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Abstract does not cite sources.

Suggestions to limit city bus idling

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ABSTRACT

Several factors make limiting the operation of diesel engines desirable. Dwindling oil resources and recent political measures to limit combustion exhaust have increased the cost of operation. In addition, diesel exhaust has been linked to many human health concerns, such as bronchitis, chronic respiratory symptoms, and even lung cancer. Environmental health is also affected by exhaust. Visibility will be reduced by 22% in large cities by the year 2000 at the current exhaust emission rate. While a vehicle is moving, its exhaust is easily dispersed; while a vehicle is stationary, however, its exhaust in a city may be confined and concentrated within the "walls" created by tall buildings. Buses idle in downtown Troy for almost a half-hour out of every hour of bus operation. Idling on typical routes consumes 7% of total fuel used. Because of these factors, restraints need to be imposed

Source: The New St. Martin's Pocket Guide to Research and Documentation by Andrea Lunsford, Robert Connors and Marcia Muth (Bedford/St. Martin's Press, 1999)

and enforced to limit the time of stationary idling in highly residential areas such as downtown Troy where emissions can reach dangerous concentrations. Effectively limiting idling exhaust would reduce high concentrations of emission levels at extended-wait stops and lessen fuel consumption. Though several options exist to limit idling, the most effective for other cities, such as Washington, D.C., has been to impose a regulation forbidding idling in residential areas and restricting idling to under three minutes in nonresidential areas. If a regulation of this sort were to be imposed in Troy, monitoring drivers and reprimanding offenders would also be necessary. Imposing a regulation, such as the one used in Washington, D.C., would effectively remove a portion of downtown Troy's exhaust pollution and reduce the risk of human and environmental health problems associated with the exhaust.

Sections of the report are numbered in outline form.

I. INTRODUCTION

Every day city buses provide excellent public transportation to the citizens of Troy. The buses' exhaust, however, may be doing Troy a disservice. Diesel exhaust has been linked to many human and environmental health problems. The problem is compounded by the high volumes of exhaust common to diesel engines. A recent

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congressional subcommittee has found that "high toxin concentrations emitted per vehicle cause heavy-duty diesel to be responsible for a disproportionate share of air pollution."[1] While upcoming federal regulations will control exhaust, as do the 1998 California zero-emission requirements,[2] the problem is in Troy now.

Observations of bus idling in downtown Troy show that up to three buses at once spend a large percentage of time idling in Troy Park. While on their routes, buses also consume a significant percentage of fuel idling. Large volumes of exhaust pose a significant threat to the residents of Troy through both human and environmental damages associated with diesel exhaust.

II. PROBLEMS LINKED WITH CITY BUS EXHAUST

City buses generate a large portion of exhaust, even though there are far fewer buses than automobiles. Bus exhaust also has a variety of effects on human health and contributes to a significant portion of air pollution. Trucks and buses produce far more exhaust than gasoline-powered automobiles. Studies show that buses create approximately 80% of visible air pollution and 40% of of invisible pollutants that are dangerous to human health.[3] The particulate emissions most concern the EPA[4] because they are the larger

In citation-sequence system, superscript numerals indicate cited sources.

Introduction provides background information and reason for report.

Discussion of problem cites specific facts.

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exhaust particles, and they do more damage to human lungs and reduce visibility because of their larger size.

Although diesel trucks produce similar emissions, it is the diesel bus that poses the immediate threat to residents. The city bus differs from the truck in its operation location. Trucks usually travel on the open road, while the bus works in heavily populated downtown city districts. These areas confine exhaust within the "walls" created by tall buildings along city streets. Emissions can sometimes reach dangerous concentrations under these conditions, especially while a bus is idling.

A. Effects on human health

1. Noncancerous effects

Buses emit diesel particulate directly into the breathing zone, rather than from smokestacks that would promote dispersion.[5] Because of this, human exposure is maximized. Inhalable particles are small enough to elude the natural body defenses and thus reach the lower respiratory tract. Finer matter can even penetrate to the deepest recesses of the lung where the oxygen/carbon dioxide exchange takes place. This is where the most obvious noncancerous health effects

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occur. The surface of the respiratory system can become injured, which can result in reduced lung function, bronchitis, or chronic respiratory symptoms. "Particulate matter may also weaken the resistance of the body to infection."[6] Furthermore, some studies have found an increase in mortality rates, especially among older people, where high particulate levels exist with other air pollutants.[7] These results have led to emissions standards, which try to minimize exposure to humans.

