

PLANNING FOR FRACKING ON THE BARNETT SHALE: URBAN AIR POLLUTION, IMPROVING HEALTH BASED REGULATION, AND THE ROLE OF LOCAL GOVERNMENTS

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In the last decade hydraulic fracturing for natural gas has exploded on the Barnett Shale in Texas. The region is now home to the most intensive hydraulic fracking and gas production activities ever undertaken in densely urbanized areas. Faced with minimal state and federal regulation, Texas cities are on the front line in the effort to figure out how best to balance industry, land use, and environmental concerns. Local governments in Texas, however, do not currently have the regulatory authority, capacity, or the information required to close the regulatory gap. Using the community experience on the Barnett Shale as a case study, this article focuses on the legal and regulatory framework governing air emissions and proposes changes to the current regulatory structure.

Under both the state and federal programs, the regulation of hazardous air emissions from gas operations is based largely on questions of cost and available technology. There is no comprehensive cumulative risk assessment to consider the potential impact to public health in urban areas. Drilling operations are being conducted in residential areas. Residents living in close proximity to gas operations on the Barnett Shale have voiced serious concerns for their health, which have yet to be comprehensively evaluated. Given the complexity of the science, and the dearth of clear, transparent, and enforceable standards, inadequate studies and limited statistical analysis have been allowed to provide potentially false assurances. The politically expedient bottom line dominates with little attention paid to the quality of the science or the adequacy of the standards.

Determining and applying comprehensive health-based standards for hazardous air pollutants has been largely abandoned at the federal level given uncertainties in the science, difficulties of determining and measuring “safe” levels of toxic pollutants, and the potential for

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economic disruption. Neither the state nor the federal government has set enforceable ambient standards for hazardous air pollutants. Identifying cumulative air pollution problems that may occur in urban areas, the State of California has called upon local governments to identify “hot spots” and to consider air quality issues in their planning and zoning actions. In Texas, however, preemption discussions dominate the analysis. Any local government regulation that might provide protection from toxic air emissions otherwise regulated by the State must be justified by some other public purpose.

Texas should consider authorizing and encouraging local level air quality planning for industrial activities, similar to what California has done. Care should be taken to separate these facilities from sensitive receptors and “hot spots” that may already be burdened with excessive hazardous air emissions. Given the difficulty of the task, there is also an important role for the state and federal governments in working to establish ambient standards for hazardous air pollutants, as well as standards for health based assessment and public communication. The uncertainty inherent in any of these standards should be made clear and accessible to local governments so that it may be considered in making appropriate and protective land use decisions. Texas should consider allowing local governments to have the power to establish ambient air quality standards, emissions limitations, monitoring, reporting, and offsets for hazardous air pollutants, following the model applied to conventional air pollutants pursuant to the federal program.

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INTRODUCTION

Hydraulic fracturing for natural gas is booming in Texas. Of the 15,466 new drillings permitted in 2010, approximately 85 percent were hydraulically fractured or “fracked.”¹ The Barnett Shale, an area which underlies 5,000 square miles over 23 counties, is the most active shale gas production area in the United States and home to one of the largest drilling programs ever undertaken in an urban area.² The Barnett Shale accounted for 25 percent of the gas production in Texas in 2009, with 13,902 preexisting gas wells and another 3,333 permitted that year.³ Though this area has historically produced oil and gas from conventional reservoirs, there has been an exponential increase in the number of wells in the region. From 2000 to 2009, the number of wells grew from 726 to 13,740.⁴ Gas production increased during this time, from 94 million cubic feet per day in 1998 to over three billion cubic feet per day in 2007.⁵ Since 2001, over one thousand permits have been issued for drilling and production of gas within the city limits of the City of Fort Worth, Texas.⁶

Air quality impacts in urban areas on the Barnett Shale are a significant concern. Natural gas development is followed by increases in emissions of methane, a potent greenhouse gas, volatile organic compounds (VOCs) which contribute to smog formation,

¹ Memo from Leslie Savage, Chief Geologist, Oil & Gas Div., Railroad Comm’n of Tex., to Elizabeth Ames Jones, Chairman, Railroad Comm’n of Tex. 5-6 (Aug. 22, 2011), available at <http://www.rrc.state.tx.us/rules/prop-new-3-29-frac-disclosure-Aug29.PDF>.

