

STATE OF NEW MEXICO
ALBUQUERQUE-BERNALILLO COUNTY AIR QUALITY CONTROL BOARD

IN THE MATTER OF THE PETITION
FOR A HEARING ON THE MERITS
REGARDING AIR QUALITY PERMIT
No. 3135 ISSUED TO SMITH'S FOOD
AND DRUG CENTERS, INC.

Margaret M. Freed, Mary Ann Roberts, and Pat Toledo, Petitioners

AQCB Petition No. 2014-15

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NOTICE OF ERRATA

Please take notice that the City of Albuquerque, Environmental Health Department files this Notice of Errata with respect to the City of Albuquerque's Motion for Summary Judgment filed on September 17, 2014. Due to an error in compiling, the dividing pages for UMF #6-#8 (either tabs in the hard copies or labeled pages in the scanned copies) were positioned incorrectly. As a result, the attachments were not correctly labeled.

A corrected copy of the City of Albuquerque's Motion for Summary Judgment is attached to this Notice of Errata as indicated on the Certificate of Service.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on September 18, 2014:

1. A true and correct hard copy of this Notice of Errata with an attached, correctly compiled hard copy of the City of Albuquerque's Motion for Summary Judgment was filed with the Hearing Clerk in the above-captioned matter with nine hard copies of the entire filing hand delivered to the Hearing Clerk.
2. A true and correct hard copy and electronic copy of this Notice of Errata with an attached, correctly compiled hard copy and electronic copy of the City of Albuquerque's Motion for Summary Judgment was either emailed directly to the Hearing Officer/Air Board Attorney or hand delivered to the Hearing Clerk for delivery to the Hearing Officer/Air Board Attorney:

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AQCB Petition No. 2014-2*

3. A true and correct electronic copy of this Notice of Errata with an attached, correctly compiled electronic copy of the City of Albuquerque's Motion for Summary Judgment was emailed directly to the following:

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**STATE OF NEW MEXICO
ALBUQUERQUE-BERNALILLO COUNTY AIR QUALITY CONTROL BOARD**

**IN THE MATTER OF THE PETITION FOR
A HEARING ON THE MERITS REGARDING
AIR QUALITY PERMIT NO. 3135 ISSUED TO
SMITH'S FOOD AND DRUG CENTERS, INC.**

AQCB No. 2014-2

Margaret M. Freed, Mary Ann Roberts, and Pat Toledo, Petitioners

CITY OF ALBUQUERQUE'S MOTION FOR SUMMARY JUDGMENT

The City of Albuquerque Environmental Health Department ("EHD") moves the Albuquerque-Bernalillo County Air Quality Control Board ("Air Board") to grant it summary judgment on Petitioners' request for a hearing before the Air Board ("Motion") because there is no genuine dispute of material fact that EHD correctly issued Permit No. 3135 and the Air Board can decide the issues raised by the Petition as a matter of law. In support of its motion, EHD states the following:

INTRODUCTION

Petitioners are (1) Margaret M. Freed ("Petitioner Freed"), who owns property adjacent to the property on which Smith's Food and Drug Centers, Inc. ("Smith's") proposes to build a gasoline dispensing facility (the "Smith's GDF"), (2) Mary Ann Roberts ("Petitioner Roberts"), who owns a gasoline dispensing facility ("the "Roberts GDF") across the street from the proposed Smith's GDF, and (3) Pat Toledo ("Petitioner Toledo"), who provides regular care and assistance for his father who lives at 3232 La Ronda NE, Albuquerque, New Mexico, approximately 4/5 of a mile from the proposed Smith's GDF. All Petitioners claim that their health and quality of life might be adversely affected by increased air pollution or non-air pollution consequences resulting from EHD's issuance of Air Quality Permit No. 3135 ("Permit No. 3135").

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The Air Board should sustain EHD's issuance of Permit No. 3135 as a matter of law because there is no genuine dispute of material fact that EHD correctly issued Permit No. 3135 pursuant to applicable law. Petitioners' own expert opinion provides no support for the Air Board to take any other action. Petitioners' expert recommends only further study to determine "if" unacceptable impacts will occur from the issuance of Permit No. 3135. Petitioners' expert does not establish that the construction of the Smith's GDF would (1) not meet the applicable standards, rules or requirements of New Mexico's Air Quality Control Act ("Air Act") or the Clean Air Act; (2) would cause or contribute to any exceedance of an ambient air standard; or (3) would violate any other provision of the Air Act or the Clean Air Act. NMSA 1978, § 74-2-7(C)(1). Petitioners have the burden of proof, NMSA 1978, § 74-2-7(K), and they plainly cannot carry it.

That underlying failure forces Petitioners to resort to an array of untenable arguments, such as relying on the Solid Waste Act and New Mexico common law interpreting its provisions, misconstruing the regulation of Hazardous Air Pollutants ("HAPs") and exaggerating their impact, and alleging possible impacts from motor vehicle emissions already subject to stringent regulation as a component of aggregate air pollution to assemble a cumulative 'quality of life' impact that is not contemplated by the Air Act and is impossible to quantify, all the while ignoring the limitations on the Air Board's authority.

The practical implications of Petitioners' arguments, if successful, would be that air pollution cannot be prevented and abated by EHD's faithful adherence to the regulations promulgated by the Air Board and the requirements of the Clean Air Act and the Air Act. This would imply that preventing and abating air pollution in Bernalillo

County demands an adjudicatory hearing before the Air Board for each permit, notwithstanding EHD's satisfaction of every provision in all applicable air quality laws and regulations that EHD administers. This scenario is something that the Legislature and the City Council never intended.

The far-reaching and ironic result of treating the Air Board regulations as non-dispositive would be ad hoc, standardless, and arbitrary permitting decisions that elevate emotion over science and politics over process. Embracing Petitioners' arguments would transform the Air Board's limited authority into virtually boundless, administrative-appellate discretion over every permit. Petitioners' request for a hearing should be denied because Petitioners cannot prove that Permit No. 3135 should be modified or reversed under applicable law.

I. UNDISPUTED MATERIAL FACTS

1. On November 5, 2013, Smith's applied ("Application") for an air quality permit for the Smith's GDF at 6941 Montgomery Blvd. NE, Albuquerque, NM. Administrative Record ["AR"] No. 3, Bates No. 9.

2. On December 3, 2013, EHD deemed the Application complete. AR No. 8, Bates No. 18.

3. On December 6, 2013, EHD published public notice of the Application in compliance with the notice requirements of 20.11.41.14(A)(3) NMAC (2002). AR No. 11, Bates No. 24.

4. On April 3, 2014 from 6:00 to 8:30 pm, EHD held a public hearing at the Cleveland Middle School concerning Smith's Application. AR No. 37, Bates No. 95.

5. On April 30, 2014, EHD issued Permit No. 3135 to Smith's for the Smith's GDF at 6941 Montgomery Blvd NE, Albuquerque, NM. AR #78, Bates No. 320-324.

- a. Permit No. 3135 authorizes the Smith's GDF to emit up to 45.5 tons per year of volatile organic compounds. AR # 78, Bates No. 321.
- b. Permit No. 3135 requires Smith's to comply with 40 C.F.R. Part 63 Subpart CCCCCC ("Hex C") to control benzene emissions from gasoline vapors at the Smith's GDF. AR # 78, Bates No. 322.
- c. Permit No. 3135 requires Smith's to comply with 20.11.65 NMAC to control emissions of volatile organic compounds from the Smith's GDF. AR # 78, Bates No. 320.

6. On April 30, 2014, EHD provided notice of the issuance of Permit No. 3135 in compliance with 20.11.41.14(A)(5) NMAC (2002). AR No. 79-80, Bates Nos. 325-329.

7. On June 2, 2014, Petitioners Margaret Freed, Mary Ann Roberts and Pat Toledo petitioned ("Petition") for an Air Board hearing on Permit No. 3135 alleging that they had participated in EHD's permitting process and alleging that they were adversely affected by it. *See* Petition (Jun. 2, 2014).¹

¹ EHD provides the Petition as admissible evidence of Petitioners' allegations and does not concede that those allegations themselves are undisputed material facts.

8. On August 8, 2014, pursuant to the Corrected Prehearing Order, Petitioners filed a Notice of Intent (“NOI”) containing the technical testimony of one technical witness, Dr. Dana Rowangould which concludes:

In light of the high throughput that is expected at the proposed Smith’s gas station (and resulting potential for greater than normal emissions), the potential health impacts associated with vehicle traffic and vapor losses, and the facility’s proximity to residents and at least one school, we recommend conducting additional analysis to ensure that the potential air quality and health impacts associated with the proposed Smith’s fueling station are better understood. If the facility is found to result in air quality and/or health impacts that exceed levels that are acceptable (based on regulatory levels, health risks, and/or community sentiment), mitigations and/or alternatives should be explored.

Petitioners’ NOI, Ex. 1 p. 4.

II. STANDARD OF REVIEW

The Air Act allows EHD to deny an application for a construction permit if the construction (a) will not meet applicable standards, rules or requirements of the Air Act or the Clean Air Act; (b) will cause or contribute to air contaminant levels in excess of an ambient air standard; or (c) will violate any other provision of the Air Act or the Clean Air Act. NMSA 1978, § 74-2-7(C)(1).

The scope of the Air Board’s review of EHD’s permitting decisions is whether the permit “will or will not meet applicable local, state and federal air pollution standards and regulations.” NMSA 1978, § 74-2-7(L).

Any person who participated in the City's permitting action and who is adversely affected by it can petition for a hearing on the permit before the Air Board. NMSA 1978, § 74-2-7(H). The petitioner bears the burden of proof to establish that the permit does not "meet applicable local, state and federal air pollution standards and regulations." NMSA 1978, § 74-2-7(K and L).

Any party who wishes to present technical evidence at an Air Board hearing must file a Notice of Intent. 20.11.81.14(H)(1) NMAC. "Technical evidence means scientific, engineering, economic or other specialized testimony, but does not include legal argument, general comments, or statements of policy or position concerning matters at issue in the hearing." 20.11.81.7(T) NMAC. Based on the evidence, the Air Board has the authority to "sustain, modify or reverse" EHD's permitting action. NMSA 1978, § 74-2-7(K).

In this case, the Air Board's Hearing Officer has issued a Prehearing Order requiring any Petitioner who wishes to offer technical evidence or testimony to file a Notice of Intent ("NOI") by August 8, 2014. Corrected Prehearing Order ¶ 6 (Aug. 8, 2014). Among other things, the Corrected Prehearing Order requires that an NOI contain the testimony of each technical witness in "full narrative fashion, particularly any opinion to be offered by each witness and an explanation of the basis for each opinion[.]" Corrected Prehearing Order ¶ 6. Failure to file a complete and timely NOI precludes a person from presenting the technical evidence or testimony to be offered. Corrected Prehearing Order ¶ 6. On August 8, 2014, Petitioners' counsel filed a Notice of Intent. Thus, as of August 8, 2014, the full narrative for all of Petitioners' technical testimony is in the record.

The Air Board's procedural rules allow the Rules of Civil Procedure to be used for guidance in the absence of a specific provision in 20.11.81 NMAC. 20.11.81.12(A) NMAC. The Air Board's procedural rules do not have a specific provision for summary judgment, so the Rules of Civil Procedure may be used as guidance.

The Rules of Civil Procedure provide that, if there is no genuine dispute of material fact, a party may move for summary judgment as a matter of law. NMRA 1-056(C). To move for summary judgment, the moving party submits a written memorandum containing a short concise statement of the reasons in support of the motion with a list of authorities relied upon, and a numbered, concise statement of all the material facts as to which the moving party contends no genuine issue exists. NMSA 1-056(D).

When a motion for summary judgment is made, the opposing party may not rely merely on the allegations in his pleading; instead, his response must set forth specific facts based on admissible evidence, showing that there is a genuine issue for trial. NMRA 1-056(D) [emphasis added]. Summary judgment is proper if there is no genuine dispute of material fact and the moving party is entitled to judgment as a matter of law. *Paca v. K-Mart Corporation*, 1989-NMSC-034, ¶ 7, 108 N.M. 479.

A fact is "material" for the purposes of determining whether a motion for summary judgment should be granted if it will affect the outcome of the case. *Parker v. E.I. DuPont de Nemours & Co., Inc.*, 1995-NMCA-086, ¶ 9, 121 N.M. 120. Even if there is a dispute over immaterial issues, summary judgment is proper as long as no material facts are disputed. *San Juan Com'n v. Taxpayers and Water Users of San Juan County*, 1993-NMSC-050, ¶ 22, 116 N.M. 106, 860 P.2d 748.

In this case, Petitioners' entire narrative technical testimony is already in the record. In order to justify going forward to an Air Board hearing, that record would have to contain some evidentiary basis to show that EHD should not have issued Permit No. 3135 as it did. No such basis exists.

For the purposes of this motion, EHD does not dispute the facts in Petitioners' Notice of Intent but does dispute their legal effect. EHD reserves the right to dispute the facts in Petitioners' Notice of Intent if the Air Board denies this Motion and the Air Board decides to hold a hearing on EHD's issuance of Permit No. 3135.

III. ARGUMENT

A. Petitioners Cannot Carry Their Burden of Proof that Permit No. 3135 Should be Modified or Reversed.

The Air Act imposes the burden of proof on the petitioner. NMSA 1978, § 74-2-7(K). However, the technical evidence that Petitioners have in their NOI contains no evidence to prove that EHD should not have issued Permit No. 3135 as it did. Petitioners' own expert does not opine that any violation of the Clean Air Act, the Air Act or any applicable standard or regulation adopted pursuant to those laws would result from approval of Permit No. 3135. UMF No. 8. Petitioners' expert offers only an opinion that more study should be done to see "if" a violation would occur if Permit No. 3135 were issued. Because, based on Petitioners' own expert testimony, Petitioners cannot meet their burden of proof to show that Permit No. 3135 should be reversed or modified, no Air Board hearing is necessary and EHD should be granted summary judgment as a matter of law.

1. *Petitioners cannot prove that they are adversely affected by the issuance of Permit No 3135.*

The Air Act requires that a petitioner be “adversely affected” in order to petition the Air Board for a hearing on an EHD permit. At the petition stage, it is sufficient to merely allege facts about being adversely affected but at the summary judgment stage, a petitioner must have admissible evidence to prove how he or she is adversely affected in a way that requires a permit to be modified or reversed. NMRA 1-056(D); NMSA 1978, § 74-2-7(K and L). Petitioners cannot satisfy this standard.

The term “adversely affected” is a legal term of art that begins with the concept of standing to sue. When a statute creates a cause of action and identifies who may sue, standing is a prerequisite to bringing a civil action. *ACLU of New Mexico v. City of Albuquerque*, 2008-NMSC-045, ¶¶ 9-11, 144 N.M. 471, 188 P.3d 1222.

In this case, the Air Act creates a cause of action (to challenge an EHD issued permit before the Air Board) and identifies who may sue (someone who participated in the EHD permitting action and who is adversely affected by it). NMSA 1978, § 74-2-7(H). Thus, standing is a prerequisite to petitioning the Air Board. *ACLU of New Mexico*, 2008-NMSC-045, ¶¶ 9-11.

The Court of Appeals has interpreted the phrase “adversely affected” to mean standing to sue. *N.M. Cattle Growers Ass’n v. New Mexico Water Quality Control Com’n*, 2013-NMCA-046, ¶ 13, 299 P.3d 436. The elements of standing are “injury in fact, causation, and redressability.” *Protection and Advocacy System v. City of Albuquerque*, 2008-NMCA-149, ¶ 18, 145 N.M. 156.

The term “injury in fact” is another legal term of art that means an “invasion of a legally protected interest which is concrete and particularized and actual or imminent, not conjectural or hypothetical.” *Forest Guardians v. Powell*, 2001-NMCA-028, ¶ 24, 130 N.M. 368. Critically here, Petitioners have no evidence that they have suffered an injury in fact—they cannot show that the injuries they alleged in their Petition constitute an invasion of a legally protected interest. Thus, Petitioners cannot carry their burden of proof to show that they are adversely affected.

a. Petitioners cannot prove that they have suffered an invasion of a legally protected interest.

Petitioners have alleged that they will be adversely affected by “increased VOC emissions, odors, fumes, increased traffic and other negative impacts on their quality of life,” and that the increased traffic will “cause an increase in air pollution.” Petition at 2, 5. In their discovery responses, Petitioners speculate about possible effects on the children at Cleveland Middle School, possible loss of business and tenants, and Petitioner Roberts contends that she believes that her husband contracted multiple myeloma from working at their Chevron gas station. Petitioners Responses to Smith’s Interrogatories, Requests for Admissions, and Request for Production (Aug. 2, 2104). These allegations, speculations, and beliefs, even accompanied by Petitioners’ expert opinion, do not amount to an invasion of a legally protected interest.

Starting with traffic, traffic increases occur from time to time in a metropolitan area as a matter of course. Petitioners can point to no law that protects citizens from an increase in traffic from construction of a stationary source like the Smith’s GDF or any associated increase in air pollution that it may cause. As a practical reality, the opening of every new business causes an increase in traffic, however small. Without any standard

to apply to how much traffic is too much, no new business activity which requires an air quality permit would be permissible under Petitioners' implicit theory of air pollution regulation. Thus, it is clear that a standard or rule must be violated before the Air Board can take action. This is what it means to require an invasion of a legally protected interest. Petitioners can point to no law that protects them from any and all increases in traffic due to construction of a stationary source like the Smith's GDF and EHD is aware of none.

Further, with respect to air pollution from mobile sources, EPA decided long ago to regulate *all* tailpipe and evaporative emissions through the imposition of sophisticated technologies on vehicles. To illustrate, in February 2007 EPA finalized a rule to reduce hazardous air pollutants ("HAPs") from mobile sources like passenger vehicles. *See* Control of Hazardous Air Pollutants from Mobile Sources, February 26, 2007.² In adopting that rule, the EPA specifically addressed the same concerns that Petitioners' expert recommends should be studied for possible consideration in the present *stationary source* permit:

These controls will significantly reduce emissions of benzene and other mobile source air toxics such as 1, 3-butadiene, formaldehyde, acetaldehyde, acrolein, and naphthalene. There will be additional substantial benefits to public health and welfare because of significant reductions in emissions of particulate matter from passenger vehicles.

72 Fed. Reg. 8428 (Feb. 26, 2007), available at: <http://www.gpo.gov/fdsys/pkg/FR-2007-02-26/pdf/E7-2667.pdf>.

² An overview of the regulations controlling mobile source air toxics may be found at: <http://www.epa.gov/otaq/toxics-regs.htm>

Mobile sources are regulated differently and separately from stationary sources. Petitioners can point to no law that protects them from incremental traffic or the associated traffic related air emissions that may result from issuing a permit to construct a stationary source.

The same rationale applies to Petitioners' allegations of increased VOC emissions, odors, and fumes. The daily activities of any gas station, including Petitioner Mary Ann Roberts' Chevron gas station, result in incremental VOC emissions, odors and fumes. The legally significant issue is not whether VOC emissions, odors and fumes occur—it is whether the emissions, odors or fumes violate any standard or rule. Petitioners point to no standard or rule that the Smith's GDF would violate which protects them from the VOC emissions authorized by Permit No. 3135 or any odors or fumes which may occur.

Here, Petitioners' expert opinion does not establish that any standard or rule would be violated by the activities authorized by Permit No. 3135. She merely recommends conducting additional studies and says that action could be taken "if" those studies revealed any violation of any standard. UMF No. 8. This is not sufficient to prove that Petitioners will suffer an invasion of a legally protected interest. Petitioners have no evidence to show that Permit No. 3135 will cause them an invasion of a legally protected interest and the Air Board should sustain Permit No. 3135 as a matter of law.

Petitioners' concerns may be sincere and heartfelt. But none of them add up to an invasion of a legally protected interest. Because Petitioners cannot prove that they will suffer an invasion of a legally protected interest from the construction of the Smith's GDF, the Air Board should sustain Permit No. 3135 as a matter of law.

b. Petitioner Freed has not been adversely affected by EHD issuing Permit No. 3135 as a minor source, rather than a major source of air pollutants.

Petitioner Margaret Freed alleges that Permit No. 3135 should have been issued as a major source, rather than a minor source permit. Petition, Ex. 2.

In general, a major source is any stationary source³ which emits at least 100 tons of any regulated air pollutant, 10 tons per year of any individual hazardous air pollutant, or 25 tons per year of all hazardous air pollutants combined. 20.11.42.2 and 7(S) NMAC (subject to certain exceptions including provisions for non-attainment areas which are not relevant here). The meaning of "hazardous air pollutants" as used in this definition means those listed pursuant to Clean Air Act Section 112(b). 20.11.42.7(S) NMAC.

Permit No. 3135 authorizes the Smith's GDF to emit 45.5 tons per year of volatile organic compounds ("VOCs"). UMF No. 5(a). "Volatile organic compounds" are not listed as a hazardous air pollutant pursuant to Clean Air Act Section 112(b) or any regulation adopted pursuant to that Act. Thus, the 45.5 tons per year of VOCs authorized by Permit No. 3135 are not sufficient to regulate the Smith's GDF as a major source.

³ The emissions from multiple sources which are located in one or more contiguous or adjacent areas *and* are under common control *and* are in the same standard industrial code are aggregated for the purpose of determining whether a source is a major source. 20.11.42.7(S) NMAC (emphasis added).

Petitioners' expert's opinion does not provide any facts to support Petitioner Freed's allegation that Permit No. 3135 should have been issued as a major source of air pollutants. Petitioners themselves are not experts and cannot establish these facts through their interrogatories or admissions. Since Petitioners bear the burden of proof, Petitioners' lack of technical evidence on this point is dispositive. There is no genuine dispute of material fact that EHD correctly permitted the Smith's GDF as a minor source of air pollutants and the Air Board should decide the merit of Petitioner Freed's allegation as a matter of law.

- c. Based on EPA estimates, Permit No. 3135 would result in the emission of 2.18 tons of combined hazardous air pollutants per year and the Smith's GDF does not constitute a major source.**

The EPA has estimated the percentage of hazardous air pollutants in gasoline vapor to be 4.8%.⁴ National Emission Standards for Hazardous Air Pollutants for Source Categories: Gasoline Distribution Bulk Terminals, Bulk Plants and Pipeline Facilities, and Gasoline Dispensing Facilities, 73 Fed. Reg. 1916, 1930 (Jan. 10, 2008) (40 C.F.R. Part 63 Subpart CCCCCC). EPA has adopted various federal standards to address benzene emissions from gasoline vapor. Petitioners' expert has not offered any other

⁴ Estimates of the percentage of hazardous air pollutants in volatile organic compounds in gasoline vapor vary. Older estimates may be 2-11% or generally less than 17%. As EPA explained when it adopted Hex C, 73 Fed. Reg. at 1930, EPA imposed a fuel standard in 2007 that reduced the percentage of benzene in gasoline and MTBE (another hazardous air pollutant in gasoline) has been phased out. Factoring in these recent regulatory changes led EPA to an estimate of 4.8%, as cited. Whether the estimate is 4.8%, 11% or 17%, all lead to a conclusion that the hazardous air pollutant emissions from the Smith's GDF do not require regulation as a major source. Regardless of which estimate is applied, all lead to a conclusion that the emissions of hazardous air pollutants would be less than 10 tons per year individually or in the aggregate:

$$4.8\% \times 45.5 \text{ tons VOC/yr} = 2.2 \text{ tons HAPs/yr}$$

$$11\% \times 45.5 \text{ tons VOC/yr} = 5.0 \text{ tons HAPs/yr}$$

$$17\% \times 45.5 \text{ tons VOC/yr} = 7.7 \text{ tons HAPs/yr}$$

estimate. Using EPA's estimate, the 45.5 tons per year of VOCs from the Smith's GDF, equate to 2.2 tons per year of all combined hazardous air pollutants and the Smith's GDF will not constitute a major source of hazardous air pollutants.

2. *The Air Board does not have authority to impose more stringent limitations on emissions of hazardous air pollutants from the Smith's GDF.*

The Air Board has adopted Hex C twice: initially, becoming effective on February 16, 2009 and second, updating it effective December 12, 2011. Hex C is a prescriptive standard which Petitioners ignore. The significance of Hex C to Permit No. 3135 and its emissions of hazardous air pollutants ("HAPs") cannot be overstated.

The Legislature and Albuquerque City Council have granted very narrow rulemaking authority to the Air Board to promulgate rules concerning hazardous air pollutants. Such rules must be "*no more stringent than but at least as stringent as*" the federal rules. NMSA 1978, § 74-2-5(C)(2) [emphasis added]; *see also* ROA § 9-5-1-4(C)(2). Thus, even if the Air Board wished to impose more stringent rules on hazardous air pollutant emissions from GDFs than Hex C would require, the Air Act and the applicable city ordinance does not grant it authority to do so. If Petitioners believe that more stringent rules would nonetheless be advisable, Petitioners would have to first persuade the New Mexico Legislature and then the Albuquerque City Council⁵ to amend the Air Act to remove this statutory restriction on the Air Board's rulemaking authority, among other things.

⁵ Amendment of the Bernalillo County Joint Air Quality Control Board ordinance, Section 30-33(c)(2), would also be required, although in this case, the County Ordinance is inapplicable because the Smith's GDF is located in the City of Albuquerque.

a. Hex C is part of a national strategy to reduce the concentration of hazardous air pollutants in ambient air and appropriately prevents and abates air pollution.

EHD does not dispute that gasoline vapors contain benzene and that benzene has important and serious impacts on human health. Benzene was one of the first eight hazardous air pollutants regulated by the Clean Air Act between its passage in 1970 and 1990. Clean Air Act Amendments of 1989, S. Rep. 101-228, 3385 at 3389 (Dec. 20, 1989). Benzene is a known human carcinogen. Control of Hazardous Air Pollutants from Mobile Sources, 72 Fed. Reg. 8428 (Feb. 26, 2007). Mobile sources (i.e., planes, trains, and automobiles) are the largest source of benzene emissions in the United States. 72 Fed. Reg. 8428. For obvious reasons, including technical practicability and economic reasonableness, EPA has not banned either gasoline or mobile sources.

Instead, EPA has been actively engaged for years in decreasing benzene concentrations in ambient air, particularly in urban areas. National Air Toxics Program: The Second Integrated Urban Air Toxics Report to Congress, pp. 3-8 (Aug 21, 2014) [“Second Air Toxics Report”].

For example, in 2008, EPA adopted rules, including Hex C, to limit benzene emissions from gasoline dispensing facilities like the Smith’s GDF and Hex B to limit benzene emissions from gasoline bulk terminals and small gasoline bulk plants. 73 Fed. Reg. 1916 (Jan. 10, 2008).

In 2011, an EPA rule adopted in 2007 became effective to mandate lowered benzene concentrations in gasoline. 72 Fed. Reg. 8428, 8431 (Feb. 26, 2007).

In April of 2014, EPA imposed more stringent motor vehicle emissions and fuel standards which will further reduce benzene emissions, among other things. 79 Fed. Reg. 23414 (Apr. 28, 2014). Thus, the reduction of benzene in ambient air from multiple sources is a clear focus of EPA's efforts. When the Air Board adopted Hex C and EHD applies it during permitting, the Air Board and EHD are EPA's partners in executing this national strategy aimed squarely at protecting the public from benzene air emissions.

This stepwise approach has been effective at reducing benzene in ambient air. From 1994 to 2009, the concentration of benzene in ambient air has declined 66%. Second Air Toxics Report at 3-8. The more recently adopted rules (post-2009) are likely to continue that trend.

Where benzene emissions are concerned, reasonable minds might differ how to best balance public health versus economic reasonableness and technical practicability. But there is no dispute how the New Mexico Legislature and the City Council expect the Air Board to resolve concerns about hazardous air emissions—by adopting and applying rules that are as stringent as EPA's rules and no more stringent. NMSA 1978, § 74-2-5(C)(2); *see also* ROA § 9-5-1-4(C)(2). The Legislature and the City Council are the people's elected representatives and they have decided that hazardous air pollution is appropriately prevented and abated by participating in EPA's national strategy to reduce hazardous air pollution.

Accordingly, EPA and the Air Board have adopted Hex C which EHD has applied to Permit No. 3135. With respect to hazardous air pollutants from the Smith's GDF, Permit No. 3135 appropriately prevents and abates hazardous air pollutants from gasoline

vapors. UMF No. 5(b). With respect to hazardous air pollutants, there is no genuine dispute of material fact that EHD appropriately issued Permit No. 3135 and the Air Board can sustain it as a matter of law.

3. *Petitioners improperly invoke the Solid Waste Act and common law interpreting its provisions.*

Lacking any evidence to show they have been adversely affected by the issuance of Permit No. 3135, Petitioners attempt to justify their request for a hearing by pointing to *Colonias Dev. Council v. Rhino Env't'l Serv.*, 2005-NMSC-024, 138 N.M. 133. Petitioners suggest that *Colonias* stands for the sweeping proposition that “[t]he purpose of regulatory provisions regarding public notice and hearings is to ensure that persons with an interest in environmental permitting matters be allowed to participate before a final decision is made.” Petition, p. 3.

In fact, the Air Act was not before the Court in *Colonias*, which interpreted language in the Solid Waste Act and its related regulations. It is settled that “cases are not authority for propositions not considered.” *Sangre de Cristo Development Corp., Inc. v. City of Santa Fe*, 1972-NMSC-076, ¶ 23, 84 N.M. 343, 503 P.2d 323. Moreover, the Uniform Statute and Rule Construction Act requires that a statute be construed to “(1) give effect to its objective and purpose; (2) give effect to *its* entire text; and (3) avoid an unconstitutional, absurd, or unachievable result.” NMSA 1978, § 12-2A-18(A) [emphasis added]. “The text of a statute... is the primary, essential source of *its* meaning.” NMSA 1978, § 12-2A-19 [emphasis added]. These fundamental principles of statutory construction require the Air Board to focus on the provisions of the Air Act and not the provisions of a different statute that regulates solid waste rather than air pollution.

A comparison of the provisions of the Air Act with the provisions of the Solid Waste Act which the Court found significant in *Colonias* reveals the wisdom of the rule expressed in *Sangre de Cristo* and the above principles of statutory construction, because the Solid Waste Act is different from the Air Act in a number of ways.

a. Consideration of Public Health, Safety and Welfare

Unlike the Solid Waste Act which has an overarching “purpose” of protecting public health, safety and welfare, NMSA 1978, § 74-9-2(C), the Air Act does not even have a “purpose” section. *See* NMSA 74-2-1 to -22. That is not to say that the Legislature was unconcerned about health or welfare—the Legislature provided for it in the Air Act but in a more nuanced way.

Public health, safety or welfare is considered in certain statutory subsections but the permitting section is not among them. NMSA 1978, § 74-2-2(B) (defining air pollution); § 74-2-5(E) (in making regulations to prevent or abate air pollution); § 74-2-5.1 (authorizing classification and recording of air contaminant sources); § 74-2-8(A)(2)(a) (variances); § 74-2-10 (emergency orders); § 74-2-11.1 (Air Act does not supersede laws relating to industrial health, safety or sanitation). Even when the Legislature authorized a focus on health, safety or welfare in a particular section, the Legislature generally imposed qualifications or required consideration of competing factors. *See, e.g.*, NMSA 1978, § 74-2-2(B) (qualifying the definition of air pollution); *and* NMSA 1978. § 74-2-5(E) (requiring consideration during rulemaking of the economic value of sources of air pollution and technical and economic reasonableness).

Only in the case of variances (where, by definition, one or more rules would not be applied) does protection of health and safety create a minimum floor. The Legislature's approach is unsurprising when the practical realities of protecting air quality are considered.

In the Air Act, the Legislature intended that prevention and abatement of air pollution would result by rulemaking in which "injury to...health, welfare, visibility and property" would be considered simultaneously with the public interest, technical practicability, economic reasonableness and the social and economic value of sources of air pollution. NMSA 1978, § 74-2-5(B and E). Similarly, during rulemaking, the Air Board conscientiously applies the various limitations that the Legislature and City Council have imposed on rules such as limitations on rules about hazardous air pollutants. NMSA 1978, § 74-2-5. This approach assures that air quality will be regulated in the manner envisioned by New Mexico's elected representatives and that due regard has been given to economic and technical challenges. Following this overall plan requires simultaneous consideration of both (1) the need to protect the public from air pollution and (2) the economic realities and technical challenges of meeting that need.

Once applicable rules are adopted, issuing a permit for an air quality source does not require a new assessment of how to protect health, welfare, visibility and property. Appropriate protection is provided by following the rules. Indeed, treating the rules as non-dispositive would upset the balanced approach the Legislature required the Air

Board to follow in the Air Act. Thus, unlike the Solid Waste Act which has an overarching purpose of protecting public health, in the Air Act, air pollution is prevented and abated by adopting rules that provide balanced consideration of certain factors and then applying those rules during permitting. NMSA 1978, §§ 74-2-5 and -7.

b. Public Notice Provisions

The Solid Waste Act imposes statutory public notice provisions which require, among other things, that public notice be published in a newspaper of general circulation in two places, the classified or legal notices and another place “calculated to give the general public the most effective notice.” NMSA 1978, § 74-2-22. The Solid Waste Act is one of only two New Mexico statutes containing such stringent public notice provisions. *Martinez v. Maggiore*, 2003-NMCA-043, ¶¶ 7 and 8, 133 N.M. 472.

In contrast, the Legislature did not mandate any particular form of notice for permits in the Air Act. Instead, the Legislature delegated discretion to the Air Board to develop appropriate notice requirements. NMSA 1978, § 74-2-7(B)(5). The Air Board chose to require notice by publication, 20.11.41.14(A)(3) NMAC (2002), and EHD complied with that requirement. UMF No. 3. Clearly then, the Legislature did not intend that involvement of the general public was as essential in air quality permitting as it is in solid waste permitting.

c. Hearing Requirement

The Solid Waste Act requires a hearing for every permit. There is no need to file a petition, no requirement to have previously participated in the permitting process, and no requirement to be adversely affected to get a hearing on the issuance of a permit. NMSA 1978, § 74-9-28(A); *and see Martinez*, 2003-NMCA-043, ¶ 14 (rejecting standing argument).

In contrast, the Air Act does not require a hearing prior to issuing a permit, NMSA 1978, § 74-2-7(B)(5) (authorizing adoption of rules for hearings “*if any*” before permitting). The Air Board has granted EHD the discretion to determine whether a hearing should occur. 20.11.41.14(B) NMAC. The Legislature’s choice not to require an adjudicatory hearing in each instance before issuing an air quality permit is the opposite of what it required in the Solid Waste Act.

d. Burden of Proof

Finally, and essential to deciding this Motion, is that the Air Act imposes the burden of proof on the petitioner. NMSA 1978, § 74-2-7(K). This is not an issue under the Solid Waste Act or its regulations, which place the burden of proof on the applicant, other than proof to support challenged conditions. 20.1.4.400(A)(1) NMAC.

The above differences, among others, between the Solid Waste Act and the Air Act, reflect the Legislature’s conscious decisions, which in turn reflect the will of the people. If Petitioners want the Air Act to provide the procedures that the Solid Waste Act provides, the appropriate course of action for Petitioners is to seek an amendment of the Air Act, not to improperly suggest that the Air Board rely on the Solid Waste Act which does not apply to this matter. This is especially so when Petitioners have no evidence to

show that EHD failed to comply with any requirement of the Clean Air Act, the Air Act or the applicable air quality regulations. Petitioners' arguments based on *Colonias* are unavailing because the Solid Waste Act is not similar to the Air Act and the Air Board should reject their arguments.

4. *Based on Petitioners' own expert opinion, the Air Board should sustain Permit No. 3135.*

In practice, the Air Act's requirement that a petitioner carry the burden of proof has a key consequence. There are only three possible outcomes of an Air Board hearing on an EHD issued permit—" [b]ased on the evidence presented at the hearing, the... [Air Board] shall sustain, modify or reverse the action of the [EHD]." NMSA 1978, § 74-2-7(K). Thus, if a petitioner has no technical evidence to prove that Permit No. 3135 should be reversed or modified, then the Air Board should sustain Permit No. 3135. That is exactly the situation presented by Petitioners' Notice of Intent.

Petitioners' expert does not conclude that Permit No. 3135 would violate any provision of the Clean Air Act or the Air Act, or any regulation adopted pursuant to those acts or would cause or contribute to any exceedance of any ambient air quality standard. NMSA 1978, § 74-2-7(C)(1). Instead, Petitioners' expert, Dr. Rowangould, concludes that because of

the *potential* health impacts associated with vehicle traffic and vapor losses, and the facility's proximity to residents and at least one school, we recommend conducting additional analysis to ensure that the *potential* air quality and health impacts associated with the [Smith's GDF] are better understood.

Petitioners' NOI, Ex 1, p. 4 (emphasis added).

Dr. Rowangould continues, using language that reveals Petitioners' failure to carry their burden:

If the facility is found to result in air quality and/or health impacts that exceed levels that are acceptable (based on regulatory levels, health risks, and/or community sentiment), mitigations and/or alternatives should be explored.

Id. [emphasis added].

Plainly, if Petitioners had evidence that the construction of the Smith's GDF as authorized by Permit No. 3135 would violate any air quality law or rule within the meaning of Section 74-2-7(C)(1), their expert would have said so. She did not because she cannot. Permit No. 3135 complies with all applicable requirements of the Clean Air Act, the Air Act and the applicable regulations adopted pursuant to those laws. Merely identifying the possibility that air quality impacts could occur is not sufficient to carry Petitioners' burden of proof.

Dr. Rowangould's conclusion also reveals she does not understand the regulatory regime established by the Legislature. Nowhere in the Air Act or the Air Board's regulations is "community sentiment" a criterion that may factor into a permitting decision and 'health risks' are considered during rulemaking, not during permitting. NMSA 1978, § 74-2-5(E). During permitting, rules are applied which have been developed after consideration of public health, among other things. NMSA 1978, §§ 74-2-5(E) and 74-2-7(C)(1).

If studies such as Dr. Rowangould proposes were done and they were to show that significant air quality impacts would occur, Petitioners could choose to seek an amendment of the Air Act or petition to change the rules under which EHD and the Air Board presently operate.⁶ Such rules could then be applied to future permitting decisions. For the permitting action before the Air Board today, the rules already exist and Petitioners' expert has offered no proof that any existing rule would be violated by the Smith's GDF operating as Permit No. 3135 permits it to operate.

a. The Air Board has no authority to require either Smith's or the City to conduct the studies that Dr. Rowangould proposes.

The Air Board's rules require that a petition state what remedy it is seeking and the legal basis for that remedy. 20.11.81.14(B)(2)(e) NMAC. In their petition, Petitioners request only that the Air Board hold an evidentiary hearing. Petition at 6 (Jun. 2, 2104). Holding an evidentiary hearing is not a form of relief. The purpose of an evidentiary hearing is to gather relevant facts to support an ultimate Air Board decision. 20.11.81.12(D) (emphasis added) and 18(C and D). In order for a fact to be relevant, it must be of consequence in determining the action. Rule 11-401(B); *and see* 20.11.81.12(A) NMAC. Thus, it is essential to focus on the relief Petitioners seek in order to determine what facts are relevant.

⁶ In certain areas, the Air Act limits the Air Board's rulemaking discretion to adopting rules which are as stringent as but no more stringent than federal rules. *See, e.g.*, NMSA 1978, § 5(C)(1 and 2). For example, studies alone, regardless of the outcome, would not allow the Air Board to adopt a more stringent rule for emissions of hazardous air pollutants from gasoline dispensing facilities because the Legislature has limited its rulemaking authority regarding control of hazardous air pollutants.

In this case, the Air Board can only take one of three actions on an EHD permit: sustain it, modify it or reverse it. NMSA 1978, § 74-2-7(K). Although Petitioners have not expressly asked for any relief, EHD assumes from considering the Petition as a whole, including Petitioners' allegations that they contend they are adversely affected by the issuance of Permit No. 3135, that Petitioners are seeking to have Permit No. 3135 either reversed or modified.

The scope of the Air Board's review of EHD's permitting decisions is whether the permit "will or will not meet applicable local, state and federal air pollution standards and regulations." NMSA 1978, § 74-2-7(L). Petitioners' NOI does not establish that Permit No. 3135 will not meet any standard or regulation. Thus, Petitioners' NOI is irrelevant for the purpose of the Air Board's decision on the merits of a permit and cannot support a decision to reverse or modify the permit. An NOI which is irrelevant cannot raise a genuine dispute of material fact. *San Juan Com'n*, 1993-NMSC-050, ¶ 22.

Moreover, the Petition does not even raise the possibility that studies should be required. It does not cite any legal authority that would allow the Air Board to require either Smith's or EHD to conduct Dr. Rowangould's studies and EHD is aware of none. While Part 41 allows conditions to be imposed on a permit, the basis for those conditions must be in the application. 20.11.41.18(A) NMAC ("The contents of the application submitted...[as amended]...shall form the basis for the terms and conditions contained in the permit.") The Air Board cannot violate its own regulations to impose the studies recommended by Dr. Rowangould.

