of a consent decree signed between the EPA and 7 major engine manufacturers, those manufacturers must meet the 2004 standard by October 2002. Despite manufacturer protests, the EPA recently announced that it was holding these manufacturers to this deadline this month.

⁸ Another potential weakness in the regulations as they are written deals with the issue of particle size versus particle mass. Although the vast majority of particles in diesel exhaust are nanoparticles, smaller than 1 μm, the particles that contribute the most to the total mass of diesel exhaust are those between 1 mm and 2.5 mm. Because emission standards are given in terms of mass – engines must emit no more than .01 grams of particulate matter per hour, per brake-horsepower of the engine – it is possible to meet these standards by removing just those few larger particles.

Policy Recommendations

While the Heavy-Duty Diesel standards do help to reduce the emissions from diesel-fueled vehicles, ultimately the only way to eliminate these still-toxic fumes are to eliminate our dependence on diesel fuel altogether. Several viable fueling alternatives exist.

Alternatives to Diesel

Compressed Natural Gas

Natural gas is a gaseous fuel, composed of 90% methane, found in underground deposits. Like oil, it must be mined through the drilling of surface wells, but unlike oil, natural gas requires minimal refining to produce a commercially viable product. In addition, natural gas is primarily mined in Canada or the United States whereas oil is primarily imported from the Middle East. Natural gas vehicle emissions are considerably lower in NO_x, particulate matter, and air toxics (Cannon et al 2000).

Typically, CNG buses cost between \$290,000 to \$318,000, while a new diesel bus costs \$250,000 to \$275,000, (Cannon et al, p.30). Additionally, CNG requires an independent fueling infrastructure that frequently must be built up from scratch, including connection to a natural gas pipeline and on-site fueling systems that store the natural gas and compress it under high pressure into the tanks on buses.

Hybrid Electric

Hybrid diesel-electric engines are split into two power sources: an electricity-producing battery that powers the vehicle during start-up and slow speeds, and the regular fuel-burning internal combustion engine that powers the vehicle upon reaching a certain speed. Hybrid electric vehicles are often misperceived as requiring charging. In fact the battery is automatically recharged during operation by recovery of the energy that is normally lost to heat during braking. Diesel fuel is burned only part of the time the vehicle is operating; consequently hybrid electric vehicles offer superior fuel efficiency and reduced emissions. Nevertheless, diesel hybrid trucks and buses are still powered by diesel, perpetuating the systematic dependence on diesel fuel that many environmental justice activists are challenging. Fleets that make the significant cost investment in purchasing hybrid buses and trucks have a disincentive to eventually make the switch to a clean, non-diesel fuel.

Pursuing or accepting diesel hybrid vehicles is an option that should only be entertained when significant, severe, and non-changeable factors exist, and should be aggressively coupled with a conversion to biodiesel. However, hybrid electric vehicles fueled by compressed natural gas with certain emissions control technologies offer one of the cleanest way to power our heavy-duty bus and truck fleets.⁹

Biodiesel

Biodiesel is a fuel made from any vegetable oil – usually soybean or peanut, although any restaurant-grade vegetable oil can be used as feedstock – that has undergone a certain refining process. Emissions from burning biodiesel are significantly lower in particulate matter, carbon monoxide, hydrocarbons, VOC's, and PAH's, although with current biodiesel formulations the emissions of NO_x appear to increase. This is problematic from the perspective of ozone production, particularly in urban areas. Nonetheless, heavy-duty vehicle engines made in 2007 and later must meet NO_x emissions standards, regardless of the types of fuels they use, so biodiesel remains a viable choice. However, from an environmental justice perspective further research is needed to ensure that the process of “refining” vegetable and restaurant oil into biodiesel does not cause harmful emissions.

Think about a box filled with a hundred golf balls and just five bowling balls. Removing those 5 bowling balls will considerably reduce the total weight of the box, but all those golf balls still remain. This would not be a concern were it not for the fact that there is some evidence that nanoparticles may be exerting a disproportionate share of the health impacts caused by diesel exhaust, (Kittelson 1998).

⁹ See United States Department of Energy, Office of Transportation Technologies, “Heavy Vehicle and Engine Resource Guide,” for information on CNG hybrid buses.

Biodiesel is an appealing choice from several other perspectives. It produces very little particulate matter emissions, and is primarily made from vegetable oil, a renewable resource, which can be domestically grown. It can be burned in any diesel engine with some engine modifications, precluding the need for major infrastructure change characteristic of compressed natural gas. Biodiesel presents an interesting opportunity to stimulate sustainable development in multiple realms of our economy, including the agricultural sector (farmers supplying virgin vegetable oil,) and small-scale restaurants recycling grease and creating a local supply in major cities.¹⁰

Many fleets are looking at burning biodiesel blends – 20% biodiesel and 80% diesel – as a way to reduce their emissions. However, this would be an unacceptable compromise from an environmental justice perspective, as it does little to eliminate our dependence on diesel.