² VALERIE J. SCHLUMBERGER & JOSEPH H. FRANTZ, *SHALES GAS 2* (2005), available at http://www.pe.tamu.edu/wattenbarger/public_html/Selected_papers/—Shale%20Gas/shale_gas-%20schlumberger.pdf; Thomas Kurth et al., *Shaking Up Established Case Law and Regulation: The Impacts of Hydraulic Fracturing*, 57 *THE ADVOC.* 18, 25 (2011), available at http://www.litigationsection.com/downloads/Advocate_Vol57_Winter2011.pdf; TEX. DEP’T OF STATE HEALTH SERVS., FINAL REPORT, DISH, TEXAS EXPOSURE INVESTIGATION 3 (MAY 12, 2010), available at http://www.dshs.state.tx.us/epitox/consults/dish_ei_2010.pdf [hereinafter FINAL REPORT].

³ PowerPoint: Miles T. Whitten, Barnett Shale Open House at the North Central Texas Council of Governments, 14 (Oct. 16, 2010), available at <http://www.tceq.texas.gov/assets/public/implementation/air/ie/pseiforms/10162010arlington.pdf>.

⁴ FINAL REPORT, *supra* note 2, at 3.

⁵ *Id.* at 7.

⁶ Fort Worth, Tex., Ordinance No. 18449-02-2009 (Feb. 3, 2009), available at http://fortworthtexas.gov/uploadedFiles/Gas_Wells/gasdrilling_ordinance.pdf.

and hazardous air pollutants (HAPs), which can cause cancer and other serious health effects.⁷ Emissions include VOCs released during drilling and hydraulic fracking (where fluids including toxic chemicals are injected under high pressure to fracture and release gas from the underlying formation), combustion byproducts from mobile and stationary equipment, VOC's released from chemicals used to maintain the well pad and equipment, and numerous non-methane hydrocarbons that surface with the raw natural gas.⁸

Gas operations are particularly problematic in urban areas where there may already be excessive levels of emissions from other area-wide and mobile sources and where people are living in close proximity to industrial operations. Drilling rigs are arriving in the midst of neighborhoods. Residents on the Barnett Shale have raised air quality and health concerns, which have not been comprehensively evaluated. Faced with minimal state and federal regulation, Texas cities are on the front line in the effort to figure out how best to balance industry, land use, and environmental concerns. Local governments in Texas, however, do not currently have the regulatory authority, capacity, or the information required to close the regulatory gap. Using the community experience on the Barnett Shale as a case study, this article focuses on the legal and regulatory framework governing air emissions and proposes changes to the current regulatory structure.

Barnett Shale residents have reported a number of unusual health conditions that many believe to be related to gas industry operations, including headaches, respiratory problems, itchy and watery eyes, and nosebleeds.⁹ In August 2010, several residents blogged about the various health effects they were experiencing after large clouds were

⁷ Oil and Natural Gas Sector, New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 77 Fed. Reg. 49460 (Apr. 16, 2012) (to be codified 40 C.F.R. pts. 60, 63).

⁸ THEO COLBORN, ET AL., AN EXPLORATORY STUDY OF AIR QUALITY NEAR NATURAL GAS OPERATIONS 3 (2012), available at <http://www.endocrinedisruption.com/chemicals.air.php>.

⁹ FINAL REPORT, *supra* note 2, at 9. See also Sue Sturgis, *North Carolina Gets a Texas Sized Warning on Fracking*, THE INSTITUTE FOR SOUTHERN STUDIES (June 13, 2012), <http://www.southernstudies.org/2012/06/north-carolina-gets-a-texas-sized-warning-on-fracking.html>; TEX. OIL & GAS ACCOUNTABILITY PROJECT, NATURAL GAS FLOWBACK, HOW THE TEXAS NATURAL GAS BOOM AFFECTS HEALTH AND SAFETY 15-17 (2011), available at http://www.earthworksaction.org/library/detail/natural_gas_flowback#.UZMgGivWFk0; Group, *Town of DISH urge Texas regulators to act immediately on behalf of impacted citizens*, EARTHWORKS (Dec. 16, 2009), available at http://www.earthworksaction.org/media/detail/community_health_survey_shows_shale_gas_threatens_human_health.