Thus, there is no need to hold an Air Board hearing on a permit to decide whether to order Dr. Rowangould's recommended studies to be conducted if no law authorizes the Air Board to require them. In short, notwithstanding Dr. Rowangould's opinion, there is no genuine dispute of material fact and the Air Board should sustain Permit No. 3135 as a matter of law.

e. Near-roadway air pollution is a current focus of EPA research.

EHD does not dispute that EPA is conducting research about near-roadway air pollution; that research may determine how emissions disperse near roadways and how barriers can be used to influence or reduce those emissions, among other things. See <http://www.epa.gov/riskmanagement/appcd/nearroadway/>. This research may (or may not) lead to new rules that will be applied in the future. But unless and until those rules arrive, EHD and the Air Board must apply existing rules fairly and consistently to all applicants. In this case, there is no genuine dispute of material fact that Permit No. 3135 does not violate any existing air quality law or rule and the Air Board should sustain EHD's issuance of Permit No. 3135 as a matter of law.

B. Petitioners improperly rely on the Air Board's decision in *In re Air Quality Permit No. 2037-M1*.

Petitioners' reliance on the Air Board's decision in *In re Air Quality Permit No. 2037-M1* is misguided. The propriety of the decision in *Air Quality Permit No. 2037-M1* is disputed and it is presently before the Court of Appeals for decision. EHD will not re-litigate it here. Suffice it to say, it is not a precedent that the Air Board is required to follow.

C. Petitioners' demand for an Air Board hearing to consider the impact of the Smith's GDF on their quality of life is unsupported by admissible evidence that would support the reversal or modification of Permit No. 3135.

Petitioners' attempt to assert a cumulative 'quality of life' impact that is not contemplated by the Air Act, is impossible to quantify, and is unworkable and contrary to existing law. Petitioners had a Public Information Hearing where they had an opportunity to raise their concerns. As evidenced by EHD's issuance of Permit No. 3135, none of the concerns raised at the hearing justified denial of Permit No. 3135. Since the issuance of Permit No. 3135, EHD has produced the Administrative Record which contains the full record of the Public Information Hearing and materials EHD relied upon. Petitioners have also been given an opportunity to ask and answer discovery questions, an opportunity to offer an expert witness, and Petitioners have the assistance of counsel. Based on all of the information EHD has seen, Petitioners have no admissible evidence to prove that Permit No. 3135 should be reversed or modified. Lacking such evidence, there is no need to go forward to an Air Board hearing.

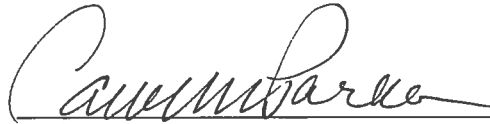
IV. CONCLUSION

An Air Board hearing is an adjudicative procedure where Petitioners are required to prove their allegations. Fears based on speculation, unfounded allegations and generalized beliefs or concerns about what happened elsewhere or what might happen here do not add up to admissible evidence that Permit No. 3135 should be reversed or

modified. Petitioners have no evidence and cannot carry their burden of proof that Permit No. 3135 should be modified or reversed. There is no genuine dispute of material fact and the Air Board should sustain Permit No. 3135 as a matter of law.

Respectfully submitted,

CITY OF ALBUQUERQUE
David Tourek
City Attorney



Carol M. Parker
Assistant City Attorney
P.O. Box 2248
Albuquerque, New Mexico 87103
Telephone: (505) 768-4500
Facsimile: (505) 768-4525
cparker@cabq.gov

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Motion for Summary Judgment was served on Sept. 17, 2014 by the method indicated below:


- 1) The City's original *Motion for Summary Judgment* was filed with the Hearing Clerk in the above-captioned matter and nine copies were hand delivered.
- 2) One copy was sent by electronic mail to the Hearing Officer/Air Board Attorney and an additional copy was hand-delivered to the Hearing Clerk for delivery:

Felicia Orth
c/o Andrew Daffern, Hearing Clerk
Control Strategies Section
Environmental Health Department
One Civic Plaza, Room 3023
Albuquerque, NM 87102
orthf@yahoo.com
*Attorney for the Albuquerque-Bernalillo County Air Quality Control Board
and Hearing Officer for AQCB Petition No. 2014-2*

- 3) One hard copy was mailed by first class mail and an electronic copy was sent by electronic mail to:

Pete V. Domenici, Jr. and
Lorraine Hollingsworth
Domenici Law Firm, P.C.
320 Gold Avenue SE, Suite 1000
Albuquerque, NM 87102
pdomenici@domenicilaw.com
*Attorneys for Petitioners Margaret M. Freed,
Mary Ann Roberts, and Pat Toledo, Petitioners*

Frank C. Salazar
Timothy J. Adler
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P.O. Box 1945
Albuquerque, NM 87103-1945
fcs@sutinfirm.com
tja@sutinfirm.com
Attorneys for Smith's Food & Drug Centers, Inc.

By: 
Carol M. Parker, Assistant City Attorney
98229

UMF #1

RECEIVED
ENVIRONMENTAL HEALTH



13 NOV - 5 PM 3:11

CITY OF ALBUQUERQUE
ENVIRONMENTAL HEALTH DEPARTMENT
AIR QUALITY DIVISION

Please mail this application, or hand deliver between 8:00am - 4:00pm Monday - Friday to
Environmental Health Department.

Air Quality Division
Air Quality Permitting Section
11850 Sunset Gardens SW
Albuquerque, NM 87121
Telephone: (505)768-1930

13 NOV - 5 PM 3:11



APPLICATION FOR SOURCE REGISTRATION AND AUTHORITY-TO-CONSTRUCT PERMITS FOR
FUEL DISPENSING STATIONS LOCATED IN BERNALILLO COUNTY (20.11.40 NMAC & 20.11.41 NMAC)

Notice of initial application fee and subsequent annual permit fees will be sent to the Company (20.11.02 NMAC).

Section 1: General Information:

Date Submitted: _____

- Name of Company: SMITH'S FOOD & DRUG CENTERS, INC. Company Ph: (801) 974-1400
- Company Address: 1550 SO. REDWOOD ROAD, SALT LAKE CITY, UT Zip 84104
- Local Office Address: _____ Zip _____
- Person to Contact: KERRY BUSEY Title: DR. OF OPERATIONS Ph: (505) 801-977-1048
- Location of the station: 6941 MONTGOMERY NE, ABQ Zip _____
(Please provide a detailed hand drawing, site plan or survey of the property)
- UTM coordinates: east 357035 north 3888720 (if available)
- Is this a proposed (new) station? Yes No.
If no, give original date of startup: Month _____ Day _____ Year _____
- Date of (anticipated - new) startup: Month 5 Day 15 Year 14
- Normal or requested operating hours: hrs/day 24 days/wk 7 mos/yr 12

Section 2: Storage Tanks -- List all tanks that will contain any hydrocarbon liquid

Individual Tank Information	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5
Type of fuel stored (reg. unl., super unl., diesel, etc.)	REG UNL	SUPER UNL	DIESEL		
Location (aboveground or underground)	UNDERGROUND	UNDERGROUND	UNDERGROUND		
Tank Construction (steel, fiberglass, both)	FIBERGLASS	FIBERGLASS	FIBERGLASS		
Cathodic Protection (Yes or No)	NO	NO	NO		
Storage Capacity (In Gallons)	20,000	8,000	10,000		
Date of installation or proposed Installation (month/year)	3/14	3/14	3/14		

APPLICATION FOR SOURCE REGISTRATION AND AUTHORITY-TO-CONSTRUCT PERMITS FOR
FUEL DISPENSING STATIONS LOCATED WITHIN BERNALILLO COUNTY

Section 3: Submersible Pumps FOR GASOLINE ONLY

(If possible, match pump number to tank number from Section 2 Table)

Section 4: Fuel Throughput

Individual Submersible Pump Information FOR GASOLINE(S)	Gasoline Submersible Pump Rating (In gallons/hour) (use 600 per pump if unknown)	Type of Fuel Dispensed from Submersible Pump (Reg. unl., super unl., unl. plus, etc.)	Date of Pump Installation (Month/Year if known)	TOTAL REQUESTED ANNUAL FUEL THROUGHPUT LIMIT IN GALLONS PER YEAR	
				GASOLINE(S)	DIESEL
Pump 1	600	REG UNL.	3/14 ±	6,500,000 gallons	500,000 gallons
Pump 2	600	SUPER UNL.			
Pump 3	600	DIESEL			
Pump 4					
Pump 5					
Total of pumps 1 - 5 gallons/hour					

Section 5: Potential Emissions FOR GASOLINE(S) ONLY

Total Submersible Pump Rating In Gallons/Hour, For Gasoline(s) Only, From Section 3 Table Above (Second Column Total)	T I M E S	Emission Rate (Given)	T I M E S	Theoretical Potential Operating Hours (Given) (12 hours/day & 365 days/year)	D I V I D E	Pounds Per Ton (Given)	E Q U A L S	Potential Tons Per Year of Volatile Organic Compounds (VOC)
1800 gallons/hour	X	0.013 pounds/gallon	X	4,380 hours/year	/	2,000	=	51.25

Section 6: Actual Emissions FOR GASOLINE(S) ONLY

Requested Annual Fuel Throughput of Gasoline(s) From Section 4 Table Above	T I M E S	Emission Rate (Given)	D I V I D E	Pounds Per Ton (Given)	E Q U A L S	Allowable Tons Per Year of Volatile Organic Compounds (VOC)
1,000,000 Gallons	X	0.013 pounds/gallon	/	2,000	=	45.5

Section 7: Certification:

I, the undersigned, a responsible officer of the applicant company, certify that to the best of my knowledge, the information stated on this application, together with associated drawings, specifications, and other data, give a true and complete representation of the planned new station or modifications to an existing station with respect to air pollution sources and control equipment. I also understand that any significant omissions, errors, or misrepresentations in these data will be cause for revocation of part or all of the resulting permit.

Printed Name: Roger Goyon Title: CONSTRUCTION MANAGER
 Signature: [Signature] Date: 10-31-13

NOTE: Information relating to process or production techniques unique to owner, or data relating to profits and costs not previously made public can be protected as confidential if requested by applicant.

UMF #2

Eyerman, Regan V.

From: Eyerman, Regan V.
Sent: Tuesday, December 03, 2013 2:05 PM
To: 'Kirk Randall'
Cc: 'kerry.busey@sfdc.com'
Subject: RE: Smith's #485 and #423 Fuel Center Applications
Attachments: Smiths Public Notice.doc

Kirk,

Thank you, the applications for the gasoline dispensing facilities are complete and attached is the notice that will publish in the Albuquerque Journal this Friday. Thank you and if you have any questions or require additional information please do not hesitate to contact me.

Thank you,
Regan Eyerman, P.E.
Environmental Health Scientist
City of Albuquerque, Air Quality Division
505-767-5625

From: Kirk Randall [<mailto:kirk@greatbasinsouth.com>]
Sent: Tuesday, December 03, 2013 10:09 AM
To: Eyerman, Regan V.
Subject: Smith's #485 and #423 Fuel Center Applications
Importance: High

Regan,

This email will confirm our conversation and our intent to request an annual throughput of 7,000,000 gallons of gasoline as noted in Section 6 of the application which as we discussed would revise the 6,500,000 gallons of gasoline listed in Section 4 to 7,000,000 for both the proposed Smith's #485 Fuel Center at 6941 Montgomery NE and the #423 Fuel Center at 6310 4th Street NW.

Thanks for your help with this, let me know if this raises any problems or if you need anything else,

Kirk Randall
Senior Project Manager
Great Basin Engineering - South
2010 No. Redwood Road
Salt Lake City, UT 84116
kirk@greatbasinsouth.com
801-521-8529

UMF #3



Published in the Albuquerque Journal on Friday December 06, 2013

PUBLIC NOTICE Air Quality Authority-to-Construct Permit For Smith's Food & Drug Centers, Inc. Smith's Food & Drug Centers, Inc. (Smith's) has submitted authority-to-construct air quality permit applications to the Air Quality Division (Division) of the City of Albuquerque Environmental Health Department to construct two new gasoline dispensing facilities to be located across the street from two existing Smith's grocery stores. The two new gasoline dispensing facilities with their associated permit application numbers are to be located at the following addresses in Albuquerque, NM: Permit Application #3135 - Smith's #485 Fuel Center - 6941 Montgomery Blvd. NE, 87110 Permit Application #3136 - Smith's #423 Fuel Center - 6310 4th St. NW, 87107 For each air quality permit application, Smith's is requesting the following gasoline throughputs for each gasoline dispensing facility: Permit Application #3135 - 7,000,000 gallons of gasoline per year Permit Application #3136 - 7,000,000 gallons of gasoline per year The volatile organic compound (VOC) emissions are estimated to be the following amounts from each facility: Permit Application #3135 - 45.5 tons/year Permit Application #3136 - 45.5 tons/year The owner of the two new proposed facilities is Smith's Food & Drug Centers, Inc., 1550 South Redwood Rd., Salt Lake City, Utah, 84116. The Division expects to initiate formal action on each permit application by January 24, 2014. However, the final writing of the permits will be reserved pending receipt and analysis of any additional details or information developed during the public comment period. Interested persons may submit written comments or request a public hearing on Permits #3135 or #3136 to the City of Albuquerque Environmental Health Department, Air Quality Division, P.O. Box 1293, Albuquerque, NM 87103. Comments will be accepted and considered if postmarked by January 20, 2014. A copy of each permit application is available for inspection by the public at the Division offices, which are located at One Civic Plaza, Room 3047. For more information call Regan Eyeran, at (505) 767-5625. NOTICE FOR PERSON WITH DISABILITIES: If you have a disability and/or require special assistance, please call (505) 768-2600 (Voice) and special assistance will be made available to you to review the above referenced applications. TTY users call the New Mexico Relay at 1-800-659-8331 and special assistance will be made available to you to review the above referenced applications. Journal: December 6, 2013

UMF #4

**NOTICE OF PUBLIC INFORMATION HEARING FOR PROPOSED
CONSTRUCTION AIR QUALITY PERMIT APPLICATION #3135
FOR SMITH'S FOOD & DRUG CENTERS, INC.
GASOLINE DISPENSING FACILITY**

A Public Information Hearing (hearing) will be held on Thursday, April 3, 2014 from 6:00 p.m. to 8:30 p.m. at Cleveland Middle School, 6910 Natalie Ave. NE, Albuquerque, NM 87110. The purpose of the hearing is to provide information and answer questions regarding Construction Air Quality Permit Application #3135 for a proposed Smith's Food & Drug Centers, Inc. (Smith's) gasoline dispensing facility. The location was chosen to accommodate the significant public interest that has been expressed in this matter.

Smith's has submitted a Construction Permit Application to the Air Quality Program (Program) of the City of Albuquerque Environmental Health Department, for their proposed facility at 6941 Montgomery Blvd. NE in Albuquerque, New Mexico. A construction permit is required before Smith's can commence construction at the site.

The maximum volatile organic compound (VOC) emission to the atmosphere from the Smith's gasoline dispensing facility has been estimated to be 45.5 tons/yr.

Representatives for Smith's will speak regarding the proposed Construction Permit Application. The public will have an opportunity to voice concerns, submit data or arguments, orally or in writing, for the public record regarding the application. Program staff will be available to answer questions regarding the review process for air quality permits and the status of the Smith's Construction Permit Application #3135. Community members who wish to testify at the April 3, 2014 hearing should sign the registry upon their arrival at the hearing. A hearing officer will direct the proceedings and is authorized to limit the length of the testimony.

Program staff will consider relevant testimony and documentation submitted at the hearing before making a decision on the Construction Permit Application.

The hearing is open to the public. A summary of the Construction Permit Application file is available for review at the Program offices, which are located at One Civic Plaza, Room 3047. For information regarding the application file, call 768-1972.

NOTICE TO DISABLED PERSONS: If you have a disability and require special assistance to participate at this hearing, please contact 311; TTY users contact 1-800-659-8331, as soon as possible prior to the hearing.

UMF #5



AIR QUALITY AUTHORITY TO CONSTRUCT PERMIT #3135
FACILITY CDS # NM/001/02260
Facility ID: FA0003035 Record ID: PR0006342



Richard J. Berry, Mayor

Mary Lou Leonard, Director

Issued to: Smith's Food & Drug Centers, Inc.
 Company Name

Certified Mail # 7010 3090 0001 4395 9326
 Return Receipt Requested

1550 South Redwood Road
 Mailing Address

Salt Lake City
 City

UT
 State

84104
 Zip

Responsible Official: Roger Gough, Construction Manager
 Authorized Representative

Pursuant to the New Mexico Air Quality Control Act, Chapter 74, Article 2 New Mexico Statutes Annotated 1978 (as amended); the Joint Air Quality Control Board Ordinance, 9-5-1 to 9-5-99 ROA 1994; the Bernalillo County Joint Air Quality Control Board Ordinance, Bernalillo County Ordinance 94-5; the Albuquerque-Bernalillo County Air Quality Control Board (AQCB) regulation, Title 20, New Mexico Administrative Code (20 NMAC), Chapter 11, Part 40 (20.11.40 NMAC), Source Registration; and AQCB regulation, Title 20, NMAC, Chapter 11, Part 41 (20.11.41 NMAC), Authority to Construct,

Smith's Food & Drug Centers, Inc. ("permittee") is hereby issued this **AUTHORITY TO CONSTRUCT PERMIT** as a **NEW STATIONARY SOURCE**.

This **AUTHORITY TO CONSTRUCT** Permit Number 3135 has been issued based on the review of the application information received by the Albuquerque Environmental Health Department (Department), Air Quality Program (Program) on November 5, 2013, which was deemed complete on December 3, 2013, and on the National Ambient Air Quality Standards, New Mexico Ambient Air Quality Standards, and Air Quality Control Regulations for Albuquerque/Bernalillo County, as amended. As these standards and regulations are updated or amended, the applicable changes will be incorporated into this Air Quality Permit Number 3135 and will apply to the facility. This facility is authorized to construct and operate the following type of process at:

Facility Name & Address	UTM Coordinates	Process Description	SIC	NAICS
<u>Smith's Food & Drug Centers, Inc.</u> <u>6941 Montgomery Blvd. NE</u> <u>Albuquerque, NM 87110</u>	<u>357035 Easting</u> <u>3888720 Northing</u>	<u>Gasoline Dispensing Facility (GDF)¹</u>	<u>5541</u>	<u>447190</u>

¹Gasoline dispensing facility (GDF) means any stationary facility which dispenses gasoline into the fuel tank of a motor vehicle, motor vehicle engine, nonroad vehicle, or nonroad engine, including a nonroad vehicle or nonroad engine used solely for competition. These facilities include, but are not limited to, facilities that dispense gasoline into on- and off-road, street, or highway motor vehicles, lawn equipment, boats, test engines, landscaping equipment, generators, pumps, and other gasoline-fueled engines and equipment.

Issued on the 30th day of April, 2014
Isreal L. Tavaroz Isreal L. Tavaroz
 Print Name Sign Name

Air Quality Protection Programs - Permitting Section
 Air Quality Program
 City of Albuquerque Environmental Health Department



1. AUTHORITY TO CONSTRUCT PERMIT THRESHOLD (74-2-7.A.(1) NMSA). By regulation, the local board shall require a person intending to construct or modify any source, except as specifically provided by regulation, to obtain a construction permit from the local agency prior to such construction or modification. This permit recognizes the construction and operation of the following equipment:

Unit Number	Unit Description	Storage Capacity in gallons	Installation Date	Product Stored	Minimum Required Emissions Control ¹
1	Underground Storage Tank	20,000	2014	Regular Unleaded Gasoline	<u>Stage I</u> <u>Vapor Balanced, Submerged Filling</u>
2	Underground Storage Tank	8,000	2014	Premium Unleaded Gasoline	<u>Stage I</u> <u>Vapor Balanced, Submerged Filling</u>

¹**GASOLINE HANDLING AND HOLDING AT RETAIL OR FLEET SERVICE STATIONS:** No person shall allow loading of gasoline into an underground storage tank with greater than 3,000 gallons capacity, unless it is equipped with an approved vapor loss control system, including a submerged fill pipe, in which the displaced vapors are either continuously contained or processed such that the emission of gasoline vapors to the atmosphere do not exceed 1.15 pounds of gasoline per 1,000 gallons loaded into said tank. Liquid gasoline dispensing from the underground storage tank as well as momentary opening of the system for gasoline gauging purposes shall not be considered as vapor loss in the requirement of this section. [Albuquerque-Bernalillo Air Quality Control Board Regulation 20.11.65.15 NMAC, Volatile Organic Compounds.]

2. COMPLIANCE ASSURANCE.

- A. All air pollution emitting facilities within Bernalillo County are subject to all applicable Albuquerque/Bernalillo County Air Quality Control Regulations, whether listed in this permit or not.
- B. The issuance of an Authority to Construct permit does not relieve the Company from the responsibility of complying with the provisions of the state air quality control act, federal clean air act, or any applicable regulations of the board. (20.11.41.17 NMAC)
- C. Any term or condition imposed by the department in an Authority to Construct permit shall apply to the same extent as a regulation of the board. (20.11.41.18.C NMAC)
- D. Whenever two or more parts of the Air Quality Control Act, or the laws and regulations in force pursuant to the Act, limit, control or regulate the emissions of a particular air contaminant, the more restrictive or stringent shall govern.
- E. The department is authorized to issue a compliance order requiring compliance and assessing a civil penalty not to exceed Fifteen Thousand and no/100 Dollars (\$15,000) per day of noncompliance for each violation, commence a civil action in district court for appropriate relief, including a temporary and permanent injunction. (74-2-12 NMSA).

3. SUBSTITUTION. Substitution of equipment is authorized provided the equipment has the same or lower process capacity as the piece of equipment being substituted. The department shall be notified in writing within 15 days of equipment substitution. Equipment that is substituted shall comply with the requirements in the Section 4 Gasoline Unit Emission Limits table.

4. GASOLINE UNIT EMISSION LIMITS. Allowable monthly and annual gasoline throughput. Allowable ton per year (tpy) emissions.

Unit	Unit Description	Allowable Average Monthly Throughput of Gasoline (in gallons) ¹	Allowable Annual Throughput of Gasoline (in gallons) ²	Allowable Annual Emissions of Volatile Organic Compounds (VOC's) ² (in tons per year)
1	Underground Storage Tank	≥100,000	For Stage I Vapor Recovery 7,000,000	45.5 tons per year
2	Underground Storage Tank			

¹ Monthly throughput means the total volume of gasoline that is loaded into, or dispensed from, all gasoline storage tanks at each Gasoline Dispensing Facility (GDF) during a month. Monthly throughput is calculated by summing the volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the current day, plus the total volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the previous 364 days, and then dividing that sum by 12.

² Based on the annual gasoline throughput requested in the permit application. There is no restriction on individual tank throughput.

5. EMISSIONS INVENTORY REQUIREMENTS (20.11.47 NMAC). Subsection 20.11.47.14.A.(1) – Applicability - requires an emissions inventory of any stationary source in Bernalillo county that has an active permit issued pursuant to 20.11.41 NMAC Authority to Construct. Subsection 20.11.47.14.B.(1) – Reporting Requirements – requires the submittal of an emissions inventory report annually. Therefore, an annual emissions inventory (in pounds per calendar year) shall be submitted to the department by March 15 each year by: multiplying the actual, annual gallons of gasoline throughput for the previous calendar year (January 1st through December 31st) for Units 1 and 2 in the Section 4 Gasoline Unit Emission Limits table above, by 0.013 pounds/gallon if Stage I Vapor Recovery or 0.0031 pounds/gallon if Stage II Vapor Recovery. An electronic emission inventory form is available at cabq.gov/airquality, under Business Resources - Business Applications, Permits and Forms.

6. MODIFICATION. Any future physical changes or changes in the method of operation which result in an increase in the pre-controlled emission rate may constitute a modification. Change in the method of control of emissions or in the character of emissions shall not be made unless submitted to the department as a modification to this permit. 20.11.41.7.H NMAC defines proposed changes to a facility that may constitute a permit modification. Compliance will be based on department inspections and the submittal of a new permit application for any modification. No modification shall begin prior to issuance of a permit and shall be processed in accordance with 20.11.41 NMAC.

7. MONITORING and RECORDKEEPING (20.11.41.18.B.(8)NMAC). Monitor and maintain a log of the total monthly gasoline throughput for the facility. These records must be retained for the most recent five-year period for the facility.

8. REPORTING.

A. The following reporting requirements, in accordance with 20.11.41.18, 20.11.41.20, 20.11.47 and 20.11.49 NMAC, to allow the department to determine compliance with the terms and conditions of the permit. Compliance will also be based on timely submittal of the reports. The permittee shall notify the department in writing of:

- 1. Any change in control or ownership, within 15 days of the change in control or ownership. In the event of any such change in control or ownership, the permittee shall notify the succeeding owner of the permit. The permit conditions apply in the event of any change in control or ownership of the facility. At minimum, an administrative permit modification is required to address any change in control or ownership of the facility;
- 2. Any substitution of equipment, within 15 days of equipment substitutions. Equipment may only be substituted if it has the same or lower process capacity as the piece of equipment being substituted, and there are no other federal, state, or local air quality permit requirements triggered by the introduction of the substituted piece of equipment. Substituted equipment shall comply with the Section 4 Gasoline Unit Emission Limits table;
- 3. The annual (January 1 through December 31 of previous year) throughput of gasoline and emission inventory, by March 15 of every year; and
- 4. Any breakdown of equipment or air pollution control devices or apparatus so as to cause emissions of air contaminants in excess of limits set by permit conditions. Any breakdown or abnormal operating conditions shall be reported to the department by submitting the following reports on forms provided by the department:
 - a) Initial Report: The permittee shall file an initial report, no later than the end of the next regular business day after the time of discovery of an excess emission pursuant to 20.11.49.15.A.(1) NMAC;
 - b) Final Report: The permittee shall file a final report, no later than 10 days after the end of the excess emission. If the period of an excess emission extends beyond 10 days, the permittee shall submit the final report to the department within 72 hours of the date and time the excess emission ceased. This condition is pursuant to 20.11.49.15.A.(2) NMAC and 20.11.49.15.C NMAC; and

c) Alternative Reporting: If the facility is subject to the federal reporting requirements of 40 CFR Parts, 60, 61, or 63 and the federal requirements duplicate the requirements of 20.11.49.15 NMAC, then the federal reporting requirements shall suffice. This condition is pursuant to 20.11.49.15.D NMAC.

B. The emission of a regulated air pollutant in excess of the quantity, rate, opacity, or concentration specified in an air quality regulation or permit condition that results in an excess emission is a violation of the air quality regulation or permit condition and may be subject to an enforcement action. The owner or operator of a source having an excess emission shall, to the extent practicable, operate the source, including associated air pollution control equipment, in a manner consistent with good air pollution control practices for minimizing emissions. This condition is pursuant to 20.11.49.14 NMAC.

9. INSPECTION (74-2-13 NMSA).

A. The department may conduct scheduled and unscheduled inspections, and, upon presentation of credentials:

1. Shall have a right of entry to, upon, or through any premises on which an emission source is located or on which any records required to be maintained by regulations of the board or by any permit condition are located; and
2. May, at reasonable times:
 - a) Have access to and copy any records required to be established and maintained by regulations of the board or any permit condition;
 - b) Inspect any monitoring equipment and method required by regulations of the board or by any permit condition; and
 - c) Sample any emissions that are required to be sampled pursuant to regulation of the board or any permit condition.

B. Any credible evidence may be used to establish whether the facility has violated or is in violation of any regulation of the board, or any other provision of law. Credible evidence and testing shall include, but is not limited to 20.11.41.26.A and B NMAC as follows:

1. A monitoring method approved for the source pursuant to 20.11.42 NMAC, Operating Permits, and incorporated into an operating permit;
2. Compliance methods specified in the regulations, conditions in a permit issued to the facility, or other provision of law;
3. Federally enforceable monitoring or testing methods, including methods in 40 CFR parts 51, 60, 61, 63 and 75; and
4. Other testing, monitoring or information-gathering methods that produce information comparable to that produced by any CFR method and approved by the department and the USEPA.

C. Compliance will be based on department inspections of the facility, reviews of production records, submission of appropriate permit applications for modification, and timely notification to the department regarding equipment substitutions and relocations.

10. **FEDERAL RULEMAKING.** In addition to Albuquerque-Bernalillo Air Quality Control Board Regulation 20.11.65 NMAC, *Volatiles Organic Compounds*; 40 CFR Part 63, Subpart CCCCCC – National Emission Standards for Hazardous Air Pollutants for Source Categories: Gasoline Dispensing Facilities apply to this facility. Based on the requested annual throughput for gasoline, this facility's monthly throughput would amount to 100,000 gallons or more of gasoline. Therefore, the permittee shall ensure the applicable requirements of 40 CFR Part 63, Subpart CCCCCC, §63.11116, §63.11117, and §63.11118 are met as well as the Subpart A – General Provisions of 40 CFR Part 63.

A. **GENERAL APPLICABLE REQUIREMENTS (§63.11116).**

1. You must not allow gasoline to be handled in a manner that would result in vapor releases to the atmosphere for extended periods of time.
2. §63.11116(a) requires that measures to be taken include, but are not limited to, the following:
 - (a)(1) Minimize gasoline spills;
 - (a)(2) Clean up spills as expeditiously as practicable;
 - (a)(3) Cover all open gasoline containers and all gasoline storage tank fill-pipes with a gasketed seal when not in use; [§63.11116(d) Portable gasoline containers that meet the requirements of 40 CFR Part 59, Subpart F, are considered acceptable for compliance with this requirement]; and
 - (a)(4) Minimize gasoline sent to open waste collection systems that collect and transport gasoline to reclamation and recycling devices, such as oil/water separators.

3. §63.11116(b) requires that records be made available within 24 hours of request by the department to document your gasoline throughput.

B. **SUBMERGED FILLING OF GASOLINE STORAGE TANKS (§63.11117).**

1. §63.11117(b) requires that except as specified in §63.11117(c), you must only load gasoline into storage tanks at your facility by utilizing submerged filling, as defined in §63.11132, and as specified in paragraph (b)(2) of this section:
 - (b)(2) Submerged fill pipes installed after November 9, 2006, must be no more than 6 inches from the bottom of the storage

tank.

4. §63.11117(c) Gasoline storage tanks with a capacity of < 250 gallons are not required to comply with the submerged fill requirements in paragraph (b) of this section.

C. **CONTROL REQUIREMENTS.**

1. §63.11118(b) requires that you must the requirements in paragraph (b)(1) of this section:

(b)(1) Each management practice in Table 1 of 40 CFR Part 63, Subpart CCCCCC that applies to your GDF by installing and operating a vapor balance system on your gasoline storage tanks that meets the following design criteria:

- a) All vapor connections and lines on the storage tank shall be equipped with closures that seal upon disconnect;
- b) The vapor line from the gasoline storage tank to the gasoline cargo tank shall be vapor-tight, as defined in § 63.11132;
- c) The vapor balance system shall be designed such that the pressure in the tank truck does not exceed 18 inches water pressure or 5.9 inches water vacuum during product transfer;
- d) The vapor recovery and product adaptors, and the method of connection with the delivery elbow, shall be designed so as to prevent the over-tightening or loosening of fittings during normal delivery operations;
- e) If a gauge well separate from the fill tube is used, it shall be provided with a submerged drop tube that extends the same distance from the bottom of the storage tank as specified in § 63.11117(b);
- f) Liquid fill connections for all systems shall be equipped with vapor-tight caps;
- g) Pressure/vacuum (PV) vent valves shall be installed on the storage tank vent pipes. The pressure specifications for PV vent valves shall be: a positive pressure setting of 2.5 to 6.0 inches of water and a negative pressure setting of 6.0 to 10.0 inches of water. The total leak rate of all PV vent valves at an affected facility, including connections, shall not exceed 0.17 cubic foot per hour at a pressure of 2.0 inches of water and 0.63 cubic foot per hour at a vacuum of 4 inches of water;
- h) The vapor balance system shall be capable of meeting the static pressure performance requirement of the following equation:

$$P_f = 2e^{-500.887/V}$$

Where:

Pf = Minimum allowable final pressure, inches of water.
 v = Total volume affected by the test, gallons.
 e = Dimensionless constant equal to approximately 2.718.
 2 = The initial pressure, inches water; and

i) If you own or operate a new or reconstructed GDF, or any storage tank(s) constructed after November 9, 2006, at an existing affected facility subject to § 63.11118, then you must equip your gasoline storage tanks with a dual-point vapor balance system as defined in § 63.11132, and comply with the requirements of item 1 in Table 1.

2. The management practices specified in Table 1 of 40 CFR Part 63, Subpart CCCCCC are not applicable if you are complying with the requirements in § 63.11118(b)(2), except that if you are complying with the requirements in § 63.11118(b)(2)(i)(B), you must operate using management practices at least as stringent as those listed in Table 1 of 40 CFR Part 63, Subpart CCCCCC.

D. PERFORMANCE TEST REQUIREMENTS.

Source Type	Initial Test Date	Additional Testing	Citation
New or Reconstructed Source (commenced construction after 11/9/06) with a monthly throughput ¹ of ≥ 100,000 gal/month	Upon startup after 09/23/08	Every three years §63.11120(a)	63.11113(d)(2)

Monthly throughput means the total volume of gasoline that is loaded into, or dispensed from, all gasoline storage tanks at each Gasoline Dispensing Facility (GDF) during a month. Monthly throughput is calculated by summing the volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the current day, plus the total volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the previous 364 days, and then dividing that sum by 12.

1. §63.11118(e) - You must comply with the applicable testing requirements contained in §63.11120.

2. §63.11120(a) - Each owner or operator, at the time of installation, as specified in §63.11113(e), of a vapor balance system required under §63.11118(b)(1), and every 3 years thereafter, must comply with the requirements in paragraphs (a)(1) and (2) as follows:

(a)(1) - You must demonstrate compliance with the leak rate and cracking pressure requirements, specified in item 1(g) of Table 1 of 40 CFR Part 63, Subpart CCCCCC, for pressure-vacuum vent valves installed on your gasoline storage tanks using the test methods identified in paragraph (a)(1)(i) or paragraph (a)(1)(ii) as follows:

(a)(1)(i) - California Air Resources Board Vapor Recovery Test Procedure TP-201.1E,—Leak Rate and Cracking Pressure of Pressure/Vacuum Vent Valves, adopted October 8, 2003 (incorporated by reference, see §63.14);

(a)(1)(ii) - Use alternative test methods and procedures in accordance with the alternative test method requirements in §63.7(f); and

(a)(2) - You must demonstrate compliance with the static pressure performance requirement, specified in item 1(h) of Table 1 of 40 CFR Part 63, Subpart CCCCCC, for your vapor balance system by conducting a static pressure test on your gasoline storage tanks using the test methods identified in paragraph (a)(2)(i) or paragraph (a)(2)(ii) as follows:

(a)(2)(i) - California Air Resources Board Vapor Recovery Test Procedure TP-201.3,—Determination of 2-Inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities, adopted April 12, 1996, and amended March 17, 1999 (incorporated by reference, see §63.14); and

(a)(2)(ii) - Use alternative test methods and procedures in accordance with the alternative test method requirements in §63.7(f).

§63.11120(b) - Each owner or operator choosing, under the provisions of §63.6(g), to use a vapor balance system other than that described in Table 1 of 40 CFR Part 63, Subpart CCCCCC must demonstrate to the Administrator or delegated authority under paragraph §63.11131(a) of this subpart, the equivalency of their vapor balance system to that described in Table 1 of 40 CFR Part 63, Subpart CCCCCC using the procedures specified in paragraphs (b)(1) through (3) as follows:

(b)(1) - You must demonstrate initial compliance by conducting an initial performance test on the vapor balance system to demonstrate that the vapor balance system achieves 95 percent reduction using the California Air Resources Board Vapor Recovery Test Procedure TP-201.1,—Volumetric Efficiency for Phase I Vapor Recovery Systems, adopted April 12, 1996, and amended February 1, 2001, and October 8, 2003, (incorporated by reference, see §63.14);

(b)(2) - You must, during the initial performance test required under paragraph (b)(1) of this section, determine and document alternative acceptable values for the leak rate and cracking pressure requirements specified in item 1(g) of Table 1 of 40 CFR Part 63, Subpart CCCCCC and for the static pressure performance requirement in item 1(h) of Table 1 of 40 CFR Part 63, Subpart CCCCCC; and

(b)(3) - You must comply with the testing requirements specified in paragraph §63.11120 (a).

§63.11120(c) - **Conduct of Performance Tests.** Performance tests conducted for this subpart shall be conducted under such conditions as the Administrator specifies to the owner or operator based on representative performance (i.e., performance based on normal operating conditions) of the affected source. Upon request, the owner or operator shall make available to the Administrator such records as may be necessary to determine the conditions of performance tests.

§63.11126 - Each owner or operator subject to the management practices in §63.11118 shall report to the Administrator the results of all volumetric efficiency tests required under §63.11120(b). Reports submitted under this paragraph must be submitted within 180 days of the completion of the performance testing.

E. NOTIFICATIONS.

1. §63.11118(f) requires that you must submit the applicable notifications as required under §63.11124.

2. §63.11124(b) requires that each owner or operator subject to the control requirements in §63.11118 must comply with paragraphs (b)(1) through (5) of §63.11124 as follows:

(b)(1) You must submit an Initial Notification that you are subject to this subpart upon startup. The notification must be submitted to the applicable EPA Regional Office and the delegated State authority as specified in §63.13. The Initial Notification must contain the information specified in paragraphs (b)(1)(i) through (iii) of this section as follows:

(b)(1)(i) the name and address of the owner and the operator;

(b)(1)(ii) the address (i.e., physical location) of the GDF; and

(b)(1)(iii) a statement that the notification is being submitted in response to this subpart and identifying the requirements in paragraphs (a) through (c) of §63.11118 that apply to you;

(b)(2) You must submit a Notification of Compliance Status to the applicable EPA Regional Office and the delegated State authority, as specified in §63.13, in accordance with the schedule specified in §63.9(h). The Notification of Compliance Status must be signed by a responsible official who must certify its accuracy and must indicate whether the source has complied with the requirements of this subpart. If your facility is in compliance with the requirements of this subpart at the time the Initial Notification required under paragraph (b)(1) of this section is due, the Notification of Compliance Status may be submitted in lieu of the Initial Notification provided it contains the information required under paragraph (b)(1) of this section;

(b)(4) You must submit a Notification of Performance Test, as specified in §63.9(e) [60 calendar days before the performance test is scheduled to allow the Administrator to review and approve the site-specific test plan required under §63.7(c), if requested by the Administrator, and to have an observer present during the test], prior to initiating testing required by §63.11120(a) and (b); and

(b)(5) You must submit additional notifications specified in §63.9, as applicable.

3. Sources in Bernalillo county that are in compliance with a 20.11.41 NMAC, Authority to Construct should be meeting the 20.11.65 NMAC, Volatile Organic Compounds requirements for submerged fill pipe and vapor loss control system for loading of fuel storage tanks and vapor recovery, and therefore should not have to submit an Initial Notification or a Notification of Compliance Status. **Since all gasoline dispensing facilities permit through 20.11.41 NMAC, Initial Notifications and Notifications of Compliance Status are met through the permitting process and through the inspection program.**

F. RECORDKEEPING.

1. §63.11118(g) - You must keep records and submit reports as specified in §§ 63.11125 and 63.11126.

2. §63.11125(a) - Each owner or operator subject to the management practices in §63.11118 must keep records of all tests performed under §63.11120(a) and (b).

3. §63.11125(b) - Records required under paragraph (a) of this section shall be kept for a period of 5 years and shall be made available for inspection by the Administrator's delegated representatives during the course of a site visit.

11. **FEES (20.11.2 NMAC).** Every owner or operator of a source that is required to obtain an Authority to Construct permit shall pay an annual emission fee pursuant to 20.11.2 NMAC. The annual emission fee for maintenance of this permit will be based on the greater of a base annual fee or a per ton fee rate based on the per ton allowable annual emissions of volatile organic compounds (VOC's) given in the Section 4 – Gasoline Unit Emission Limits table.