Hydrogen Fuel Cells

Hydrogen fuel cells are the state-of-the-art, emissions-free technology that generates electricity by combining hydrogen with oxygen in the air. Although this technology is still largely in the research and development stages, a few pilot programs are currently testing fuel cells in buses, including the city of Chicago, Georgetown University (Cannon et al, p.52), and several counties in California.

Policies to encourage alternative fuels

There are several public policy approaches to encouraging a switch away from diesel to clean alternative fuels in this country.

Financial incentives

One approach focuses on creating financial incentives for both public and privately owned fleets to make the initial cost investment in switching to a clean fuel. Several states currently provide tax incentives to mitigate the incremental cost of purchasing a compressed natural gas vehicle. For example, money from Federal transportation dollars is currently available through what is known as CMAQ – congestion mitigation and air quality improvement – to offset the cost (to private fleets) of purchasing alternative fuel vehicles. Additionally, recent funding under CMAQ provides a rebate on the incremental fuel cost for alternative fuels.

Various states also offer tax incentives and write-offs to cover the incremental cost of alternative fuel and AF vehicles. For example, New York State provides direct funding through the Clean Air / Clean Water Bond Act to public agencies and municipalities to cover up to 100% of the incremental cost of new alternative-fuel buses and the needed infrastructure, (NAFDES).

Additional needs include increased Federal funding to cover the costs of converting yellow school buses to a clean alternative fuel.

Public purchasing policies

Another policy approach is to legislate or otherwise mandate (e.g. through Executive Orders) that public fleets incorporate a certain proportion of alternative fuels in their fleet. For example, in New York City a local law mandates that at least 20% of the City's new bus acquisitions must be vehicles that are ready for clean alternative fuels.

¹⁰ The Department of Energy also notes:

“(T)here is only enough of the feedstocks to supply 1.9 billion gallons of biodiesel (under policies designed to encourage biodiesel use). The Department of Energy is developing a new, low cost biodiesel oil from spicy mustard seeds that could add another 5-10 billion gallons of biodiesel to the fuel supply. The mustard meal (the seed that remains once the oil is removed) is a high value natural pesticide that helps keep the price of mustard oil low,” (AFDC).

Other policy measures

Broader policy support for clean fuels includes increasing the research and development (R & D) for emerging technologies like biodiesel and fuel cells, in order to accelerate their commercial marketability. A further need is to reduce federal subsidies of diesel fuel (and other oil products), that maintain their artificially low prices and inhibit competition from cleaner alternatives. The low cost of diesel fuel, like the unnaturally low cost of gasoline in our country, is a direct result of the oil industry being one of the most heavily (Federally) subsidized industries in this country. Because this industry receives direct and indirect government support in the form of tax incentives, lowered sales taxes, and military protection of overseas oil sources, (Union of Concerned Scientists, 2002), a gallon of diesel costs less than a gallon of milk or even a gallon of bottled water.

As a nation we are highly dependent on oil, almost all of which is imported, largely from the Middle East. America consumes 25% of the world's oil, while comprising only 5% of the world's population. This dependence on oil fuels much of our foreign policy; it is also subject to the volatility of politics and economics in other nations. Consequently, natural gas is increasingly gaining appeal from an energy security perspective. The U.S. Department of Energy is increasingly investing in supporting R & D for the commercial use of alternative fuels. Its Clean Cities program (<http://www.cities.doe.gov/>) focuses on encouraging the wider use of alternative fuel vehicles and supports the development of alternative fuels infrastructures.

From an environmental justice perspective it is also important to push for public policy measures that prioritize the most highly exposed communities for supporting the conversion of diesel vehicles to alternative fuels. The state of California leads the nation with its exemplary recent decision to provide funding to support the development of zero-emission vehicles (ZEV's) in targeted "environmental justice communities." (CARB 2002).

Another specific policy measure targets specific fleets, including school buses and garbage trucks, for conversion to clean fuels. Local municipalities can require that the school district only purchase clean fuel school buses, that it place emissions controls on existing buses, and accelerate the retirement of the oldest, dirtiest buses on the road.¹¹ Similar, with their low miles traveled and centralized parking structure, city garbage trucks are an ideal fleet for fueling with compressed natural gas.