noted at a nearby well site.¹⁰ Calvin Tillman, the former Mayor of the small town of Dish, decided to move his family after his two boys began experiencing nosebleeds that coincided with the presence of strong gas odors.¹¹ One of Tillman's sons was diagnosed with asthma and it was reported that the air quality conditions exacerbated his symptoms.¹² After relocating, the former mayor reported that his son's asthma has improved and that neither child had since experienced a nosebleed.¹³ Residents in Argyle have complained that children attending school near gas operations have also experienced nosebleeds and symptoms of asthma, as well as dizziness and disorientation.¹⁴

Although a causal relationship has not been established, William Subra, a chemist working for Earthworks, conducted a health effects survey of 31 residents in Dish, Texas, and found a correlation between claimed health effects and the known health effects of chemicals associated with shale gas industry operations.¹⁵ Summarizing the results, she noted that doctors are observing not only respiratory ailments and headaches, but also brain disorders, pre-cancerous lesions, and impairment of motor skills.¹⁶

Cancer rates are also a concern. Residents in Flower Mound, Texas, called on the state to investigate the seemingly excessive number of children with leukemia.¹⁷ Six counties in the western Dallas-Fort Worth area, all home to shale gas operations, had the highest incidence of invasive breast cancer in the state.¹⁸ While cancer and health disorders are not unique to residents of the Barnett Shale, and air quality is not the

¹⁰ *Emissions from Blessing well 8/18/10*, ARGYLE-BARTONVILLE COMMUNITIES ALLIANCE (Aug. 18, 2010), <http://abcalliance.org/?p=364>.

¹¹ Sturgis, *supra* note 9.

¹² Interview with Calvin Tillman, Former Mayor of Dish, Tex., in Denton, Tex. (July 12, 2011), available at <http://nben.ca/en/my-nb-eco-community/groups/viewdiscussion/19-calvin-tillman-interview-former-mayor-of-town-wracked-by-qfrackingq?groupid=11>.

¹³ *Id.*; *Dallas Drilling Task Force*, Earthworks, Sharon Wilson, 6 (Aug. 20, 2011), available at http://www.dallascityhall.com/pdf/GasDrilling/Wilson_DallasTaskForce_083011pdf.pdf.

¹⁴ Lowell Brown & Britney Tabor, *Parents Voice Health Concerns: Gas Drilling near Argyle Schools Making Kids Ill, Residents Tell Board*, DENTON CHRON. (Oct. 24, 2010).

¹⁵ WILMA SUBRA, RESULTS OF HEALTH SURVEY OF CURRENT AND FORMER DISH/CLARK, TEXAS RESIDENTS 16 (2009), available at http://www.marcellus-shale.us/pdf/DISH_Health-Survey_Dec09.pdf.

¹⁶ EARTHWORKS, *supra* note 9.

¹⁷ *Health officials to investigate cancer cases in Flower Mound* (WFAA-TV television broadcast Jan. 12, 2010) [hereinafter *WFAA-TV Broadcast*].

¹⁸ These counties are Tarrant (which includes the city of Fort Worth), Denton, Wise, Parker, Hood, and Johnson. *Addressing the Cancer Burden at a Glance*, CTRS. FOR DISEASE CONTROL & PREVENTION, <http://www.cdc.gov/chronicdisease/resources/publications/AAG/dcp.html> (last updated Aug. 30, 2012).

only source of toxic exposure, the fact remains that air pollution may affect public health.¹⁹

Residents in many communities have reported apparent leaks and malfunctions associated with gas industry operations and equipment, some of which have been so severe as to warrant evacuation.²⁰ The complaint log for the City of Fort Worth indicates a number of such instances, including a release from an over-pressurized glycol filter line,²¹ the venting of gas from a gas well,²² a cut seal,²³ a leak from ruptured tubing on a well pad,²⁴ and a leak in a valve on the fuel line to a compressor.²⁵ In January 2011, a small hole in a valve in Flower Mound released 75,000 cubic feet of natural gas, before the well was shut off by a fireman.²⁶ The amount of gas released was equivalent to the amount one family uses in a year for heating, cooking or water²⁷ or nineteen tons of dynamite. According a local police blotter from September 2011, a woman reported strange noises coming from a drilling site in Argyle.²⁸ Firemen were forced to use the emergency shut off.²⁹