12. **PERMIT CANCELLATION.** The department may cancel any permit if the construction or modification is not commenced within one (1) year from the date of issuance or if, during the construction or modification, work is suspended for a total of one (1) year. (20.11.41.19.A and B NMAC)

13. **INFORMATION SUBMITTALS [Air Quality Program contact numbers: (505) 768-1972 (voice); 1-800-659-8331 (NM Relay)].**

- Completed forms can be hand delivered to 1 Civic Plaza – Room 3047 (8:00am – 4:30pm Mon. – Fri. except city holidays) or can be mailed to:

Albuquerque Environmental Health Department
Air Quality Program
Permitting Section
P.O. Box 1293
Albuquerque, New Mexico 87103

- Test protocols and compliance test reports shall be submitted to:

Albuquerque Environmental Health Department
Air Quality Program
Attention Enforcement Supervisor
P.O. Box 1293
Albuquerque, New Mexico 87103

- All reports shall be submitted to:

Albuquerque Environmental Health Department
Air Quality Program
Attention Compliance Officer
P.O. Box 1293
Albuquerque, New Mexico 87103

UMF #6

CITY OF ALBUQUERQUE

Environmental Health Department
Mary Lou Leonard, Director



April 30, 2014

**RE: Air Quality Permit No. 3135 ~ Smith's Food & Drug Centers, Inc.
(Smith's) – Authority-to-Construct Permit – 6941 Montgomery Blvd. NE**

Dear Interested Person:

Environmental Health Dept.

Air Quality Program

PO Box 1293

Albuquerque, NM 87103

www.cabq.gov

This letter is to notify you that the Air Quality Program (Air Program) of the City of Albuquerque (City) Environmental Health Department (Department) has issued the above referenced permit. Smith's had submitted an application requesting a permit that would authorize Smith's to have an annual gasoline throughput of 7,000,000 gallons per year for a fuel dispensing (gas) station proposed to be located at 6941 Montgomery Blvd NE (Smith's Gas Station).

Applicable Laws and Regulations for Air Quality Permits

When the Department receives an application for an air quality permit, it can only deny the application for the permit if (1) it will not meet the standards, rules or requirements of the Clean Air Act or the Air Quality Control Act (Air Act); (2) it will cause or contribute to an exceedance of an air quality standard; or (3) it will violate any other provision of the Clean Air Act or the Air Act. NMSA 1978, § 74-2-7(C)(1). As such, in reaching a decision on the permit, the Air Program can only address air quality issues and only to the extent authorized by the Clean Air Act, the Air Act, and applicable air quality ordinances and regulations. An air quality permit cannot address zoning, non-air-quality building issues, road and traffic control and public safety. Issues not related to air quality have been brought to the attention of the appropriate City departments by written, telephonic, and oral communication by interested participants and, in some cases, communication by Air Program staff.

The decision of the Department regarding Smith's application for a permit is based on the requirements of the Clean Air Act, the Air Act, and the applicable air quality ordinances and regulations. The applicable regulations include, in addition to the substantive regulations discussed below, 20.11.41 NMAC (2002), *Authority to Construct* also known as "Part 41."

AR 79

Regulation of Air Quality at Gas Stations

The primary regulated air pollutants emitted at gas stations are volatile organic compounds (VOCs). There are no ambient air standards for VOCs. VOCs are not controlled in the same manner as pollutants that are subject to the national ambient air quality standards (NAAQS). Therefore, a VOC emission standard cannot be "exceeded" in the same manner as a NAAQS standard. Air dispersion modeling is not required by the United States Environmental Protection Agency (EPA) when an application for a gas station air quality permit or modification is submitted to the Air Program. Unlike NAAQS, there are no enforceable ambient VOC emission standards that can be the basis for denying a VOC permit or an application for modification of an existing gas station VOC permit pursuant to Section 74-2-7(C)(1).

Instead, for purposes of air quality, VOC emissions from gas stations are controlled by using federally-required "performance based" standards, which are found at 40 CFR 63, Subpart CCCCCC and locally-required 20.11.65 NMAC and 20.11.64 NMAC. Performance based standards for a gas station like the Smith's Gas Station proposed at 6941 Montgomery Blvd NE include vapor recovery systems and work practice standards. The VOC tons-per-year numbers in such permits are not emission maximums. Rather, they are used for calculating emission fees pursuant to 20.11.2 NMAC.

Public Notice and Public Information Hearing

Once Smith's permit application was complete, the Air Program published notice of the application in the Albuquerque Journal and sent copies of the information from the public notice to surrounding neighborhood associations and to permitting staff at EPA Region 6 and the New Mexico Environment Department (NMED). The Air Program received requests for a Public Information Hearing (PIH) and published notice of the April 3, 2014 PIH in the Albuquerque Journal and sent approximately 65 letters providing notice of the PIH. The Air Program placed the following documents on the Department's Air Program website for public access: the Smith's air quality permit application, the draft Smith's Gas Station air quality Permit No. 3135; the PIH flyer; and a summary of federal regulations controlling air emissions from gas stations.

The Air Program held the PIH on April 3, 2014 to solicit relevant testimony and documents and to provide an opportunity for interested participants to ask questions. City staff and supervisory/management personnel, including the Air Program permit writer assigned to primary review of the Smith's permit application, attended the PIH.

As explained by the Hearing Officer at the PIH, the PIH was not an adjudicatory hearing and the Hearing Officer has not made a decision or recommendation relating to the application. Before the Department made a decision regarding Smith's application, the Department considered all written comments and evidence, testimony, exhibits and questions supporting and opposing the permit application. The Department considered whether the application complied with the technical requirements of the Clean Air Act, the Air Act, and applicable air quality ordinances and regulations. Public opinion regarding air quality issues, wider public health and environmental issues, and additional public safety and welfare issues were duly noted and, in some cases, conveyed to City Departments with jurisdiction over the particular issue.

Application Review Process

As a part of the application review process, the Air Program established an "administrative record" regarding the permit application. The administrative record includes the application, evidence submitted by the applicant, all written comments and evidence received by the Air Program, and all written and oral questions, testimony and exhibits submitted at the PIH (the PIH record). Before the Department made a decision, Air Program staff reviewed the administrative record.

As stated by the Hearing Officer at the PIH, and as authorized by Subsection C of 20.11.41.15 NMAC (2002), the Department can make three different decisions regarding an application for an air quality permit or modification.

1. The permit may be issued as requested in the application;
2. The permit may be issued with additional authorized air quality conditions not requested in the application; or
3. The permit may be denied as authorized by the Air Act or the applicable air quality ordinances or regulations

The Air Program determined the permit application met all requirements of the Clean Air Act, the Air Act, and the applicable air quality ordinances and regulations. In addition, the Air Program determined that, if the Smith's Gas Station is operated as required by Permit No. 3135, it will satisfy all applicable air quality laws and regulations.

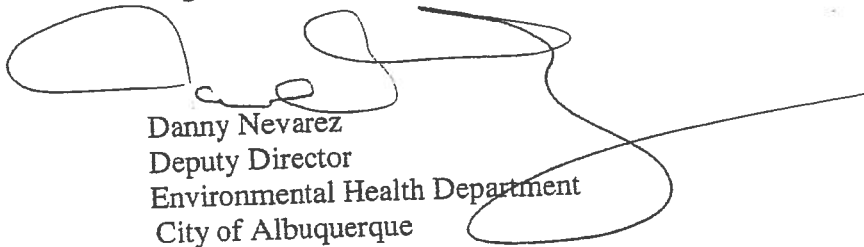
Decision

The Department issued Air Quality Permit No. 3135 effective April 30, 2014. If you have any questions concerning this permit issuance, or the permitting process, please contact Regan Eyerman at (505)767-5625 or at reyerman@cabq.gov.

Appeal Process

Persons who participated in a permitting action and who are adversely affected may file a petition for a hearing on the merits before the Air Board, as provided by NMSA 1978, § 74-2-7(H) and 20.11.81 NMAC, *Adjudicatory Procedures-AQCB available at: <http://www.nmcpr.state.nm.us/nmac/parts/title20/20.011.0081.htm>*. At the time the petition is filed, the board hearing fee of \$125 shall be paid. 20.11.2.22(C) NMAC and 20.11.81.14(B)(1) NMAC.

Regards,



Danny Nevarez
Deputy Director
Environmental Health Department
City of Albuquerque

cc: File

Mailing List			
Name	Address	City, State	Zip Code
Greg Schultz	5327 Montgomery Blvd NE	Albuquerque, NM	87109
Christy Maloney	1401 Pennsylvania	Albuquerque, NM	87110
Dean Metzger	11600 Academy Rd	Albuquerque, NM	87111
Steve Marchtall	3613 Georgia St	Albuquerque, NM	87110
Don Wan	6250 Indian School Rd NE	Albuquerque, NM	87110
Steve Stevens	6128 Quemado Dr NE	Albuquerque, NM	87109
Karol Smith	4135 Alcazar NE	Albuquerque, NM	87109
Brandy McPalmer	6329 Salem	Albuquerque, NM	87112
Victor Valterra	6805 Prairie Rd NE	Albuquerque, NM	87109
Virginia Johnston	6034 Katson Ave NE	Albuquerque, NM	87109
Ralph Johnson	6601 Arroyo del Oso NE	Albuquerque, NM	87109
Bill Strube	2899 Monroe St NE	Albuquerque, NM	87110
John Yount	3020 San Pablo St NE	Albuquerque, NM	87110
Ron Amberg	7605 Gladden Ave NE	Albuquerque, NM	87110
Rose Amberg	7605 Gladden Ave NE	Albuquerque, NM	87110
Wendy Wagner	4200 Spanish Bit NE	Albuquerque, NM	87111
Ron Clark	11475 Ranchitos NE	Albuquerque, NM	87122
Melony Danielson	3901 Georgia St NE	Albuquerque, NM	87110
Amy Woolley	6709 Arroyo del Oso Ave NE	Albuquerque, NM	87109
Mine Dubay	7400 Eagle Crest Ave NE	Albuquerque, NM	87113
Randy Deitite	13404 Osage Orange Rd NE	Albuquerque, NM	87111
Noi Perkins	4152 Alcazar St NE	Albuquerque, NM	87109
Steven A Washburn	3901 Georgia St NE	Albuquerque, NM	87110
Bernadette Salazar	3303 Honeck Rd SW	Albuquerque, NM	87105
Michael Montroy	6921 Montgomery NE	Albuquerque, NM	87109
Elizabeth Goldfarb	6921 Montgomery NE	Albuquerque, NM	87109
Shiela Freed	6921 Montgomery NE	Albuquerque, NM	87109
Travis Snow	4001 Louisiana Blvd NE	Albuquerque, NM	87110
Margaret Janson	6921 Montgomery Blvd NE	Albuquerque, NM	87109
Jeff Livingston	7208 Carriveau Ave NE	Albuquerque, NM	87110
Sarah Williams	1416 Wilmoore Dr SE	Albuquerque, NM	87106
Carmela Hughes	4001 Montgomery Blvd NE	Albuquerque, NM	87109

Joe Toledo	3232 La Ronda Pl NE	Albuquerque, NM	87110
Eric Shelton	7001 Montgomery Blvd NE	Albuquerque, NM	87109
Janson Bishop	7001 Montgomery Blvd NE	Albuquerque, NM	87109
Barbara Courtney	7001 Montgomery Blvd NE	Albuquerque, NM	87109
Priscilla Peck	7001 Montgomery Blvd NE	Albuquerque, NM	87110
Mckaila Goodart	7100 Natalie Ave NE	Albuquerque, NM	87110
Susan Labarge	6910 Natalie Ave NE	Albuquerque, NM	87109
MaryAnn Roberts	6940 Montgomery Blvd NE	Albuquerque, NM	87109
David Ruiz	6940 Montgomery Blvd NE	Albuquerque, NM	87109
Andrew Williams	6940 Montgomery Blvd NE	Albuquerque, NM	87109
Ella Maloney	6940 Montgomery Blvd NE	Albuquerque, NM	87111
William Lock	5009 Miguel Ct NE	Albuquerque, NM	87110
Dave Heintzleman	3209 Palomas Dr Ave	Albuquerque, NM	87110
Rachel Bauer	3413 Georgia St NE	Albuquerque, NM	87110
David Mason	3633 Georgia St NE	Albuquerque, NM	87109
Rodrigo Chavez	5723 Montgomery NE	Albuquerque, NM	87109
Matthew Bacon	7303 Montgomery NE	Albuquerque, NM	87109
Jennifer Sinclair	6805 Prairie Rd NE	Albuquerque, NM	87109
Sachy Greenbaum	6703 Prairie Rd NE	Albuquerque, NM	87111
Brian Anderson	11100 Double Eagle NE	Albuquerque, NM	87109
Bobby Herrera	7500 Montgomery Blvd NE	Albuquerque, NM	87114
Gearld Krontz	3809 Diablo Trail Pl	Albuquerque, NM	87109
Brad Mickelson	7524 Prairie Rd NE	Albuquerque, NM	87110
Steven Petropoulos	2938 Kentucky St NE	Albuquerque, NM	87109
Brenda Muller	4209 Louisiana Blvd NE	Albuquerque, NM	87110
Kay Deuiston	7108 Kiowa Ave NE	Albuquerque, NM	87114
Pete Ruiz	6601 Diablo Trail Pl	Albuquerque, NM	87110
Steve S Torres	3550 Old Airport Rd NW	Albuquerque, NM	87110
Rob Martin	6113 Mossman Pl NE	Albuquerque, NM	87110
Victor Burmwatt	6201 Natalie Ave NE	Albuquerque, NM	87110
Joe Azar	8000 Palo Duro	Albuquerque, NM	87109
Orlando Sanchez	6916 Montgomery Blvd NE	Albuquerque, NM	87103
Tim Atler, Sutin Thayer & Brown	P. O. Box 1945	Albuquerque, NM	87111
Andy Carrasco	6505 Cypress Point Way NE	Albuquerque, NM	87111

UMF #7

STATE OF NEW MEXICO
ALBUQUERQUE-BERNALILLO COUNTY
AIR QUALITY CONTROL BOARD

RECEIVED
ENVIRONMENTAL HEALTH
14 JUN -2 PM 1:03

IN THE MATTER OF THE PETITION
FOR A HEARING ON THE MERITS
REGARDING AIR QUALITY PERMIT
NO. 3135

PETITION FOR HEARING

The Petitioners in this matter, Margaret Freed, Mary Ann Roberts, and Pat Toledo, by and through undersigned counsel of record, pursuant to Section 74-2-7 NMSA 1978 and 20.11.81 NMAC, hereby petition the City of Albuquerque Environmental Health Department (EHD) and the Albuquerque-Bernalillo County Air Quality Control Board for a hearing as authorized by law with reference to Air Quality Permit No. 3135 issued effective April 30, 2014 to Smith's Food & Drug Centers, Inc. (Smith's). The notification letter and the permit are attached as Exhibit 1. The permit authorizes Smith's to have an annual throughput of 7 million gallons per year at a fuel dispensing station Smith's proposes to build at 6941 Montgomery Blvd. NE., Albuquerque, New Mexico. In accordance with 20.11.81.14 NMAC, the Petitioners provide the following information.

- I. **Petitioners' names and addresses**
 - A. Margaret M. Freed
6921 Montgomery Blvd. NE
Albuquerque, New Mexico 87109
505-884-1449
 - B. Mary Ann Roberts
6940 Montgomery Blvd. NE
Albuquerque, New Mexico 87109
505-881-9399
 - C. Pat Toledo
3404 Calle Del Rancho NE

Albuquerque, New Mexico 87106
505-256-0848

II. Petitioners' participation in permitting action and how Petitioners were adversely affected by permitting action

Petitioner Margaret Freed owns property located at 6921 Montgomery Blvd. NE, which is adjacent to the property on which Smith's proposes to construct the fuel dispensing station.

Petitioner Mary Ann Roberts owns property located at 6940 Montgomery Blvd. NE, which is directly across the street from the property on which Smith's proposes to construct the fuel dispensing station.

Petitioner Pat Toledo's 94-year-old father, Joe Toledo, resides at 3232 La Ronda NE, close to the property on which Smith's proposes to construct the fuel dispensing station. Pat Toledo provides regular assistance and care for his father, is regularly in the area of the proposed fuel dispensing station and is concerned regarding the impact of the fuel dispensing station on his father's property and quality of life.

Each of the Petitioners participated in the April 3, 2014 Public Information Hearing (PIH).

Each of the Petitioners are adversely affected by the permitting action because the Air Program refused and failed to take into consideration quality-of-life concerns raised by the participants at the PIH. In addition, each of the Petitioners are likely to be adversely affected by increased VOC emissions, odors, fumes, increased traffic and other negative impacts on their property and quality of life resulting from the construction of the Smith's fuel dispensing station at the proposed location. In addition, see Exhibit 2, attached hereto, from Petitioner Margaret Freed.

III. Specific permitting action appealed from, permitting action to which Petitioners object and factual and legal basis of Petitioners' objections to the permitting action

The Petitioners are appealing the issuance of Permit 3135, issued to Smith's on April 30, 2014, with notice provided to Petitioners by letter dated April 30, 2014. (See Exhibit 1, attached). The Petitioners object to the issuance of the permit allowing for a throughput of 7 million gallons at a fuel dispensing station proposed to be constructed at 6941 Montgomery NE, Albuquerque, New Mexico. Permit No. 3135 was issued pursuant to §20.11.41 NMAC, Authority to Construct. The PIH was held on April 3, 2014 and approximately 25 people attended the meeting in opposition to the issuance of the permit, with approximately 14 people providing public comments opposing the issuance of the permit. Approximately 12 Smith's employees appeared at the PIH in support of the permit issuance. In addition, a petition with over 100 signatures objecting to the issuance of the permit was submitted to the administrative record.

The purpose of regulatory provisions regarding public notice and hearings is to ensure that persons with an interest in environmental permitting matters be allowed to participate before a final decision is made. *Colonias Dev. Council v. Rhino Enviro. Services*, 2005-NMSC-024, 21, 138 N.M. 133. The New Mexico Supreme Court has recognized that "the public plays a vital role" in an administrative environmental permitting process and must be allowed a reasonable opportunity to be heard. *Id.* Pursuant to the *Colonias* decision, adverse impacts on a community's social well-being and quality of life may be raised during public hearings concerning permit applications and the final decision maker must take such concerns into consideration when deciding whether to approve or deny a permit. *Id.* at ¶24. Quality of life issues may include concerns about public health and welfare and other impacts on the

community not addressed by specific technical regulations. *Id.* Such concerns may also include impacts on private property. Adverse public testimony, whether in the form of technical testimony or public comment, must be taken into account when reaching a final decision. *Id.* at ¶¶24, 41, 43. The New Mexico Supreme Court specifically found that the hearing officer was incorrect in stating that the only determination to be made was whether the permit application met the technical requirements of the regulations. *Id.* at ¶¶7, 8, 24.

The Air Quality Board has already held, in regard to Smith's Permit No. 2037-M1 for the Smith's fuel dispensing station located at 1313 Carlisle Blvd. NE, Albuquerque, NM, that the Air Quality Act and regulations require permitting decisions to take into account quality-of-life issues. The Air Quality Act mandates that the Board "shall prevent or abate air pollution." NMSA §74-2-5. In addition, Part 41 of the Air Quality Control Board Regulations, which governs authority to construct permits, states that the objective of the part "is to insure that new facilities or modified existing facilities will not emit air pollution, which will cause violations of air pollution control regulations upon operation following construction. This procedure will protect the source owner's investment as well as uphold public concern and desire for input prior to commencement of air pollution sources in Bernalillo County." 20.11.41.6 NMAC. The Air Quality Act and the Board's regulations, as well as the Board's decision in the Carlisle permitting matter, clearly express that the issuance of permits must be made in the context of impacts to public welfare and the reasonable use of property.

In issuing Permit No. 3135, the City of Albuquerque Air Quality Program (Air Program) refused to take into consideration the concerns raised by the public comments at the PIH. The Air Program stated: "An air quality permit cannot address zoning, non-air-quality building issues, road and traffic control and public safety." (Exhibit 1, attached hereto). The Program

further stated: “Before the Department made a decision regarding Smith’s application, the Department considered all written comments and evidence, testimony, exhibits and questions supporting and opposing the permit application. The Department considered whether the application complied with the technical requirements of the Clean Air Act, the Air Act, and applicable air quality ordinances and regulations. Public opinion regarding air quality issues, wider public health and environmental issues, and additional public safety and welfare issues were duly noted and, in some cases, conveyed to City Departments with jurisdiction over the particular issue.” *Id.*

Permit No. 3135 is for a fuel dispensing station that has not yet been built. Smith’s proposes to build the station at the intersection of Montgomery and Louisiana, one of busiest intersections in New Mexico. There are already two gas stations at the intersection, one of which is owned by Petitioner Mary Ann Roberts. The Chevron station owned by Ms. Roberts has an annual throughput of 800,000 gallons, as compared to the 7 million gallons approved for the proposed Smith’s station. The location borders residential areas and is close to Cleveland Middle School. The construction of the Smith’s station will result in significantly increased traffic, which will cause an increase in air pollution. The property owned by Ms. Freed is immediately adjacent to the proposed Smith’s location and would be impacted by the VOCs, fumes and increased traffic. The proposed fuel dispensing station would have negative and cumulative impacts on the quality of life in the area and on the health, welfare and safety of people who own property, live, go to school and regularly travel in the area. These and other concerns were raised at the PIH. Exhibit 2, attached, includes the specific concerns of Petitioner Margaret Freed.

The Air Program's refusal to take into consideration issues regarding quality of life, public health, impacts to private property and impacts to the community is inconsistent with the holding in *Colonias*, with the applicable statutes and regulations, and with the Board's decision in the Carlisle permitting matter. "Duly noting" the concerns raised by the public is insufficient. The Air Program is incorrect in stating that they may only rely on technical requirements. If the concerns of the public are not addressed, including quality of life issues, impacts to the community, and impacts to property, then the requirements for public participation are merely a pro forma process that has no meaning and no relation to the actual permit decision. Public participation is rendered meaningless, despite statutory and regulatory provisions for public input and numerous decisions by the New Mexico appellate courts emphasizing the importance of public participation in environmental permitting.

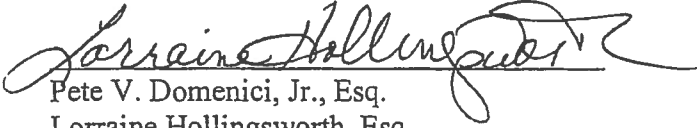
IV. Remedies sought by Petitioners, legal basis therefor, and basis for jurisdiction of Board in this matter

Pursuant to §74-2-7 NMSA and 20.11.81 NMAC, the Petitioners, persons who participated in the permitting action before the Department, request that the Air Quality Board hold an evidentiary hearing on Permit No. 3135, including but not limited to the failure of the Air Quality Program to properly take into consideration public comments and concerns regarding quality of life and impacts on the community, impacts on air quality, cumulative effects of the permitting action, impacts on private property and other issues raised by the public, including those raised by Petitioner Margaret Freed, in Exhibit 2, attached hereto. As stated above, pursuant to *Colonias Dev. Council v. Rhino Enviro. Services*, 2005-NMSC-024, 138 N.M. 133, NMSA §74-2-5., 20.11.41.6 NMAC, and the Board's decision in the Smith's Carlisle permitting matter, permitting decisions must take into consideration community concerns and cannot rely solely on technical considerations. The requested remedy is within the Board's jurisdiction to

review decisions made by the Air Quality Program and to prevent and abate air pollution set forth in §74-2-5 and the applicable air quality regulations.

Respectfully Submitted,

DOMENICI LAW FIRM, P.C.



Pete V. Domenici, Jr., Esq.

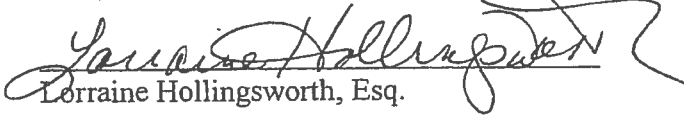
Lorraine Hollingsworth, Esq.

320 Gold Ave. SW, Suite 1000

Albuquerque, New Mexico 87102

(505) 883-6250

I hereby certify that a true and correct copy of the foregoing Petition for Hearing was served on the Albuquerque Environmental Health Department, Mary Lou Leonard, Director, and Felicia Orth, counsel for the Board, on the 2nd day of June, 2014.



Lorraine Hollingsworth, Esq.

VERIFICATION

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

Margaret M. Freed, being of legal age, hereby affirm and testify to the truth of the information contained in the foregoing Petition for Hearing.

Margaret M. Freed
Margaret M. Freed

SUBSCRIBED AND SWORN TO before me on this 2nd day of June
2014, by Margaret M. Freed

Brandi Sanchez
Notary Public

My Commission Expires:

2/13/14



OFFICIAL SEAL
Brandi J. Sanchez
NOTARY PUBLIC-STATE OF NEW MEXICO
My commission expires: 2/13/14

VERIFICATION

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

Mary Ann Roberts, being of legal age, hereby affirm and testify to the truth of the information contained in the foregoing Petition for Hearing.

Mary Ann Roberts
~~Mary Ann Roberts~~

SUBSCRIBED AND SWORN TO before me on this 2nd day of June
2014, by ~~Brandi J. Sanchez~~ Mary Ann Roberts

Brandi J. Sanchez
Notary Public

My Commission Expires:

2/13/16



OFFICIAL SEAL
Brandi J. Sanchez
NOTARY PUBLIC-STATE OF NEW MEXICO

My commission expires: 2/13/16

VERIFICATION

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

Pat Toledo, being of legal age, hereby affirm and testify to the truth of the information contained in the foregoing Petition for Hearing.

Pat Toledo

Pat Toledo

SUBSCRIBED AND SWORN TO before me on this 2nd day of June
2014, by Pat Toledo.

Brandi Sanchez
Notary Public

My Commission Expires:

2/13/14



OFFICIAL SEAL
Brandi J. Sanchez
NOTARY PUBLIC-STATE OF NEW MEXICO

My commission expires: 2/13/14

CITY OF ALBUQUERQUE

Environmental Health Department
Mary Lou Leonard, Director



April 30, 2014

**RE: Air Quality Permit No. 3135 ~ Smith's Food & Drug Centers, Inc.
(Smith's) – Authority-to-Construct Permit – 6941 Montgomery Blvd. NE**

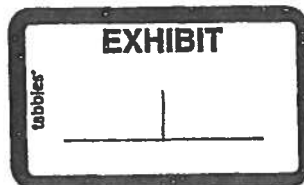
Dear Interested Person:

This letter is to notify you that the Air Quality Program (Air Program) of the City of Albuquerque (City) Environmental Health Department (Department) has issued the above referenced permit. Smith's had submitted an application requesting a permit that would authorize Smith's to have an annual gasoline throughput of 7,000,000 gallons per year for a fuel dispensing (gas) station proposed to be located at 6941 Montgomery Blvd NE (Smith's Gas Station).

Applicable Laws and Regulations for Air Quality Permits

When the Department receives an application for an air quality permit, it can only deny the application for the permit if (1) it will not meet the standards, rules or requirements of the Clean Air Act or the Air Quality Control Act (Air Act); (2) it will cause or contribute to an exceedance of an air quality standard; or (3) it will violate any other provision of the Clean Air Act or the Air Act. NMSA 1978, § 74-2-7(C)(1). As such, in reaching a decision on the permit, the Air Program can only address air quality issues and only to the extent authorized by the Clean Air Act, the Air Act, and applicable air quality ordinances and regulations. An air quality permit cannot address zoning, non-air-quality building issues, road and traffic control and public safety. Issues not related to air quality have been brought to the attention of the appropriate City departments by written, telephonic, and oral communication by interested participants and, in some cases, communication by Air Program staff.

The decision of the Department regarding Smith's application for a permit is based on the requirements of the Clean Air Act, the Air Act, and the applicable air quality ordinances and regulations. The applicable regulations include, in addition to the substantive regulations discussed below, 20.11.41 NMAC (2002), *Authority to Construct* also known as "Part 41."



Environmental Health Dept.

Air Quality Program

P.O. Box 1293

Albuquerque, NM 87103

www.cabq.gov

Regulation of Air Quality at Gas Stations

The primary regulated air pollutants emitted at gas stations are volatile organic compounds (VOCs). There are no ambient air standards for VOCs. VOCs are not controlled in the same manner as pollutants that are subject to the national ambient air quality standards (NAAQS). Therefore, a VOC emission standard cannot be "exceeded" in the same manner as a NAAQS standard. Air dispersion modeling is not required by the United States Environmental Protection Agency (EPA) when an application for a gas station air quality permit or modification is submitted to the Air Program. Unlike NAAQS, there are no enforceable ambient VOC emission standards that can be the basis for denying a VOC permit or an application for modification of an existing gas station VOC permit pursuant to Section 74-2-7(C)(1).

Instead, for purposes of air quality, VOC emissions from gas stations are controlled by using federally-required "performance based" standards, which are found at 40 CFR 63, Subpart CCCCCC and locally-required 20.11.65 NMAC and 20.11.64 NMAC. Performance based standards for a gas station like the Smith's Gas Station proposed at 6941 Montgomery Blvd NE include vapor recovery systems and work practice standards. The VOC tons-per-year numbers in such permits are not emission maximums. Rather, they are used for calculating emission fees pursuant to 20.11.2 NMAC.

Public Notice and Public Information Hearing

Once Smith's permit application was complete, the Air Program published notice of the application in the Albuquerque Journal and sent copies of the information from the public notice to surrounding neighborhood associations and to permitting staff at EPA Region 6 and the New Mexico Environment Department (NMED). The Air Program received requests for a Public Information Hearing (PIH) and published notice of the April 3, 2014 PIH in the Albuquerque Journal and sent approximately 65 letters providing notice of the PIH. The Air Program placed the following documents on the Department's Air Program website for public access: the Smith's air quality permit application, the draft Smith's Gas Station air quality Permit No. 3135; the PIH flyer; and a summary of federal regulations controlling air emissions from gas stations.

The Air Program held the PIH on April 3, 2014 to solicit relevant testimony and documents and to provide an opportunity for interested participants to ask questions. City staff and supervisory/management personnel, including the Air Program permit writer assigned to primary review of the Smith's permit application, attended the PIH.

As explained by the Hearing Officer at the PIH, the PIH was not an adjudicatory hearing and the Hearing Officer has not made a decision or recommendation relating to the application. Before the Department made a decision regarding Smith's application, the Department considered all written comments and evidence, testimony, exhibits and questions supporting and opposing the permit application. The Department considered whether the application complied with the technical requirements of the Clean Air Act, the Air Act, and applicable air quality ordinances and regulations. Public opinion regarding air quality issues, wider public health and environmental issues, and additional public safety and welfare issues were duly noted and, in some cases, conveyed to City Departments with jurisdiction over the particular issue.

Application Review Process

As a part of the application review process, the Air Program established an "administrative record" regarding the permit application. The administrative record includes the application, evidence submitted by the applicant, all written comments and evidence received by the Air Program, and all written and oral questions, testimony and exhibits submitted at the PIH (the PIH record). Before the Department made a decision, Air Program staff reviewed the administrative record.

As stated by the Hearing Officer at the PIH, and as authorized by Subsection C of 20.11.41.15 NMAC (2002), the Department can make three different decisions regarding an application for an air quality permit or modification.

1. The permit may be issued as requested in the application;
2. The permit may be issued with additional authorized air quality conditions not requested in the application; or
3. The permit may be denied as authorized by the Air Act or the applicable air quality ordinances or regulations

The Air Program determined the permit application met all requirements of the Clean Air Act, the Air Act, and the applicable air quality ordinances and regulations. In addition, the Air Program determined that, if the Smith's Gas Station is operated as required by Permit No. 3135, it will satisfy all applicable air quality laws and regulations.

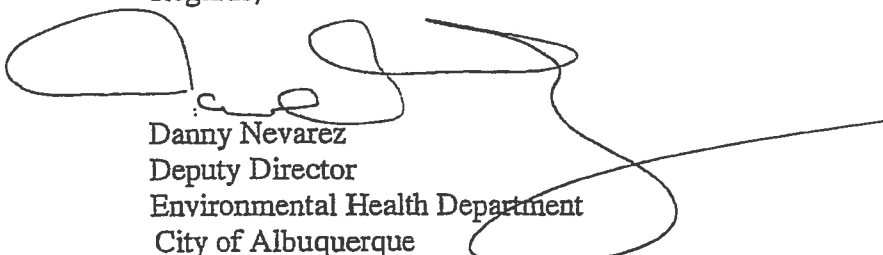
Decision

The Department issued Air Quality Permit No. 3135 effective April 30, 2014. If you have any questions concerning this permit issuance, or the permitting process, please contact Regan Eyerman at (505)767-5625 or at reyerman@cabq.gov.

Appeal Process

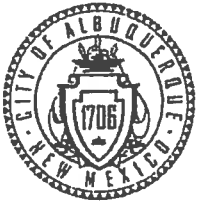
Persons who participated in a permitting action and who are adversely affected may file a petition for a hearing on the merits before the Air Board, as provided by NMSA 1978, § 74-2-7(H) and 20.11.81 NMAC, *Adjudicatory Procedures-AQCB available at: <http://www.nmcpr.state.nm.us/nmac/parts/title20/20.011.0081.htm>*. At the time the petition is filed, the board hearing fee of \$125 shall be paid. 20.11.2.22(C) NMAC and 20.11.81.14(B)(1) NMAC.

Regards,



Danny Nevarez
Deputy Director
Environmental Health Department
City of Albuquerque

cc: File



AIR QUALITY AUTHORITY TO CONSTRUCT PERMIT #3135
FACILITY CDS # NM/001/02260
Facility ID: FA0003035 Record ID: PR0006342



Richard J. Berry, Mayor

Mary Lou Leonard, Director

Issued to: Smith's Food & Drug Centers, Inc.
 Company Name

Certified Mail # 7010 3090 0001 4395 9326
 Return Receipt Requested

1550 South Redwood Road
 Mailing Address

Salt Lake City
 City

UT
 State

84104
 Zip

Responsible Official: Roger Gough, Construction Manager
 Authorized Representative

Pursuant to the New Mexico Air Quality Control Act, Chapter 74, Article 2 New Mexico Statutes Annotated 1978 (as amended); the Joint Air Quality Control Board Ordinance, 9-5-1 to 9-5-99 ROA 1994; the Bernalillo County Joint Air Quality Control Board Ordinance, Bernalillo County Ordinance 94-5 Albuquerque-Bernalillo County Air Quality Control Board (AQCB) regulation, Title 20, New Mexico Administrative Code (20 NMAC), Chapter 11, Part 41 (20.11.40 NMAC), Source Registration; and AQCB regulation, Title 20, NMAC, Chapter 11, Part 41 (20.11.41 NMAC), Authority to Construct,

Smith's Food & Drug Centers, Inc. ("permittee") is hereby issued this **AUTHORITY TO CONSTRUCT PERMIT** as a **NEW STATIONARY SOURCE**

This **AUTHORITY TO CONSTRUCT** Permit Number 3135 has been issued based on the review of the application information received by the Albuquerque Environmental Health Department (Department), Air Quality Program (Program) on November 5, 2013, which was deemed complete on December 3, 2013 and on the National Ambient Air Quality Standards, New Mexico Ambient Air Quality Standards, and Air Quality Control Regulations Albuquerque/Bernalillo County, as amended. As these standards and regulations are updated or amended, the applicable changes will be incorporated into Air Quality Permit Number 3135 and will apply to the facility. This facility is authorized to construct and operate the following type of process at:

Facility Name & Address	UTM Coordinates	Process Description	SIC	NAICS
Smith's Food & Drug Centers, Inc. 6941 Montgomery Blvd. NE Albuquerque, NM 87110	357035 Easting 3888720 Northing	Gasoline Dispensing Facility (GDF) ¹	5541	447190

¹Gasoline dispensing facility (GDF) means any stationary facility which dispenses gasoline into the fuel tank of a motor vehicle, motor vehicle engine, nonroad vehicle, or nonroad engine, including a nonroad vehicle or nonroad engine used solely for competition. These facilities include, but are limited to, facilities that dispense gasoline into on- and off-road, street, or highway motor vehicles, lawn equipment, boats, test engines, landscape equipment, generators, pumps, and other gasoline-fueled engines and equipment.

Issued on the 30th day of April, 2014
Israel L. Tovar Israel L. Tovar
 Print Name Sign Name

Air Quality Protection Programs - Permitting Section
 Air Quality Program
 City of Albuquerque Environmental Health Department

I. AUTHORITY TO CONSTRUCT PERMIT THRESHOLD (74-2-7.A.(1) NMSA). By regulation, the local board shall require a person intending to construct or modify any source, except as specifically provided by regulation, to obtain a construction permit from the local agency prior to construction or modification. This permit recognizes the construction and operation of the following equipment:

Unit Number	Unit Description	Storage Capacity in gallons	Installation Date	Product Stored	Minimum Required Emissions Control
1	Underground Storage Tank	20,000	2014	Regular Unleaded Gasoline	Stage I Vapor Balanced, Submerged Filling
2	Underground Storage Tank	8,000	2014	Premium Unleaded Gasoline	Stage I Vapor Balanced, Submerged Filling

¹ **GASOLINE HANDLING AND HOLDING AT RETAIL OR FLEET SERVICE STATIONS:** No person shall allow loading of gasoline into underground storage tank with greater than 3,000 gallons capacity, unless it is equipped with an approved vapor loss control system, including submerged fill pipe, in which the displaced vapors are either continuously contained or processed such that the emission of gasoline vapors to atmosphere do not exceed 1.15 pounds of gasoline per 1,000 gallons loaded into said tank. Liquid gasoline dispensing from the underground storage tank as well as momentary opening of the system for gasoline gauging purposes shall not be considered as vapor loss in the requirement of Section. [Albuquerque-Bernalillo Air Quality Control Board Regulation 20.11.65.15 NMAC, Volatile Organic Compounds.]

2. COMPLIANCE ASSURANCE.

- A. All air pollution emitting facilities within Bernalillo County are subject to all applicable Albuquerque/Bernalillo County Air Quality Control Regulations, whether listed in this permit or not.
- B. The issuance of an Authority to Construct permit does not relieve the Company from the responsibility of complying with the provisions of state air quality control act, federal clean air act, or any applicable regulations of the board. (20.11.41.17 NMAC)
- C. Any term or condition imposed by the department in an Authority to Construct permit shall apply to the same extent as a regulation of the board (20.11.41.18.C NMAC)
- D. Whenever two or more parts of the Air Quality Control Act, or the laws and regulations in force pursuant to the Act, limit, control or regulate the emissions of a particular air contaminant, the more restrictive or stringent shall govern.
- E. The department is authorized to issue a compliance order requiring compliance and assessing a civil penalty not to exceed Fifteen Thousand (\$15,000) per day of noncompliance for each violation, commence a civil action in district court for appropriate relief, including a temporary and permanent injunction. (74-2-12 NMSA).

3. SUBSTITUTION. Substitution of equipment is authorized provided the equipment has the same or lower process capacity as the piece of equipment being substituted. The department shall be notified in writing within 15 days of equipment substitution. Equipment that is substituted shall comply with requirements in the Section 4 Gasoline Unit Emission Limits table.

4. GASOLINE UNIT EMISSION LIMITS. Allowable monthly and annual gasoline throughput. Allowable ton per year (tpy) emissions.

Unit	Unit Description	Allowable Average Monthly Throughput of Gasoline (in gallons) ¹	Allowable Annual Throughput of Gasoline (in gallons) ²	Allowable Annual Emissions of Volatile Organic Compounds (VOC's) ² (in tons per year)
1	Underground Storage Tank	≥100,000	For Stage I Vapor Recovery 7,000,000	45.5 tons per year
2	Underground Storage Tank			

¹ Monthly throughput means the total volume of gasoline that is loaded into, or dispensed from, all gasoline storage tanks at each Gasoline Dispensing Facility (GDF) during a month. Monthly throughput is calculated by summing the volume of gasoline loaded into, or dispensed from, all gas storage tanks at each GDF during the current day, plus the total volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at GDF during the previous 364 days, and then dividing that sum by 12.

² Based on the annual gasoline throughput requested in the permit application. There is no restriction on individual tank throughput.

5. EMISSIONS INVENTORY REQUIREMENTS (20.11.47 NMAC). Subsection 20.11.47.14.A.(1) – Applicability - requires an emissions inventory of any stationary source in Bernalillo county that has an active permit issued pursuant to 20.11.41 NMAC Authority to Construct. Subsection 20.11.47.14.B.(1) – Reporting Requirements – requires the submittal of an emissions inventory report annually. Therefore, an annual emissions inventory (in pounds per calendar year) shall be submitted to the department by March 15 each year by: multiplying the actual, annual gallons of gasoline throughput for the previous calendar year (January 1st through December 31st) for Units 1 a in the Section 4 Gasoline Unit Emission Limits table above, by 0.013 pounds/gallon if Stage I Vapor Recovery or 0.0031 pounds/gallon if Stage II Vapor Recovery. An electronic emission inventory form is available at cabq.gov/airquality, under Business Resources - Business Application Permits and Forms.

6. MODIFICATION. Any future physical changes or changes in the method of operation which result in an increase in the pre-controlled emission may constitute a modification. Change in the method of control of emissions or in the character of emissions shall not be made unless submitted to the department as a modification to this permit. 20.11.41.7.H NMAC defines proposed changes to a facility that may constitute a permit modification. Compliance will be based on department inspections and the submittal of a new permit application for any modification. No modification shall begin to issuance of a permit and shall be processed in accordance with 20.11.41 NMAC.

