

A CALIFORNIA AND UNITED STATES PERSPECTIVE ON THE IMPACT OF AIR QUALITY POLICIES ON GOODS MOVEMENT BY HEAVY DUTY TRUCKS

James D. Boyd

*California Air Resources Board, P.O. Box 2815, Sacramento, CA 95812,
U.S.A.*

Introduction:

April 22, 1990 ... the twentieth anniversary of Earth Day ... signaled the beginning of a new era that will be characterized by heightened global environmental concerns. By working together, in every state and nation, we can achieve new standards of environmental success ... bringing healthy air to all our people, and more important, to our future generations.

The study of environmental policy and air quality is an incredibly dynamic field. Air quality is impacted by economic activity, population growth, land use planning, transportation, energy demand, personal lifestyle, and many other social, economic, and technical factors.

The movement of goods by air, land, and sea is an essential component of our society. Whether the movements are by aircraft, rail, ship, or heavy duty truck, the efficiency of movement is a critical factor in determining mode choice. However, financial analyses are not enough to evaluate the total costs that transport modes incur upon society. External costs (such as air pollution, congestion delay, and regulatory overhead) need to be examined in relation to the economy and social welfare.

This paper will provide an overview of the air pollution problem in California, examine the links between the transportation of goods and air quality, review our progress in control of motor vehicle emissions, and discuss some of the efforts that will be undertaken in the future.

The California Air Quality Dilemma:

Air pollution is part of everyday life for millions of Californians. Sixteen million residents of Southern California are exposed regularly to levels of air pollution that can cause nausea, headaches, eye irritation, and dizziness even in healthy adults.

Seventy-five percent of the population exposure in the United States to unhealthy levels of ozone occurs in Southern California and more than 90% of the people in California live in areas with unhealthy air.

California, with 28 million people and over 150,000 square miles of land, has developed an intensive, technology-forcing air pollution strategy over the years. We have been successful in meeting the standards for nitrogen dioxide and lead and have significantly reduced carbon monoxide levels in all urban areas.

Nevertheless, we still have some of the worst problems--the City of Los Angeles, regrettably, has the highest ozone levels in the United States.

Transportation, Air Quality, and a Successful Economy:

Some people have the misconception that efforts to protect the environment will severely limit growth and development. However, in California, this has not been the case. Californians recognize that the movement of information, goods, and services is critical to the maintenance and expansion of our economy. The evidence is clear that a healthy economy is compatible with our efforts to establish the most effective air pollution control program possible. The worst air pollution area of California and the United States, Los Angeles, is a prime example of strict environmental controls in a robust economy.

California's contribution to the Gross National Product (GNP) of the United States is approximately 13%, ranking California's economy presently as the sixth largest in the world. Our economic growth rate is substantially higher than the growth rate for the rest of the United States. All this growth has been possible in a state which may have among the most stringent environmental regulations in the world.

We definitely want to protect California's robust growth. Our own air quality goals depend upon it. It is fairly clear that we cannot sustain an improved environment without a healthy economy to finance the effort. The converse is also true. We need effective air pollution control to support the continued economic growth that is predicted for California.

Motor Vehicle and Goods Movement Emissions:

Approximately 44% of hydrocarbon (HC) emissions, 71% of the oxides of nitrogen (NOx) emissions, and 68% of carbon monoxide (CO) emissions in California are from motor vehicles. Plus, a significant amount of the emissions from stationary sources are associated with processing and distributing motor vehicle fuels. California is the third largest consumer of gasoline in the world, behind the U.S. and U.S.S.R. With more than 20 million cars and trucks on the road in California today, it is no wonder that motor vehicles continue to be the single largest emission source of pollution in our state.

Emissions from aircraft, ships, and locomotives are not currently regulated by the ARB or local governments. In general, the emissions from these sources are relatively small compared to automobiles and heavy duty trucks. [The only exception to this general rule are sulfur dioxide emissions from ships, which constitute approximately 45% of the mobile source emissions of SOx.] The relative usage of heavy duty trucks for shipping valuable and perishable goods is high, due to low fuel prices and the premium that our population places upon the rapid movement and quick delivery of goods. In the future, as goods movement by modes other than truck increase and as emission reductions become even more scarce, we will be examining these modes for potential emission reductions.