Gas industry operations are also raising concerns at the regional level. Nine counties around the cities of Dallas and Fort Worth, four of which have substantial oil and gas production, are failing to meet the National Ambient Air Quality Standards for ozone and have been designated as ozone nonattainment areas by the EPA.³⁰ Ground-level ozone is a primary component of the “smog” that is created when

¹⁹ *Importance of Children's Environmental Health*, MOUNT SINAI HOSP., <http://www.mountsinai.org/patient-care/service-areas/children/areas-of-care/childrens-environmental-health-center/childrens-disease-and-the-environment> (last visited May 14, 2013) (“Toxic chemicals in the environment—lead, pesticides, toxic air pollutants, phthalates, and bisphenol A—are important causes of disease in children, and they are found in our homes, at our schools, in the air we breathe, and in the products we use every day.”).

²⁰ Wilson, *supra* note 13, at 8.

²¹ *City of Fort Worth Complaint Log 2008-2012*, at Fourth Street Model, on file with author.

²² *Id.* at Iglesia Bautista and Reed Mitchell.

²³ *Id.* at Mercer Ranch Pad 4.

²⁴ *Id.* at Alliance Pad B.

²⁵ *Id.* at Railhead.

²⁶ *Repairs from Gas Well Leak Completed*, CROSS TIMBERS GAZETTE (Jan. 4, 2011, 2:37 PM), <http://www.crosstimbersgazette.com/local-news/1300-repairs-from-gas-well-leak-completed.html>.

²⁷ *Id.* (reporting that benzene and 45 other VOCs measured at a state air quality monitoring station in Flower Mound remained below levels of concern and air quality remained “safe” throughout the event, but not identifying the location of the monitor or the prevailing winds).

²⁸ *Argyle Police Blotter*, THE CROSS TIMBERS GAZETTE (Sept. 18, 2011), <http://www.crosstimbersgazette.com/local-news/1843-argyle-police-blotter.html>.

²⁹ *Id.*

³⁰ AL ARMENDARIZ, EMISSIONS FROM NATURAL GAS PRODUCTION IN THE BARNETT SHALE AREA AND OPPORTUNITIES FOR COST-EFFECTIVE IMPROVEMENTS 3 (2009).

nitrogen oxides (NO_x), VOCs, and oxygen react in the presence of sunlight, generally at elevated temperatures.³¹ Both NO_x and VOCs are produced by gas operations.³² Notably, the region's highest ozone violations are being measured in the same geographic area where the greatest fracking activity is taking place.³³

The Texas Commission on Environmental Quality (TCEQ) dismissed the correlation between natural gas activity and ozone problems based on the location of operations and the prevailing wind direction.³⁴ However, according to the TCEQ State Implementation Plan, oil and gas operations in the Dallas Fort Worth region contribute more to the area's VOCs than emissions from all cars, trucks, buses and other on-road mobile sources in the area combined.³⁵ In July 2011, the North Central Texas Council of Governments recommended that the State adopt additional measures as part of the ozone State Implementation Plan to regulate area oil and gas activities.³⁶ Examples of ozone nonattainment in largely rural areas make the potential emissions contributions from gas industry operations startling clear. In 2012, the United States Environmental Protection Agency (EPA) designated rural areas on shale gas fields in three Wyoming counties as nonattainment areas for the NAAQ 8 hour ozone levels.³⁷ The shale gas industry does not dispute that their activities are the major source for ozone nonattainment in Wyoming.³⁸

³¹ See Approval and Promulgation of Implementation Plans, 73 Fed. Reg. 63,408, 63,409 (Oct. 24, 2008) (to be codified at 40 C.F.R. pt. 52).

³² TEX. COMM'N ON ENVTL. QUALITY, REVISIONS TO THE STATE OF TEXAS AIR QUALITY IMPLEMENTATION PLAN FOR THE CONTROL OF OZONE AIR POLLUTION, DALLAS-FORT WORTH EIGHT-HOUR OZONE NONATTAINMENT AREA 3-24 tbl. 3-13 (2011), available at http://www.tceq.texas.gov/assets/public/implementation/air/sip/dfw/ad_2011/10022SIP_ado_111811.pdf.