2. Cancerous effects

A number of studies have concluded that "exposure to diesel particulate may represent a significant portion of all non-smoking-related lung cancer."[8] This portion may be as high as 10% of all non-smoking-related lung cancer in the United States,[9] far above the point where regulatory agencies usually determine the need for control. Future regulations, such as the 1998 California zero-emission regulations, attempt to curb exposure. At this time, however, no such regulation has been proposed for New York State.

Direct quotation provides technical accuracy.

B. Effects on environment

The environment also suffers from diesel emissions. Research on consequences for the human-related

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environment, such as visibility and soiling effects, shows that diesel exhaust also affects the appearance of Troy.

1. Visibility effects

Reduced visibility is one of the most obvious effects of diesel exhaust. "Because diesel particles are of a diameter most effective in scattering light and their 65-80 percent carbon content produces a high degree of light absorption, visibility reduction results."[10] The estimated visibility reduction for the future is startling; by the year 2000, a 22% reduction is projected in large cities.[11] Recent stringent exhaust controls will reduce the severity of this figure, but obviously limiting exhaust where possible would be a better solution.

2. Soiling effects

Research has shown that diesel exhaust makes a disproportionately large contribution to soiling on downtown confined buildings, such as those in Troy.[12] The oily nature of the diesel fuel also makes it difficult to clean. A Senate subcommittee has concluded that "there are significant economic benefits to be gained from control of diesel particulates with respect to soiling."[13]

Superscript numbers follow all punctuation.

Source: The New St. Martin's Pocket Guide to Research and Documentation by Andrea Lunsford, Robert Connors and Marcia Muth (Bedford/St. Martin's Press, 1999)

Reference to table.

Reference to calculation in appendix.

III. BUS EXHAUST IN TROY

Table I shows the results of an observational experiment conducted on October 23, 1993, at the Uncle Sam Park in downtown Troy. During the one-hour observation period, three buses spent a total of 28 minutes stationary at curbside, idling. According to Paul, "The engine's consumption at a bus stop must not be underestimated. As a rule it amounts to 0.3 gallons per hour."[14] For this particular test hour, 0.14 gallons were consumed. For a typical hour for a 10-hour day, 1.4 gallons were spent idling. At this rate, about 500 gallons a year are wasted on idling. (See Appendix, Calculations 1.)

Idling fuel consumption on a typical route also consumes a large amount of fuel. (See Table II.) The bus on Route 87, from Troy to Wynantskill, made an average of 25 stops per hour. It also waited, idling for 13 minutes of the hour in the heavily re-sidential area of Wynantskill. From Figure 1 (see Appendix), this bus consumed 0.15 gallons per mile.[15] From Calculations 2 (see Appendix), this equals 4.3 gallons per hour. Dividing 0.3 gallons spent idling by 4.3 gallons consumed, the bus spent 7% of its fuel just idling.

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IV. SOLUTIONS TO LIMIT IDLING AND FUEL CONSUMPTION

It is obvious from the data presented that particular buses present a risk to Troy's residents. If this is truly an epidemic common to all buses, why aren't many of us concerned?

In 1990, Washington, D.C., added a regulation to the bus driver's handbook that states "buses are not allowed to idle in residential areas and only idle for three minutes in non-residential areas."[16] This significant measure effectively cut down Washington's fuel bill and reduced exhaust exposure to humans. The cost of imposing this regulation was limited to the cost associated with announcing the regulation.

If this regulation were imposed in Troy, long-term idling would be eliminated, and the buses could run more routes, improving service. If buses had to wait at one location, the engines would be shut off if the wait time were over three minutes.

Suggested solutions to problem.

While these suggestions are aimed at reducing emissions in residential areas, they would not be effective unless they were monitored and enforced. The local police department could hand out demerits to bus drivers who ignored the regulation. A toll-free number could be set up so the public could call in their observations. These are just two possible ways to

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enforce the regulation to make sure it would effectively preserve the public health.