7. MONITORING and RECORDKEEPING (20.11.41.18.B.(8)NMAC). Monitor and maintain a log of the total monthly gasoline throughput at the facility. These records must be retained for the most recent five-year period for the facility.

8. REPORTING.

- A. The following reporting requirements, in accordance with 20.11.41.18, 20.11.41.20, 20.11.47 and 20.11.49 NMAC, to allow the department to determine compliance with the terms and conditions of the permit. Compliance will also be based on timely submittal of the reports. The permittee shall notify the department in writing of:
 - 1. Any change in control or ownership, within 15 days of the change in control or ownership. In the event of any such change in control or ownership, the permittee shall notify the succeeding owner of the permit. The permit conditions apply in the event of any change in control or ownership of the facility. At minimum, an administrative permit modification is required to address any change in control or ownership of the facility;
 - 2. Any substitution of equipment, within 15 days of equipment substitutions. Equipment may only be substituted if it has the same or lower process capacity as the piece of equipment being substituted, and there are no other federal, state, or local air quality permit requirements triggered by the introduction of the substituted piece of equipment. Substituted equipment shall comply with the Section 4 Gasoline Unit Emission Limits table;
 - 3. The annual (January 1 through December 31 of previous year) throughput of gasoline and emission inventory, by March 15 of every year; and
 - 4. Any breakdown of equipment or air pollution control devices or apparatus so as to cause emissions of air contaminants in excess of limits set by permit conditions. Any breakdown or abnormal operating conditions shall be reported to the department by submitting the following reports on file provided by the department:
 - a) Initial Report: The permittee shall file an initial report, no later than the end of the next regular business day after the time of discovery of an excess emission pursuant to 20.11.49.15.A.(1) NMAC;
 - b) Final Report: The permittee shall file a final report, no later than 10 days after the end of the excess emission. If the period of an excess emission extends beyond 10 days, the permittee shall submit the final report to the department within 72 hours of the date and time the excess emission ceased. This condition is pursuant to 20.11.49.15.A.(2) NMAC and 20.11.49.15.C NMAC; and

c) Alternative Reporting: If the facility is subject to the federal reporting requirements of 40 CFR Parts, 60, 61, or 63 and the federal requirements duplicate the requirements of 20.11.49.15 NMAC, then the federal reporting requirements shall suffice. This condition is pursuant to 20.11.49.15.D NMAC.

B. The emission of a regulated air pollutant in excess of the quantity, rate, opacity, or concentration specified in an air quality regulation or a condition that results in an excess emission is a violation of the air quality regulation or permit condition and may be subject to an enforcement action. The owner or operator of a source having an excess emission shall, to the extent practicable, operate the source, including associated air pollution control equipment, in a manner consistent with good air pollution control practices for minimizing emissions. This condition is pursuant to 20.11.49.14 NMAC

9. INSPECTION (74-2-13 NMSA).

A. The department may conduct scheduled and unscheduled inspections, and, upon presentation of credentials:

1. Shall have a right of entry to, upon, or through any premises on which an emission source is located or on which any records required to be maintained by regulations of the board or by any permit condition are located; and
2. May, at reasonable times:
 - a) Have access to and copy any records required to be established and maintained by regulations of the board or any permit condition;
 - b) Inspect any monitoring equipment and method required by regulations of the board or by any permit condition; and
 - c) Sample any emissions that are required to be sampled pursuant to regulation of the board or any permit condition.

B. Any credible evidence may be used to establish whether the facility has violated or is in violation of any regulation of the board, or any other provision of law. Credible evidence and testing shall include, but is not limited to 20.11.41.26.A and B NMAC as follows:

1. A monitoring method approved for the source pursuant to 20.11.42 NMAC, Operating Permits, and incorporated into an operating permit;
2. Compliance methods specified in the regulations, conditions in a permit issued to the facility, or other provision of law;
3. Federally enforceable monitoring or testing methods, including methods in 40 CFR parts 51, 60, 61, 63 and 75; and
4. Other testing, monitoring or information-gathering methods that produce information comparable to that produced by any CFR method approved by the department and the USEPA.

C. Compliance will be based on department inspections of the facility, reviews of production records, submission of appropriate permit applications for modification, and timely notification to the department regarding equipment substitutions and relocations.

10. FEDERAL RULEMAKING. In addition to Albuquerque-Bernalillo Air Quality Control Board Regulation 20.11.65 NMAC, *Volatile Organic Compounds*; 40 CFR Part 63, Subpart CCCCCC – National Emission Standards for Hazardous Air Pollutants for Source Categories: Gasoline Dispensing Facilities apply to this facility. Based on the requested annual throughput for gasoline, this facility's monthly throughput would amount to 100,000 gallons or more of gasoline. Therefore, the permittee shall ensure the applicable requirements of 40 CFR Part 63, Subpart CCCCCC, §63.11116, §63.11117, and §63.11118 are met as well as the Subpart A – General Provisions of 40 CFR Part 63.

A. GENERAL APPLICABLE REQUIREMENTS (§63.11116).

1. You must not allow gasoline to be handled in a manner that would result in vapor releases to the atmosphere for extended periods of time.
2. §63.11116(a) requires that measures to be taken include, but are not limited to, the following:
 - (a)(1) Minimize gasoline spills;
 - (a)(2) Clean up spills as expeditiously as practicable;
 - (a)(3) Cover all open gasoline containers and all gasoline storage tank fill-pipes with a gasketed seal when not in use: [§63.11116(d) Portable gasoline containers that meet the requirements of 40 CFR Part 59, Subpart F, are considered acceptable for compliance with this requirement];
 - (a)(4) Minimize gasoline sent to open waste collection systems that collect and transport gasoline to reclamation and recycling devices, such as oil/water separators.
3. §63.11116(b) requires that records be made available within 24 hours of request by the department to document your gasoline throughput.

B. SUBMERGED FILLING OF GASOLINE STORAGE TANKS (§63.11117).

1. §63.11117(b) requires that except as specified in §63.11117(c), you must only load gasoline into storage tanks at your facility by utilizing submerged filling, as defined in §63.11132, and as specified in paragraph (b)(2) of this section:
 - (b)(2) Submerged fill pipes installed after November 9, 2006, must be no more than 6 inches from the bottom of the storage tank.
4. §63.11117(c) Gasoline storage tanks with a capacity of < 250 gallons are not required to comply with the submerged fill requirements in paragraph (b) of this section.

C. CONTROL REQUIREMENTS.

1. §63.11118(b) requires that you must meet the requirements in paragraph (b)(1) of this section:
 - (b)(1) Each management practice in Table 1 of 40 CFR Part 63, Subpart CCCCCC that applies to your GDF by installing and operating a vapor balance system on your gasoline storage tanks that meets the following design criteria:
 - a) All vapor connections and lines on the storage tank shall be equipped with closures that seal upon disconnect;
 - b) The vapor line from the gasoline storage tank to the gasoline cargo tank shall be vapor-tight, as defined in § 63.11132;
 - c) The vapor balance system shall be designed such that the pressure in the tank truck does not exceed 18 inches water pressure or 5.9 inches water vacuum during product transfer;
 - d) The vapor recovery and product adaptors, and the method of connection with the delivery elbow, shall be designed so as to prevent the over-tightening or loosening of fittings during normal delivery operations;
 - e) If a gauge well separate from the fill tube is used, it shall be provided with a submerged drop tube that extends the same distance from the bottom of the storage tank as specified in § 63.11117(b);
 - f) Liquid fill connections for all systems shall be equipped with vapor-tight caps;
 - g) Pressure/vacuum (PV) vent valves shall be installed on the storage tank vent pipes. The pressure specifications for PV vent valves shall be: a positive pressure setting of 2.5 to 6.0 inches of water and a negative pressure setting of 6.0 to 10.0 inches of water. The total leak rate of all PV valves at an affected facility, including connections, shall not exceed 0.17 cubic foot per hour at a pressure of 2.0 inches of water and 0.63 cubic foot per hour at a vacuum of 4 inches of water;
 - h) The vapor balance system shall be capable of meeting the static pressure performance requirement of the following equation:

$$Pf = 2e^{-500.887/v}$$

Where:

Pf = Minimum allowable final pressure, inches of water.
 v = Total ullage affected by the test, gallons.
 e = Dimensionless constant equal to approximately 2.718.
 z = The initial pressure, inches water; and

i) If you own or operate a new or reconstructed GDF, or any storage tank(s) constructed after November 9, 2006, at an existing afl facility subject to § 63.11118, then you must equip your gasoline storage tanks with a dual-point vapor balance system as defined in § 63.11132 comply with the requirements of item 1 in Table 1.

2. The management practices specified in Table 1 of 40 CFR Part 63, Subpart CCCCCC are not applicable if you are complying with the requirements in § 63.11118(b)(2), except that if you are complying with the requirements in § 63.11118(b)(2)(i)(B), you must operate using manage practices at least as stringent as those listed in Table 1 of 40 CFR Part 63, Subpart CCCCCC.

D. PERFORMANCE TEST REQUIREMENTS.

Source Type	Initial Test Date	Additional Testing	Citation
New or Reconstructed Source (commenced construction after 11/9/06) with a monthly throughput ¹ of ≥ 100,000 gal/month	Upon startup after 09/23/08	Every three years §63.11120(a)	63.11113(d)(2)

¹ Monthly throughput means the total volume of gasoline that is loaded into, or dispensed from, all gasoline storage tanks at each Gas Dispensing Facility (GDF) during a month. Monthly throughput is calculated by summing the volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the current day, plus the total volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at each GDF during the previous 364 days, and then dividing that sum by 12.

1. §63.11118(e) - You must comply with the applicable testing requirements contained in §63.11120.

2. §63.11120(a) - Each owner or operator, at the time of installation, as specified in §63.11113(c), of a vapor balance system required in §63.11118(b)(1), and every 3 years thereafter, must comply with the requirements in paragraphs (a)(1) and (2) as follows:

(a)(1) - You must demonstrate compliance with the leak rate and cracking pressure requirements, specified in item 1(g) of Table 1 of 40 CFR Part 63, Subpart CCCCCC, for pressure-vacuum vent valves installed on your gasoline storage tanks using the test methods identified in paragraph (a)(1)(i) or paragraph (a)(1)(ii) as follows:

(a)(1)(i) - California Air Resources Board Vapor Recovery Test Procedure TP-201.1E,—Leak Rate and Cracking Pressure/Vacuum Vent Valves, adopted October 8, 2003 (incorporated by reference, see §63.14);

(a)(1)(ii) - Use alternative test methods and procedures in accordance with the alternative test method requirements in §63.7(f); and

(a)(2) - You must demonstrate compliance with the static pressure performance requirement, specified in item 1(h) of Table 1 of 40 CFR Part 63, Subpart CCCCCC, for your vapor balance system by conducting a static pressure test on your gasoline storage tanks using the test method identified in paragraph (a)(2)(i) or paragraph (a)(2)(ii) as follows:

(a)(2)(i) - California Air Resources Board Vapor Recovery Test Procedure TP-201.3,—Determination of 2-Inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities, adopted April 12, 1996, and amended March 17, 1999 (incorporated by reference, see §63.14); and

(a)(2)(ii) - Use alternative test methods and procedures in accordance with the alternative test method requirements in §63.7(f);

§63.11120(b) - Each owner or operator choosing, under the provisions of §63.6(g), to use a vapor balance system other than that described in Table 1 of 40 CFR Part 63, Subpart CCCCCC must demonstrate to the Administrator or delegated authority under paragraph §63.11131(a) of this subpart, the equivalency of their vapor balance system to that described in Table 1 of 40 CFR Part 63, Subpart CCCCCC using the procedures specified in paragraphs (b)(1) through (3) as follows:

(b)(1) - You must demonstrate initial compliance by conducting an initial performance test on the vapor balance system to demonstrate that the vapor balance system achieves 95 percent reduction using the California Air Resources Board Vapor Recovery Test Procedure TP-201.1,—Volumetric Efficiency for Phase I Vapor Recovery Systems, adopted April 12, 1996, and amended February 1, 2001, and October 8, 2003, (incorporated by reference, see §63.14);

(b)(2) - You must, during the initial performance test required under paragraph (b)(1) of this section, determine and document alternative acceptable values for the leak rate and cracking pressure requirements specified in item 1(g) of Table 1 of 40 CFR Part 63, Subpart CCCCCC and for the static pressure performance requirement in item 1(h) of Table 1 of 40 CFR Part 63, Subpart CCCCCC; and

(b)(3) - You must comply with the testing requirements specified in paragraph §63.11120 (a).

§63.11120(c) - Conduct of Performance Tests. Performance tests conducted for this subpart shall be conducted under such conditions as the Administrator specifies to the owner or operator based on representative performance (i.e., performance based on normal operating conditions) of the affected source. Upon request, the owner or operator shall make available to the Administrator such records as may be necessary to determine the conditions of performance tests.

§63.11126 - Each owner or operator subject to the management practices in §63.11118 shall report to the Administrator the results of volumetric efficiency tests required under §63.11120(b). Reports submitted under this paragraph must be submitted within 180 days of the completion of the performance testing.

E. NOTIFICATIONS.

1. §63.11118(f) requires that you must submit the applicable notifications as required under §63.11124.

2. §63.11124(b) requires that each owner or operator subject to the control requirements in §63.11118 must comply with paragraphs (b)(1) through (5) of §63.11124 as follows:

(b)(1) You must submit an Initial Notification that you are subject to this subpart upon startup. The notification must be submitted to the applicable EPA Regional Office and the delegated State authority as specified in §63.13. The Initial Notification must contain the information specified in paragraphs (b)(1)(i) through (iii) of this section as follows:

(b)(1)(i) the name and address of the owner and the operator;

(b)(1)(ii) the address (i.e., physical location) of the GDF; and

(b)(1)(iii) a statement that the notification is being submitted in response to this subpart and identifying the requirements specified in paragraphs (a) through (c) of §63.11118 that apply to you;

(b)(2) You must submit a Notification of Compliance Status to the applicable EPA Regional Office and the delegated State authority specified in §63.13, in accordance with the schedule specified in §63.9(h). The Notification of Compliance Status must be signed by a responsible person who must certify its accuracy and must indicate whether the source has complied with the requirements of this subpart. If your facility is in compliance with the requirements of this subpart at the time the Initial Notification required under paragraph (b)(1) of this section is due, the Notification of Compliance Status may be submitted in lieu of the Initial Notification provided it contains the information required under paragraph (b)(1) of this section:

(b)(4) You must submit a Notification of Performance Test, as specified in §63.9(e) [60 calendar days before the performance test scheduled to allow the Administrator to review and approve the site-specific test plan required under §63.7(c), if requested by the Administrator, and have an observer present during the test], prior to initiating testing required by §63.1120(a) and (b); and

(b)(5) You must submit additional notifications specified in §63.9, as applicable.

3. Sources in Bernalillo county that are in compliance with a 20.11.41 NMAC, Authority to Construct should be meeting the 20.11.41 NMAC, Volatile Organic Compounds requirements for submerged fill pipe and vapor loss control system for loading of fuel storage tanks and recovery, and therefore should not have to submit an Initial Notification or a Notification of Compliance Status. Since all gasoline dispensing facility permit through 20.11.41 NMAC, Initial Notifications and Notifications of Compliance Status are met through the permitting process and through the inspection program.

F. RECORDKEEPING.

1. §63.1118(g) - You must keep records and submit reports as specified in §§ 63.1125 and 63.1126.

2. §63.1125(a) - Each owner or operator subject to the management practices in §63.1118 must keep records of all tests performed under §63.1120(a) and (b).

3. §63.1125(b) - Records required under paragraph (a) of this section shall be kept for a period of 5 years and shall be made available for inspection by the Administrator's delegated representatives during the course of a site visit.

11. FEES (20.11.2 NMAC). Every owner or operator of a source that is required to obtain an Authority to Construct permit shall pay an annual emission fee pursuant to 20.11.2 NMAC. The annual emission fee for maintenance of this permit will be based on the greater of a base annual fee or a ton fee rate based on the per ton allowable annual emissions of volatile organic compounds (VOC's) given in the Section 4 – Gasoline Unit Emission Limits table.

12. PERMIT CANCELLATION. The department may cancel any permit if the construction or modification is not commenced within one (1) year from the date of issuance or if, during the construction or modification, work is suspended for a total of one (1) year. (20.11.41.19.A and B NMAC)

13. INFORMATION SUBMITTALS [Air Quality Program contact numbers: (505) 768-1972 (voice); 1-800-659-8331 (NM Relay)].

- Completed forms can be hand delivered to 1 Civic Plaza – Room 3047 (8:00am – 4:30pm Mon. – Fri. except city holidays) or can be mailed to:

Albuquerque Environmental Health Department
Air Quality Program
Permitting Section
P.O. Box 1293
Albuquerque, New Mexico 87103

- Test protocols and compliance test reports shall be submitted to:

Albuquerque Environmental Health Department
Air Quality Program
Attention Enforcement Supervisor
P.O. Box 1293
Albuquerque, New Mexico 87103

- All reports shall be submitted to:

Albuquerque Environmental Health Department
Air Quality Program
Attention Compliance Officer
P.O. Box 1293
Albuquerque, New Mexico 87103

Plaza Del Oso
6921 Montgomery Blvd. NE
Albuquerque, NM 87109

City of Albuquerque, Environmental Health Department
Air Quality Program, One Civic Plaza, Albuquerque, NM 87104

April 19, 2014

Re: Permit Application Request #3135

This permit request has been made by Smith's Food and Drug Centers, Inc. for 6941 Montgomery Blvd. NE, Albuquerque, NM 87109. The requested annual gasoline throughput of 7,000,000 gallons per year, results in 45.5 tons per year of emissions of Volatile Organic Compounds (VOC'S). The area in question is a C-2 zone and therefore their request is in violation of proper zoning regulations. This permit would be more properly permitted in an industrial (C-3) zone; not in this C-2 zone.

According to the summary of "Regulations Controlling Air Emissions from Gasoline Dispensing Facilities," the permit request is not for an "Area Source" but is instead for a "Major Source" due to their stated 45.5 tons of VOC's. The rules and regulations listed are for permitting "Area Source" and not for "Major Source" facilities.

Therefore, I request that the permit #3135 be denied and be re-submitted as an "Area Source" which is limiting emissions to less than 10 tons of VOC's per year.

My property, 6921 Montgomery Blvd. NE, is right next door to 6941 (the permit request property) where we would receive a large portion of the 45.5 tons per year of VOC's. Also, one block away is a middle school and their students and parents would be greatly affected. There is a group of 3/4 story apartment homes next door to the NW of the permit property. Were they notified of the requested permit #3135? I understand that some of Smith's gasoline dispensing facilities have been quite heavily fined by the City of Albuquerque and this ignores health issues.

Could you please expedite my request since I come late to this process because I was never notified that this permit had been requested or that the land had even been sold for this reason? I learned about the request from a concerned citizen the last week in March that the permit process was started 11-5-13. I attended the public meeting on April 3, 2014 which did not produce any answers to our concerns about health issues. I would think that because of the health issues of the very high amounts of pollutants that it would be required that I be notified of this permit request #3135.

I cannot stress enough how important it is for the City of Albuquerque not to make the mistake of permitting this "Major Source" gasoline dispensing facility in the wrong zone which will result in polluting the area with the very large amount of VOC's per year at the location proposed.

I do not believe that such a decision should be allowed to stand.

Sincerely,

Margaret M. Freed, Owner
Plaza Del Oso

cc: EPA, Region 6, 1445 Ross Avenue, Suite 1200, Dallas, Texas 76202-2733

EXHIBIT

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UMF #8

STATE OF NEW MEXICO
ALBUQUERQUE-BERNALILLO COUNTY AIR QUALITY CONTROL BOARD

IN THE MATTER OF THE PETITION
FOR A HEARING ON THE MERITS
REGARDING AIR QUALITY PERMIT
NO. 3135

Margaret M. Freed, Mary Ann Roberts
and Pat Toledo,

No. AQCB 2014-2

Petitioners.

NOTICE OF INTENT TO PRESENT TECHNICAL TESTIMONY

COME NOW the Petitioners, by and through undersigned counsel of record, and hereby submit their Notice of Intent (“NOI”) to Present Technical Testimony.

(A) Name of persons filing the NOI.

Petitioners Margaret M. Freed, Mary Ann Roberts and Pat Toledo

(B) Statement clarifying whether the person filing the statement supports or opposes the petition at issue.

The Petitioners support the petition at issue.

(C) Name of each witness to present technical testimony, estimated length of direct testimony and summary of anticipated direct testimony:

Dr. Dana (Rowan) Rowangould

1 hour estimated direct testimony

Summary of testimony

For a more detailed summary of Dr. Rowangould’s anticipated technical testimony including her affiliation, qualifications, educational and work background please find, *attached*, Rowangould Memorandum—**Exhibit 1**; CV—**Exhibit 2**.

Rowangould is expected to testify to:

- 1) the direct vehicle emission is a function of number of vehicles entering and exiting the station and the degree to which their entry and exit slows traffic on adjacent streets.

Applied to the specific permit of annual throughput of 7,000,000 gallons vs. the typical permit of annual throughput of 1,000,000, greater number of vehicles exiting and entering the Smith's gas station is expected to cause greater emissions from those vehicles and from other vehicles experiencing delays on adjacent streets. As a result, elevated levels of pollutants that are linked to health impacts increase the risk of respiratory inflammation, including asthma and related lung/ breathing disorders, non-fatal heart attacks, increased risk of cancer, premature death due to pre-existing conditions, and other neurophysiological symptoms among other health effects.

The elevated levels of pollutants of concern include carbon monoxide, nitrogen oxide, and toxic air pollutants including some volatile organic compounds and increased particulate matter.

- 2) Vapor losses which are not captured contain volatile organic compounds. Although the Smith station allows for "Stage I" recovery, the station is not required to have a "Stage II" vapor recovery at the pump, thus older vehicles without onboard vapor recovery systems will likely emit VOCs from the gas tanks into the air. Vapor losses are associated with health risks, and particularly the release of benzene is determined to elevate cancer risk among other health effects. Applying the quantitative study (South Coastal Air Quality Management District (CA), increased cancer risk is multiplied by a factor of 7 under the Smith permit.
- 3) Location of potential receptors are identified near the Smith's gas station on the basis of available data, including aerial imagery. These receptors include homes, and at least one school. Distance of receptors relevant to the Smith's station is a key factor in determining health impacts from vehicle pollution. Health risks from vehicle pollution/emissions are greater on vulnerable populations that include children, elderly, and people with respiratory conditions.

In conclusion and in light of the above technical testimony supported by the attached reliance materials, Dr. Rowangould recommends additional analysis be conducted to ensure potential air quality and health impacts associated with the proposed Smith's fueling station are better understood. If impacts are found to exceed acceptable levels on the basis of regulations, increased health risks and community sentiment then mitigation and or other alternatives should be explored.

(D) Additional witnesses to be called.

The Petitioners may call the following witnesses to offer non-technical testimony:

1. Pat Toledo
2. Mary Ann Roberts
3. Margaret M. Freed

The above-listed fact witnesses/interested parties reserve the right to rely on and or refer to the attached numbered exhibits (reliance materials). Such reliance or reference is intended for the limited purpose/ extent of supporting fact witness testimony.

The Petitioners reserve the right to call additional non-technical witnesses, including any witnesses/interested parties identified by Smith's and the City.

(E) List of exhibits, if any, to be offered into evidence at the hearing on the merits.

The Petitioners may offer the following as exhibits at the hearing on the merits:

Any documents in the Administrative Record.

Any exhibits identified by Smith's and the City.

Exhibit 1—Memorandum of technical testimony (Dr. Rowangould).

Exhibit 2—Dr. Dana (Rowan) Rowangould, CV

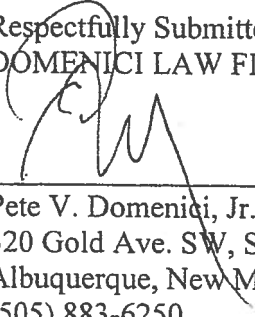
Exhibit 3—Gregory M. Rowangould, *A Census of the U.S. Near-Roadway Population: Public Health and Environmental Justice Considerations*, Transportation Research Part D 25, 59-67 (2013).

Exhibit 4—Alex A. Karner, et al., *Near-Roadway Air Quality: Synthesizing the Findings from Real-World Data*, Vol. 44, No. 14, *Envtl. Sci. & Tech.* 5334-5344 (2010).

Exhibit 5—*On Behalf of the American Lung Association and the American Thoracic Society Before the Senate Committee on Environment; Public Works Subcommittee on Clean Air; Nuclear Safety ; Subcommittee on Children's Health, and Environmental Responsibility*, Air quality and Children's Health Hearing (2011) (Statement of Dona J. Upson, MD, MA).

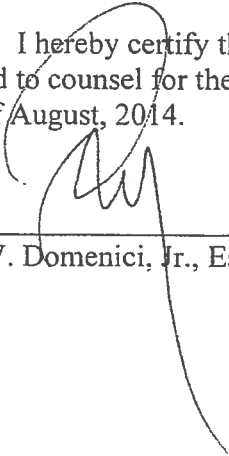
Exhibit 6— American Academy of Pediatrics (Policy Statement) Committee on Environmental Health, *Ambient Air Polution: Health Hazards to Children*, Vol. 114, No. 6, *Pediatrics*, 1699-1707 (2010).

Respectfully Submitted,
DOMENICI LAW FIRM, P.C.



Pete V. Domenici, Jr., Esq.
320 Gold Ave. SW, Suite 1000
Albuquerque, New Mexico 87102
(505) 883-6250

I hereby certify that a true and correct copy of the foregoing with attachments was e-mailed to counsel for the City of Albuquerque and Smith's Food & Drug Centers, Inc. on the 8th day of August, 2014.



Pete V. Domenici, Jr., Esq.

MEMORANDUM

TO: Pat Toledo
FROM: Dr. Dana Rowangould, Sustainable Systems Research, LLC
DATE: August 8, 2014
RE: Air Quality and Health Risks of the Proposed Smith's Fueling Station at 6941 Montgomery Blvd NE

Smith's Food and Drug has submitted a permit application for a high-throughput refueling station to the Albuquerque Environmental Health Department. The proposed refueling station will be located at 6941 Montgomery Blvd, NE, Albuquerque, NM, 87110. A vehicle refueling station has the potential to lead to air pollution from two types of sources: 1) direct emissions from vehicles entering and exiting the station and vehicles on feeder streets that slow or idle as a result of vehicle entry/exit, and 2) vapor losses from the refueling station's fuel storage tanks and some vehicles' fuel tanks occurring during refueling processes.

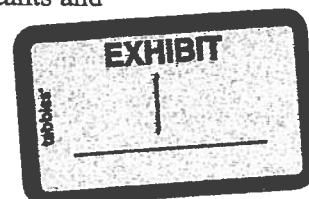
At your request I have reviewed the permit application and summarized insights from applicable scientific research and government agency guidance related to health risks from air pollution that may be associated with the proposed refueling station.

I have also attached my qualifications and two academic articles providing additional information about near-road health risks and exposures. One article describes the distances at which emissions from roads remain elevated above background levels (Karner et al. 2010) and the other characterizes the populations living near roads in the US (Rowangould 2013).

Direct Vehicle Emissions

The amount of air pollution directly emitted from vehicles will be a function of the number of vehicles entering and exiting the station and the degree to which their entry and exit slows traffic on adjacent streets (e.g. pass-by vehicles that slow or idle as a result of turning and queuing of entering and exiting vehicles). The proposed Smith's gas station will have a maximum permitted annual throughput of 7,000,000 gallons, much greater than for a typical refueling station, which might have a permitted annual throughput closer to 1,000,000 gallons. Fueling stations with greater throughput will have a greater number of vehicles entering and exiting and therefore greater direct emissions from those vehicles and from other vehicles experiencing delays on adjacent streets.

Vehicles directly emit several pollutants that can result in health impacts: carbon monoxide (CO), nitrogen oxides (NO_x), and toxic air pollutants (some of which are volatile organic compounds, or VOCs); diesel exhaust also contains these pollutants and



others, including particulate matter (PM). Exposure to these vehicle pollutants is associated with a number of adverse health outcomes:

- Nitrogen oxides (NO_x): Causes respiratory inflammation, increased symptoms in asthmatics (1).
- Carbon monoxide (CO): Reduces oxygen carrying capacity of the blood, leading to chest pain and myocardial ischemia in those with heart disease and even death at very high levels (2).
- Mobile Source Air Toxics (MSATs): Of particular health concern are benzene, 1,3-butadiene, formaldehyde, acrolein, acetaldehyde, polycyclic organic matter, and naphthalene. Human health effects studies are limited but evidence suggests that exposure to MSATs can increase cancer risks, respiratory irritation, and potentially lead to other health effects (3).
- Particulate matter (PM): Can lead to nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, irritation of airways, coughing, difficulty breathing, and premature death in people with preexisting health issues (4).
- Diesel exhaust (including diesel PM): In the short term can lead to acute irritation, neurophysiological symptoms, respiratory symptoms; in the long term it is associated with noncancer respiratory effects and elevated cancer risks (5).

A number of studies have measured elevated levels of vehicle pollutants in close proximity to busy roads; levels generally drop off between 115-570 meters, or 377 – 1870 feet (depending on local weather patterns, traffic volumes, etc.) (6). At the same time, 19% of the US population lives near busy roads and may be exposed to elevated air pollution levels (7)¹.

Vapor Losses

Vapor losses occur when the gases in fuel tanks are displaced by liquid fuel during refueling; if not captured, the gases escape from the fuel tank. Escaping gasoline vapors contain VOCs, including benzene. Stage I vapor losses refer to vapors that escape from a fueling station's storage tank when it is refilled. The permit application for the proposed Smith's station indicates that the station will have Stage I recovery which can be expected to capture most Stage I vapors. Stage II vapors are those that escape from a vehicle's fuel tank when it is refueled. Newer cars (2000 and later) and light trucks (2006 and later) have onboard refueling vapor recovery systems; however many older cars and light trucks do not. Fueling stations in Albuquerque are not currently required to have

¹ This reference uses a criterion of 25,000 average annual daily traffic to define busy roads. Note that according to 2008 highway performance monitoring system data, Montgomery reached nearly 35,000 AADT in 2008.

Stage II vapor recovery at the pump, so when older vehicles without onboard vapor recovery systems are refueling, VOCs are likely emitted from gas tanks into the air.

Gasoline vapors are associated with health risks. In particular, benzene is associated with elevated cancer risks and a number of other health problems (8).

In 2007, the South Coast Air Quality Management District (SCAQMD) quantified the cancer risks associated with gasoline vapors at typical fueling stations in southern California by modeling emissions and dispersion of gasoline vapors near 35 monitoring locations (9). There are differences between the fueling stations evaluated and the proposed Smith's station: evaluated stations were assumed to have Stage I and Stage II vapor recovery, local weather conditions may differ, and the assumed permitted throughput was lower at the evaluated stations. However, the SCAQMD findings can be adapted to higher throughput gas stations² (such as the proposed Smith's), providing a range of distances at which residential cancer risks due to vapor losses would exceed 1 in a million: 150 – 200 meters (492 – 656 feet) and at which occupational cancer risks would exceed 1 in a million: 60 – 100 meters (197 - 328 feet)³. Note that this is a rough estimate, assuming that the effect of the weather conditions at the proposed Smith's location fall within the range of the 35 locations evaluated in southern California, and also assuming that current Stage II vapor losses in Albuquerque are equivalent to losses in southern California in 2007 with Stage II vapor recovery in place. The lack of a Stage II vapor recovery system means that risks from a gas station in Albuquerque could extend farther than those described above.

Location of Potential Receptors

As described above, evidence suggests that vehicle emissions from busy roads are elevated for distances as great as 377 – 1870 feet, and that residential cancer risks that exceed 1 in a million from vapor losses from the proposed fueling system could extend to distances of 492 – 656 feet, while occupational risks could extend to 197 – 328 feet.

Based on aerial imagery and the address of the proposed fueling station, we have identified a number of receptors located near the facility, including homes and at least one school (Table 1). In particular, the distance from Cleveland Middle School is of concern. Health risks from vehicle pollution are greater for vulnerable populations, including children, the elderly, and people with respiratory problems (1, 4). In particular,

² SCAQMD estimates are based on an assumed permitted throughput of 1,000,000 gallons/yr. SCAQMD indicates that these estimates can be adapted to higher throughput stations by scaling their estimates proportionately. We therefore adapt SCAQMD estimates by multiplying their estimated cancer risks by 7 to reflect risks at stations permitted for 7,000,000 gallons/yr. The estimates presented here are the adapted estimates not the SCAQMD estimates.

³ Occupational exposure estimates assume a shorter duration of exposure, consistent with an 8-hour workday. This may apply to people working at the gas station itself or nearby.

a number of studies have found evidence of adverse health effects in children associated with air pollution from vehicle traffic (for example see refs. 10-13).

Table 1: Distance from proposed fueling station property to potential receptors

Cleveland Middle School (main building)	800 feet
Monterra Apartment Homes	250 feet
Houses on Indian Springs Drive NE	600 feet
Houses on Chama Street NE and Alcazar Street NE	450 feet

Conclusions

In light of the high throughput that is expected at the proposed Smith's gas station (and the resulting potential for greater than normal emissions), the potential health impacts associated with vehicle traffic and vapor losses, and the facility's proximity to residents and at least one school, we recommend conducting additional analysis to ensure that the potential air quality and health impacts associated with the proposed Smith's fueling station are better understood. If the facility is found to result in air quality and/or health impacts that exceed levels that are acceptable (based on regulatory levels, health risks, and/or community sentiment), mitigations and/or alternatives should be explored.

Attachments

Curriculum Vitae of Dr. Dana Rowangould

Karner, Alex, Douglas S. Eisinger, Deb A. Niemeier, 2010. "Near-Roadway Air Quality: Synthesizing the Findings from Real-World Data" *Environmental Science & Technology* 2010 44 (14), 5334-5344

Rowangould, Gregory M. "A census of the US near-roadway population: Public health and environmental justice considerations", *Transportation Research Part D: Transport and Environment*, Volume 25, December 2013, Pages 59-67

References

1. US EPA, 2013. "Health | Nitrogen Dioxide | US EPA" Retrieved from <http://www.epa.gov/oaqps001/nitrogenoxides/health.html>. Updated on February 14, 2013. Accessed on August 7, 2014.
2. US EPA, 2012. "Health Effects | Carbon Monoxide | US EPA" Retrieved from <http://www.epa.gov/airquality/carbonmonoxide/health.html>. Updated on December 10, 2012. Accessed on August 7, 2014.
3. HEI Air Toxics Review Panel, 2007. Mobile-Source Air Toxics: A Critical Review of

the Literature on Exposure and Health Effects. HEI Special Report 16. Health Effects Institute, Boston, Mass. Available at <http://pubs.healtheffects.org/getfile.php?u=384>

4. US EPA, 2014. "Health | Particulate Matter | US EPA" Retrieved from <http://www.epa.gov/airquality/particulatepollution/health.html>. Updated on May 6, 2013. Accessed on August 7, 2014.
5. US EPA, 2002. "Health assessment document for diesel engine exhaust." Prepared by the National Center for Environmental Assessment, Washington, DC, for the Office of Transportation and Air Quality; EPA/600/8-90/057F. Available at <http://www.epa.gov/ttn/atw/dieselfinal.pdf>
6. Karner, Alex, Douglas S. Eisinger, Deb A. Niemeier, 2010. "Near-Roadway Air Quality: Synthesizing the Findings from Real-World Data" *Environmental Science & Technology* 2010 44 (14), 5334-5344
7. Rowangould, Gregory M. "A census of the US near-roadway population: Public health and environmental justice considerations", *Transportation Research Part D: Transport and Environment*, Volume 25, December 2013, Pages 59-67
8. US EPA, 2009. "Benzene TEACH Chemical Summary." Retrieved from http://www.epa.gov/teach/chem_summ/BENZ_summary.pdf. Updated on 2/27/2009. Accessed on August 7, 2014.
9. South Coast Air Quality Monitoring District, 2007. "Emission Inventory and Risk Assessment Guidelines for Gasoline Dispensing Stations." Available at http://www.aqmd.gov/docs/default-source/planning/risk-assessment/gas_station_hra.pdf?sfvrsn=0
10. Kim, Janice J., Svetlana Smorodinsky, Michael Lipsett, Brett C. Singer, Alfred T. Hodgson, and Bart Ostro, 2004. "Traffic Related Air Pollution Near Busy Roads: East Bay Children's Respiratory Health Study", *American Journal of Respiratory and Critical Care Medicine*, Vol. 170, No. 5 (2004), pp. 520-526.
11. Brunekreef, Bert, Nicole A. H. Janssen, Jeroen de Hartog, Hendrik Harssema, Mirjam Knape and Patricia van Vliet. "Air Pollution from Truck Traffic and Lung Function in Children Living near Motorways." *Epidemiology*, Vol. 8, No. 3 (May, 1997), pp. 298-303
12. Krämer, Ursula; Koch, Thilo; Ranft, Ulrich; Ring, Johannes; Behrendt, Heidrun "Traffic-Related Air Pollution is Associated with Atopy in Children Living in Urban Areas." *Epidemiology*, Vol. 11, No. 1 (2000), pp. 64-70.
13. M Wjst, P Reitmeir, S Dold, A Wulff, T Nicolai, E F von Loeffelholz-Colberg, E von Mutius. "Road traffic and adverse effects on respiratory health in children." *British Medical Journal*. 1993 September 4; 307 (6904): 596-600.

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Eastern Environmental Law Center and Natural Resources Defense Council, *Mapping Communities and Pollution Sources in NY/NJ*, 2013

Diesel Health Project and Natural Resources Defense Council, *Mapping Pollution Sources and Demographics in Kansas City, KS*, 2013

Save Our Creek, *Review of the Summerhill Homes/Magee Ranch Draft EIR*, 2013

Save Our Creek, *Danville General Plan Review*, 2012

Natural Resources Defense Council, *Review of Southern California International Gateway Project Recirculated Draft EIR*, 2012

Natural Resources Defense Council, *Coal Dust and Rail: Impacts of Coal Transport from the Powder River Basin*, 2012

East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR*, 2012

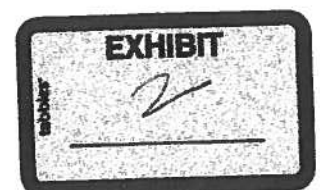
Natural Resources Defense Council, *Ports and Air Quality: Moving Toward Clean Cargo*, 2012

TransForm, *Looking Deeper: A detailed review of the project performance assessment being used to develop OneBayArea*, 2011-2012

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PUBLICATIONS

- Rowangould, D. Karner, A., London, J. (submitted). Identifying Environmental Justice Communities for Transportation Analysis. Submitted for presentation at the Transportation Research Board's 94th Annual Meeting and for publication in the Transportation Research Record.
- Rowan, D., Eldridge, M., Niemeier, D. (2013). Incorporating regional growth into forecasts of greenhouse gas emissions from project-level residential and commercial development. *Energy Policy*, 62:1288-1300.
- London, J., A. Karner, J. Sze, D. Rowan, G. Gambirazzio and D. Niemeier. (2013). Racing Climate Change: Collaboration and Conflict in California's Global Climate Change Policy Arena. *Global Environmental Change* 23(4):791-799
- Rowan, D., Karner, A., Niemeier, D. (2010). Miles per gallon illusions and Corporate Average Fuel Economy distortions: When even the transport experts have trouble. *Transportation Research Record*, 2191:8-15.
- Sze, J., Gambirazzio, G., Karner, A., Rowan, D., London, J., Niemeier, D. (2009). Best in show? Climate and environmental justice policy in California. *Environmental Justice*, 2(4):179-184.
- Niemeier, D., Rowan, D. (2009). From kiosks to megastores: The evolving carbon market. *California Agriculture*, 63(2): 96-103.
- Madani, K., Rowan, D., Lund, J. (2007). The next step in central valley flood management: Connecting costs and benefits. Proceedings of the University Council on Water Resources Annual Conference, Boise, ID. July 24-26, 2007.