³³ Letter from Jungus Jordan, Chair, N. Tex. Clean Air Steering Comm., to Jamie Zech, Tex. Comm. on Env'tl. Quality (July 13, 2011), available at <http://www.nctcog.org/trans/committees/ntcasc/SIPComments/TCEQSIPCommentLtr071311.pdf>.

³⁴ *A Commitment to Air Quality in the Barnett Shale*, TEX. COMM'N ON ENVTL. QUALITY, <http://www.tceq.state.tx.us/publications/pd/020/10-04/a-commitment-to-air-quality-in-the-barnett-shale> (last updated Aug. 9, 2012). See also TEX. COMM'N ON ENVTL. QUALITY, *Are Oil and Gas Emissions Equivalent to Mobile Emissions in the DFW*, available at <http://www.energyindepth.org/wp-content/uploads/2012/04/TCEQ-Are-oil-and-gas-emissions-equivalent-to-mobile-emissions-in-the-DFW.pdf> (industry arguing that its contribution to area emissions was overestimated).

³⁵ TEX. COMM'N ON ENVTL. QUALITY, *supra* note 34, at 3-32 tbls.3-21 & 3-10. See also ARMENDARIZ, *supra* note 33, at 1 (providing similar estimates based on 2009 data).

³⁶ See Letter from Jordan, *supra* note 33.

³⁷ Kelsey Dayton, *EPA: Upper Green River Basin exceeded federal multi-year air standard*, STAR-TRIBUNE (May 3, 2013), http://trib.com/news/state-and-regional/epa-upper-green-river-basin-exceeded-federal-multi-year-air/article_58bb20f6-1ff5-5b52-9064-2ccfbf0ee874.html.

³⁸ *Id.*

Increasing chemical emissions related to ozone formation may present a significant health risk, particularly to children who are most vulnerable due to the state of their lung development and their tendency to be active outdoors when ozone levels are high.³⁹ Even at very low levels, ozone can cause serious health problems by damaging lung tissue and sensitizing lungs to other irritants.⁴⁰ Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion.⁴¹ It can exacerbate bronchitis, emphysema, and asthma.⁴² Ground level ozone can also reduce lung function and inflame the linings of the lungs.⁴³ Repeated exposure may permanently scar lung tissue.⁴⁴ Some studies have associated high ozone levels with increased rates of asthma and it is well-documented that air pollution plays a role in asthma attacks.⁴⁵

Although it is unclear the extent to which gas industry operations may be contributing to the problem, childhood asthma rates are extraordinarily high on the Barnett Shale. In the six counties with some of the heaviest drilling in the Barnett Shale region, children age six to nine are three times more likely to have asthma than the state average for that age group.⁴⁶ One out of every four children in the eight to nine age group and one out of every five children ages ten to fourteen has asthma.⁴⁷ The Cook Children's Hospital Community-wide Children's Health Assessment & Planning Survey estimates that, in 2008, 111,000 children out of a total of 612,000 children living in Denton, Hood, Johnson, Parker, Tarrant and Wise Counties in north central Texas had asthma.⁴⁸ In 2009, childhood asthma rates in Tarrant County, where Fort Worth is located, were more than double the national average.⁴⁹

³⁹ TEX. COMM'N ON ENVTL. QUALITY, *supra* note 34, at 3-24 tbl.3-13.

⁴⁰ Approval and Promulgation of Implementation Plans, 73 Fed. Reg. 63,408, 63,409 (Oct. 24, 2008) (to be codified at 40 C.F.R. pt. 52) (discussing health problems related to ozone).

⁴¹ TEX. COMM'N ON ENVTL. QUALITY, *supra* note 34, at 3-24 tbl.3-13.

⁴² *Id.*

⁴³ *Id.*

⁴⁴ *Id.*

⁴⁵ *Air Resources Board: Asthma an Air Pollution*, CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY, <http://www.arb.ca.gov/research/asthma/asthma.htm> (last visited May 7, 2013) (including discussion of findings from the Children's Health Study at the University of Southern California that children who participated in several sports and lived in communities with high ozone levels were more likely to develop asthma than the same active children living in areas with less ozone pollution; and a University of California, Irvine study that found a positive association between some volatile organic compounds and symptoms in asthmatic children).