A more innovative approach to accelerating our nation's shift away from diesel dependence is to use Federal transportation legislation as a means of developing non-vehicular forms of transportation in our communities. Our country's major transportation law, the Transportation Equity Act for the 21st Century ("TEA-21"), emphasizes the concept of "livable communities." This concept can be used to support urban EJ efforts to encourage walking and biking as essential modes of transit, potentially reducing the need for diesel-fueled public buses.

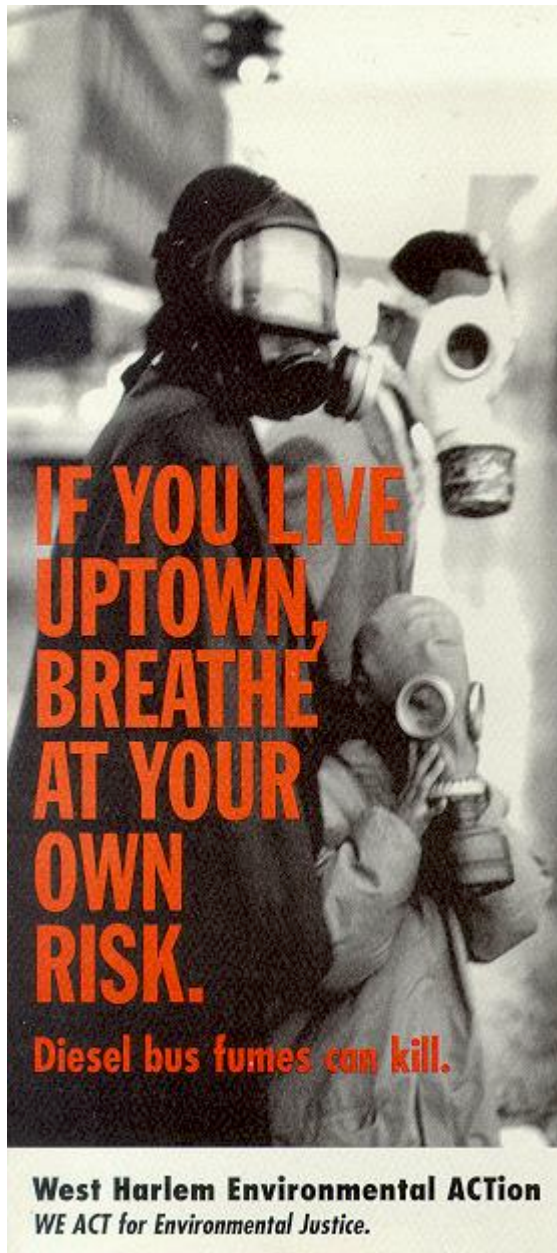
Currently under TEA-21 a gasoline tax has been established to set aside money from the sale of gasoline for supporting the development of transportation infrastructure. This bill can be expanded to create a "diesel tax," to generate revenues to support the R & D of alternative fuels and other clean transportation systems.

Action Plan and Resources

Public fleets rely on tax dollars to operate. When these fleets create emissions that disproportionately impact communities of color then it can be argued that taxpayer money is being used in a racist manner. This was the rationale behind a Title VI Civil Rights administrative complaint filed by West Harlem Environmental Action (WE ACT) with the Department of Transportation (DOT) against the New York City Metropolitan Transit Authority in November 2000. The MTA responded with a request to the DOT to dismiss our complaint, citing its commitment to purchasing ultra-low sulfur diesel fuel as a "clean" fuel.

WE ACT's "If You Live Uptown, Breathe at Your Own Risk" campaign launched in 1997 culminated in the signing of an Executive Order by Governor Pataki prohibiting the construction of any new diesel bus depots, and mandating the conversion of several existing depots to compressed natural gas. However, this apparent victory has been

¹¹ See the NRDC report "No Breathing in the Aisles," for a comprehensive list of funding available to school districts to purchase clean fuel buses (Solomon et al).



marred by foot-dragging and severe reluctance on the part of the MTA to implement these policies, largely because they are wedded to maintaining their diesel infrastructure. WE ACT's experiences illustrates just how deeply entrenched the "diesel mentality" is within one particular institution. This profound attachment to diesel fuel is seen throughout our economy, and represents a significant obstacle to efforts to accelerate a conversion to cleaner fuels in our society. Additionally, the manufacturers of diesel fuels are extremely powerful and have a significant stake in ensuring that this nation's bus and truck fleets continue burning this dirty petroleum product. The American Petroleum Institute in particular represents the strongest opposition to any efforts to reduce our dependence on dirty diesel. The American Trucking Association is another lobby with vested interest in maintaining the toxic status quo.¹² Another industry group to keep an eye on is the Diesel Technology Forum, whose Executive Director notes "There's very clearly a strong future for diesel. . . It's really woven into the fabric of life here," (EHP p.A464).