There are approximately 750,000 heavy duty vehicles in service in California. These vehicles travel approximately 43 million miles per day (57 miles/day/vehicle on average) and use 2.8 billion gallons of fuel each year. These vehicles account for 37% of the NOx and 64% of the PM10 emissions from on-road vehicles. About 35% of the heavy duty trucks in the state are diesel powered and they account for about 50% of the heavy duty truck travel.

History of California's Regulatory Policy:

In the United States, transportation and air quality policies have developed on separate paths. The goals of transportation agencies (increasing mobility for people and goods) have often been in conflict with the goals of air quality agencies (reducing air pollution).

Air pollution control efforts in the U.S. and in California have focused on both industrial and motor vehicle sources of pollution. The primary focus of motor vehicle emission control strategies has historically been to control exhaust emissions. Past policies have tended to overlook the implications of population growth and the increase in vehicle activity that would follow in the wake of economic prosperity.

However, explosive growth in California over the past 15 years has overwhelmed the precedent-setting environmental controls that were adopted. During this time, our economy grew by 4.5 million jobs, including 11% of the nation's manufacturing employment. Looking ahead, economic growth in California is projected to be another 4.5 million jobs by the year 2010... one-quarter of the economic growth projected for the whole country. With this economic growth, comes an increase in vehicular emissions.

Vehicle travel in California has been growing at a faster rate than population. The rate of increase in the number of trips made and miles driven, if it continues, will overwhelm the reductions achieved, and total vehicular emissions will begin to increase again in the late 1990s.

Although California has an excellent highway system, over 430,000 hours are wasted daily by motorists in the Los Angeles area alone waiting on overcrowded freeways. Congestion delay, and reduced operating speeds, significantly increases the emissions of air pollutants per vehicle mile traveled. As more people move to California, the amount of time spent waiting in traffic is expected to increase. From a human standpoint, the increase in traffic volumes has an even broader social impact than just the air quality concerns.

We are now giving greater emphasis to reductions in transportation usage to achieve air pollution control. At the same time, the transportation sector has recognized that it cannot build sufficient facilities to meet current and future projected travel demand... we cannot build our way out of the problem. Thus, transportation and air quality policies are beginning to converge and focus upon reducing both congestion and subsequent air pollution emissions.

Therefore, we have recommended that the 1991 air quality plans prepared by our regional air quality agencies include transportation control measures designed to decrease overall vehicle activity and to increase the efficiency of vehicle use. Transportation and traffic congestion relief is now a key part of our motor vehicle control program.

The Air Resources Board and Motor Vehicle Programs:

In 1988, our California Legislature enacted the California Clean Air Act. This Act requires all areas of the state to attain both state and national ambient air quality standards at the earliest practicable date, and requires each local air pollution control agency to prepare a demonstration plan. The Act will mean new rules in some areas, and increased emphasis on compliance with existing regulations in all areas. The Act directs the ARB to require the "maximum degree of emission reduction possible from vehicular and other mobile sources" to attain both federal and more stringent state air quality standards.

The California Air Resources Board is continuing to develop and implement new and in-use heavy duty motor vehicle standards, as well as fuel specification standards. These existing policies have, and always will, affect the transportation of goods by truck.

Diesel exhaust from trucks and buses contributes to a multitude of air quality problems. Diesel NOx emissions, which play a primary role in ozone formation, are a major concern. Particulate matter (PM) emissions are also a serious problem as the public finds the smoke emitted by diesel vehicles to be highly objectionable and offensive, and a major portion of the visibility degradation in urban areas can be traced to primary diesel PM emissions as well as the secondary sulfate and nitrate particles formed from diesel SOx and NOx emissions.

In California, our adopted and proposed emission control strategies for heavy duty motor vehicles include seven measures:

1. new vehicle certification requirements,
2. in-use vehicle inspection and maintenance requirements,
3. roadside diesel inspection programs,
4. fuel specification limits,
5. fuel transfer evaporation controls,
6. transportation control measures, and
7. energy/fuel efficiency measures.

1. New Vehicle Certification Program:

The first category, new vehicle emission standards is the core of our motor vehicle program. Overall, the California emission standards for new medium and heavy duty trucks are more stringent than the requirements of other states, and we are continuing to tighten these standards. However, medium and heavy duty trucks registered for interstate travel, or travel between states, are not always subject to the California motor vehicle emission standards. Hopefully, when the new Clean Air

Act is approved by Congress, more stringent emission standards will be applied nationwide and additional emission reductions can be achieved.