V. CONCLUSION AND RECOMMENDATION

Data collected for this report shows a direct injection of exhaust into the heart of downtown Troy. Scientific data supports the claims that lung complications, respiratory symptoms, and cancerous maladies can result from diesel particulate exposure. Extended exposure to exhaust also costs society through soiling and visibility reduction. A regulation similar to that passed in Washington, D.C., forbidding idling in residential areas and limiting it to three minutes in non-residential areas, would directly solve the problem in Troy's Uncle Sam Park. Imposing this regulation would simultaneously reduce CDTA's fuel bill and maintain public health.

Conclusion summarizes problem and solution.

NOTES

[1]Hearing before the Subcommittee on Transportation, Aviation, and Materials of the Committee on Science, Space, and Technology (U.S. Government Printing Office. Washington, DC, 1988), p. 74.

[2]Ibid., p. 20.

In citation-sequence system, references listed at end of paper in numberical order.

"Ibid." indicates the same source as noted in the previous citation.

Source: The New St. Martin's Pocket Guide to Research and Documentation by Andrea Lunsford, Robert Connors and Marcia Muth (Bedford/St. Martin's Press, 1999)

[3]Ibid., p. 20.

[4]Ibid., p. 20.

[5]Ibid., p. 48.

[6]Ibid., p. 49.

[7]Ibid., p. 49.

[8]Ibid., p. 50.

[9]Ibid., p. 50.

[10]Ibid., p. 50.

[11]Ibid., p. 50.

[12]Ibid., p. 50.

[13]Ibid., p. 51.

[14]H. J. Paul, in International Conference on the Bus '86 (Institution of Mechanical Engineers, London, 1986), p. 112.

[15]C.S. Papacostas, Fundamentals of Transportation Engineering (Prentice Hall, Englewood Cliffs, NJ, 1986), p. 369.

[16]Hearing before the Subcommittee on Transportation, Aviation, and Materials of the Committee on Science, Space and Technology (U.S. Government Printing Office, Washington, DC, 1988), p. 82.

Notes double-spaced throughout; no extra space between entries.

Source: The New St. Martin's Pocket Guide to Research and Documentation by Andrea Lunsford, Robert Connors and Marcia Muth (Bedford/St. Martin's Press, 1999)

TABLE I. Stationary idling in downtown Troy

Test Date: October 23, 1993

Test Location: Uncle Sam Park

Start: 10:33 a.m.

Finish: 11:31 a.m.

Bus number	Time in	Time out	Time idling
716	10:57	11:13	16 minutes
668	11:10	11:14	4 minutes
647	11:16	11:24	8 minutes
		Total Time:	28 minutes

Table II. Stationary idling on a typical route

Test Date: October 24, 1993

Test Location: Troy-Wynantskill Route

Start: 11:31 a.m.

Finish: 12:09 p.m.

Time	Stops	Miles
11:31 - 11:47	11	6
11:47 - 12:00	0	0-idling
12:00 - 12:09	5	6
Total: 16 stops in 38 minutes = 25 stops/hour		

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APPENDIX

Calculations 1

0.3 gallons/hour x 28 minutes / 60 minutes/hour = 0.14 gallons per hour

0.14 gallons per hour x 10 hours/operating day x 360 operating days per year $\cong$ 500 gallons per year

Calculations 2

16 stops per 12 miles = 1.33 gallons per mile

(From Figure 1) = 0.15 gallons per bus mile

0.15 gallons per bus mile x 12 miles / 25 minutes x 60 minutes/hour = 4.3 gallons per hour

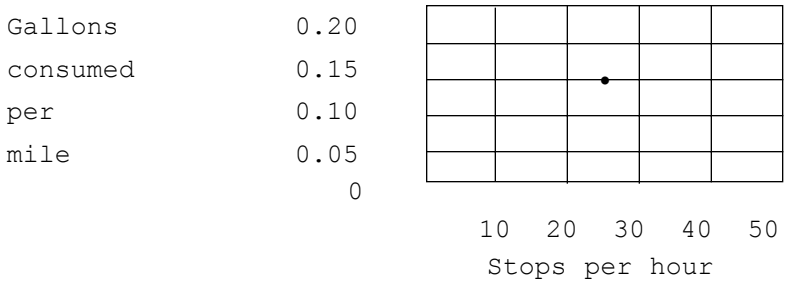

FIG 1. Relationship between gallons per mile and stops per hour.[a]

Figure caption with footnote.

[a]C.S. Papacostas, Fundamentals of Transportation Engineering (Prentice Hall, Englewood Cliffs, NJ, 1986), p. 369.

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