Organizing strategies

Organizing locally to pressure city and state fleets to switch to clean fuels is one important tactic to improving our living environments. However, these local strategies must be accompanied with a concerted statewide, regional, and national strategy to address the supply of diesel fuel. In particular, commercial trucking fleets, which operate regionally and nationally, cannot only be targeted locally.

Frequently, anti-diesel activists find themselves in the difficult position of appearing to have to choose between advocating for short-term reductions in diesel emissions through the installation of diesel emissions controls, and long-term investments in the switch to cleaner fuels. Fleet owners may offer to install particulate filters on their vehicles, reducing emissions of particulate matter, clearly a goal for EJ activists. Yet if this short-term reduction comes at the cost of long-term investment in clean fuels (as fleet owners later claim that the somewhat costly investment in emissions controls has sapped their financial commitment), we have won the battle but lost

the war.

This does not mean that communities of color must continue to live with toxic and deadly diesel emissions until some vaguely defined point in the future when fleet owners make the switch to cleaner fuels. Rather, we can advocate for

- 1) immediate reductions in emissions from on-road vehicles through particle filters and NOx controls;
- 2) accelerated retirement of the oldest vehicles currently on the road;
- 3) state and local clean fuel vehicle purchasing policies; and
- 4) financial incentives for purchasing clean fuels and clean fuel vehicles.

¹² In fact it was the ATA that challenged the EPA's fine particulate matter standard in a court case that went all the way up to the Supreme Court and delayed implementation of the standard by 3 years.

Understanding the life cycle of diesel helps us see how dependence on this toxic fuel is part of a larger system of environmental racism. The oil refineries that convert oil into diesel fuel are largely located in low-income communities of color and responsible for creating severe health risks in those communities. From the deadly wars that protect America's oil supplies overseas and the destructive process of oil mining, to the toxic processing of oil in dangerous refineries and the ultimate burning of diesel fuel to produce noxious fumes, this nation's dependence on dirty oil and diesel is systematically poisoning poor people and people of color all over the globe. Developing and maintaining national and international solidarity as EJ activists is indispensable for collectively overcoming the repression created by this toxic, environmentally destructive form of energy.

Potential allies

Considering that diesel exhaust exposure is highest among workers, this issue is ripe for community-labor collaborations. This type of collaboration can also boost efforts made by each party on its own. In New York City the MTA, for example, often views labor organizing efforts to minimize health and safety risks with the same dismissive attitude that characterizes its response to community efforts to limit emissions from their bus fleet. One innovative approach being explored in New York City focuses on the fact that new CNG buses are manufactured in-state, whereas the primary supplier of new diesel vehicles is out-of-state. This has the potential to encourage a rare alliance between workers in the upstate facility and environmental justice activists in New York City.

Although exposure to diesel exhaust disproportionately impacts urban residents and low-income communities of color, it is important to ensure that the diesel issue does not become segregated into a ghetto of environmental concerns. Because this issue cuts across a spectrum of social, political, and environmental concerns, it is ideal for approaching through a coalitional effort. Strategically framing the problem of diesel within a broader context can lead to much broader support, sometimes from unexpected allies. For example, the issue of reducing U.S. dependence on foreign oil cuts appeals to a broad range of interests – critics of U.S. foreign and military policy that is increasingly based on our insatiable need for oil, conservatives who are uncomfortable with our lack of a secure energy supply, and labor communities who see opportunities to generate employment through the development of domestic sources of energy. Similarly, addressing the issue of limiting campaign finance contributions of powerful oil industries would surely find supporters among campaign finance reformers from all political walks of life.

As with the development of any alliance, collaboration with potential allies should be approached strategically, acknowledging those common points and interests, while recognizing that an ally does not necessarily share the experiences that have informed environmental justice goals. For example, many of our allies in the mainstream environmental movement are not the ones living next door to diesel bus depots. Frequently mainstream environmental organizations adopt a utilitarian approach to environmental protection, focusing on protection for the greatest number of people. Environmental justice activists, on the other hand, focus our efforts on protecting the populations with the greatest exposures and health impacts. Consequently, measures that would be acceptable from a utilitarian standpoint, such as installing particulate filters in order to reduce fine PM emissions, are not acceptable permanent solutions for environmental justice goals. Nonetheless, the ability to win short-term victories through strategic participation in coalitions should not be underestimated as a powerful tool for ultimately realizing our larger vision of clean transportation and clean air.

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