2. Inspection and Maintenance:

The second category is our inspection and maintenance program. California adopted a decentralized biennial inspection and maintenance (I&M) program designed to reduce motor vehicle emissions by up to 25%. Under the "Smog Check" program, approximately 16 million vehicles are inspected biennially (almost 90% of the light and medium duty on-road vehicles in California).

Although heavy duty diesel vehicles are currently exempted from the I&M program, heavy duty gasoline trucks registered solely in California are required to participate in the biennial inspections, regardless of vehicle size or weight. January 1, 1990 marks the first year that heavy duty gasoline vehicles have been included in the I&M program and significant emission reductions are expected. A smog check typically includes: a visual inspection, functional emission control inspection, and tailpipe emissions tests. The tailpipe emissions must meet the age-based vehicle emissions criteria for hydrocarbon and carbon monoxide emissions at idle.

For diesel-powered vehicles, California will consider their inclusion in the Smog Check program when their inclusion is technologically and economically feasible.

3. Heavy Duty Diesel Roadside Inspections:

Our third program is the new heavy duty truck roadside inspection program. In 1988, the California Legislature passed a bill that was designed to enhance California's Smog Check Program and to provide for the adoption of a heavy duty vehicle smoke and tampering inspection program for gasoline and diesel fueled interstate and intrastate vehicles operating in California. Under this program, inspected vehicles can be cited and required to immediately correct deficiencies specified in the citation.

Tampering with and malmaintenance of specific engine components and malmaintenance of the engine itself are the primary causes of excessive diesel emissions. We expect this program to reduce emissions of NOx by 11 tons per day (2% of the heavy duty diesel truck NOx emissions), reduce emissions of hydrocarbons by 9 tons per day (9%), and reduce emissions of particulate matter by 31 tons per day (36%).

A 35% smoke opacity limit is used for the tests. In a demonstration inspection project, approximately 240 (42%) of the tested vehicles failed the test procedure. A preliminary review of this data indicates that there are three primary causes of excessive smoke emissions: improper air/fuel ratio control settings, fuel injection system or fuel injection timing problems, and inadequate intake air. These problems were generally corrected with repairs costing less than \$500 per vehicle.

The ARB and the California Highway Patrol plan to commence inspecting heavy duty motor vehicles under this program during 1990. Inspections will be conducted in conjunction with safety and weight enforcement activities of the Department of the California Highway Patrol and at private facilities where fleet vehicles are serviced or maintained.

4. Fuel Specification:

The fuel specification program is the fourth prong of our control effort. Motor vehicle fuels contain many substances which become air pollutants upon either evaporation or combustion. California regulations specify limits on the sulfur content of both unleaded gasoline and diesel fuel intended for use in motor vehicles. The limit for motor vehicle diesel fuel is 500 ppm sulfur (0.05% by weight) in the South Coast Air Basin and Ventura County. New limits that will take effect in 1993 will establish this standard statewide. In California, no person shall sell, offer for sale, or supply, as a fuel for motor vehicles, any unleaded gasoline or diesel fuels that do not meet the sulfur content limits prescribed by law.

Decreases in sulfur dioxide and sulfate levels correspond to decreases in levels of particulate matter. Both the state and national standards for particulate matter of diameter 10 microns or smaller (PM10) are exceeded in most air basins. In addition, increases in sulfates impact visibility.

In 1988, the Board approved a 10% limit on the aromatic hydrocarbon content of diesel fuel (or 20% for small refiners), effective in 1993, down from the then current level of over 30%.

We expect the new requirements for the sulfur and aromatic content for motor vehicle diesel fuel to reduce exhaust emissions of sulfur dioxide by 80 tons per day (a 90% reduction from on-road diesel trucks and automobiles), particulate matter by 14 tons per day (a 26% reduction), and oxides of nitrogen by 53 tons per day (a 10% reduction).

5. Fuel Transfer Evaporation Controls:

Our fifth control strategy is the gasoline vapor recovery program. California's Phase I and II vapor recovery program reduces HC evaporative emissions by 430 tons per day (a 10% reduction in statewide HC emissions). This program employs vapor balancing or vacuum nozzles at fuel pumps and bulk transfer stations to recycle gasoline vapors. The program is well known to California motorists who use self-serve gasoline stations. The vapor recovery program not only reduces air pollution but recovers 50 million gallons of valuable fuel per year.