PRESENTATIONS

- Rowangould, D. Niemeier, D. (2014). Smart growth policy and practice: Retrospective evaluation of residential development in the Sacramento region. Poster presentation at the Transportation Research Board's 93rd Annual Meeting. Washington, DC. January 12-16, 2014.
- Rowan, D., Karner, A. (2011). Moving toward equity: The ongoing struggle for environmental justice in California. Session co-organizer and moderator. Interdisciplinary Graduate and Professional Symposium, UC Davis, Davis, CA. April 23, 2011.
- Rowan, D., Niemeier, D. (2011). Greenhouse gas emissions inventories of proposed residential and commercial developments: Dealing with growth. Poster presentation at the Transportation Research Board's 90th Annual Meeting. Washington, DC, January 23-27, 2011.
- Karner, A., Rowan, D., London, J., Sze, J., Niemeier, D. (2009). Environmental justice, gender, and conflict in California climate policy. Poster presentation at the 4th International Conference on Women's Issues in Transportation. Irvine, CA, Oct. 27 – 30, 2009.
- Rowan, D., Kirk, C., Gim, V., Stasio, K., Stillwater, T., Vassilian, C., Gunda, S., Hsieh, T. (2009). Campus energy solutions: Innovations and results from a collaborative program. Poster presentation at the International Energy Program Evaluation Conference. Portland, OR., August 12-14, 2009.
- Niemeier, D., Silvis, J., Rowan, D. (2007). Private Funding of High Profile Climate Change Skeptics: A Dense Network. Presented at the Energy Crossroads Conference, the Roosevelt Institute. Stanford, CA, March 1-2, 2007.
- Newell, C., Aziz, C., Farhat, S., McDade, J., Rowan, D., Adamson, D., Hughes, J. (2003). Low Volume Pulsed Hydrogen Biosparging in an Experimental Controlled Release System. Presented at the Battelle Seventh International In Situ and On-Site Bioremediation Symposium. Orlando, FL. June 2-5, 2003.



A census of the US near-roadway population: Public health and environmental justice considerations



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ABSTRACT

This study estimates the size and distribution of the population living near high volume roads in the US, investigates race and income disparities in these near roadway populations, and considers the coverage of the national ambient air quality monitoring network. Every US census block is classified by traffic density and proximity to roads falling within several traffic volume ranges using year 2008 traffic data and the 2010 and 2000 US Census. The results indicate that 19% of the population lives near high volume roads. Nationally, greater traffic volume and density are associated with larger shares of non-white residents and lower median household incomes. Analysis at the county level finds wide variation in the size of near roadway populations and the severity of environmental justice concerns. Every state, however, has some population living near a high volume road and 84% of counties show some level of disparity. The results also suggest that most counties with residents living near high volume roads do not have a co-located regulatory air quality monitor.

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1. Introduction

There is an accumulation of evidence that people living near high volume roads face elevated health risks from exposure to vehicle emissions. Given the nature of road networks and the geography of local residence and work places, there are disparities in exposure to mobile source emissions across socioeconomic and racial groups. While many studies document high levels of air pollutant concentrations and negative health outcomes alongside high volume roads, there is less information about the size and geographic distribution of the near-roadway population.

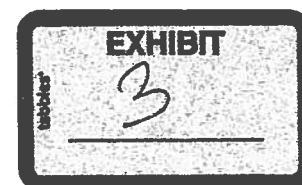
I create a national census of the US near-roadway population to offer insights into these issues. It is similar in spirit to Tian et al. (2013) but uses a more robust and spatially detailed set of roadway proximity and traffic exposure measures. The analysis is performed at the census block level rather than the census tract level using both traffic density and roadway proximity metrics. The finer spatial scale of the analysis aligns more closely with the spatial scale of near roadway emissions gradients. The approach is also broader and quantifies the size of the near roadway population both nationally and at the county level while also evaluating the spatial relationship between near roadway populations and the regulatory air quality monitoring network.

2. Methodology and data

The area includes all US states. Average annual daily traffic (AADT) volume data for 2008 were obtained from the highway performance monitoring system (HPMS) road network included in the 2010 National Transportation Atlas Database (US

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Department of Transportation, 2010). The network includes the entire US highway network and most other primary roads. Block level population counts by race were obtained from the 2010 US Census while block-group level median household income data were obtained from the 2000 Census.

Proximity to high volume roads is measured using a series of distance buffers along roads with greater than 25,000 AADT in the HPMS dataset. High volume roads are defined as having greater than 25,000 AADT, generally corresponding to limited access divided highways and multi-lane urban arterials that are the class of roads considered in previous near-roadway population and health studies. Each HPMS road segment is classified by AADT in 25,000 AADT increments up to 200,000 AADT. Roads with greater than 200,000 AADT are classified into one category. Buffers are constructed parallel to each of the classified road segments at 100 m intervals extending out to a maximum of 500 m. These buffers cover an area where the greatest concentration of mobile source air pollutants are expected. Each census block, or portion of a census block, is then assigned to one of the distance-traffic buffers by computing a geographic intersection of the roadway buffers and census block boundaries using a GIS. For census blocks that were only partially intersected by a buffer, the census block is split into multiple parts. The population of each block part is estimated in proportion to the block part's area. The smallest spatial scale that income data were available is the block-group. Individual blocks in each block-group were assigned the block-group median household income. The 40 traffic-distance buffers contain 25.2% of populated US census blocks.

Traffic density is calculated for each US census block by constructing a 250 m buffer around each block and then intersecting the buffered block with the HPMS road network in a GIS following Gunier et al. (2003). Vehicle kilometers traveled (VKT) is then calculated for each road segment by multiplying each road segment's length by its AADT. The VKT in each block's buffered area is then divided by the block's area to estimate traffic density. The 250 m buffer is used to capture traffic on roadways in close proximity to but not intersecting a block. Census blocks with no population or traffic density are discarded. The traffic density data set includes 52.2% of populated US census blocks.

The traffic-distance buffer dataset is used to count the population living within each traffic-distance buffer in each county and for the US. A cumulative plot of population by increasing levels of traffic and decreasing distance from the road is created. The county level results are also mapped to explore spatial patterns.

Roadway proximity and traffic density are used as proxy variables for emissions exposure. To evaluate disparities across the US, each region's baseline population characteristics are controlled for. This is accomplished by calculating the difference in the population share of minority residents and percent difference in median household income between each block and the county where the block is located. These two quantities are herein referred to as "race disparity" and "income disparity" respectively. One improvement made over past studies is that a range of traffic volume and proximity is considered rather than a single definition of being near a high volume road. This analysis also includes a much larger study area than most previous studies.

Demographic data are aggregated for each traffic-distance buffer and tabulated for the US and for each county. Population weighted mean values for each traffic-distance buffer are then estimated and plotted to identify potential associations between traffic level or proximity and race and income disparity.

Multinomial regression models are also created to test for associations between traffic-distance buffer levels and race and income disparity. The first model included the race and income disparity as covariates and the second model also included the log of population density as an additional covariate. Separate models were created for blocks in each of the five 100 m buffer bands to explore differences in association at different distances from the roadway. In each model the 200,000 AADT buffer was set as the reference category and the coefficient estimates are exponentially transformed to provide conditional odds ratios. The conditional odds ratios indicate the multiplicative effect that a unit increase in race disparity, income disparity, or logged population density has on the odds of a census block being located in the specified AADT buffer relative to the reference buffer.

There are several advantages to using traffic density over the buffer data. First, traffic density is a continuous variable that does not require the researcher to define traffic level and proximity categories. Traffic density also captures the relatively worse-off condition of living at the intersection of multiple high volume roads (the buffer method categorizes blocks by the highest high volume road in this situation). One limitation of using traffic density is that the link between particular traffic density levels and emission concentrations is less understood.

As with the buffer data, the difference in each block's minority population share from county minority population share is calculated to control for regional differences in baseline population characteristics. This is repeated for median household income. The traffic density data set is divided into traffic density quintiles for the US and individually for each county. The average race and income disparity is estimated for each quintile and compared.

Two linear regression models are also created to test for associations between traffic density, race disparity, and income disparity. Logged traffic density is regressed on race and income disparity for each block. A second model includes the logged population density as an additional covariate.

The location (*x*, *y* coordinates) of every air quality monitor used by EPA in 2010 to enforce the Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), and particulate matter (coarse – PM₁₀ and fine – PM_{2.5}) NAAQS was downloaded from EPA's Air Explorer Website. Each monitor is classified by traffic volume and roadway proximity by intersecting the monitor data with the traffic-distance buffers using a GIS. Counties that do not have air quality monitors co-located with populations living in the near roadway buffers are identified.

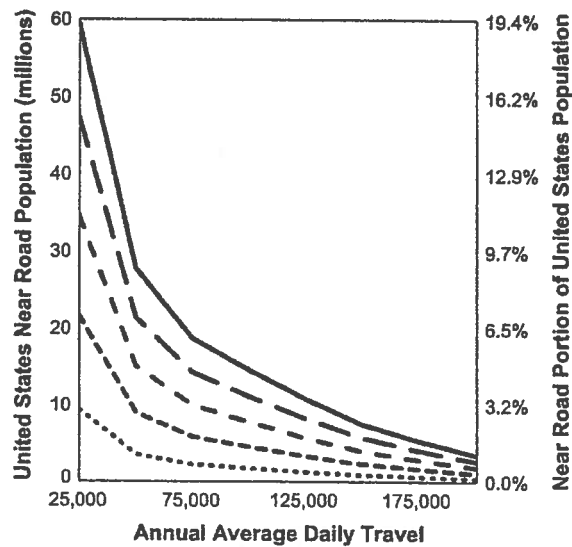


Fig. 1. US population living near high volume roads during the year 2010.

3. Results

The buffer analysis indicates that a large share of the US population lives near high volume roads (Fig. 1). There are 59.5 million people living within 500 m of roads with greater than 25,000 AADT, an area where residents are potentially exposed to elevated concentrations of many mobile source emissions. For individual states and counties the share of the population living near these roads can be much greater. For example, 40% of California's population lives near high volume roads; the largest share of any state excluding the District of Columbia where 62% of the population lives near high volume roads. In Falls Church County Virginia 79% of the population lives near high volume roads as does over 50% of the population in 14 other counties. Counties with the largest share of their population living near high volume roads are mostly, but not entirely, confined to major urban areas (Fig. 2).

A much smaller share, 0.1%, of the US population lives within very close proximity to the highest traffic volume roads where exposure to elevated concentrations of mobile source emissions is extremely likely. While a small share of the population, this represents over 400,000 people. The population living close to the highest volume roads is confined to major metropolitan areas, most notably in California which is the only state where counties have greater than 10% of their population living near these very high volume roads.

The buffer analysis indicates that persons belonging to a racial minority group or with lower household incomes are more likely to live near a high volume road. While 19.3% of the US population lives near high volume roads, 27.4% of the non-white population (including 23.7% of the black population and 29.4% of the Latino population) live near high volume roads. The average median household income of census blocks near high volume roads is \$1221 less than the US average of \$46,525.

There is also a strong association between race, income, and traffic volume as shown by the plots in Fig. 3. The plots in Fig. 3a and b do not control for baseline differences in each county's minority population share and median household incomes while the plots in Fig. 3c and d do. Fig. 3a and b shows that on average the US population living closer to higher traffic volume roads is disproportionately composed of non-white residents but that there is little association with median household income. In Fig. 3c and d, where baseline population characteristics are controlled for, there is a clear association between increasing race and income disparity and increasing traffic volume. There is no apparent association with proximity within the considered range.

For example, within 200–300 m of roads with 25,000 AADT to 50,000 AADT the average share of non-white residents is 42.6% while the average share of non-white residents in the surrounding county is 39.8%, a difference of 2.8 percentage points. For roads with greater than 200,000 AADT the average share of non-white residents within 200–300 m increases to 65.3% while the average share of non-white residents in the surrounding county increases to 56.6%, a difference of 8.7 percentage points. Additionally, populations living near roads with 25,000 AADT on average have median household incomes that are 8–11% less than the county average while populations living near the highest traffic volume roads have median household incomes that are 18% less than the county average.¹

The traffic density and buffer data agree, with high traffic density quintiles having a much larger share of minority residents and lower median household incomes than lower traffic density quintiles (Table 1). The population share of

¹ All averages are population weighted mean values of block level data.

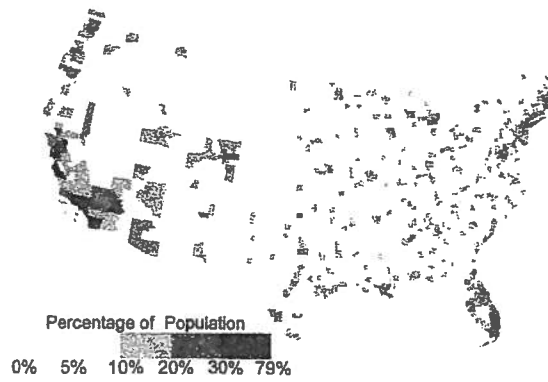


Fig. 2. Percentage of the population living within 500 m of a roadway with over 25,000 AADT in each county. Note: Hatched areas indicate counties with no population living near high volume roads.

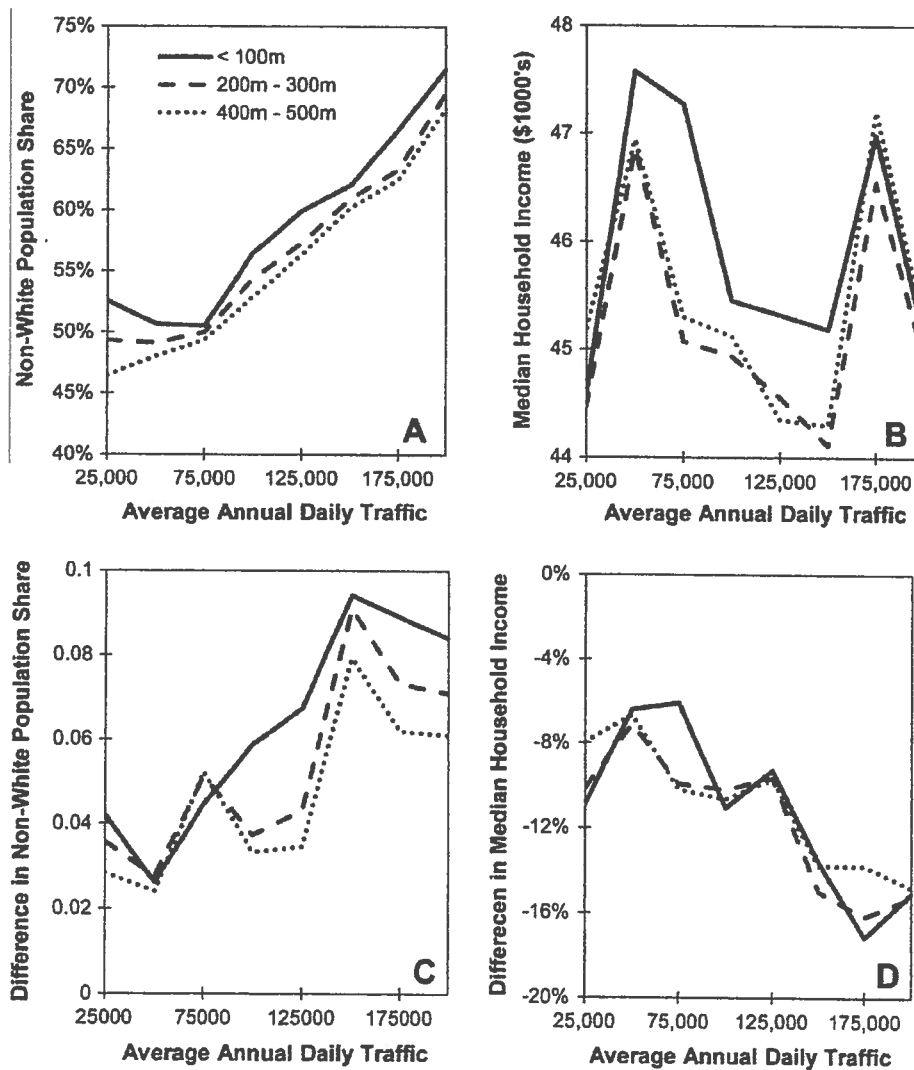


Fig. 3. Relationships between traffic volume, roadway proximity, race and income. Note: Relationship between the share of non-white residents and traffic volume (a), median household income and traffic volume (b), the difference in the share of non-white residents [near road – county] (c), and the percentage difference in median household income [(near road – county)/county × 100] (d). Values for (c) and (d) represent the US population weighted mean difference between the population living within the indicated distance of a high volume road and the entire county population.

Table 1
Mean disparity in income and race/ethnicity by traffic density quintile.

Quintile	Traffic density ^a	Income ^b	Share of population by race/ethnicity				
			Non-white	Latino	Black	Asian	Other ^c
<i>Aggregate^d</i>							
1st	6825	\$43,466	19%	7%	8%	1.6%	2.8%
2nd	66,118	\$47,421	31%	13%	11%	4.0%	3.0%
3rd	240,948	\$44,813	41%	19%	13%	5.7%	3.3%
4th	633,366	\$42,648	49%	24%	15%	7.2%	3.3%
5th	3,761,149	\$42,127	57%	28%	17%	9.4%	3.2%
<i>Difference relative to county population^e</i>							
1st	6825	\$2901	−4.3	−1.9	−1.9	−0.38	−0.16
2nd	66,118	\$1415	−0.7	−1.0	−0.1	0.33	0.08
3rd	240,948	−\$3486	3.5	1.4	1.4	0.43	0.22
4th	633,366	−\$6464	5.8	3.1	2.2	0.26	0.21
5th	3,761,149	−\$7591	6.1	4.0	1.6	0.30	0.15

^a Mean daily vehicle kilometers traveled per square meter.

^b Mean block-group median household income from the 2000 US Census.

^c All other races/ethnicities excluding white, includes Pacific Islanders and American Indians.

^d Mean values by traffic density quintile.

^e Mean population weighted difference between block and county populations by traffic density quintile.

non-whites is 3 times, Latinos 4 times, blacks 2.1 times, and Asians 5.9 times greater in the highest traffic density quintile as compared to the lowest traffic density quintile. The main exception to this pattern of disparity is for Native Americans (included in the "other" category) where their population share is greater in lower traffic density quintiles. The average median household income of residents in the highest traffic density quintile is \$1339 less than that of households in the lowest traffic density quintile. However, unlike the ordinal increase in minority population shares across traffic density quintiles, the highest average median household income occurs in the 2nd quintile; this likely represents the generally lower incomes in very rural places.

The trends noted also hold when baseline county population characteristics are controlled for (lower half of Table 1). For example, the percentage of non-white residents in the lowest traffic density quintile is 4.3 percentage points lower than the percentage of non-white residents in the surrounding counties and the percentage of non-white residents in the highest traffic density quintile is 6.1 percentage points greater than the percentage of non-white residents in the surrounding counties. Similarly, average median household incomes are \$2901 greater than county averages in the lowest traffic density quintile and \$7591 less than county averages in the highest traffic density quintile.

Large minority and low-income populations in urban areas could drive the aggregate results in Fig. 1 and Table 1. The maps in Fig. 4 shows the difference in population characteristics between the lowest and highest traffic density quintiles for each county in the US. Fig. 4a and b indicate that in most counties a disproportionate number of non-white residents live in high traffic density areas (84% of US counties) as do a disproportionate number of residents with lower median household incomes (83% of US counties). The disparities among non-whites are greatest in the southern states; however, there is no general geographic region of the country without any disparity. When the non-white population is isolated to just black or Latino residents (Fig. 4c and d) strong spatial patterns of disparity emerge. Blacks are much more likely to live in high traffic density areas in a region following the coast from East Texas to Virginia while Latinos are much more likely to live in high traffic density areas in a region extending from Texas to the West Coast and also a small area in the Northeast. These areas correspond to regions with higher baseline populations of black and Latino residents. Disparities in median household income are greatest in urbanized areas, most notably in the Northeast, along the West Coast, and the Great Lakes region.

The buffer and traffic density data both provide evidence that living near a high volume road or in a high traffic density area is associated with larger race and income disparities. The regression analysis results further confirm these findings while also disentangling the relationship between race and income (Table 2).

The conditional odds ratios shown in Table 2 indicate the relative odds of a census block being located near a roadway in a particular traffic volume category relative to being located near a roadway with greater than 200,000 AADT. The odds ratios for each parameter indicate the multiplicative effect that a unit change in the parameter would have on the conditional odds ratio. For example, a one unit increase in racial disparity (β_{dNW}) would decrease the odds of a census block being located near a road with 25,000 to 50,000 AADT by 0.58 times, while increasing the odds of a census block being located near a road with 150,000 to 175,000 AADT by about 20%, relative to the block being located near a road with greater than 200,000 AADT. The odds ratios in Model 1 indicate an association between increasing race and income disparity and increased odds of living near higher volume roads. These associations could occur if race and income disparities are larger in dense urban areas where all census blocks have relatively high odds of being located near a high volume road. Model 2 controls for population density and continues to find that increasing disparities in race and income are associated with greater odds of a census block being located near higher volume roads.

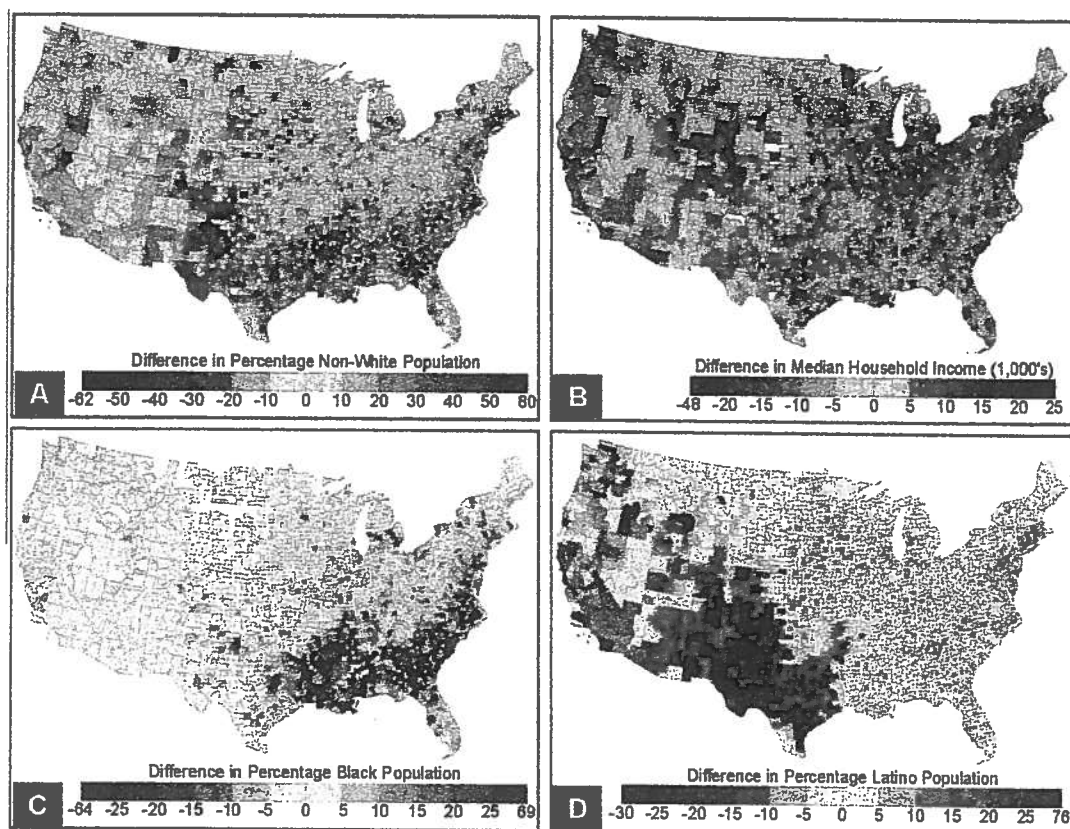


Fig. 4. Spatial distribution of county level income and race disparities. Note: Difference in the percentage of non-white population (a) average median household income (b), percentage black population (c), and percentage Latino population (d) between the lowest and highest traffic density quintile for each US county.

Analysis of the traffic density data produces similar conclusions (Table 3). Model 1 indicates that increasing levels of race and income disparity are associated with increasing traffic density. Negative values indicate greater income disparity so that negative income disparity coefficient estimates indicate greater income disparity is associated with greater traffic density.

Table 2
Conditional Odds Ratios^a for Census Blocks in 100 m Traffic-Distance Buffers.

AADT ^b	Model 1		Model 2		
	Exp (β_{dnw}) ^c	Exp (β_{pdinc}) ^d	Exp (β_{dnw})	Exp (β_{pdinc})	Exp ($\beta_{\log(\text{density})}$) ^e
25,000	0.58 (0.54, 0.63) ^f	1.21 (1.15, 1.29)	0.68 (0.63, 0.73)	0.97 (0.91, 1.02)	0.70 (0.69, 0.71)
50,000	0.63 (0.58, 0.69)	1.51 (1.42, 1.61)	0.74 (0.68, 0.81)	1.19 (1.12, 1.27)	0.69 (0.68, 0.70)
75,000	0.82 (0.75, 0.90)	1.33 (1.24, 1.42)	0.95 (0.87, 1.04)	1.05 (0.98, 1.12)	0.70 (0.69, 0.71)
100,000	0.75 (0.68, 0.82)	1.03 (0.96, 1.11)	0.82 (0.74, 0.90)	0.89 (0.83, 0.95)	0.79 (0.78, 0.81)
125,000	1.07 (0.97, 1.18)	0.93 (0.86, 1.01)	1.15 (1.04, 1.27)	0.85 (0.79, 0.92)	0.84 (0.83, 0.86)
150,000	1.21 (1.08, 1.34)	0.91 (0.83, 0.99)	1.30 (1.16, 1.45)	0.84 (0.77, 0.91)	0.85 (0.83, 0.87)
175,000	0.83 (0.74, 0.94)	0.82 (0.74, 0.90)	0.84 (0.74, 0.95)	0.79 (0.72, 0.86)	0.93 (0.91, 0.95)
n	325,140		325,140		
AIC	791,502		797,591		

^a Conditional odds ratios derived by exponential transformation of coefficients estimated by multinomial logistic regressions where the 200,000 AADT category is the basis for comparison.

^b Values represent lower bound of each 25,000 AADT interval.

^c dnw = race disparity, defined as the difference in the non-white population share between near road and county populations (% non-white near road – % non-white in county).

^d pdInc is income disparity, defined as the percentage difference in average median household income between near road and county populations ((near road income – county income)/county income × 100).

^e Natural log of population density.

^f values in parentheses are 95% confidence intervals for the conditional odds ratios.

Table 3
Traffic density ordinary least squares regression results.

	Model 1	Model 2
Intercept	11.80 (11.80, 11.81) ^a	5.94 (5.93, 5.95)
dNW ^b	0.50 (0.48, 0.51)	-0.33 (-0.34, -0.32)
pdInc ^c	-1.03 (-1.04, -1.02)	-0.06 (-0.07, -0.06)
log(density) ^d		0.84 (0.84, 0.84)
n	1,693,957	1,693,957
adj-R ²	0.05	0.61

^a Values in parentheses are 95% confidence intervals for the parameter estimates.

^b dNW = race disparity, defined as the difference in the non-white population share between near road and county populations (% non-white near road - % non-white in county).

^c pdInc = income disparity, defined as the percentage difference in average median household income between near road and county populations [(near road income - county income)/county income × 100].

^d Natural log of population density.

Table 4
Count of counties with co-located air quality monitors.

Pollutant	AADT	Distance from road		
		<100 m	<300 m	<500 m
CO	>25,000	48 (4%) ^a	83 (6%)	103 (8%)
	>100,000	14 (5%)	26 (10%)	38 (14%)
	>200,000	2 (3%)	5 (8%)	11 (17%)
NO _x	>25,000	32 (2%)	64 (5%)	88 (6%)
	>100,000	10 (4%)	21 (8%)	31 (11%)
	>200,000	2 (3%)	4 (6%)	11 (17%)
PM10	>25,000	65 (5%)	106 (8%)	138 (10%)
	>100,000	22 (8%)	42 (15%)	53 (19%)
	>200,000	4 (6%)	11 (17%)	14 (22%)
PM2.5	>25,000	82 (6%)	146 (11%)	195 (14%)
	>100,000	21 (8%)	42 (15%)	54 (20%)
	>200,000	3 (5%)	9 (14%)	13 (20%)

^a As percentage of all counties with near road population in given traffic-distance buffer.

When population density is controlled for in Model 2 the association between race disparity and traffic density is reversed and the association between income disparity and traffic density is reduced. These results indicate that the apparent association between race and income disparity in Model 1 may be explained by larger race and income disparities occurring in dense urban areas where the probability of living near a high volume road is also greater.

The buffer and traffic density results do not correspond when population density is controlled for. This may be explained by limitations in the buffer data set. First, only census blocks near high volume roads are considered. This was done out of convenience for counting the size of the near roadway population and making the GIS analysis more tractable. Additionally, the relatively small number of census blocks in the highest traffic volume category were located near roads having a wide

Table 5
Population (millions) living near high volume roads in counties without co-located air quality monitors.

Pollutant	AADT	Distance from road		
		<100 m	<300 m	<500 m
CO	>25,000	5.9 (62%) ^a	16.9 (51%)	25.9 (46%)
	>100,000	1.6 (91%)	6.2 (81%)	7.1 (50%)
	>200,000	0.4 (96%)	1.6 (91%)	1.2 (34%)
NO _x	>25,000	6.2 (65%)	18.6 (56%)	27.5 (49%)
	>100,000	1.7 (93%)	6.1 (80%)	7.5 (53%)
	>200,000	0.4 (96%)	1.6 (91%)	1.1 (33%)
PM10	>25,000	5.3 (56%)	16.1 (49%)	25.4 (45%)
	>100,000	1.6 (87%)	5.2 (69%)	7.0 (49%)
	>200,000	0.4 (94%)	1.5 (85%)	1.3 (38%)
PM2.5	>25,000	5.1 (54%)	13.1 (40%)	18.0 (32%)
	>100,000	1.5 (85%)	5.3 (70%)	5.8 (41%)
	>200,000	0.4 (98%)	1.7 (93%)	1.4 (43%)

^a Percentage of population living within the indicated traffic-distance buffer without a co-located air quality monitor.

range of traffic volume. The buffer data were also not able to account for the relative worse off condition of living near multiple high volume roads.

While I find that a large share of the US population lives near high volumes roads, very few air quality monitors are located in these areas (Table 4). For example, only 14% of counties with residents living near high volumes roads also have a co-located and active PM_{2.5} air quality monitor. The percentage of counties that have co-located monitors in areas closer to higher volume roads is much smaller. Overall 18 million people live near high volume roads in counties where there are no co-located PM_{2.5} monitors (32% of the US population living near high volume roads) (Table 5). Very few monitors are placed near roads with the highest traffic volumes. For example, only three counties out of 63 with population living within 100 m of roads with greater than 200,000 AADT have a co-located PM_{2.5} monitor. The findings are similar for CO, NO_x, and PM₁₀ monitors.

4. Conclusions

I find that a large portion of the US population lives near high volume roads where the concentration of mobile source air pollutants is typically elevated. This is true in almost every region of the country. While prior research has focused on the largest urban areas, these results indicate that exposure to high concentrations of mobile source emissions from living in close proximity to high volume roads is potentially a much larger and more widespread public health concern.

I also find that minority and low-income households are on average more likely to live near a high volume road or in an area with higher traffic density. The results also align with those of prior studies. As with Guiner et al. (2003) and Houston et al. (2004), I find that higher traffic density areas in California and the Los Angeles California metropolitan area have larger proportions of low income and minority residents. The results also agree with studies that have used the US Environmental Protection Agency's National-Scale Air Toxics Assessment database to assess health risks from mobile source emissions exposure.²

Aggregate results, however, do not tell the complete story. For example, when county level results are compared with prior studies that find an association between greater shares of minority residents and increasing levels of traffic density or health risk in California, the Los Angeles area, the Tampa Bay area, and Maryland, a more complex picture is revealed. There are counties where no disparities are apparent, or where disparities work in the opposite direction, as well as a wide range in the magnitude of disparities. There are also areas of the country where environmental justice concerns appear much larger than others. While the areas of highest concern include regions considered in past studies, it is notable that many areas across the south also tend to have large disparities in who lives and does not live near high volume roads. While some regions have greater disparities; overall, the findings demonstrate that environmental justice concerns are not isolated to any particular state or region but that they are widespread and very common.

In aggregate, at the national scale, my results also partially agree with Tian et al. (2013). Both studies find that increasing traffic density is associated with greater shares of minority residents but Tian et al. find little or no association with income while I do. Tian et al. also find little correlation between race and traffic density in the northeast; whereas, my analysis indicates that there are greater shares of minority residents in higher traffic density census blocks in most counties in the northeast. Furthermore, Tian et al. provide a top ten list of states with the greatest correlation between share of minority residents and household income, and traffic density. Most of the states on the top ten lists are located in the northern half of the country. In contrast I find that the greatest disparities in race tend to occur in the southeastern quadrant of the country while income disparities are more scattered. The differences between the studies likely stem from the spatial scales used in the underlying data analysis and presentation of the results.

Additionally, I control for regional differences in baseline population characteristics when analyzing the complete national data set by measuring disparity as the departure from a county's mean population characteristics. As shown controlling for baseline population characteristics can result in different findings. Differences in each study's findings highlight the role of spatial scale when investigating spatial phenomena and how various definitions of disparity can influence aggregate results.

Further, I find that very few monitors used to enforce the NAAQS are co-located with near road populations. This is significant because a violation of the NAAQS generally requires a region to reduce emissions from mobile sources and perform more detailed air quality analysis when developing transportation plans. While current federal law requires "hotspot" analysis for CO and PM_{2.5} when building new transportation infrastructure in non-attainment areas there is currently no method to enforce possible violations of the NAAQS alongside existing transportation corridors or in attainment areas lacking air quality monitors.

References

- Apelberg, B.J., Buckley, T.J., White, R.H., 2005. Socioeconomic and racial disparities in cancer risk from Air Toxics in Maryland. *Environmental Health Perspectives* 113, 693–699.

² For example, Chakraborty (2009) finds that census tracts with greater health risks from vehicle emissions exposure in the Tampa Bay metropolitan area have higher shares of minority residents and in Maryland Apelberg et al. (2005) find that high risk census blocks have higher shares of minority and low income residents.

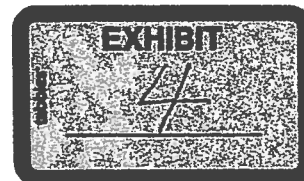
- Chakraborty, J., 2009. Automobiles, Air Toxics, and Adverse Health Risks: environmental inequities in Tampa Bay, Florida. *Annals of the Association of American Geographers* 99, 674–697.
- US Department of Transportation, 2010. National Transportation Atlas Database. US DoT, Bureau of Transportation Statistics, Washington, DC.
- Gunier, R.B., Hertz, A., von Behren, J., Reynolds, P., 2003. Traffic density in California: socioeconomic and ethnic differences among potentially exposed children. *Journal of Exposure Analysis and Environmental Epidemiology* 13, 240–246.
- Houston, D., Wu, J., Ong, P., Winer, A., 2004. Structural disparities of urban traffic in Southern California: implications for vehicle-related air pollution exposure in minority and high-poverty neighborhoods. *Journal of Urban Affairs* 26, 565–592.
- Tian, N., Xue, J., Barzyk, T.M., 2013. Evaluating socioeconomic and racial differences in traffic-related metrics in the US using a GIS approach. *Journal of Exposure Science and Environmental Epidemiology* 23, 215–222.

Near-Roadway Air Quality: Synthesizing the Findings from Real-World Data

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Despite increasing regulatory attention and literature linking roadside air pollution to health outcomes, studies on near roadway air quality have not yet been well synthesized. We employ data collected from 1978 as reported in 41 roadside monitoring studies, encompassing more than 700 air pollutant concentration measurements, published as of June 2008. Two types of normalization, background and edge-of-road, were applied to the observed concentrations. Local regression models were specified to the concentration-distance relationship and analysis of variance was used to determine the statistical significance of trends. Using an edge-of-road normalization, almost all pollutants decay to background by 115–570 m from the edge of road; using the more standard background normalization, almost all pollutants decay to background by 160–570 m from the edge of road. Differences between the normalization methods arose due to the likely bias inherent in background normalization, since some reported background values tend to underpredict (be lower than) actual background. Changes in pollutant concentrations with increasing distance from the road fell into one of three groups: at least a 50% decrease in peak/edge-of-road concentration by 150 m, followed by consistent but gradual decay toward background (e.g., carbon monoxide, some ultrafine particulate matter number concentrations); consistent decay or change over the entire distance range (e.g., benzene, nitrogen dioxide); or no trend with distance (e.g., particulate matter mass concentrations).

Introduction

Since the early 2000s, there has been increased regulatory interest in understanding and mitigating near-road air pollution in the United States. The U.S. Environmental Protection Agency's 2001 Mobile Source Air Toxics (MSAT) Rule identified locations near heavily trafficked roads as important microenvironments for MSAT exposure (1). In 2003, California Senate Bill 352 classified freeways and other busy traffic corridors as facilities with the potential to emit hazardous air pollutants (2). The bill required environmental review of proposed school sites located within a quarter mile (~400 m) of urban or rural roads with average daily traffic exceeding 100,000 and 50,000 vehicles, respectively. In 2004, the Sierra Club litigated to prevent expansion of highway US 95 in Las Vegas, Nevada, citing concerns regarding near-road air pollutants. The lawsuit settlement agreement committed state and federal agencies to monitoring at several

roadside locations and to pilot mitigation strategies at nearby schools (3). A 2005 California Air Resources Board (CARB) land use guide recommended siting "sensitive land uses" further than 500 feet (~150 m) from a freeway or high-traffic road (4).

Concern over near-road pollution is motivated by a growing body of literature examining associations among pollutant concentrations, health impacts, and road proximity. To date, empirical findings on health effects related to near-road pollutant exposures have been mixed (5–17), and there have been few attempts to synthesize what is known about real-world near-road pollutant concentrations. This study begins to fill this gap by synthesizing and evaluating approximately three decades of published real-world monitoring data and characterizing the relationships that exist between pollutant concentrations and road proximity.

Two meta-analyses of near-road air quality have been undertaken in recent years. In the first, Brugge et al. (13) reviewed cardiopulmonary health risks associated with near-road exposures and concluded, from a review of eight studies, that ultrafine particle number, black carbon, carbon monoxide (CO), and oxides of nitrogen (NO_x, including nitric oxide [NO], and nitrogen dioxide [NO₂]) are elevated near roadways and the most important exposure zone extends to those individuals residing 30 m from freeways. In the second study, Zhou and Levy (18) performed a meta-analysis to determine important parameters affecting the "spatial extent" of impacts resulting from mobile source air pollution. They reviewed 33 studies; 18 were monitoring studies; the remainder involved dispersion modeling, land use regression, biomonitoring, and epidemiology. Spatial extent was defined as the distance at which roadway effects were no longer observable; it focused on measures of pollution concentration or health impacts. Their findings varied as a function of the spatial extent definition (concentration vs. health impacts), pollutant type, and local meteorology. Overall, they observed that the concentration-based spatial extent of mobile source impacts ranged from 100–500 m from roads. One limitation to this study, as noted by Zhou and Levy, was that results for particulate pollutants were not disaggregated by particulate size and mass fraction, a limitation that has been addressed in this study.

This paper advances understanding of the dispersion of near-road air pollutant concentrations by synthesizing findings from 41 monitoring studies undertaken beginning 1978 and published by June 2008. The findings document, by individual pollutant type, the distances over which near-road concentrations decay to background. Concentration measurements are normalized using two techniques: normalizing to a background and an edge-of-road concentration.

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The findings also complement other work describing the physical and atmospheric processes governing the shape and rate of decay curves for individual pollutants (18); such prior work has dealt mostly with chemical reactivity and dispersion impacts on the atmospheric transport and fate of given pollutants such as NO₂ and ultrafine particles (19). Finally, our results will help validate modeling tools or assess under which conditions model estimates are most robust. Pollutant exposure is determined by many factors such as time of day and location of activities (20); to the extent that exposure occurs in the near-road environment, this study provides a stronger scientific context for designing buffer zones to avoid exposure to higher pollution concentration levels.

Methods

Data Assembly and Preparation. To populate our database, we included reported distance/concentration pairs from all monitoring studies we identified that included information or findings on near-road concentration gradients. If upwind or background data were unavailable, downwind data were still included in the database. A comprehensive literature search was completed to identify and include data available as of June 2008; however, it is possible that studies not previously cited or widely distributed were missed. No judgment was made regarding the quality of the fieldwork or the instrumentation used. Rather, we assumed that study authors performed the necessary quality assurance and quality control to validate their data.

Although a diversity of measurement approaches and technologies have been used to assess near-road concentrations, the most frequently applied method was to arrange pollutant monitoring equipment along a vector approximately perpendicular to the road. Distances and pollutants varied among studies, as did motivation. Some studies collected data solely to observe near-road conditions; others were designed to improve model verification or calibration. Collected measurements typically involved measurement campaigns conducted over periods ranging from several hours to several weeks or longer. Meteorology also varied widely.

Our analysis unit was one distance/concentration pair (e.g., a single CO measurement at 30 m from the edge of road). We identified 780 such pairs from 41 papers (8, 21–60); the literature represents wide geographic, meteorological, and traffic operational variation. (The Supporting Information includes an annotated bibliography of all studies.)