6. Transportation Control Measures:

Strategy number six is transportation control. Improved fuels and motor vehicle emission control equipment are not the sole solution to the California smog problem. As I mentioned earlier, vehicle travel is growing twice as fast as California's population.

Transportation control measures need to be a key component of the 1991 local district air quality plans. Local governments will need to adopt transportation control measures in order to meet air quality standards. Transportation control measures can include regulatory measures and systemwide measures.

Regulatory measures set requirements that focus on reducing traffic at the source. They can include such measures as: employer trip reduction programs, parking pricing, and indirect source control.

Reducing emissions from indirect sources is an increasing focus for the ARB. Indirect sources are sources which attract vehicle trips and thereby pollute "indirectly." An indirect source attracts mobile sources due to the nature of the activity conducted at the location. For example, a workplace might attract the commute trips of the employees, delivery trips from receiving supplies, shopping trips by customers, and trips associated with the shipping of products within the facility and from the facility. Typical examples of indirect sources include: industrial parks, shopping malls, residential areas, grocery stores, and even facilities that are as small as local convenience stores.

Systemwide measures are actions taken to design and operate the system in such a manner as to give preference to less polluting transportation. High occupancy vehicle lanes that give transit riders and carpoolers significant time savings are an example of a systemwide measure. Other measures include strengthened transit systems and land use planning to minimize vehicle activity.

Currently, the ARB is evaluating a number of transportation control measures that may affect heavy duty trucks:

- o Truck idling restrictions - establishing a five minute maximum idle time for trucks that are not moving;
- o Onsite freight consolidation centers - requiring all new multi-business facilities to provide a single freight consolidation center for efficient deliveries and shipments;
- o Rapid accident response - providing emergency response helicopters and tow trucks to quickly clear truck accidents from freeway segments, thereby minimizing congestion delay;
- o AM-PM peak-period operating restrictions - limiting the urban freeway and local road access of heavy duty trucks during peak congestion hours to minimize congestion delay;
- o Mandated night time receiving - requiring large facilities to provide labor for receipt of deliveries after normal working hours;

- o Peak period pricing - implementing economic incentives to shift truck and/or automobile traffic out of peak congestion hours;
- o Truck-only facilities - providing the capital for construction of new facilities designed exclusively for the movement of goods by heavy duty trucks;
- o Improved parking enforcement - improving the effectiveness of parking citation and towing programs to minimize traffic congestion;
- o Improved enforcement of speed limits - enforcing maximum speed limits to prevent the radical increase in emission rates that are noted to occur above 55 miles per hour;
- o Public awareness and safety campaigns - preparing educational programs designed to improve driver awareness and safety, especially focusing on auto/truck road sharing, in an effort to reduce accidents;
- o Technological innovations - encouraging the development of alternatives to the current methods of goods movements.

7. Energy Efficiency:

Finally, our last strategy is improved energy efficiency. We support and encourage improvements in energy efficiency, and we believe that these efforts will help us meet the air quality goals of the California Clean Air Act. Although air pollution control has been criticized as conflicting with energy efficiency, this is not necessarily true today. For example: in the early 1970s, pollution control for motor vehicles was "bolt-on" equipment. It did interfere with performance and gas mileage. However, today air pollution control is an integral part of the engine. And in part, because of stricter emissions standards, the automobile engine has been designed to be more efficient and on-board computers provide early detection of engine malfunction.

Conclusions:

Some are fearful that stricter air quality rules will stifle economic growth and cost jobs. Our experience over the last two decades shows that hasn't happened and that it doesn't have to be the case in the future. There are many safeguards built into the California Clean Air Act and the planning process, generally, to insure that the need for a strong economy and better air quality are balanced.

All of the emission controls that reduce large amounts of pollution at low cost are already in place. Each of the measures we adopt in the future will control smaller amounts of pollution and at a higher unit cost than anything we have already done.

As previously stated, in California we feel that economic growth and strict environmental controls are not only

complementary, but it is impossible to pursue one without the other. We are entering an era in California where the greatest contribution to clean air will come from the lifestyle changes individuals and society will have to make. Our efforts toward clean air will in turn help to fuel our economic growth.