Our final database includes distance/concentration pairs that spanned 263 unique measurement sets. A measurement set is defined here as a group of distance/concentration pairs originating from the same study and representing one pollutant under one set of measurement conditions. Many studies reported results from different observation days, seasons, or traffic conditions. If these data were available from the study results, we recorded them as separate measurement sets for analysis.

To partially control for the important influence of wind direction on observed concentration (31), data were only entered into the database for concentrations measured when wind was approximately from the road or was aggregated over meteorological conditions including winds from the road. Studies typically used prevailing wind patterns to orient monitors to measure downwind impacts, but four studies (13 measurement sets total) reported observations under parallel wind conditions (31, 44, 58, 59). These measurements were not included.

Field measurements were grouped by pollutant type or surrogate (EC includes black carbon, black smoke, and the reflectance of PM filters). Ultrafines were also grouped but as a separate category. The term “ultrafine” typically refers to particles less than 100 nm in diameter (61), and particle

number concentrations (as opposed to mass concentrations) are typically used to quantify ultrafine roadside concentrations. We categorized particle number concentration into three groups: UF1 particle number denotes data collection beginning at 3 nm, UF2 particle number signifies data collection beginning at 15 nm, and fine particle number begins at 300 nm (0.3 μm, just above the ultrafine classification). We also grouped volatile organic compounds (VOC) into two categories. The first was VOC1 including eight VOCs whose concentrations generally varied with distance from road; examples include 1,3-butadiene and methyl tert-butyl ether. VOC2 included four VOCs whose concentrations generally did not vary with distance from road; examples include propane and *n*-butane. (The Supporting Information contains further details on data reduction and complete information on pollutant grouping.)

Normalization. Monitored concentration data are typically normalized to wind speed or traffic volume (58), to a reference near-road distance (43, 44), or by subtracting out background concentration (41, 53). There are problems in normalizing to traffic volume or meteorological conditions when aggregating data across numerous studies. First, many studies do not provide sufficient information (e.g., temporal resolution) to derive similar measures of traffic or meteorological conditions elsewhere. Second, even when data can be gathered, studies frequently aggregate or resolve data to the units most useful for that particular study interest. For example, daily traffic might be used for cumulative effects, whereas peak hour traffic might be applied for a study interested in acute effects.

We have chosen two types of normalization procedures that can easily be replicated in future studies and rely on factors that are usually readily available from or described in published work. The first, normalizing to background, yields the relative concentration of pollutants measured in the near-road zone compared to nearby concentrations unaffected by (typically upwind of) the road. This normalization can directly identify whether and where measured concentrations fall to background levels. The normalization divides observed near-road concentrations by the reported background value; as values approach one, near-road concentrations approach background.

The second approach, normalizing to edge-of-road, yields the relative concentration of pollutants in the near-road zone compared to concentrations measured at the point of expected maximum roadway influence: the roadway edge. This type of normalization indirectly allows assessment of whether and where measured concentrations fall to background levels. This approach has two benefits relative to background normalization. First, it enables use of data from (many) studies for which no background measurements were published or recorded. Second, it avoids data comparison problems—since there is no standard protocol in use to measure near-road background concentrations, background concentrations reported in monitoring may result from a variety of measurement approaches and locations relative to the road being studied.

Edge-of-road normalization involves dividing all concentrations in a measurement set by the edge-of-road concentration. If the edge concentration was unavailable, in most cases an exponential fit of the individual measurement set was used. Previous work has shown that an exponential decay describes the atmospheric fate of pollutants which vary by distance (43, 55, 56, 59). We also used linear regression to estimate an edge concentration for pollutants that showed little variation with distance according to the supporting annotated bibliography. This did not affect the shape of the decay curve in the event that the concentration actually varied exponentially with distance. The estimated value was used simply to normalize the rest of the measurement set. If the

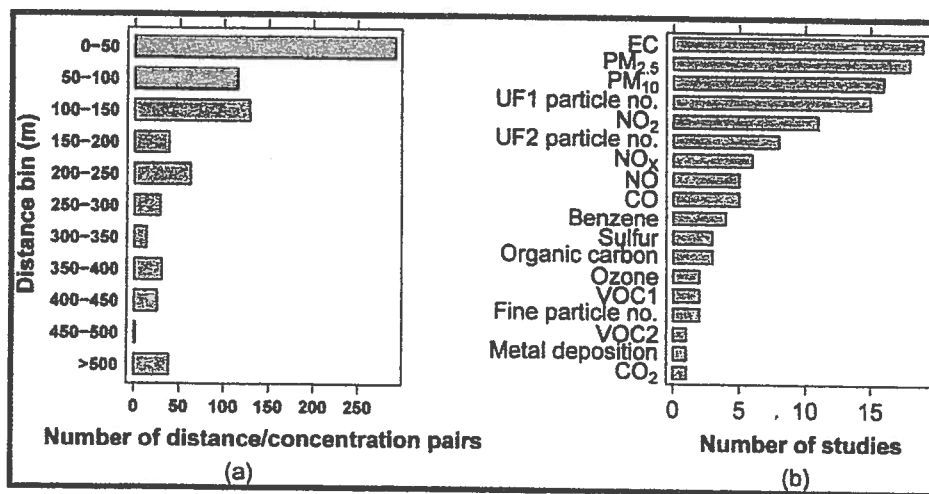


FIGURE 1. Database summary: (a) observations grouped by 50 m distance bin and (b) studies grouped by pollutant. EC in (b) refers to direct and surrogate measures; measures of particle number (UF1, UF2, Fine) and VOCs (VOC1, VOC2) are discussed in the text and the Supporting Information. The sum of bars in (b) exceeds the 41 studies in our database—some studied several pollutants.

edge concentration was underpredicted by linear regression, then normalized downwind values were artificially increased relative to the edge-of-road concentration; however, the point at which background was reached should not have been affected. We also used ANOVA assessments (discussed below) to quality check the assignment of edge concentrations. The ANOVA coefficients for near-road values confirmed that the assigned edge concentrations were reasonable.

The edge-normalized values indicate whether and at what distance from the road concentrations reach a stable value. In concept, stability is indicative of near-road concentrations approaching or reaching background, although it is numerically possible (though physically less likely) that stability could also represent a steady concentration above background. (See the Supporting Information for further edge normalization details.)

While many factors affect the magnitude of observed near-road concentrations (22, 35, 40, 59, 62), if the *shape* of the concentration decay curve is expected to be roughly similar across multiple studies for a given pollutant, dividing by the roadway edge concentration should preserve the shape while removing the absolute magnitude of the observations. This intuition has been confirmed by recent work on the influence of roadway configuration and sound/vegetation barriers on observed concentrations (62) and in other normalized comparisons undertaken by Zhu et al. (58) for three facilities normalized to unit wind speed and traffic volume. Others have taken a similar approach with more limited data; for example, Pleijel et al. (43) compared Swedish and Canadian monitoring data for NO_2 by dividing all observations by the NO_2 concentration at 10 m from the road.

Local Regression. Locally weighted regression (loess) was used to regress concentration on distance for both sets of normalized data. Loess is a robust smoother that does not impose a functional form on the relationship between the dependent and independent variables (63). The smoother uses a specified data window that moves along the x axis of a scatterplot. At each data point a fitted value is calculated using the subset of the data contained within the moving window. The size of the subset is defined as a percentage of total data and is referred to as the smoothing parameter; larger smoothing parameter values produce smoother concentration vs distance curves. Local regression has previously been applied to near roadway data by Gramotnev and Ristovski (59). However, the authors did not specify the value of the smoothing parameter used. We set the smoothing parameter by visual inspection. Parameter values of 0.75 and 0.70 (background normalization and edge normalization,

respectively) produced smoothed curves sufficient for the purpose of our research.

Analysis of Variance. Discussion of statistical significance is rare in the near-road literature. In studies that do conduct statistical analysis, paired t -tests comparing observed concentrations to a reference group typically located closest to the roadway are used (46, 50). Sabin et al. (47) used paired t -tests and an analysis of variance (ANOVA) to test differences in the dry deposition rates of metals between downwind locations. However, there is some question as to whether near-road pollution concentrations (in addition to other meteorological and traffic measurements) meet the normality criteria for a t -test, and in at least one study the nonparametric Mann-Whitney test has been used (22). The distribution of observed near-road concentrations may be skewed since there are generally a large number of low-concentration observations. If deviation from normality is very large, then ANOVA results may not be robust. To overcome this possibility, we performed an ANOVA to identify the magnitude and significance of changes in concentration by distance from road and augmented the ANOVA results with the nonparametric Kruskal-Wallis test [ref 64, pp 103–104]. R was used for all statistical analyses (65) and figure preparation (66).

Results and Discussion

The literature confirms intuition: meteorology—wind speed and direction—strongly affects near-road pollutant concentrations. When wind flows from the road to receptors, concentration gradients are more pronounced and extend to a greater distance than when wind is parallel to or away from receptors (31). Traffic volume and fleet composition (22, 59) and other factors such as the presence of a noise barrier (62) can also contribute to differences in observed concentrations of traffic-related air pollution. In general, concentrations decay to background within a few hundred meters downwind of a road, although studies measuring pollutants solely in the evening hours indicate that higher concentrations persist beyond 500 m (57). Most of the observations collected from the studies were obtained within 150 m of the roadway (Figure 1a). Studies focused on particulate matter (PM) mass, particle number concentrations, elemental carbon and surrogates (EC), and all oxides of nitrogen (Figure 1b). Approximately 68% of included studies involved some measurements near freeways or highways; the remainder involved measurements only near arterial and/or local roads.

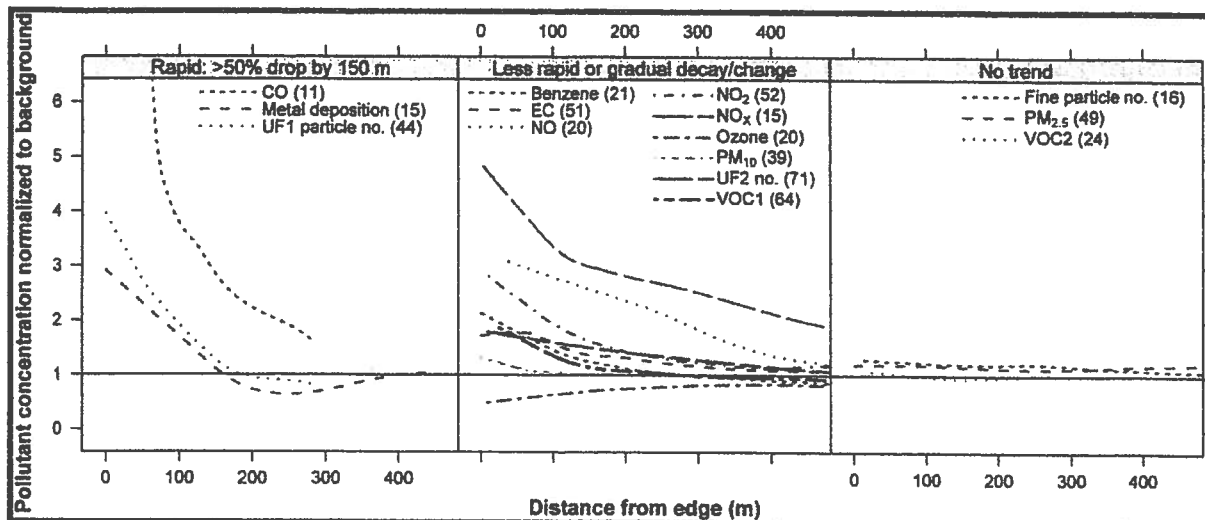


FIGURE 2. Local regression of background normalized concentrations on distance. The horizontal line indicates background concentration. A loess smoother ($\alpha = 0.75$, degree = 1) is fitted to each pollutant which is placed into one of three groups. The regression sample size, n , is given in parentheses after each pollutant.

TABLE 1. Summary of Background Normalized Data

group	pollutant	approximate multiplier above background concentration at edge-of-road	approximate distance required to reach background concentration (m) ^a
rapid: >50% drop by 150 m	CO	21 ^b	— ^c
	metal deposition	2.9	161
	UF1 particle no.	4.0	189
less rapid or gradual decay/change	benzene	2.1	280
	EC	1.7	420 ^d
	NO	3.3	565 ^e
	NO ₂	2.9	380 ^f
	NO _x	1.8	570 ^e
	PM ₁₀	1.3	176
	UF2 particle no.	4.8	910 ^e
	VOC1	2.0	270

^a The approximate distances were derived from an expanded version of Figure 2; the distance point at which the smoothed line reached a value of one on the y-axis is cited here as background. ^b Near-road CO concentrations extended outside of the range plotted in Figure 2. ^c CO concentrations did not reach background within the 285 m for which data were measured. ^d Background normalized concentrations attained an approximate minimum value of 1.1 at this distance from the road. ^e Reached background concentrations outside of the range plotted in Figure 2. ^f Background normalized concentrations attained an approximate minimum value of 1.08 at this distance from the road.

Background Normalization. The background-normalized concentrations are shown in Figure 2, and near-road concentrations and distance-to-background values are summarized in Table 1. (The Supporting Information contains supplemental figures illustrating the data used to produce Figures 2 and 3.)

In Figure 2, the range on the y-axis has been constrained to six times above background concentration. The only pollutant exceeding this is CO, which was observed to reach 20 times above background at the roadway edge. The range on the x-axis in Figure 2 has been constrained to 0–450 m from the edge of road where most of the data fall (Figure 1a). We also excluded data from two studies because the sampling and vehicle fleet characteristics were very unique relative to the rest of the studies. One study measured concentrations only at night; another study measured near-road conditions in 1978, when vehicle emissions and near-road concentrations were substantially higher than the values reported in other studies (45, 57). Organic carbon and sulfur are not shown in Figure 2 due to limited data. (See the Supporting Information for further discussion of omitted data.)

Changes in pollutant concentrations over distance generally fell into three groups. The first showed rapid initial concentration decay—defined here as at least a 50% decrease in peak/edge-of-road concentration by 150 m—followed by consistent but more gradual decay toward background; the second consistently decayed or changed over the entire distance range, while the third showed no trend with distance.

One pollutant, ozone, which is shown in the second panel, displayed a unique increasing trend, beginning below background near the road and gradually approaching background by 400 m from the edge. However, ozone values were consistent with expected near-road titration due to interaction with direct vehicle emissions of NO to form NO₂ (67).

All pollutants except for CO, UF2 particle number, NO, and NO_x, reached background by approximately 400 m. UF2 particle number concentrations should generally be lower than UF1 particle number concentrations (38, 48, 68). Reasons for anomalously high UF2 particle numbers are discussed below along with other study limitations. Generally, the high concentrations shown in the first 100 m drop off by 400 m, even considering the between-study differences in methods

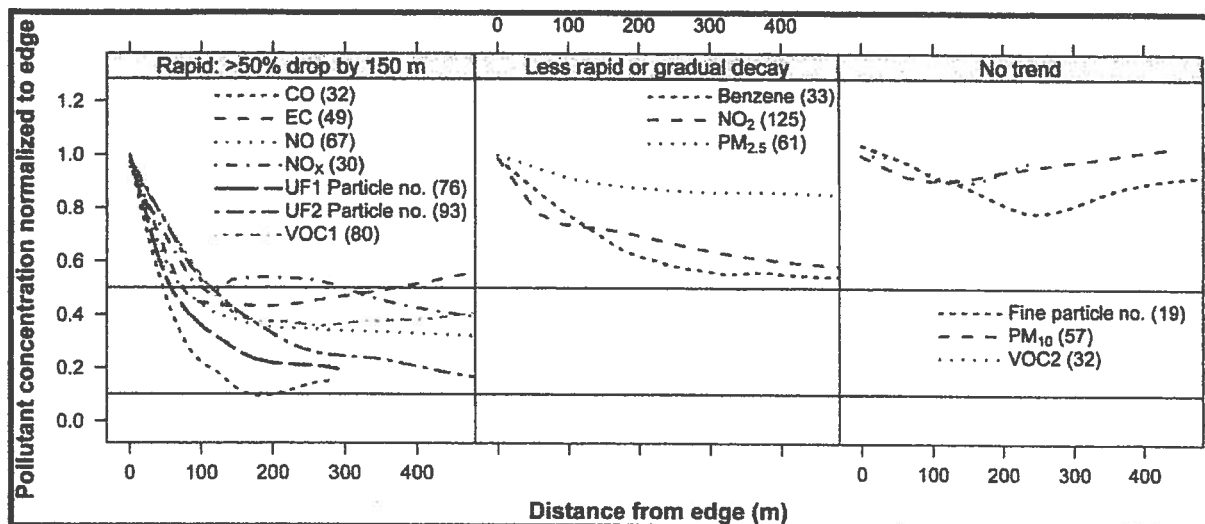


FIGURE 3. Local regression of edge normalized concentrations on distance. The horizontal black lines show a reduction from the edge-of-road concentration of 90% (at 0.1) and 50% (at 0.5). A loess smoother ($\alpha = 0.70$, degree = 1) was fitted to pollutant data which was placed in one of three groups. The regression sample size, n , is given in parentheses after each pollutant. The n includes an estimated (not in the literature) edge-of-road value to facilitate normalization.

TABLE 2. Summary of Edge Normalized Data^a

group	pollutant	percentage decrease ^b	distance (m)	reached background
rapid: >50% drop by 150 m	CO	90	170	yes
	EC	56	130	yes
	NO	65	200	yes
	NO _x	52	115	yes
	UF1 particle no.	79	210	yes
	UF2 particle no.	86	570 ^c	yes
	VOC1	62	180	yes
less rapid or gradual decay	benzene	45	320	yes
	NO ₂	42	550 ^c	yes
	PM _{2.5}	22	986 ^d	no

^a Distances and percentage decreases were derived from an expanded version of Figure 3. ^b For pollutant concentrations that reached background: defined as percent decrease in edge-of-road concentration at the stabilization distance. For pollutants that did not reach background: defined as percent decrease in edge-of-road concentration at the furthest distance for which measurement data were available. ^c Reached background outside of the range plotted in Figure 3. ^d Data for PM_{2.5} extended to 986 m from the edge of road.

and traffic characteristics; this is notable considering the wide variation in data and the inherent limitations of this normalization method (i.e., the lack of common protocols used to define background). The curves indicate (ignoring ozone) that concentrations of certain pollutants are elevated near roadways and decrease as the distance increases, while other pollutants show no roadway influence. These background normalized results suggest that a range of approximately 160–400 m is sufficient to reach background concentrations for the majority of pollutants.

Edge Normalization. The results for the normalization to roadway edge are shown in Figure 3 and summarized in Table 2. We were able to include more data in the edge normalization than background normalization since background measurements or estimates were not required for normalizing in this method. Of the 138 total measurement sets comprising Figure 3, 114 did not include an edge-of-road concentration. Exponential fits (total number of measurement sets for each pollutant in parentheses) were used to determine edge concentrations for benzene (6), CO (3), EC (6), NO (5), NO₂ (14), NO_x (4), UF1 particle number (6), UF2 particle number (14), and VOC1 (16). Linear regression was used to estimate an edge concentration for PM₁₀ (9), PM_{2.5} (11), fine particle number (3), and VOC2 (8). The remaining nine measurement sets contained only two

distance/concentration pairs. Edge-of-road concentrations for these pollutants were also estimated using linear regression including EC (1), NO₂ (2), NO_x (1), UF1 particle number (3), and UF2 particle number (2). We omitted organic carbon, sulfur, and metal deposition from Figure 3; the data for these pollutants were too sparse to smooth without significantly increasing the smoothing parameter. We also omitted ozone because its increasing concentration with increased distance from the road would plot outside the range of Figure 3. Data from the nighttime-only Zhu et al. (57) study were also excluded. (See the Supporting Information for details on omitted data and edge normalization.)

Edge normalization provides the percentage decrease in pollution concentration as measured from the roadway edge to the distance of interest (Figure 3). For concentrations that varied by distance, the percentage of the near road high concentration at which leveling occurred represents a proxy of that pollutant's background concentration; this assumes that the roadway influence has dropped to approximately zero when no further changes occur in the smoothed curve.

Figure 3 shows CO, benzene, EC, NO, NO_x, NO₂, PM_{2.5}, and UF1 particle number, UF2 particle number, and VOC1 all decreased as distance from road increased. PM₁₀, fine particle number, and VOC2 showed ambiguous or little to no trend with distance.

TABLE 3. ANOVA and Kruskal-Wallis Results: Background Normalization^a

	ANOVA		Kruskal-Wallis <i>p</i> -value ^a	0-80 m		80-120 m		>120 m	
	Df	F		coeff. ^f	n	coeff. ^f	n	coeff. ^f	n
benzene	(2,18)	17.13 ^d	0.0027	1.967	6		1	-0.968 ^d	14
CO	(1,9)	6.14 ^b	0.0140	12.41	7			-9.97 ^b	4
EC	(1,49)	9.62 ^c	<0.001	2.41	36			-1.119 ^c	15
metal deposition	(1,13)	30.8 ^d	0.0022	3.06	5			-1.947 ^d	10
NO	(2,17)	4.48 ^b	0.0320	5.13	4		1	-3.22 ^b	15
NO _x	(1,13)	4.80 ^b	0.0022	5.55	5			-4.26 ^b	10
NO ₂	(2,49)	13.49 ^d	<0.001	2.63	21		10	-1.378 ^d	21
UF1 p.m. no.	(2,41)	6.06 ^c	<0.001	4.72	29		4	-3.46 ^c	11
UF2 p.m. no.	(2,68)	8.90 ^d	<0.001	6.84	27	-3.46 ^b	10	-4.34 ^d	34
VOC1	(2,61)	37.6 ^d	<0.001	2.09	18	-0.826 ^b	2	-1.037 ^d	44
VOC2	(1,22)	4.31 ^b	0.0431	1.053	8			-0.0817 ^b	16
fine PM no.	(2,13)	3.48	0.1426		4		2		10
ozone	(2,17)	1.64	0.547		5		1		14
PM ₁₀	(2,36)	3.00	<0.001	1.424	27		3	-0.412 ^b	9
PM _{2.5}	(2,46)	0.383	0.791		24		3		22
sulfur	(2,3)	0.987	0.1717		2		1		3

^a The last five rows contain those pollutants with insignificant *F* statistics. ^b Statistical significance is indicated as follows: *p* < 0.05. ^c Statistical significance is indicated as follows: *p* < 0.01. ^d Statistical significance is indicated as follows: *p* < 0.001. ^e The Kruskal-Wallis *p*-value is taken from the nonparametric Kruskal-Wallis test whose null hypothesis is that there is no difference in the mean ranks of the groups. ^f Refers to the regression coefficients extracted from a linear regression of normalized concentrations on distance bin. The coefficient in the 0-80 m bin was the model intercept which represents the mean normalized value in that range, while the coefficients in the other two distance bins represent mean changes relative to the first bin. Missing values in the table indicate insignificant results as judged by the omnibus *F* and the Kruskal-Wallis *p*-value, or no data, evidenced by a blank *n* for the cell.

We again categorized rapidly decaying pollutants as those which decreased at least 50% from their peak value by 150 m. Several pollutants exhibited sharp declines within the first 100-150 m before leveling off. CO and UF1 particle number showed the greatest declines. Benzene, NO₂, and PM_{2.5} showed gradually decreasing trends. NO₂ declined continuously to 450 m indicating that background concentrations were not reached over the plotted distance range but flattened beginning at approximately 550 m from the roadway edge. UF2 particle number showed substantial declines over the entire plotted distance range but did not appear to level until approximately 570 m from the road. The majority of the edge-normalized pollutant concentrations appear to reach background by 115 to 300 m from the edge of road.

Analysis of Variance. Some of the most frequently cited studies using real-world observations (55, 56) show substantial pollutant reductions by 80 m from the road, only slightly shorter than the 100 m zone of highest exposure for some pollutants found in a recent meta-analysis (18).

Near-road concentrations have traditionally been modeled as a Gaussian plume [e.g. ref 11] with as much as 96% of the concentration dissipating by 150 m (69). Our work, however, suggests that decay regimes may be more complex and possibly organized into those pollutants that, under certain conditions, decay rapidly, those that decay gradually, and those that do not decay. To test this hypothesis, we divided our data into three different groups organized by findings in the literature. Specifically, the first bin (0-80 m) represents the window of anticipated peak concentration, as evidenced by our synthesis and widely referenced work (55, 56), the second bin (80-120 m) captures the window which some of the literature has flagged as the end of the spatial extent of mobile source impacts (18), and finally, the third bin (120 m and beyond) represents a reference for the distance range where the literature (modeled and monitored) suggests a substantial decline in observed roadway influence. Some pollutants have no data in the second bin, but this simply reduces the test to a comparison between the first and third groups. The null hypothesis in this case is that there is no difference in mean observed

concentrations between observations near the road (i.e., the first distance bin) and observations further downwind of the road (distance bins two and three).

The mean values (coefficients) for the pollutant within distance category are reported in Tables 3 and 4 for background and edge normalized data, respectively. The coefficients in the second and third distance bins (i.e., 80-120 m and >120 m) are mean changes relative to the first category. It should be noted that the means are not directly comparable to the loess plots, since the loess algorithm uses a weighting function to calculate its fitted values at each data point.

All coefficients in the second and third bin for both normalization methods are negative, since concentrations generally decrease when moving from the first to the second and third distance categories. Results from the Kruskal-Wallis test and ANOVA are generally in agreement, indicating that any deviations from normality are generally not severe enough to affect the ANOVA results.

Background Normalized Concentrations. Mean values of multipliers above background in the first 80 m from the road range from a factor of 1.05 for VOC2 to 12.4 for CO. For PM₁₀, the ANOVA *F*-statistic differs from the Kruskal-Wallis *p*-value. PM₁₀ is on average 1.42 times above background concentrations (0-80 m) and declines by an average of approximately 0.4 from the near road value beyond 120 m (28% decrease). Benzene also shows a small but significant increment above background at 1.97, declining to 1.0 past 120 m (49% decrease). Each of the remaining pollutants that vary by distance both begin at a higher above-background increment than PM₁₀ and decrease more sharply. Thus, the relationship of PM₁₀ with distance appears to be weak, if it exists. PM_{2.5}, fine particle number, and sulfur do not vary by distance, and VOC2 shows a small but statistically significant relationship with distance bin, decreasing by 8% over the distance range greater than 120 m from the road.

Edge Normalized Concentrations. Results show that 10 pollutants out of 11 had mean concentration values less than or equal to one in the 0-80 m range. Mean concentration values for PM₁₀, PM_{2.5}, and VOC2 for the same distance range

TABLE 4. ANOVA and Kruskal-Wallis Results: Edge Normalization^a

	ANOVA		Kruskal-Wallis <i>p</i> -value ^a	0-80 m		80-120 m		>120 m	
	Df	<i>F</i>		coeff. ^f	<i>n</i>	coeff. ^f	<i>n</i>	coeff. ^f	<i>n</i>
benzene	(2,24)	4.40 ^b	0.0282	0.876	7				
CO	(2,24)	15.42 ^c	<0.001	0.652	16	-0.564 ^c	3	-0.255 ^c	17
EC	(2,37)	6.16 ^c	0.0057	0.740	20		2	-0.477 ^d	9
fine PM no.	(2,13)	3.86 ^b	0.0184	1.018	4		1	-0.264 ^c	19
metal deposition	(1,13)	144.7 ^d	0.00182	1.000	5		2	-0.202 ^b	10
NO	(2,52)	16.02 ^d	<0.001	0.751	25	-0.574 ^d	3	-0.615 ^d	10
NO _x	(2,22)	3.95 ^b	0.0369	0.737	8	-0.609 ^b	2	-0.385 ^d	27
NO ₂	(2,97)	34.8 ^d	<0.001	0.883	41	-0.248 ^d	17	-0.1777 ^d	15
UF1 p.m. no.	(2,61)	15.04 ^d	<0.001	0.611	41	-0.277 ^c	7	-0.353 ^d	42
UF2 p.m. no.	(2,74)	40.5 ^d	<0.001	0.763	29	-0.239 ^d	12	-0.445 ^d	16
VOC1	(2,61)	6.83 ^c	0.0042	0.730	18	-0.448 ^b	2	-0.241 ^c	36
ozone	(2,17)	0.807	0.319		5		1		14
PM ₁₀	(2,41)	1.507	0.214		22		7		15
PM _{2.5}	(2,46)	0.877	0.0334		16		5		28
sulfur	(1,2)	0.061	0.655				1		3
VOC2	(1,22)	3.71	0.066		8				16

^a The last five rows contain those pollutants with insignificant *F* statistics. ^b Statistical significance is indicated as follows: *p* < 0.05. ^c Statistical significance is indicated as follows: *p* < 0.01. ^d Statistical significance is indicated as follows: *p* < 0.001. ^e The Kruskal-Wallis *p*-value is taken from the nonparametric Kruskal-Wallis test whose null hypothesis is that there is no difference in the mean ranks of the groups. ^f Refers to the regression coefficients extracted from a linear regression of normalized concentrations on distance bin. The coefficient in the 0-80 m bin was the model intercept which represents the mean normalized value in that range, while the coefficients in the other two distance bins represent mean changes relative to the first bin. Missing values in the table indicate insignificant results as judged by the omnibus *F* and the Kruskal-Wallis *p*-value, or no data, evidenced by a blank *n* for the cell.

not shown in Table 4 averaged 0.98, providing evidence that edge concentrations were not consistently underestimated.

Concentrations were significantly different for CO, NO, NO₂, VOC1, UF1, and UF2 particle number when comparing the second (80-120 m) and third distance bins (>120 m) to the first (0-80 m). NO_x concentrations were significantly different when comparing the second distance bin to the first. Benzene, EC, metal deposition, and fine particle number showed significant decreases in concentration when comparing the third distance bin to the first. Ozone, PM₁₀, PM_{2.5}, sulfur, and VOC2, all show insignificant *F* statistics.

The Kruskal-Wallis *p*-value indicates significant differences among means by distance group across all pollutants (*p* < 0.05) except for ozone, sulfur, PM₁₀, and VOC2. PM_{2.5} is the only pollutant which shows disagreement between tests. This is likely due to the distribution of PM_{2.5} measurements. When distributions are non-normal, Kruskal-Wallis is more likely to reject a false null hypothesis than ANOVA. A significant decrease in concentration with increasing distance for PM_{2.5} is consistent with graphical evidence from Figure 3. A similar explanation likely holds for background-normalized PM₁₀.

Limitations and Differences between Normalization Methods. We have introduced the first comprehensive use of the edge normalization technique to the literature, partially to offset limitations of using the standard background normalization. We find that normalizing on the basis of the edge-of-road concentration offers advantages to normalizing by the background concentration because the definition of background concentrations differs across studies in the absence of a standard protocol. If, in a particular study, background is mischaracterized as either too high or too low, that study's results can obscure or overstate trends when pooled with other findings. Different studies variously defined background as concentrations measured at the edge of the upwind lanes, some distance from the upwind lanes, the nearest stationary monitoring site, or other locations. These inconsistencies also raise the possibility that our database may include "background" concentrations which reflect roadway influence. This situation could have occurred if

investigators measured background during very low wind speed (meandering wind), when roadway pollutants could drift toward the background monitor. If such situations occurred, they would have artificially increased background values and reduced the observed near-road (downwind) impacts. In general, high background concentrations will tend to generate flatter gradients, and low background concentrations will generate steeper gradients.

For example, background measurements of PM₁₀ for a study in Macao, China were taken on a separate island at sites located 2-4 km away from the roadways under study (54). The resultant low background measurements tended to inflate the background-normalized Macao concentrations relative to other studies in our database that typically measured background just upwind of the roadway under study.

As another illustration, different background measurement protocols resulted in anomalous UF2 particle number findings. Particle number concentrations increase with measurement of smaller-diameter particles (38, 48, 68). However, in Figure 2, normalized UF2 particle number (>15 nm diameter) concentrations exceeded UF1 particle number (>3 nm diameter) concentrations. Part of the explanation involves a study by Hitchins et al. (31) which measured UF2 particle numbers. The authors did not take background measurements but did report concentrations when the wind direction was from the receptors to the road—a background estimation approach that has been used in some other studies [e.g. ref 27]. Additionally, Hitchins et al. (31) reported concentration values under several different wind speed scenarios. The highest values of UF2 particle number were reported at the lowest wind speed, but the background value was given for conditions with a higher wind speed. In this case, normalizing by the reported background concentration resulted in exaggerated concentration values. If another study contemporaneously reported background and near road values, it would likely show lower normalized concentrations. This highlights the difficulties associated with pooling data from studies that frequently employ different measurement and reporting protocols. Depending upon the sample size

TABLE 5. Summary of Pollutant Profiles under Both Normalization Methods^{a,c}

	distance from road at which leveling begins or background reached (m)		percentage of near-road high concentration at which leveling begins or background is reached		edge-of-road multiplier above background concentration (multiples of background)	
	EN	BN	EN	BN ^b	EN ^c	BN
NO _x	115	570	48	56	2.1	1.8
EC	130	420	44	59	2.3	1.7
CO	170	— ^d	10	5	10	21
VOC1	180	270	38	50	2.6	2.0
UF1 particle no.	210	189	21	25	4.8	4.0
NO	200	565	35	30	2.9	3.3
benzene	320	280	55	48	1.8	2.1
NO ₂	550	380	58	34	1.7	2.9
UF2 particle no.	570	910	14	21	7.1	4.8
metal deposition	—	161	—	34	—	2.9

^a Table entries are sorted based on the edge normalized distance at which background concentrations are reached (**bold**). Pollutants that showed significant results in both ANOVA models are included. ^b Calculated as the inverse of the edge-of-road multiplier above background concentrations. ^c Calculated as the inverse of the percentage of near road high at which leveling occurs. ^d Missing values indicate no smoothed data for estimation (e.g., metal deposition) or similar limitations. ^e Abbreviations: EN is edge normalization; BN is background normalization.

across studies, a single study can substantially alter the position of a pollutant's background normalized curve by reporting a background concentration much higher or lower than the background values found in other studies.

In general, it is likely that the bias across studies is for some reported background values to underpredict (be lower than) actual background, due to lengthy averaging periods for background vs near-road measurements, or use of monitoring locations at relatively unpolluted sites distant from areas immediately upwind of the roads studied. This bias would tend to increase the background normalized values estimated here and lengthen the estimated distance required to reach background (affecting results shown in Figure 2). Biasing the distance required to reach background could result in a pollutant being placed into a different decay category depending on the normalization method used.

When normalizing by edge concentrations, the data yield their own background value by virtue of leveling off. The general assumption with edge normalization is that, when pooling data from numerous studies, if the regression approaches a horizontal line, this approximately signifies that roadway influence has diminished to background.

A limitation of the information derived from edge normalization is the possibility that concentrations level off at values which are site-specific—for example, due to abnormally high background concentrations or due to conditions that inhibit dispersion and result in stabilized concentrations above background. If site-specific situations caused the distance at which background was reached to vary across studies, or caused the stabilized value to be an unusually large fraction of the edge-of-road concentration, the regression results (Figure 3) may be biased (e.g., stabilized values higher than background, or the point of stabilization at a shorter distance than would be expected without unusually high background). Finally, while predicting an edge-of-road concentration does not affect the shape of an individual measurement set, it may affect the shape and position of the smoother. If the edge concentration were consistently underpredicted, Figure 3 would show an initial increase in concentrations moving away from the edge of road. Similarly, if the edge concentration was consistently overpredicted, the observed decrease in concentrations would be exaggerated.

Table 5 summarizes the concentration gradients of each pollutant that showed a significant variation with distance in both ANOVA models (see Tables 3 and 4 for significance). Overall, compared to background normalization, edge nor-

malization showed a more rapid decline to background concentrations for EC, NO_x, NO, UF2 particle number concentrations, and VOC1, and a less rapid decline for NO₂. Benzene and UF1 particle number concentrations declined to background at similar distances from the road under both normalization methods. Background normalization has more pollutants in the "gradual decay" category than edge normalization (nine and three, respectively). These results are consistent with the hypothesis that background normalization results in increased distance-to-background values and partially explains why pollutants can change decay categories depending on the normalization method. These differences would likely be smaller if studies better matched background concentrations to the location of near-road measurements.

The findings show that, for almost all pollutants, the influence of the roadway on air pollution concentrations decays to background between 115–570 m according to edge normalization and between 160–570 m based on background normalization. These ranges cover all background normalized pollutants except for CO, which declines continuously to 285 m (end point of available CO data), and UF2 particle number, which achieved background after 910 m; and all edge-normalized pollutants except for metal deposition which was too sparse to smooth and PM_{2.5}, which achieved background by 990 m. Edge-of-road concentrations were elevated from 1.7–20 times above background.

The trends indicated by both normalization methods are broadly consistent, not considering the specific distance at which background is reached. As Table 5 indicates, there is general agreement in terms of the increment at the roadway edge relative to background concentrations (at least to an order of magnitude, in the case of CO, and much closer for benzene, EC, NO_x, and UF1 particle number).

Relevance for Future Research. Key considerations for future near-road work include the following: standardizing the location and method of obtaining background measurements and reporting more completely on site conditions. Some studies at specific sites have assessed how changes in traffic volumes or meteorological characteristics affected near-road concentrations (40, 70, 71). Greater and more consistent specification of site conditions in future work will broaden understanding of the key factors that contribute to near-road concentrations. This study is based on published, mostly daytime, data available as of June 2008. These data were aggregated from studies with nonuniform sampling procedures and nonuniform locations (i.e., different roadway,

geographic, and meteorological conditions). The majority of field studies were conducted at-grade with no obstructions to air flow between the road and the pollution monitors. Such obstructions have been shown to affect observed concentrations (62). Data were only entered when wind direction was approximately from the road to the receptors. Additionally, the sampling periods employed by each investigator typically varied from several hours to several weeks or longer. Concentrations averaged over longer periods will likely vary less than those measured during shorter intervals. Background concentrations were not always averaged over the same period as the associated near-road measurements, nor were they taken in similar locations relative to the road. The choice of background measurement technique can over- or understate roadway increments for a single study; as evidenced by Table 5, the variability in reporting background concentrations may result in an overall bias to overestimate the distance at which pollutant concentrations decay to background.

Some omitted data (57) (described in the Supporting Information), combined with more recent findings (72), indicate that nighttime or presunrise conditions can lengthen, to perhaps two or three thousand meters, the distance at which near-road pollutant concentrations decay to background. Additionally, nighttime near-road ultrafine particle number concentrations can occasionally exceed daytime conditions, despite reduced traffic volumes (72). Further work is needed to integrate daytime and nighttime findings and to assess their relative importance given daytime and nighttime differences in travel activity, near-road pollutant concentrations, and factors affecting human exposure.

In addition to integrating nighttime and daytime near-road findings, future work should update the findings presented here to reflect ongoing research. Additional near-road measurement results were published following assembly and analysis of the data presented in this paper [e.g. refs 73–75]. Findings from recent studies are consistent with results presented here—they show that daytime near-road concentrations are generally indistinguishable from background within several hundred meters from the road.

Acknowledgments

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Supporting Information Available

Annotated bibliography of all studies included in the synthesis, further discussion on data reduction, omitted data, and edge normalization as well as supplementary figures. This material is available free of charge via the Internet at <http://pubs.acs.org>.

Literature Cited

- U.S. Environmental Protection Agency. Control of Emissions of Hazardous Air Pollutants from Mobile Sources; Final Rule. *Fed. Regist.* 2001, 66 (61), 17230–17273.
- California State Legislature, Session 2003–2004, Senate Bill 352.
- Federal Highway Administration FHWA MSAT Study US 95 Settlement Agreement. <http://www.fhwa.dot.gov/environment/airtoxicmsat/setagree.htm> (accessed November 19, 2009).
- CARB. *Air Quality and Land Use Handbook: A Community Health Perspective*; California Air Resources Board: Sacramento, CA, 2005.
- Lin, S.; Munsie, P. M.; Hwang, S.; Fitzgerald, E.; Cayo, M. R. Childhood asthma hospitalization and residential exposure to state route traffic. *Environ. Res.* 2002, 88 (2), 73–81.
- Gauderman, W. J.; Avol, E.; Lurmann, F.; Kunzli, N.; Gilliland, F.; Peters, J.; McConnell, R. Childhood asthma and exposure to traffic and nitrogen dioxide. *Epidemiology* 2005, 16 (6), 737–743.
- Edwards, J.; Walters, S.; Griffiths, R. K. Hospital admissions for asthma in preschool children: relationship to major roads in Birmingham, United Kingdom. *Arch. Environ. Health* 1994, 49 (4), 223–227.
- Kim, J. J.; Smorodinsky, S.; Lipsett, M.; Singer, B. C.; Hodgson, A. T.; Ostro, B. Traffic-related air pollution near busy roads - The East Bay children's respiratory health study. *Am. J. Respir. Crit. Care Med.* 2004, 170 (5), 520–526.
- McConnell, R.; Berhane, K.; Yao, L.; Jerrett, M.; Lurmann, F. W.; Gilliland, F.; Kunzli, N.; Gauderman, W. J.; Avol, E.; Peters, J. Traffic, susceptibility, and childhood asthma. *Environ. Health Perspect.* 2006, 114 (5), 766–772.
- Savitz, D. A.; Feingold, L. Association of childhood cancer with residential traffic density. *Scand. J. Work, Environ. Health* 1989, 15 (5), 360–363.
- Pearson, R. L.; Wachtel, H.; Ebi, K. L. Distance-weighted traffic density in proximity to a home is a risk factor for leukemia and other childhood cancers. *J. Air Waste Manage. Assoc.* 2000, 50 (2), 175–180.
- Wyler, C.; Braun-Fahrlander, C.; Kunzli, N.; Schindler, C.; Ackermann-Lieblich, U.; Perruchoud, A. P.; Leuenberger, P.; Wutrich, B. Exposure to Motor Vehicle Traffic and Allergic Sensitization. *Epidemiology* 2000, 11 (4), 450–456.
- Brugge, D.; Durant, J.; Rioux, C. Near-highway pollutants in motor vehicle exhaust: A review of epidemiologic evidence of cardiac and pulmonary health risks. *Environ. Health* 2007, 6 (1), 23.
- Peters, A.; von Klot, S.; Heier, M.; Trentinaglia, I.; Hormann, A.; Wichmann, H. E.; Lowel, H. Exposure to traffic and the onset of myocardial infarction. *New Engl. J. Med.* 2004, 351 (17), 1861–70.
- Pedersen, C. B.; Raaschou-Nielsen, O.; Hertel, O.; Mortensen, P. B. New Directions: Air pollution from traffic and schizophrenia risk. *Atmos. Environ.* 2004, 38 (22), 3733–3734.
- Wjst, M.; Reitmeir, P.; Dodd, S.; Wulf, A.; Nicolai, T.; von Loeffelholz-Colberg, E. F.; von Mutius, E. Road traffic and adverse effects on respiratory health in children. *Br. Med. J.* 1993, 307, 596–600.
- Zmirou, D.; Gauvin, S.; Pin, I.; Momas, I.; Sahraoui, F.; Just, J.; Le Moulllec, Y.; Bremont, F.; Cassadou, S.; Reungoat, P.; Albertini, M.; Lauvergne, N.; Chiron, M.; Labbe, A. Traffic related air pollution and incidence of childhood asthma: results of the Vesta case-control study. *J. Epidemiol. Community Health* 2004, 58 (1), 18–23.
- Zhou, Y.; Levy, J. Factors influencing the spatial extent of mobile source air pollution impacts: a meta-analysis. *BMC Public Health* 2007, 7 (1), 89.
- Zhang, K. M.; Wexler, A. S.; Zhu, Y. F.; Hinds, W. C.; Sioutas, C. Evolution of particle number distribution near roadways. Part II: the 'Road-to-Ambient' process. *Atmos. Environ.* 2004, 38, 6655–6665.
- Sexton, K.; Ryan, P. B. Assessment of human exposure to air pollution: methods, measurements and models. In *Air Pollution, the Automobile and Public Health*; Watson, A. Y., Bates, R. R., Kennedy, D., Eds.; National Academy Press: New York, 1988; pp 207–238.
- Roemer, W. H.; van Wijnen, J. H. Differences among black smoke, PM₁₀, and PM_{2.5} levels at urban measurement sites. *Environ. Health Perspect.* 2001, 109 (2), 151–154.
- Zhu, Y.; Hinds, W. C.; Shen, S.; Sioutas, C. Seasonal trends of concentration and size distribution of ultrafine particles near major highways in Los Angeles. *Aerosol Sci. Technol.* 2004, 38 (S1), 5–13.
- Ashbaugh, L. L.; Flocchini, R. G.; Chang, D.; Garza, V.; Carvacho, O. F.; James, T. A.; Matsumura, R. T. *Traffic Generated PM₁₀ "Hot spots"*; Final Report for the California Department of Transportation, Contract No. 53V606 A2; Air Quality Group, Crocker Nuclear Laboratory: Davis, CA, August, 1996.
- Cahill, T.; Sperling, D.; Chang, D.; Gearhart, E.; Carvacho, O.; Ashbaugh, L. *PM₁₀ "Hot Spot" Emissions from California Roads*; Report to Caltrans; Air Quality Group: Davis, CA, March, 1994.
- Clements, A.; Jia, Y.; Fraser, M. P.; Zhu, Y.; Pudota, J.; DenBleyker, A.; Michel, E.; Collins, D. R.; McDonald-Buller, E.; Allen, D. T., Air Pollutant Concentrations near Texas Roadways: Chemical Transformations of Pollutants In *Air & Waste Management Association Annual Conference and Exhibition*, Portland, OR, 2008.

- (26) Cyrus, J.; Heinrich, J.; Hoek, G.; Meliefste, K.; Lewne, M.; Gehring, U.; Bellander, T.; Fischer, P.; Van Vliet, P.; Brauer, M.; Wichmann, H. E.; Brunekreef, B. Comparison between different traffic-related particle indicators: Elemental carbon (EC), PM_{2.5} mass, and absorbance. *J. Exposure Anal. Environ. Epidemiol.* 2003, 13 (2), 134–143.
- (27) Gidhagen, L.; Johansson, C.; Omstedt, G.; Langner, J.; Olivares, G. Model simulations of NO_x and ultrafine particles close to a Swedish highway. *Environ. Sci. Technol.* 2004, 38 (24), 6730–6740.
- (28) Gilbert, N. L.; Woodhouse, S.; Stieb, D. M.; Brook, J. R. Ambient nitrogen dioxide and distance from a major highway. *Sci. Total Environ.* 2003, 312 (1–3), 43–46.
- (29) Hagler, G. S. W.; Thoma, E. D.; Baldauf, R.; Long, T. R.; Snow, R. F. Impact of Meteorology, Traffic Characteristics, and Distance from Roadway on Roadside Concentrations of Ultrafine Particulate Matter In Air & Waste Management Association Annual Conference and Exhibition, Portland, OR, 2008.
- (30) Harrison, R. M.; Tilling, R.; Romero, M. S. C.; Harrad, S.; Jarvis, K. A study of trace metals and polycyclic aromatic hydrocarbons in the roadside environment. *Atmos. Environ.* 2003, 37 (17), 2391–2402.
- (31) Hitchins, J.; Morawska, L.; Wolff, R.; Gilbert, D. Concentrations of submicrometre particles from vehicle emissions near a major road. *Atmos. Environ.* 2000, 34 (1), 51–59.
- (32) Hoek, G.; Meliefste, K.; Cyrus, J.; Lewne, M.; Bellander, T.; Brauer, M.; Fischer, P.; Gehring, U.; Heinrich, J.; van Vliet, P.; Brunekreef, B. Spatial variability of fine particle concentrations in three European areas. *Atmos. Environ.* 2002, 36 (25), 4077–4088.
- (33) Janssen, N. A. H.; VanMansom, D. F. M.; VanDerJagt, K.; Harssema, H.; Hoek, G. Mass concentration and elemental composition of airborne particulate matter at street and background locations. *Atmos. Environ.* 1997, 31 (8), 1185–1193.
- (34) Kuhn, T.; Biswas, S.; Fine, P.; Geller, M.; Sioutas, C. Physical and Chemical Characteristics and Volatility of PM in the Proximity of a Light-Duty Vehicle Freeway. *Aer. Sci. Technol.* 2005, 39 (4), 347–357.
- (35) Kuhn, T.; Biswas, S.; Sioutas, C. Diurnal and seasonal characteristics of particle volatility and chemical composition in the vicinity of a light-duty vehicle freeway. *Atmos. Environ.* 2005, 39 (37), 7154–7166.
- (36) Lena, T. S.; Ochieng, V.; Carter, M.; Holguin-Veras, J.; Kinney, P. L. Elemental carbon and PM_{2.5} levels in an urban community heavily impacted by truck traffic. *Environ. Health Perspect.* 2002, 110 (10), 1009–1015.
- (37) Monn, C.; Carabias, V.; Junker, M.; Waeber, R.; Karrer, M.; Wanner, H. U. Small-scale spatial variability of particulate matter <10 μm (PM₁₀) and nitrogen dioxide. *Atmos. Environ.* 1997, 31 (15), 2243–2247.
- (38) Nanzetta, M. K.; Holmen, B. A. Roadside particle number, distributions and relationships between number concentrations, meteorology, and traffic along a northern California freeway. *J. Air Waste Manage. Assoc.* 2004, 54 (5), 540–554.
- (39) Nitta, H.; Sato, T.; Nakai, S.; Maeda, K.; Aoki, S.; Ono, M. Respiratory health associated with exposure to automobile exhaust. 1. Results of cross-sectional studies in 1979, 1982, and 1983. *Arch. Environ. Health* 1993, 48 (1), 53–58.
- (40) Ntziachristos, L.; Ning, Z.; Geller, M. D.; Sioutas, C. Particle concentration and characteristics near a major freeway with heavy-duty diesel traffic. *Environ. Sci. Technol.* 2007, 41 (7), 2223–2230.
- (41) O'Donoghue, R. T.; Broderick, B. M. Spatial variation of roadside C₂-C₆ hydrocarbon concentrations during low wind speeds: A note. *Transp. Res. Part D: Transp. Environ.* 2007, 12 (8), 589–595.
- (42) Pirjola, L.; Parviainen, H.; Hussein, T.; Valli, A.; Hameri, K.; Aalto, P.; Virtanen, A.; Keskinen, J.; Pakkanen, T. A.; Makela, T.; Hillamo, R. E. "Sniffer" - A novel tool for chasing vehicles and measuring traffic pollutants. *Atmos. Environ.* 2004, 38 (22), 3625–3635.
- (43) Pleijel, H.; Pihl Karlsson, G.; Binsell Gerdin, E. On the logarithmic relationship between NO₂ concentration and the distance from a highroad. *Sci. Total Environ.* 2004, 332 (1–3), 261–264.
- (44) Reponen, T.; Grinshpun, S. A.; Trakumas, S.; Martuzevicius, D.; Wang, Z. M.; LeMasters, G.; Lockey, J. E.; Biswas, P. Concentration gradient patterns of aerosol particles near Interstate highways in the Greater Cincinnati airshed. *J. Environ. Monit.* 2003, 5, 557–562.
- (45) Rodes, C. E.; Holland, D. M. Variations of NO, NO₂ and O₃ concentrations downwind of a Los Angeles freeway. *Atmos. Environ.* 1981, 15 (3), 243–250.
- (46) Roorda-Knape, M. C.; Janssen, N. A. H.; De Hartog, J. J.; Van Vliet, P. H. N.; Harssema, H.; Brunekreef, B. Air pollution from traffic in city districts near major motorways. *Atmos. Environ.* 1998, 32 (11), 1921–1930.
- (47) Sabin, L. D.; Lim, J. H.; Venezia, M. T.; Winer, A. M.; Schiff, K. C.; Stolzenbach, K. D. Dry deposition and resuspension of particle-associated metals near a freeway in Los Angeles. *Atmos. Environ.* 2006, 40 (39), 7528–7538.
- (48) Shi, J. P.; Khan, A. A.; Harrison, R. M. Measurements of ultrafine particle concentration and size distribution in the urban atmosphere. *Sci. Total Environ.* 1999, 235 (1–3), 51–64.
- (49) Singer, B. C.; Hodgson, A. T.; Toshifumi, H.; Kim, J. J. Passive measurement of nitrogen oxides to assess traffic-related pollutant exposure for the East Bay Children's Respiratory Health Study. *Atmos. Environ.* 2004, 38 (3), 393–403.
- (50) Smargiassi, A.; Baldwin, M.; Pilger, C.; Dugandzic, R.; Brauer, M. Small-scale spatial variability of particle concentrations and traffic levels in Montreal: a pilot study. *Sci. Total Environ.* 2005, 338 (3), 243–251.
- (51) Tiitta, P.; Raunemaa, T.; Tissari, J.; Yli-Tuomi, T.; Leskinen, A.; Kukkonen, J.; Harkonen, J.; Karppinen, A. Measurements and modelling of PM_{2.5} concentrations near a major road in Kuopio, Finland. *Atmos. Environ.* 2002, 36 (25), 4057–4068.
- (52) Vardoulakis, S.; Gonzalez-Flesca, N.; Fisher, B. E. A.; Pericleous, K. Spatial variability of air pollution in the vicinity of a permanent monitoring station in central Paris. *Atmos. Environ.* 2005, 39 (15), 2725–2736.
- (53) Weijers, E. P.; Khlystov, A. Y.; Kos, G. P. A.; Erisman, J. W. Variability of particulate matter concentrations along roads and motorways determined by a moving measurement unit. *Atmos. Environ.* 2004, 38 (19), 2993–3002.
- (54) Wu, Y.; Hao, J. M.; Fu, L. X.; Hu, J. N.; Wang, Z. S.; Tang, U. Chemical characteristics of airborne particulate matter near major roads and at background locations in Macao, China. *Sci. Total Environ.* 2003, 317 (1–3), 159–172.
- (55) Zhu, Y.; Hinds, W. C.; Kim, S.; Shen, S.; Sioutas, C. Study of ultrafine particles near a major highway with heavy-duty diesel traffic. *Atmos. Environ.* 2002, 36 (27), 4323–4335.
- (56) Zhu, Y.; Hinds, W. C.; Kim, S.; Sioutas, C. Concentration and size distribution of ultrafine particles near a major highway. *J. Air Waste Manage. Assoc.* 2002, 52 (9), 1032–1042.
- (57) Zhu, Y.; Kuhn, T.; Mayo, P.; Hinds, W. C. Comparison of daytime and nighttime concentration profiles and size distributions of ultrafine particles near a major highway. *Environ. Sci. Technol.* 2006, 40 (8), 2531–2536.
- (58) Zhu, Y.; Pudota, J.; DenBleyker, A.; Michel, E.; McDonald-Buller, E.; Fraser, M. P.; Collins, D.; Jia, Y.; Clements, A.; Allen, D., Physical Transformation of Ultrafine Particles near Three Texas Roadways In Air & Waste Management Association Annual Conference and Exhibition, Portland, OR, 2008.
- (59) Gramotnev, G.; Ristovski, Z. Experimental investigation of ultrafine particle size distribution near a busy road. *Atmos. Environ.* 2004, 38 (12), 1767–1776.
- (60) Beckerman, B.; Jerrett, M.; Brook, J. R.; Verma, D. K.; Arain, M. A.; Finkelstein, M. M. Correlation of nitrogen dioxide with other traffic pollutants near a major expressway. *Atmos. Environ.* 2008, 42 (2), 275–290.
- (61) Donaldson, K.; Stone, V.; Clouter, A.; Renwick, L.; MacNee, W. Ultrafine particles. *Occup. Environ. Med.* 2001, 58 (3), 211–216.
- (62) Baldauf, R.; Thoma, E.; Khlystov, A.; Isakov, V.; Bowker, G.; Long, T.; Snow, R. Impacts of noise barriers on near-road air quality. *Atmos. Environ.* 2008, 42 (32), 7502–7507.
- (63) Cleveland, W. S.; Devlin, S. J. Locally Weighted Regression: An Approach to Regression Analysis by Local Fitting. *J. Am. Stat. Assoc.* 1988, 83 (403), 596–610.
- (64) Myers, J. L.; Well, A. D. *Research Design and Statistical Analysis*; HarperCollins: New York, 1991.
- (65) R Development Core Team. *R: A Language and Environment for Statistical Computing, version 2.7.2*; R Foundation for Statistical Computing: Vienna, Austria, 2008.
- (66) Sarkar, D. *Lattice: Multivariate Data Visualization with R*; Springer: New York, 2008.
- (67) Finlayson-Pitts, B. J.; Pitts, J. N., Jr. Tropospheric air pollution: Ozone, airborne toxics, polycyclic aromatic hydrocarbons, and particles. *Science* 1997, 276 (5315), 1045–1051.
- (68) Molnar, P.; Janhall, S.; Hallquist, M. Roadside measurements of fine and ultrafine particles at a major road north of Gothenburg. *Atmos. Environ.* 2002, 36, 4115–4123.
- (69) Green, R. S.; Malig, B.; Windham, G. C.; Fenster, L.; Ostro, B.; Swan, S. Residential Exposure to Traffic and Spontaneous Abortion. *Environ. Health Perspect.* 2009, 117 (12), 1939–1944.

- (70) Rijnders, E.; Janssen, N. A. H.; van Vliet, P. H. N.; Brunekreef, B. Personal and outdoor nitrogen dioxide concentrations in relation to degree of urbanization and traffic density. *Environ. Health Perspect.* **2001**, *109* (Suppl. 3), 411–417.
- (71) Janssen, N. A. H.; van Vliet, P. H. N.; Aarts, F.; Harssema, H.; Brunekreef, B. Assessment of exposure to traffic related air pollution of children attending schools near motorways. *Atmos. Environ.* **2001**, *35* (22), 3875–3884.
- (72) Hu, S.; Fruin, S.; Kozawa, K.; Mara, S.; Paulson, S. E.; Winer, A. M. A wide area of air pollutant impact downwind of a freeway during pre-sunrise hours. *Atmos. Environ.* **2009**, *43* (16), 2541–2549.
- (73) Hagler, G. S. W.; Baldauf, R. W.; Thoma, E. D.; Long, T. R.; Snow, R. F.; Kinsey, J. S.; Oudejans, L.; Gullett, B. K. Ultrafine particles near a major roadway in Raleigh, North Carolina: Downwind attenuation and correlation with traffic-related pollutants. *Atmos. Environ.* **2009**, *43* (6), 1229–1234.
- (74) Buonanno, G.; Lall, A. A.; Stabile, L. Temporal size distribution and concentration of particles near a major highway. *Atmos. Environ.* **2009**, *43* (5), 1100–1105.
- (75) Barzyk, T. M.; George, B. J.; Vette, A. F.; Williams, R. W.; Croghan, C. W.; Stevens, C. D. Development of a distance-to-roadway proximity metric to compare near-road pollutant levels to a central site monitor. *Atmos. Environ.* **2009**, *43* (4), 787–797.

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**Statement of
Dona J. Upson, MD, MA
Albuquerque, New Mexico
On Behalf of the American Lung Association and
the American Thoracic Society**

**Before the
Senate Committee on Environment and Public Works
Subcommittee on Clean Air and Nuclear Safety and Subcommittee on Children's Health
and Environmental Responsibility
"Air Quality and Children's Health" Hearing
Washington, D.C.**

June 8, 2011

Good morning. Thank you, Chairman Carper, Chairman Udall and Senators, for this opportunity to speak with you today. My name is Dr. Dona Upson. I am a pulmonary/critical care physician from Albuquerque, New Mexico.

I am speaking today on behalf of the American Lung Association and the American Thoracic Society. The American Lung Association is the nation's oldest voluntary health organization, whose mission is to save lives by improving lung health and preventing lung disease. The American Thoracic Society is a medical professional organization of over 15,000 physicians, researchers and allied health professionals dedicated to the prevention, detection, treatment and cure of respiratory, sleep and critical care illnesses through research, education and advocacy. I serve on the Nationwide Assembly of the American Lung Association and the National Board of Directors of the American Thoracic Society.

I'd like to speak to you today about children and their lungs. I'm a pulmonologist and critical care physician, and I'm a mother. I'm here to tell you that children may look like miniature adults, but they're not. For many reasons, they deserve special protection, including the cleanup of major pollution sources in the nation—most particularly, power plants. Power plants add hundreds of thousands of tons of dangerous air pollution to the air, threatening the most vulnerable among us, our children.

Air pollution is especially dangerous to children because their lungs are growing and because they are so active. Just like the arms and legs, the largest portion of a child's lungs will grow long after he or she is born. Eighty percent of their tiny air sacs develop after birth. Those sacs, called alveoli, are where the life-sustaining transfer of oxygen to the blood takes place. The lungs and their alveoli aren't fully grown until children become adults.¹ In addition, the body's



defenses that help adults fight off infections are still developing in young bodies.² Children have more respiratory infections than adults, which also seems to increase their susceptibility to air pollution.³

Furthermore, children don't behave like adults, and their behavior also affects their vulnerability. They are outside for longer periods and are usually more active when outdoors, especially in the summer when ozone levels are higher. Consequently, they inhale more polluted outdoor air than adults typically do.⁴

In 2004, the American Academy of Pediatrics issued a special statement on the dangers of outdoor air pollution on children's health, pointing out the special differences for children.⁵ In their analysis, they conclude that "There is a compelling need to move forward on efforts to ensure clean air for all."⁶ I absolutely agree. I'm attaching a copy of their statement, which they reaffirmed in April 2009, to my comments.

Children's lungs are vulnerable to air pollution, especially from ozone and particulate matter. Multiple studies, both in the United States and around the world, have provided strong, consistent evidence that air pollution impairs children's ability to breathe. For example, repeated testing of school children in three California communities showed that even breathing at ozone levels during the school year, which are lower than during the summer, reduced their measured lung function (FEV₁) as pollution increased during the day.⁷

Community health studies point to less obvious, but serious effects from year-round exposure to ozone, especially for children. Scientists followed 500 Yale University students and determined that living just four years in a region with high levels of ozone and related co-pollutants was associated with diminished lung function and frequent reports of respiratory symptoms.⁸

Abundant and clear peer-reviewed research demonstrates that air pollution harms health. Chamber studies have convincingly shown that exposure to air pollution reduces pulmonary function and promotes airway inflammation. Epidemiological studies have linked air pollution to a host of adverse health consequences, including cardiac deaths, respiratory deaths, heart attacks, vascular remodeling, COPD exacerbations, asthma exacerbations and low birth weights. There is also real-world evidence that reducing air pollution can help protect children.

One of the best known examples is from Atlanta during the 1996 Olympics, when a reduction in ozone was linked to a 42-percent decrease in asthma treatment and hospitalization in the Georgia Medicaid claims files. Pediatric Emergency Departments also saw significant reductions, as did the Georgia Hospital Discharge Database and a health maintenance organization database.⁹

Other real-world studies have shown similar findings. Changes in air pollution from the reunification of Germany proved to be a real-life laboratory. Both East and West Germany had different levels and sources of particulate matter. Outdoor particle levels were much higher in East Germany, where they came from factories and homes. West Germany had higher concentrations of traffic-generated particles. After reunification, emissions from the factories and homes dropped, but traffic increased. A German study explored the impact on the lungs of six-year-olds from both East and West Germany. Total lung capacity improved with the lower particle levels. However, for children living near busy roads, the increased pollution from the increased traffic kept them from benefiting from the overall cleaner air.¹⁰

In Switzerland, particle pollution dropped during a period in the 1990s. Researchers there tracked 9,000 children over a nine-year period, following their respiratory symptoms. After taking factors such as family characteristics and indoor air pollution into account, the researchers found that during the years with less pollution, the children had fewer episodes of chronic cough, bronchitis, common cold, and conjunctivitis symptoms.¹¹

The evidence is even more compelling when you focus on children who have lung disease, such as asthma. In New Mexico alone, 47,000 kids have asthma. Similar to the adults I treat, having asthma puts children at even greater risk of harm. One example of this from my own experience came several years ago, when I was the Medical Director of a two-week asthma camp for children in New Mexico. We had to cancel the camp due to high levels of pollution from wildfires in Arizona. Many epidemiological studies have shown that particulate matter—like the soot from those wildfires—as well as ozone, and other pollutants increase “a wide variety of respiratory symptoms . . . in children” as concluded by the U.S. EPA in a 2006 review of all pertinent research on ozone.¹²

Many studies have found that higher levels of ozone and other pollutants increase the number of pediatric hospital admissions. A 2008 New York City study of hospital admissions for respiratory disease among children under age 18 found an association with higher outdoor ozone levels in five of the 11 regions included in the study.¹³ A similar, but much larger study of 11 cities in Canada—not widely known for its ozone problems—found an increase in neonatal respiratory admissions with increases in ozone.¹⁴

What is most impressive about the scientific literature on air pollution is how comprehensive it is, with literally hundreds of studies documenting that air pollution, in its various forms, is bad for human health. The research has proven to be consistent over decades. Scientists have been able to apply improved research technologies to document the health effects of air pollution at consistently smaller doses. Furthermore, to-date, most studies have looked at the health effects of individual components of air pollution, such as ozone. The National Ambient Air Quality

Standard defines what constitutes air that is healthy to breathe and safe for the environment for the most common and widespread air pollutants in terms of single pollutant criteria. However, as happens in real life, we breathe a whole mix of pollutants together. It is quite likely that, when the mix of pollutants is more thoroughly investigated, even greater impacts on health will be seen.

Some would lead you to believe that cleaning up ozone, mercury, lead, arsenic, dioxin and acid gases, as well as carbon pollution, in our air, is unnecessary, or just too expensive. Yet it's not hard to fathom how breathing toxins can lead to serious health complications, and are in fact directly linked to cancer, heart disease, neurological damage, birth defects, asthma attacks and even premature death.

But we don't have to make a choice between protecting our communities and our economy. Let me give you a New Mexico example.

Coal- and oil-fired power plants are some of the biggest sources of air pollution in the United States, especially in the Midwest, Southeast and Northeast, but also in places like the Four Corners of the Southwest. According to the EPA, the Four Corners Power Plant is the nation's largest source of nitrogen oxides, a pollutant that is one of the precursors for both fine particulate matter and ozone, and harmful on its own. Pollution from the plant blows directly into the Navajo Nation and into our national parks. Fortunately, in February the EPA and the plant's owner, Arizona Public Service, announced an agreement to cut emissions of that harmful pollutant by 87 percent, all while retaining the jobs of the workers who keep the plant fueled and operating, most of whom are Native American.¹⁵ When these changes are made, the cleanup measures will reduce air pollution, protect health, save lives and improve the view of the spectacular New Mexico landscape.

EPA is proposing to take similar steps for power plants across the nation, steps that will improve health and save tens of thousands of lives, reducing harm from the air we all breathe. The Clean Air Transport Rule, promised this summer, will protect downwind states in the eastern U.S. from nitrogen oxides that blow across state lines with similar relief to the plan for the Four Corners Plant. And at long last, 21 years after this United States Congress required the cleanup of toxic mercury, arsenic, formaldehyde, dioxins and 80 other pollutants, the EPA will be issuing final rules this fall to set limits on the amount of these pollutants that coal- and oil-fired power plants can emit.

When it comes to carbon pollution, the threat to our health is growing at an alarming pace. Carbon pollution is linked to warmer temperatures, which studies have shown, will increase the risk of unhealthy ozone levels. Even with the steps that are in place to reduce ozone, scientific

evidence warns that changes in climate are likely to increase ozone levels in the future in nearly every region of the United States. This is why the EPA is updating air pollution standards to address the dangers of too much carbon pollution, as required by a 2009 U.S. Supreme Court decision. To protect human health, the nation needs the Clean Air Act to stem the danger of climate change and increased ozone levels. Steps to reduce carbon pollution can be cost-saving over time. The solar panels I put on my house, and that we put on the roof of the building of the American Lung Association in New Mexico, will pay for themselves after 11 years; the new insulation after seven. New Mexico's new governor is trying to roll-back energy standards for new buildings, and is meeting opposition from many builders, who state that lower standards will increase costs in the long run.

The Clean Air Act, which has received bi-partisan support since it was established in 1970, has a proven track record of keeping people healthy; in 2010, the law prevented 160,000 premature deaths and 1.7 million asthma attacks. Medical studies have shown that toxins emitted by the burning of coal, oil and other sources result in premature death, pulmonary and cardiovascular inflammation, asthma attacks, heart attacks and strokes, especially among our most vulnerable — children, elderly, the impoverished and those already living with lung disease.

Moreover, clean air standards not only save Americans' lives, they save Americans' money. In 2010, it is estimated that due to averted medical bills and sick days, the EPA standards amounted to \$1.3 trillion in costs savings. While some assert that clean air regulations unnecessarily burden businesses and industry, pumping toxic, harmful and life-threatening pollution into the air is not the only way to do business. Updating and strengthening air pollution standards not only reduces health care costs through improved public health, it also spurs innovation, opens opportunities for small businesses, and creates jobs across a range of skill levels.

In conclusion, the danger from exposure to air pollution is real, the science documenting the adverse health effects of air pollution is conclusive, the technology required to reduce air pollution is readily available and in use today. Congress's clear intent to protect public health with the Clean Air Act has proven successful through over 40 years of meaningful implementation. For all these reasons, the American Lung Association and the American Thoracic Society strongly support the Clean Air Act as one of the nation's best tools to protect our families and our children.

Thank you for your time and I would be happy to answer any questions.

Statement of Dona J. Upson, MD, MA

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¹ Dietert RR, Etzel RA, Chen D, et al. Workshop to Identify Critical Windows of Exposure for Children's Health: immune and respiratory systems workgroup summary. *Environ Health Perspect* 2000; 108 (supp 3); 483-490.

² World Health Organization: The Effects of Air Pollution on Children's Health and Development: a review of the evidence E86575. 2005. Available at <http://www.euro.who.int/document/E86575.pdf>.

³ WHO, 2005.

⁴ American Academy of Pediatrics Committee on Environmental Health, Ambient Air Pollution: health hazards to children. *Pediatrics* 2004; 114: 1699-1707. The Academy reaffirmed this statement in April 2009.

⁵ American Academy of Pediatrics, 2004.

⁶ American Academy of Pediatrics, 2004.

⁷ Linn WS, Shamoo DA, Anderson KR, Peng R-C, Avol EL, Hackney JD, Gong H, Jr. Short-term air pollution exposures and responses in Los Angeles area schoolchildren. *J Exposure Anal Environ Epidemiol* 1996; 6: 449-472.

⁸ Galizia A, Kinney PL. Year-round Residence in Areas of High Ozone: association with respiratory health in a nationwide sample of nonsmoking young adults. *Environ Health Perspect* 1999; 107:675-679.

⁹ Friedman MS, Powell KE, Hutwagner L, Graham LM, Teague WG. Impact of Changes in Transportation and Commuting Behaviors During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma. *JAMA* 2001; 285:897-905.

¹⁰ Sugiri D, Ranft U, Schikowski T, Krämer U. The Influence of Large Scale Airborne Particle Decline and Traffic Related Exposure on Children's Lung Function. *Environ Health Perspect* 2006; 114: 282-288.

¹¹ Bayer-Oglesby L, Grize L, Gassner M, Takken-Sahli K, Sennhauser FH, Neu U, Schindler C, Braun-Fahrlander C. Decline of Ambient Air Pollution Levels and Improved Respiratory Health in Swiss Children. *Environ Health Perspect* 2005; 113:1632-1637.

¹² U.S. Environmental Protection Agency. Provisional Assessment of Recent Studies on Health and Ecological Effects of Ozone Exposure. September 2009. EPA/600/R-09/101. This cited the previous Air Quality Criteria for Ozone and Related Photochemical Oxidants completed in 2006.

¹³ Lin S, Bell EM, Liu W, Walker RJ, Kim NK, Hwang SA. Ambient ozone concentration and hospital admissions due to childhood respiratory diseases in New York State, 1991-2001. *Environ Res* 2008; 108: 42-47.
<http://dx.doi.org/10.1016/j.envres.2008.06.007>

¹⁴ Dales RE, Cakmak S, Doiron MS. Gaseous air pollutants and hospitalization for respiratory disease in the neonatal period. *Environ Health Perspect*, 2006; 114: 1751-1754. <http://dx.doi.org/10.1289/ehp.9044>

¹⁵ U.S. Environmental Protection Agency. EPA's New Proposal for Four Corners Power Plant Cuts More NOx Emissions, Protects Health, Saves Jobs. February 11, 2011 Accessed on June 2, 2011 from <http://yosemite.epa.gov/opa/admpress.nsf/0/B96018E71B328FAD85257834005CC08E>.

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health

Ambient Air Pollution: Health Hazards to Children

ABSTRACT. Ambient (outdoor) air pollution is now recognized as an important problem, both nationally and worldwide. Our scientific understanding of the spectrum of health effects of air pollution has increased, and numerous studies are finding important health effects from air pollution at levels once considered safe. Children and infants are among the most susceptible to many of the air pollutants. In addition to associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations, recent studies have found links between air pollution and preterm birth, infant mortality, deficits in lung growth, and possibly, development of asthma. This policy statement summarizes the recent literature linking ambient air pollution to adverse health outcomes in children and includes a perspective on the current regulatory process. The statement provides advice to pediatricians on how to integrate issues regarding air quality and health into patient education and children's environmental health advocacy and concludes with recommendations to the government on promotion of effective air-pollution policies to ensure protection of children's health. *Pediatrics* 2004;114:1699-1707; *air pollution, adverse effects, children, asthma, environmental health.*

ABBREVIATIONS. PM_{2.5}, particulate matter with a median aerodynamic diameter less than 2.5 μm ; PM₁₀, particulate matter with a median aerodynamic diameter less than 10 μm ; EPA, Environmental Protection Agency; HAP, hazardous air pollutant; AQI, air quality index.

INTRODUCTION

Although it has been 3 decades since passage of the Clean Air Act in 1970 (Pub L No. 91-604), the air in many parts of the United States is far from clean. Air quality has improved in some areas but decreased in others.¹ In addition, there are important health effects from air pollutants at levels once considered safe. Children and infants are among the most susceptible to many of the air pollutants.

In 2002, approximately 146 million Americans were living in areas where monitored air failed to meet the 1997 National Ambient Air Quality Standards for at least 1 of the 6 "criteria air pollutants": ozone, particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead (Table 1).¹ Although the standards for ozone and particulate matter were revised in 1997, legal barriers have delayed

timely implementation.² Recent reports have identified adverse health effects at levels near or below the current standards for ozone, particulate matter, and nitrogen dioxide. Thus, the 1997 federal standards may not adequately protect children. Additionally, numerous other toxic air pollutants are of public health concern.³

Outdoor air pollution is also a major problem in developing countries. The World Health Organization found that the air quality in large cities in many developing countries is remarkably poor and that very large numbers of people in those countries are exposed to ambient concentrations of air pollutants well above the World Health Organization guidelines for air quality (www.who.int/ceh/publications/en/11airpollution.pdf).

Scientific understanding of the health effects of air pollution, including effects on children, has increased in the last decade. This statement updates a 1993 American Academy of Pediatrics (AAP) statement titled "Ambient Air Pollution: Respiratory Hazards to Children."⁴

EFFECTS OF AIR POLLUTION ON CHILDREN

Children are more vulnerable to the adverse effects of air pollution than are adults. Eighty percent of alveoli are formed postnatally, and changes in the lung continue through adolescence.⁵ During the early postneonatal period, the developing lung is highly susceptible to damage after exposure to environmental toxicants.⁵⁻⁷

Children have increased exposure to many air pollutants compared with adults because of higher minute ventilation and higher levels of physical activity.⁸ Because children spend more time outdoors than do adults, they have increased exposure to outdoor air pollution.^{9,10}

Infants, children, the elderly, and those with cardiopulmonary disease are among the most susceptible to adverse health effects from criteria pollutants.¹¹⁻¹⁵ Lead is neurotoxic, especially during early childhood. Carbon monoxide interferes with oxygen transport through the formation of carboxyhemoglobin. Other criteria pollutants (ozone, sulfur dioxide, particulate matter, nitrogen dioxide) have respiratory effects in children and adults, including increased respiratory tract illness, asthma exacerbations, and decreased lung function (eg, changes in peak flow).¹¹⁻¹² In adults, particulate air pollution is associated with respiratory and cardiovascular hos-

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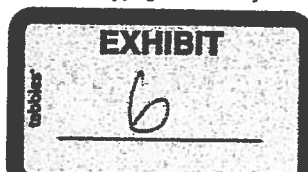


TABLE 1. National Ambient Air Quality Standards for Criteria Air Pollutants, 1997

Pollutant	Primary Standards*
Ozone	
1-h average	0.12 ppm (235 $\mu\text{g}/\text{m}^3$)
8-h average	0.08 ppm (157 $\mu\text{g}/\text{m}^3$)
PM ₁₀	
Annual arithmetic mean	50 $\mu\text{g}/\text{m}^3$
24-h average	150 $\mu\text{g}/\text{m}^3$
PM _{2.5}	
Annual arithmetic mean	15 $\mu\text{g}/\text{m}^3$
24-h average	65 $\mu\text{g}/\text{m}^3$
Sulfur dioxide	
Annual arithmetic mean	0.03 ppm (80 $\mu\text{g}/\text{m}^3$)
24-h average	0.14 ppm (365 $\mu\text{g}/\text{m}^3$)
Nitrogen dioxide	
Annual arithmetic mean	0.053 ppm (100 $\mu\text{g}/\text{m}^3$)
Carbon monoxide	
8-h average	9 ppm (10 mg/m ³)
1-h average	35 ppm (40 mg/m ³)
Lead	
Quarterly average	1.5 $\mu\text{g}/\text{m}^3$

Additional information on air quality standards are available at www.epa.gov/air/criteria.html.

* People residing in regions with pollutant concentrations above the primary standard may experience adverse health effects from poor air quality.

pitalizations, cardiovascular mortality,¹⁶ and lung cancer.¹⁷ Air pollution also has effects on indirect health indicators such as health care utilization and school absences.¹¹⁻¹³

Although numerous studies have shown that outdoor air pollution exacerbates asthma, the effect of outdoor air pollution on the development of asthma has been less clear. Recently, a prospective study found that the risk of developing asthma was not greater, overall, in children living in communities with high levels of ozone or particulate air pollution. However, in communities with high levels of ozone, there was an increased risk of developing asthma in a small subset of children involved in heavy exercise (participation in 3 or more team sports per year [relative risk: 3.3; 95% confidence interval: 1.9-5.8]). This increased risk with heavy exercise was not seen in low-ozone communities. Time spent outside was also associated with new cases of asthma in high-ozone communities (relative risk: 1.4; 95% confidence interval: 1.0-2.1) but not in low-ozone communities.¹⁸ Additional studies are needed to define the role of outdoor air pollution in the development of asthma.

Children in communities with higher levels of urban air pollution (acid vapor, nitrogen dioxide, particulate matter with a median aerodynamic diameter less than 2.5 μm [PM_{2.5}], and elemental carbon [a component of diesel exhaust]) had decreased lung function growth, and children who spent more time outdoors had larger deficits in the growth rate of lung function.^{19,20} Ambient air pollution (especially particulate matter with a median aerodynamic diameter less than 10 μm [PM₁₀]) has also been associated with several adverse birth outcomes, as discussed in the next section.

Levels of ozone and particulate matter are high enough in many parts of the United States to present health hazards to children.¹ Additionally, National

Ambient Air Quality Standards for nitrogen dioxide may not be protective. Findings on these pollutants are summarized here.

Ozone

Ambient ozone is formed by the action of sunlight on nitrogen oxides and reactive hydrocarbons, both of which are emitted by motor vehicles and industrial sources. The levels tend to be highest on warm, sunny, windless days and often peak in midafternoon, when children are most likely to be playing outside.

Ozone is a powerful oxidant and respiratory tract irritant in adults and children, causing shortness of breath, chest pain when inhaling deeply, wheezing, and cough.¹¹ Children have decreases in lung function, increased respiratory tract symptoms, and asthma exacerbations on days with higher levels of ambient ozone.^{11,21-23} Increases in ambient ozone have been associated with respiratory or asthma hospitalizations,^{24,25} emergency department visits for asthma,²⁶ and school absences for respiratory tract illness.²⁷ In Atlanta, Georgia, summertime children's emergency department visits for asthma increased 37% after 6 days when ozone levels exceeded 0.11 ppm.²⁵ In southern California, school absences for respiratory tract illness increased 63% in association with a 0.02-ppm increase in ozone.²⁷

In healthy adults, ozone causes airway inflammation and hyperreactivity, decrements in pulmonary function, and increased respiratory tract symptoms.¹¹ Ozone exposures at concentrations of 0.12 ppm or higher can result in decrements in lung function after subsequent challenge with aeroallergen.²⁸ Although most of the controlled studies of ozone exposure have been performed with adults, it is reasonable to believe that the results of these findings could be extended to children.

Ozone may be toxic at concentrations lower than 0.08 ppm, the current federal regulatory standard. Field studies suggest potential thresholds of between 0.04 and 0.08 ppm (1-hour average) for effects on lung function.²⁹⁻³¹ Recent studies of hospitalizations for respiratory tract illness in young children and emergency department visits for asthma suggest that the effects of ozone may occur at ambient concentrations below 0.09 ppm.^{32,33} Another study found associations of ozone and respiratory symptoms in children with asthma at levels below the current US Environmental Protection Agency (EPA) standards.³⁴ If these findings are confirmed, the ozone standards may need additional revision.

In addition to studies on short-term effects, 2 recent studies of college freshmen suggest that increasing cumulative childhood exposure to ozone may affect lung function when exposed children reach young adulthood, particularly in measures of flow in small airways.^{35,36} Early childhood exposures may, therefore, be particularly important.³⁵

Particulate Matter

PM₁₀ is small enough to reach the lower respiratory tract and has been associated with a wide range of serious health effects. PM₁₀ is a heterogeneous

mixture of small solid or liquid particles of varying composition found in the atmosphere. Fine particles ($PM_{2.5}$) are emitted from combustion processes (especially diesel-powered engines, power generation, and wood burning) and from some industrial activities. Coarse particles (diameter between 2.5 and 10 μm) include windblown dust from dirt roads or soil and dust particles created by crushing and grinding operations. Toxicity of particles may vary with composition.^{37,38}

Particle pollution contributes to excess mortality and hospitalizations for cardiac and respiratory tract disease.^{14,39-41} The mechanism for particulate matter-associated cardiac effects may be related to disturbances in the cardiac autonomic nervous system, cardiac arrhythmias, or increased blood concentrations of markers of cardiovascular risk (eg, fibrinogen).^{16,42}

Daily changes in mortality rates and numbers of people hospitalized are linked to changes in particulate air pollution.^{14,39-41} These studies and others have estimated that for every 10 $\mu g/m^3$ increase in PM_{10} , there is an increase in the daily mortality rate between 0.5% and 1.6%. Effects were seen even in cities with mean annual PM_{10} concentrations between 25 and 35 $\mu g/m^3$. These recent studies suggest that even the current federal standards for $PM_{2.5}$ (24-hour standard = 65 $\mu g/m^3$; annual standard = 15 $\mu g/m^3$) and PM_{10} (24-hour standard = 150 $\mu g/m^3$; annual standard = 50 $\mu g/m^3$) should be lowered to protect public health. In 2002, California adopted more stringent standards for particulate matter: the annual average standard for $PM_{2.5}$ is 12 $\mu g/m^3$ and for PM_{10} is 20 $\mu g/m^3$.⁴³

In children, particulate pollution affects lung function⁴⁴⁻⁴⁶ and lung growth.¹⁹ In a prospective cohort of children living in southern California, children with asthma living in communities with increased levels of air pollution (especially particulates, nitrogen dioxide, and acid vapor) were more likely to have bronchitis symptoms. In this study, bronchitis symptoms refers to a parental report of "one or more episodes of 'bronchitis' in the past 12 months" or report that, "apart from colds, the child usually seems to be congested in the chest or able to bring up phlegm".⁴⁷ The same mix of air pollutants was also associated with deficits in lung growth (as measured by lung function tests).¹⁹ Recent studies in different countries have also found associations between ambient air pollution (especially particulates and/or carbon monoxide) and postneonatal infant mortality (attributable to respiratory causes and possibly sudden infant death syndrome),^{48,49} low birth weight,⁵⁰⁻⁵³ and preterm birth.^{51,54-56}

The relative contribution of fine versus coarse particles to adverse health effects is being investigated. In studies of cities on the East Coast, fine particles seem to be important.⁵⁷ In other areas, coarse particles have a stronger or similar effect.⁵⁸ Several studies have found that fine particles from power plants and motor vehicles⁵⁹ or industrial sources⁶⁰ may be more closely associated with mortality.

Nitrogen Dioxide

Nitrogen dioxide is a gaseous pollutant produced by high-temperature combustion. The main outdoor sources of nitrogen dioxide include diesel and gasoline-powered engines and power plants. Levels of nitrogen dioxide around urban monitors have decreased over the past 20 years. Currently, all areas of the country meet the national air quality standard for nitrogen dioxide of 0.053 ppm (100 $\mu g/m^3$), measured as an annual arithmetic mean. However, national emissions (overall production) of nitrogen oxides have actually increased in the past 20 years because of an increase in nitrogen oxide emissions from diesel vehicles.¹ This increase is of concern, because nitrogen oxide emissions contribute to ground-level ozone (smog) and other environmental problems such as acid rain.¹

Controlled-exposure studies of people with asthma have found that short-term exposures (30 minutes) to nitrogen dioxide at concentrations as low as 0.26 ppm can enhance the allergic response after subsequent challenge with allergens.^{61,62} These findings are of concern, because some urban communities that are in compliance with the federal standards for nitrogen dioxide (annual average) may experience substantial short-term peak concentrations (1-hour average) that exceed 0.25 ppm. Confirmation of these studies is needed.

Epidemiologic studies have reported relationships between increased ambient nitrogen dioxide and risks of respiratory tract symptoms^{63,64} and asthma exacerbations.⁶⁵ As noted previously, children with asthma living in communities with increased levels of air pollution (especially nitrogen dioxide, acid vapor, and particulates) were more likely to have bronchitis symptoms.⁴⁷ The same mix of air pollutants was also associated with deficits in lung growth (as measured by lung function tests).¹⁹ These effects were increased in children who spent more time outdoors.

The epidemiologic studies of health effects associated with nitrogen dioxide should be interpreted with caution. Increased levels of ambient nitrogen dioxide may be a marker for exposure to traffic emissions or other combustion-related pollution. An independent role of nitrogen dioxide cannot be clearly established because of the high covariation between ambient nitrogen dioxide and other pollutants. Nonetheless, these studies illustrate that adverse respiratory tract effects are seen in urban areas where traffic is a dominant source of air pollution.

Traffic-Related Pollution

Motor vehicles pollute the air through tailpipe exhaust emissions and fuel evaporation, contributing to carbon monoxide, $PM_{2.5}$, nitrogen oxides, hydrocarbons, other hazardous air pollutants (HAPs), and ozone formation. Motor vehicles represent the principal source of air pollution in many communities, and concentrations of traffic pollutants are greater near major roads.⁶⁶ Recently, investigators (primarily in Europe and Japan) have found increased adverse health effects among those living near busy roads.

Studies examining associations between adverse respiratory tract health and traffic have been reviewed.⁶⁷ Increased respiratory tract complications in children (eg, wheezing, chronic productive cough, and asthma hospitalizations) have been associated with residence near areas of high traffic density (particularly truck traffic).⁶⁸⁻⁷¹ Other investigators have linked various childhood cancers to proximity to traffic.⁷²⁻⁷⁴

Diesel exhaust, a major source of fine particulates in urban areas, is carcinogenic. Numerous studies have found an association between occupational exposure to diesel exhaust and lung cancer.⁷⁵ On the basis of extensive toxicologic and epidemiologic evidence, national and international health authorities, including the EPA and the International Agency for Research on Cancer, have concluded that there is considerable evidence of an association between exposure to diesel exhaust and an increased risk of lung cancer.^{76,77} Additionally, fine particles in diesel exhaust may enhance allergic and inflammatory responses to antigen challenge and may facilitate development of new allergies.^{78,79} Thus, diesel exhaust exposure may worsen symptoms in those with allergic rhinitis or asthma.

School buses operate in proximity to children, and most of the nation's school bus fleets run on diesel fuel. The EPA and some state agencies are establishing programs to eliminate unnecessary school bus idling and to promote use of cleaner buses to decrease children's exposures to diesel exhaust and the amount of air pollution created by diesel school buses (www.epa.gov/cleanschoolbus). A recent pilot study found that a child riding inside a school bus may be exposed to as much as 4 times the level of diesel exhaust as someone riding in a car.⁸⁰ These findings underscore the importance of advocating for school districts to replace diesel buses or retrofit them with pollution-reducing devices and limit school bus idling where children congregate as soon as possible.

Other Air Pollutants

Airborne levels of lead, sulfur dioxide, and carbon monoxide have decreased dramatically because of the implementation of control measures. However, levels of these pollutants may still be high near major sources. For example, high lead levels may be found near metals-processing industries, high sulfur dioxide levels may occur near large industrial facilities (especially coal-fired power plants), and high levels of carbon monoxide may occur in areas with heavy traffic congestion.¹

In addition to criteria air pollutants, there are numerous other air pollutants produced by motor vehicles, industrial facilities, residential wood combustion, agricultural burning, and other sources that are hazardous to children. More than 50,000 chemicals are used commercially, and many are released into the air. For most of these chemicals, data on toxicity are sparse.⁸¹ Some pollutants remain airborne or react in the atmosphere to produce other harmful substances. Other air pollutants deposit into and contaminate land and water. Some toxic air pollutants

such as lead, mercury, and dioxins degrade slowly or not at all. These pollutants may bioaccumulate in animals at the top of the food chain, including humans. Children can be exposed to toxic air pollutants through contaminated air, water, soil, and food.³ One example of a persistent pollutant emitted into ambient air that leads to exposure through another route is mercury, a developmental neurotoxicant.⁸² Industrial emissions, especially from coal-fired power plants, are the leading source of environmental mercury. Although the levels of airborne mercury may not be hazardous, mercury deposits into soil and surface waters and ultimately accumulates in fish.⁸²

The HAPs, often referred to as "toxic air contaminants" or "air toxics," refer to 188 pollutants and chemical groups known or suspected to cause serious health effects including cancer, birth defects, and respiratory tract and neurologic illness.^{3,83} The Clean Air Act directs the EPA to regulate HAPs, which include compounds such as polycyclic aromatic hydrocarbons, acrolein, and benzene from fuel or fuel combustion; solvents such as hexane and toluene; hexavalent chromium from chrome-plating facilities; perchloroethylene from dry-cleaning plants; asbestos; metals (eg, mercury and cadmium); and persistent organic pollutants such as polychlorinated biphenyls. In 2001, diesel exhaust was listed as a mobile-source HAP. Many of these compounds are included in a priority list of 33 HAPs that are of special concern because of their widespread use and potential carcinogenicity and teratogenicity.⁸¹ The priority list and general sources of these compounds are available on the EPA Web site (www.epa.gov/ttn/atw/nata).

Limited monitoring data suggest that concentrations of some HAPs may exceed the goals of the Clean Air Act in many cities.⁸⁴ Mobile sources (on- and off-road vehicles) account for approximately half of the emissions³ but may contribute to 90% of the cancer risk (www.scorecard.org/env-releases/hap/us.tcl). A number of studies assessing health risks have found that estimated levels of some of the HAPs are a potential public health problem in many parts of the United States.^{3,84-86} For example, estimated concentrations of benzene, formaldehyde, and 1,3-butadiene may contribute to extra cases of cancer (at least 1 extra case per million population exposed) in more than 90% of the census tracts in the contiguous United States. Additionally, the most recent national cancer-risk assessment for HAPs (1996 data) did not include diesel exhaust in the risk estimates.³ The health risks may also be underestimated, because there is limited information on toxicity values for many of the HAPs,⁸⁷ and the risk models did not consider the potential for increased risk in children. These findings underscore the need for better ways to decrease toxic air emissions and assess exposures and risks.

Air-pollution episodes created by disasters (eg, accidents, volcanoes, forest fires, and acts of terrorism) can also create hazards for children. A discussion of these events and of bioaerosols in ambient air (eg, fungal spores and pollen) is beyond the scope of this

policy statement. Additionally, this statement does not address the hazards of indoor air pollution.

PREVENTION

Public health interventions to improve air quality can improve health at the population level. A decrease in levels of air pollution in former East Germany after reunification was associated with a decrease in parent-reported bronchitis⁸⁸ and improved lung function.⁸⁹ During the 1996 Summer Olympics in Atlanta, Georgia, extensive programs were implemented to improve mass transportation and decrease anticipated downtown traffic congestion. These programs were successful and were associated with a prolonged decrease in ozone pollution and significantly lower rates of childhood asthma visits during this period.⁹⁰ Closure of a steel mill in Utah Valley and resultant reductions in particulate matter were associated with a twofold decrease in hospitalizations for asthma in preschool children.^{91,92} Finally, lung function improved in children who moved away from communities with high particulate air pollution, compared with those who remained or moved to communities with comparable particulate air pollution.⁹³ These studies provide support for continued efforts to decrease air pollution and improve health via decreases in motor vehicle traffic and industrial emissions. Dietary factors may play a role in modulating the effects of air pollution in children. A recent study in Mexico City, Mexico, found that children with asthma given antioxidant supplements were less affected by ozone compared with a control group that did not receive supplementation.⁹⁴ Additional studies are needed to explore this issue further.

Air Pollution and the Regulatory Process

The Clean Air Act of 1970 mandated the EPA to establish the National Ambient Air Quality Standards (Table 1). Standards were set for criteria air pollutants because they are common, widespread, and known to be harmful to public health and the environment.^{11,12,83,95} The standards are reviewed every 5 years and set to protect public health, including the health of "sensitive" populations such as people with asthma, children, and the elderly. These standards are set without considering the costs of attaining these levels.

The standards for ozone and particulate matter were revised in 1997 on the basis of numerous scientific studies showing that the previous standards were not adequate to ensure health protection. Legal challenges were made by the American Trucking Associations, the US Chamber of Commerce, and other state and local business groups. However, the Supreme Court ultimately supported the EPA and ordered implementation of the standards.² Establishing implementation plans will be a lengthy process that will require the coordinated efforts of the EPA, state and local governments, and industry and environmental organizations.

Population exposures to toxic air contaminants may be of substantial public health concern.^{84,86} In contrast to criteria pollutants, monitoring of toxic air

contaminants is more limited. Exposures are estimated on the basis of reported emissions and may underestimate actual exposures.⁸⁷ The EPA is mandated to develop regulations through a lengthy process that first sets standards to control emissions on the basis of best-available technology. After maximum available control technology emission standards are established, the EPA must assess the risk remaining after emission decreases for the source take effect (residual risk).

To date, the EPA has focused primarily on establishing technology-based emission standards,³ and this has been a slow process for some sources (eg, mobile toxic air contaminants and mercury emissions). Nationwide, emissions of toxic air contaminants have dropped approximately 24% from baseline (1990–1993) because of regulation and voluntary decreases by industry. With the current plans for gradual fleet turnover and implementation of controls for motor vehicles and fuels, the EPA projects that toxic air-contaminant emissions from gasoline-powered and diesel mobile sources will not be decreased to 75% and 90% of baseline (1990–1993) levels, respectively, until the year 2020.³ However, major decreases could be more rapidly achieved simply from a prompt, wider application of existing technology.

Protecting populations from exposure to the harmful effects of air pollutants will require effective control measures. Industry (eg, coal-burning power plants, refineries, and chemical plants) and motor vehicles (both gasoline- and diesel-powered) are major sources of criteria pollutants and HAPs.^{11,12} For example, coal-fired power plants are important sources of nitrogen oxides (precursors of ozone), particulates, and sulfur dioxide and are the largest sources of mercury emission in the United States. Smaller sources such as dry cleaners, auto body shops, and wood-burning fireplaces can also affect air quality locally. Municipal and hospital waste incinerators release toxic air pollutants including mercury, lead, cadmium, and dioxin emissions. Depending on weather conditions and individual physicochemical properties, some pollutants can be carried by air currents to areas many miles from the source.

In numerous cities in the United States, the personal automobile is the single greatest polluter, because emissions from millions of vehicles on the road add up. Despite significant technologic advances that have led to tighter pollution control from vehicles, emissions vary substantially between vehicles, particularly between classes of vehicles, because of differences in fuel-economy standards set by regulatory agencies. For instance, the corporate average fuel-economy standards have less stringent fuel-economy requirements (average: 20.7 miles per gallon) for light-duty trucks, sport utility vehicles, and minivans, compared with passenger cars (average: 27.5 miles per gallon). The former group of vehicles tends to have higher emissions of air pollutants, higher fuel consumption, and higher emissions of greenhouse gases.^{96,97} Information on emissions and fuel-economy ratings for recent models and a

guide for choosing clean, fuel-efficient vehicles are available from the EPA Web site (www.epa.gov/greenvehicles/index.htm). The high levels of particulate emissions from diesel-powered buses and trucks must also be addressed. More than 70% of fine particle emissions from traffic are attributable to diesel-powered buses and trucks.

Driving a private car is probably a typical citizen's most "polluting" daily activity, yet in many cases, individuals have few alternative forms of transportation. Thus, urban planning and smart growth are imperative. Urban sprawl affects land use, transportation, and social and economic development and ultimately has important implications for public health.⁹⁸ Ways in which individuals can help to decrease air pollution are available at www.epa.gov/air/actions and www.arb.ca.gov/html/brochure/50things.htm.

Air Quality Index

The air quality index (AQI) provides local information on air quality and potential health concerns at the observed (or forecasted) levels of air pollution and can be a useful tool for educating families about local air quality and health.⁹⁹ The AQI is reported daily in metropolitan areas, often as part of local weather forecasts on television or radio or in newspapers. The AQI divides air-pollution levels into 6 categories of risk for 5 common pollutants (ozone, PM₁₀, nitrogen dioxide, carbon monoxide, and sulfur dioxide). Each category has a descriptive name reflecting levels of health concern (ranging from good through very hazardous), an associated color, and an advisory statement. Information about air quality in a specific area can be obtained from www.epa.gov/air/urbanair/index.html, www.scorecard.org, or www.weather.com. Although many states and local air districts actively forecast and disseminate health warnings, the challenge is to have people take actions to protect themselves and decrease activities that cause air pollution.

*Pediatric Environmental Health*¹⁰⁰ from the AAP provides additional information about the outdoor air pollutants and the use of the AQI.

CONCLUSIONS

Ambient air pollution has important and diverse health effects, and infants and children are among the most susceptible. Currently, levels of ozone and particulates remain unhealthful in many parts of the United States, and the current National Ambient Air Quality Standards may not protect the public adequately. There is a compelling need to move forward on efforts to ensure clean air for all.

The assurance of healthy air for children to breathe is beyond the control of an individual pediatrician, and there are no easy solutions. State chapters of the AAP, as well as individual members, can play an important role as advocates for children's environmental health. Areas of involvement might include working with community coalitions in support of strong pollution-control measures and informing local and national representatives and policy makers about the harmful effects of the environment on chil-

dren's health. Advocates for children's health are needed in discussions about land use and transportation issues. Pediatricians can also advocate for energy-saving (and pollution-minimizing) lifestyles to their patients' families, especially regarding vehicles driven.

In communities with poor air quality, pediatricians can play a role in educating children with asthma or other chronic respiratory tract disease and their families about the harmful effects of air pollution. Patients and families can be counseled on following the AQI to determine when local air-pollution levels pose a health concern. Ozone levels tend to be highest in the afternoon, and it may be possible to decrease children's exposure by scheduling strenuous outdoor activity earlier in the day.

As pediatricians become better informed about local air quality issues in their communities (eg, ozone, nearby industrial facilities, traffic, diesel buses, wood burning, etc), these local concerns can provide a starting point for discussion and education.

Pediatricians who serve as physicians for schools or for team sports should be aware of the health implications of pollution alerts to provide appropriate guidance to school and sports officials, particularly in communities with high levels of ozone.

RECOMMENDATIONS

1. The National Ambient Air Quality Standards are designed to protect the public. To achieve this, the following points should be addressed:
 - The revised standards for ozone and particulate matter adopted by the EPA in 1997 should be promptly implemented.
 - During implementation, the standards should not be weakened in any way that decreases the protection of children's health.
 - Because recent studies suggest that current standards for PM₁₀, PM_{2.5}, ozone, and nitrogen dioxide may not be protecting children, the standards should be promptly reviewed and revised.
 - Because the law requires that the most vulnerable groups be protected when setting or revising the air quality standards, the potential effects of air pollution on the fetus, infant, and child should be evaluated, and all standards should include a margin of safety for protection of children.
2. The current measures to protect children from exposures to HAPs are not effective and should be critically reevaluated. The EPA should focus on prompt implementation of the Clean Air Act Amendments of 1990 (Pub L No. 101-549) to decrease HAPs. Additional monitoring for HAPs should be undertaken to allow more accurate characterization of children's exposures to these compounds. Risk assessments for HAPs should be reviewed to ensure that goals are protective of children. Control measures that specifically protect children's health should be implemented.
3. States and local air districts with air quality concerns should actively implement forecasting and

dissemination of health warnings in ways that help people take actions to protect themselves and decrease activities that cause air pollution.

4. Children's exposure to diesel exhaust particles should be decreased. Idling of diesel vehicles in places where children live and congregate should be minimized. Ongoing programs to fund conversion of diesel school bus fleets to cleaner alternative fuels and technologies should be pursued.
5. Industrial emissions of mercury should be decreased.
6. Federal and state governments' policies should encourage reductions in mobile and stationary sources of air pollution, including increased support for mass transit, carpooling, retiring or retrofitting old power plants that do not meet current pollution-control standards, and programs that support marked improvements in fuel emissions of gasoline- and diesel-powered vehicles. Additionally, the development of alternative fuel fleets, low-sulfur diesel, and other "low-emission" strategies (eg, retrofit of existing diesel engines) should be promoted. Before promoting new alternative fuels, these alternative fuel sources should be critically evaluated and determined by governmental authorities to have a good safety profile.
7. The same overall fuel-economy standard should apply to all passenger vehicles. Programs that allow certain passenger vehicles to be exempt from the usual fuel-economy standards should be abolished.
8. City and land-use planning should encourage the design and redevelopment of communities to promote mass transit, carpooling, pedestrian walkways, and bicycle use.
9. Siting of school and child care facilities should include consideration of proximity to roads with heavy traffic and other sources of air pollution. New schools should be located to avoid "hot spots" of localized pollution.

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REFERENCES

1. US Environmental Protection Agency. Latest findings on national air quality: 2000 status and trends. Research Triangle Park, NC: Environmental Protection Agency; 2001. Publication No. EPA 454/K-01-002. Available at: www.epa.gov/airtrends/reports.html. Accessed August 8, 2003
2. US Environmental Protection Agency. Supreme Court upholds EPA position on smog, particulate rules [press release]. Available at: www.epa.gov/airlinks/rehear.htm. Accessed October 29, 2004
3. US Environmental Protection Agency. About air toxics, health and ecologic effects. Available at: www.epa.gov/air/toxicair/newtoxics.html. Accessed August 8, 2003
4. American Academy of Pediatrics, Committee on Environmental Health. Ambient air pollution: respiratory hazards to children. *Pediatrics*. 1993;91:1210–1213
5. Diertel RR, Etzel RA, Chen D, et al. Workshop to identify critical windows of exposure for children's health: immune and respiratory systems work group summary. *Environ Health Perspect*. 2000;108(suppl 3):483–490
6. Flopper CG, Fanucchi MV. Do urban environmental pollutants exacerbate childhood lung diseases? *Environ Health Perspect*. 2000;108:A252–A253
7. Pinkerton KE, Joad JP. The mammalian respiratory system and critical windows of exposure for children's health. *Environ Health Perspect*. 2000;108(suppl 3):457–462
8. Plunkett LM, Turnbull D, Rodricks JV. Differences between adults and children affecting exposure assessment. In: Guzelian PS, Henry CJ, Olin SS, eds. *Similarities and Differences Between Children and Adults: Implications for Risk Assessment*. Washington, DC: ILSI Press; 1992: 79–96
9. Wiley JA, Robinson JP, Piazza T, et al. *Activity Patterns of California Residents: Final Report*. Sacramento, CA: California Air Resources Board; 1991. Publication No. A6-177-33
10. Wiley JA, Robinson JP, Cheng YT, Piazza T, Stork L, Pladsen K. *Study of Children's Activity Patterns: Final Report*. Sacramento, CA: California Air Resources Board; 1991. Publication No. A733-149
11. American Thoracic Society, Committee of the Environmental and Occupational Health Assembly. Health effects of outdoor air pollution. Part 1. *Am J Respir Crit Care Med*. 1996;153:3–50
12. American Thoracic Society, Committee of the Environmental and Occupational Health Assembly. Health effects of outdoor air pollution. Part 2. *Am J Respir Crit Care Med*. 1996;153:477–498
13. Bates DV. The effects of air pollution on children. *Environ Health Perspect*. 1995;103(suppl 6):49–53
14. US Environmental Protection Agency. *Air Quality Criteria for Particulate Matter, Vol. II*. Research Triangle Park, NC: Environmental Protection Agency; 2001. Publication No. EPA/600/P-99/002bB
15. US Environmental Protection Agency. *Air Quality Criteria for Ozone and Related Photochemical Oxidants, Vol. III*. Research Triangle Park, NC: Environmental Protection Agency; 1996. Publication No. EPA/600/P-93/004a-cF
16. Dockery DW. Epidemiologic evidence of cardiovascular effects of particulate air pollution. *Environ Health Perspect*. 2001;109(suppl 4): 483–486
17. Pope CA III, Burnett RT, Thun MJ, et al. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *JAMA*. 2002;287:1132–114118.
18. McConnell R, Berhane K, Gilliland F, et al. Asthma in exercising children exposed to ozone: a cohort study [published correction appears in: *Lancet*. 2002;359:896]. *Lancet*. 2002;359:386–391
19. Gauderman WJ, McConnell R, Gilliland F, et al. Association between air pollution and lung function growth in southern California children. *Am J Respir Crit Care Med*. 2000;162:1383–1390
20. Gauderman WJ, Gilliland GF, Vora H, et al. Association between air pollution and lung function growth in southern California children: results from a second cohort. *Am J Respir Crit Care Med*. 2002;166:76–84

21. Kinney PL, Thurston GD, Raizenne M. The effects of ambient ozone on lung function in children: a reanalysis of six summer camp studies. *Environ Health Perspect.* 1996;104:170-174
22. Thurston GD, Lippmann M, Scott MB, Fine JM. Summertime haze air pollution and children with asthma. *Am J Respir Crit Care Med.* 1997;155:654-660
23. Ostro BD, Lipssett MJ, Mann JK, Braxton-Owens H, White MC. Air pollution and asthma exacerbations among African-American children in Los Angeles. *Inhal Toxicol.* 1995;7:711-722
24. Thurston GD, Ito K, Hayes CG, Bates DV, Lippmann M. Respiratory hospital admissions and summertime haze air pollution in Toronto, Ontario: consideration of the role of acid aerosols. *Environ Res.* 1994;65:271-290
25. White MC, Etzel RA, Wilcox WD, Lloyd C. Exacerbations of childhood asthma and ozone pollution in Atlanta. *Environ Res.* 1994;65:56-68
26. Tolbert PE, Mulholland JA, MacIntosh DL, et al. Air quality and pediatric emergency room visits for asthma in Atlanta, Georgia, USA. *Am J Epidemiol.* 2000;151:798-810
27. Gilliland FD, Berhane K, Rappaport EB, et al. The effects of ambient air pollution on school absenteeism due to respiratory illnesses. *Epidemiology.* 2001;12:43-54
28. Molfino NA, Wright SC, Katz I, et al. Effect of low concentration of ozone on inhaled allergen responses in asthmatic subjects. *Lancet.* 1991;338:199-203
29. Castillejos M, Gold DR, Damokosh AI, et al. Acute effects of ozone on the pulmonary function of exercising schoolchildren from Mexico City. *Am J Respir Crit Care Med.* 1995;152:1501-1507
30. Chen PC, Lai YM, Chan CC, Hwang JS, Yang CY, Wang JD. Short-term effect of ozone on the pulmonary function of children in primary school. *Environ Health Perspect.* 1999;107:921-925
31. Korrick SA, Neas LM, Dockery DW, et al. Effects of ozone and other pollutants on the pulmonary function of adult hikers. *Environ Health Perspect.* 1998;106:93-99
32. Burnett RT, Smith-Doiron M, Stieb D, et al. Association between ozone and hospitalization for acute respiratory diseases in children less than 2 years of age. *Am J Epidemiol.* 2001;153:444-452
33. Stieb DM, Burnett RT, Beveridge RC, Brook JR. Association between ozone and asthma emergency department visits in Saint John, New Brunswick, Canada. *Environ Health Perspect.* 1996;104:1354-1360
34. Gent JF, Tiche EW, Holford TR, et al. Association of low-level ozone and fine particles with respiratory symptoms in children with asthma. *JAMA.* 2003;290:1859-1867
35. Kunzli N, Lurmann F, Segal M, Ngo L, Balmes J, Tager IB. Association between lifetime ambient ozone exposure and pulmonary function in college freshmen—results of a pilot study. *Environ Res.* 1997;72:8-23
36. Galizia A, Kinney PL. Long-term residence in areas of high ozone: associations with respiratory health in a nationwide sample of non-smoking young adults. *Environ Health Perspect.* 1999;107:675-679
37. Ghio AJ, Silbajoris R, Carson JL, Samet JM. Biologic effects of oil fly ash. *Environ Health Perspect.* 2002;110(suppl 1):89-94
38. Pandya RJ, Solomon G, Kinner A, Balmes JR. Diesel exhaust and asthma: hypotheses and molecular mechanisms of action. *Environ Health Perspect.* 2002;110(suppl 1):103-112
39. Dockery DW, Pope CA III. Acute respiratory effects of particulate air pollution. *Annu Rev Public Health.* 1994;15:107-132
40. Schwartz J. Air pollution and daily mortality: a review and meta analysis. *Environ Res.* 1994;64:36-52
41. Samet JM, Dominici F, Currier FC, Coursac I, Zeger SL. Fine particulate air pollution and mortality in 20 U.S. cities, 1987-1994. *N Engl J Med.* 2000;343:1742-1749
42. Schwartz J. Air pollution and blood markers of cardiovascular risk. *Environ Health Perspect.* 2001;109(suppl 3):405-409
43. California Air Resources Board. June 20, 2002 board meeting summary. Sacramento, CA: California Air Resources Board; 2002. Available at: www.arb.ca.gov/research/aaqs/std-rs/bdsum620/bdsum620.htm. Accessed August 8, 2003
44. Hoek G, Dockery DW, Pope A, Neas L, Roemer W, Brunekreef B. Association between PM10 and decrements in peak expiratory flow rates in children: reanalysis of data from five panel studies. *Eur Respir J.* 1998;11:1307-1311
45. Ostro B, Lipssett M, Mann J, Braxton-Owens H, White M. Air pollution and exacerbation of asthma in African-American children in Los Angeles. *Epidemiology.* 2001;12:200-208
46. Yu O, Sheppard L, Lumley T, Koenig JQ, Shapiro GG. Effects of ambient air pollution on symptoms of asthma in Seattle-area children enrolled in the CAMP study. *Environ Health Perspect.* 2000;108:1209-1214
47. McConnell R, Berhane K, Gilliland F, et al. Air pollution and bronchitic symptoms in Southern California children with asthma. *Environ Health Perspect.* 1999;107:757-760
48. Woodruff TJ, Grillo J, Schoendorf KC. The relationship between selected causes of postneonatal infant mortality and particulate air pollution in the United States. *Environ Health Perspect.* 1997;105:608-612
49. Bobak M, Leon DA. The effect of air pollution on infant mortality appears specific for respiratory causes in the postneonatal period. *Epidemiology.* 1999;10:666-670
50. Ritz B, Yu F. The effect of ambient carbon monoxide on low birth weight among children born in southern California between 1989 and 1993. *Environ Health Perspect.* 1999;107:17-25
51. Bobak M. Outdoor air pollution, low birth weight, and prematurity. *Environ Health Perspect.* 2000;108:173-176
52. Dejmek J, Solansky I, Benes I, Lenicek J, Sram RJ. The impact of polycyclic aromatic hydrocarbons and fine particles on pregnancy outcome. *Environ Health Perspect.* 2000;108:1159-1164
53. Wang X, Ding H, Ryan L, Xu X. Association between air pollution and low birth weight: a community-based study. *Environ Health Perspect.* 1997;105:514-520
54. Ritz B, Yu F, Chapa G, Fruin S. Effect of air pollution on preterm birth among children born in Southern California between 1989 and 1993. *Epidemiology.* 2000;11:502-511
55. Ha EH, Hong YC, Lee BE, Woo BH, Schwartz J, Christiani DC. Is air pollution a risk factor for low birth weight in Seoul? *Epidemiology.* 2001;12:643-648
56. Xu X, Ding H, Wang X. Acute effects of total suspended particles and sulfur dioxides on preterm delivery: a community-based cohort study. *Arch Environ Health.* 1995;50:407-415
57. Schwartz J. Air pollution and hospital admissions for respiratory disease. *Epidemiology.* 1996;7:20-28
58. Ostro BD, Broadwin R, Lipssett MJ. Coarse and fine particles and daily mortality in the Coachella Valley, California: a follow-up study. *J Expo Anal Environ Epidemiol.* 2000;10:412-419
59. Laden F, Neas LM, Dockery DW, Schwartz J. Association of fine particulate matter from different sources with daily mortality in six US cities. *Environ Health Perspect.* 2000;108:941-947
60. Ozkaynak H, Thurston GD. Associations between 1980 U.S. mortality rates and alternative measures of airborne particle concentration. *Risk Anal.* 1987;7:449-461
61. Strand V, Svartengren M, Rak S, Barck C, Bylin G. Repeated exposure to an ambient level of NO₂ enhances asthmatic response to a nonsymptomatic allergen dose. *Eur Respir J.* 1998;10:6-12
62. Tunnicliffe WS, Burge PS, Ayres JG. Effect of domestic concentrations of nitrogen dioxide on airway responses to inhaled allergen in asthmatic patients. *Lancet.* 1994;344:1733-1736
63. Hajat S, Haines A, Goubet SA, Atkinson RW, Anderson HR. Association of air pollution with daily GP consultations for asthma and other lower respiratory conditions in London. *Thorax.* 1999;54:597-605
64. Shima M, Adachi M. Effect of outdoor and indoor nitrogen dioxide on respiratory symptoms in schoolchildren. *Int J Epidemiol.* 2000;29:862-870
65. Lipssett M, Hurley S, Ostro B. Air pollution and emergency room visits for asthma in Santa Clara County, California. *Environ Health Perspect.* 1997;105:216-222
66. Zhu Y, Hinds WC, Kim S, Sioutas C. Concentration and size distribution of ultrafine particles near a major highway. *J Air Waste Manag Assoc.* 2002;52:1032-1042
67. Delfino RJ. Epidemiologic evidence for asthma and exposure to air toxics: linkages between occupational, indoor, and community air pollution research. *Environ Health Perspect.* 2002;110(suppl 4):573-589
68. Edwards J, Walters S, Griffiths RK. Hospital admissions for asthma in preschool children: relationship to major roads in Birmingham, United Kingdom. *Arch Environ Health.* 1994;49:223-227
69. van Vliet P, Knappe M, de Hartog J, Janssen N, Harssema H, Brunekreef B. Motor vehicle exhaust and chronic respiratory symptoms in children living near freeways. *Environ Res.* 1997;74:122-132
70. Brunekreef B, Janssen NA, de Hartog J, Harssema H, Knappe M, van Vliet P. Air pollution from truck traffic and lung function in children living near motorways. *Epidemiology.* 1997;8:298-303
71. Ciccone G, Forastiere F, Agabiti N, et al. Road traffic and adverse respiratory effects in children. SIDRIA Collaborative Group. *Occup Environ Med.* 1998;55:771-778
72. Feychting M, Svensson D, Ahlbom A. Exposure to motor vehicle exhaust and childhood cancer. *Scand J Work Environ Health.* 1998;24:8-11

73. Pearson RL, Wachtel H, Ebi KL. Distance-weighted traffic density in proximity to a home is a risk factor for leukemia and other childhood cancers. *J Air Waste Manag Assoc.* 2000;50:175-180
74. Raaschou-Nielsen O, Hertel O, Thomsen BL, Olsen JH. Air pollution from traffic at the residence of children with cancer. *Am J Epidemiol.* 2001;153:433-443
75. Lipsett M, Campleman S. Occupational exposure to diesel exhaust and lung cancer: a meta-analysis. *Am J Public Health.* 1999;89:1009-1017
76. US Environmental Protection Agency. *Health Assessment Document for Diesel Engine Exhaust.* Washington, DC: Office of Research and Development NCFEA; 2002. EPA/600/8-909/057F
77. International Agency for Research on Cancer. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Diesel and Gasoline Engine Exhausts and Some Nitroarenes.* Vol 46. Lyon, France: International Agency for Research on Cancer; 1989:458
78. Diaz-Sanchez D, Garcia MP, Wang M, Jyrala M, Saxon A. Nasal challenge with diesel exhaust particles can induce sensitization to a neoallergen in the human mucosa. *J Allergy Clin Immunol.* 1999;104:1183-1188
79. Nel AE, Diaz-Sanchez D, Ng D, Hiura T, Saxon A. Enhancement of allergic inflammation by the interaction between diesel exhaust particles and the immune system. *J Allergy Clin Immunol.* 1998;102:539-554
80. Solomon GM, Campbell T, Feuer GR, Masters J, Samkian A, Paul KA. *No Breathing in the Aisles: Diesel Exhaust Inside School Buses.* New York, NY: Natural Resources Defense Council; 2001. Available at: www.nrdc.org/air/transportation/schoolbus/sbusinx.asp. Accessed August 8, 2003
81. Leikauf GD. Hazardous air pollutants and asthma. *Environ Health Perspect.* 2002;110(suppl 4):505-526
82. American Academy of Pediatrics, Goldman LR, Shannon MW, Committee on Environmental Health. Technical report: mercury in the environment: implications for pediatricians. *Pediatrics.* 2001;108:197-205
83. Suh HH, Bahadori T, Vallarino J, Spengler JD. Criteria air pollutants and toxic air pollutants. *Environ Health Perspect.* 2000;108(suppl 4):625-633
84. Woodruff TJ, Axelrad DA, Caldwell J, Morello-Frosch R, Rosenbaum A. Public health implications of 1990 air toxics concentrations across the United States. *Environ Health Perspect.* 1998;106:245-251
85. Nazemi MA. *Multiple Air Toxics Exposure Study (MATES-II) in the South Coast Air Basin.* Diamond Bar, CA: South Coast Air Quality Management District; 2000
86. Morello-Frosch RA, Woodruff TJ, Axelrad DA, Caldwell JC. Air toxics and health risks in California: the public health implications of outdoor concentrations. *Risk Anal.* 2000;20:273-291
87. Kyle AD, Wright CC, Caldwell JC, Buffler PA, Woodruff TJ. Evaluating the health significance of hazardous air pollutants using monitoring data. *Public Health Rep.* 2001;116:32-44
88. Heinrich J, Hoelscher B, Wichmann HE. Decline of ambient air pollution and respiratory symptoms in children. *Am J Respir Crit Care Med.* 2000;161:1930-1936
89. Frye C, Hoelscher B, Cyrus J, Wjst M, Wichmann HE, Heinrich J. Association of lung function with declining ambient air pollution. *Environ Health Perspect.* 2003;111:383-387
90. Friedman MS, Powell KE, Hutwagner L, Graham LM, Teague WG. Impact of changes in transportation and commuting behaviors during the 1996 Summer Olympic Games in Atlanta on air quality and childhood asthma. *JAMA.* 2001;285:897-905
91. Pope CA III. Respiratory hospital admissions associated with PM10 pollution in Utah, Salt Lake, and Cache Valleys. *Arch Environ Health.* 1991;46:90-97
92. Pope CA III. Particulate pollution and health: a review of the Utah valley experience. *J Expo Anal Environ Epidemiol.* 1996;6:23-34
93. Avol EL, Gauderman WJ, Tan SM, London SJ, Peters JM. Respiratory effects of relocating to areas of differing air pollution levels. *Am J Respir Crit Care Med.* 2001;164:2067-2072
94. Romieu I, Sienna-Monge JJ, Ramirez-Aguilar M, et al. Antioxidant supplementation and lung functions among children with asthma exposed to high levels of air pollutants. *Am J Respir Crit Care Med.* 2002;166:703-709
95. US Environmental Protection Agency. *The Plain English Guide To The Clean Air Act.* 1993. EPA-400-K-93-001. Available at: www.epa.gov/oar/oaqps/peg_caa/pegcaain.html. Accessed October 26, 2004
96. National Research Council. *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards.* Washington, DC: National Academies Press; 2002. Available at: www.nap.edu/books/0309076013/html. Accessed August 8, 2003
97. Hwang R, Millis B, Spencer T. *Clean Getaway: Toward Safe and Efficient Vehicles.* New York, NY: Natural Resources Defense Council; 2001. Available at: www.nrdc.org/air/transportation/cape/cafexn.asp. Accessed August 8, 2003
98. Jackson RJ, Kochtitzky C. *Creating a Health Environment: The Impact of the Built Environment on Public Health.* Washington, DC: Sprawl Watch Clearinghouse. Available at: www.sprawlwatch.org/health.pdf. Accessed August 8, 2003
99. US Environmental Protection Agency, Office of Air and Radiation. *Air Quality Index: A Guide to Air Quality and Your Health.* Research Triangle Park, NC: Environmental Protection Agency; 2000. Publication No. EPA-454/R-00-005. Available at: www.epa.gov/airnow/aqibroch. Accessed August 8, 2003
100. American Academy of Pediatrics, Committee on Environmental Health. Outdoor air pollutants. In: Etzel RA, Balk SJ, eds. *Pediatric Environmental Health.* 2nd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2003;69-86

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