⁴⁶ *Community-wide Children's Health Assessment and Planning Survey*, THE CENTER FOR CHILDREN'S HEALTH, <https://www.centerforchildrenshealth.org/en-us/HealthIssues/asthma/Pages/Asthma.aspx> (last visited May 14, 2013).

⁴⁷ *Id.*

⁴⁸ LARRY TUBB, CHILDHOOD ASTHMA, A GUIDE TO ACTION, THE RESULTS OF AN ASTHMA THINK TANK CONDUCTED ON DECEMBER 10, 2010 BY THE CENTER FOR CHILDREN'S HEALTH 2,

Adding gas industry operations to areas already overburdened with benzene and particulate emissions from fueling stations, automotive, and diesel truck emissions risks creating hotspots of significantly elevated health risks. Gas industry operations emit many of the same pollutants already problematic in urban areas due to other area-wide and mobile sources, including those ranked by the EPA as among the top health concerns in urban areas and those specifically identified by Congress in the 1990 Amendments to the Clean Air Act (CAA) as posing the greatest risk to human health from mobile sources.⁵⁰ In the Dallas Fort Worth Ozone Non-Attainment Area, gas industry operations and mobile sources are the primary contributors of the NO_x and VOCs responsible for ozone.⁵¹

Mobile sources alone can cause significant problems in urban areas. Air pollution studies indicate that living close to high traffic emissions may lead to adverse health effects beyond those associated with regional air pollution in urban areas, especially for children.⁵² A recent Italian university study found that residential exposure to benzene (at levels lower than the current European Union limit of 5 µg/m³), and to a lesser extent small particulate matter (PM(10))⁵³ from motorized traffic, was associated with an excess leukemia risk among children less than five

available at http://www.healthytexas.org/javascript/htmleditor/uploads/_CHILDHOOD_ASTHMA_A_GUIDE_TO_ACTION_FINAL.pdf (last visited May 14, 2013).

⁴⁹ *Baylor Researcher to Study Air Pollution, Asthma Exacerbation in Fort Worth Area School District*, BAYLOR MEDIA COMMUNICATIONS (Aug. 18, 2011), <http://www.baylor.edu/mediacommunications/news.php?action=story&story=98474>.

⁵⁰ See ENVTL. PROT. AGENCY, NATIONAL AIR TOXICS PROGRAM, THE INTEGRATED URBAN STRATEGY, REPORT TO CONGRESS 2-15 (2000), available at <http://www.epa.gov/ttn/atw/urban/natprpt.pdf> [hereinafter NATIONAL AIR TOXICS PROGRAM] (1,3-butadiene, benzene, formaldehyde, acrolein, 1,2-dibromoethene, and manganese were more consistently ranked among the top with respect to health concerns). See also 42 U.S.C. § 7521(a)(1) (identifying benzene, formaldehyde, and 1,3 butadiene as posing the greatest risk to human health from mobile sources), available at <http://www.gpo.gov/fdsys/pkg/USCODE-2010-title42/html/USCODE-2010-title42-chap85-subchapII-partA-sec7521.htm>; EASTERN RESEARCH GROUP AND SAGE ENVIRONMENTAL CONSULTING, FORT WORTH NATURAL GAS AIR QUALITY STUDY FINAL REPORT (2011), available at http://fortworthtexas.gov/uploadedFiles/Gas_Wells/AirQualityStudy_final.pdf [hereinafter E. RESEARCH GROUP & SAGE ENVTL. CONSULTING].

⁵¹ TEX. COMM'N ON ENVTL. QUALITY, *supra* note 34, at ES-1 (stationary sources are responsible for only a small fraction of the problem). See also ARMENDARIZ, *supra* note 30, at 1 (similar estimates based on 2009 data).

⁵² Press Release, California Env'tl. Prot. Agency, Air Resources Board Approves Land Use Planning Handbook (May 4, 2005), available at <http://www.arb.ca.gov/newsrel/nr050405.htm>.

⁵³ PM-10 includes particles with a diameter of 10 micrometers or less (0.0004 inches or one-seventh the width of a human hair). U.S. ENVTL. PROT. AGENCY, PARTICULATE MATTER (PM 10), <http://www.epa.gov/airtrends/aqtrnd95/pm10.html>.

years old.⁵⁴ These results for benzene are consistent with some previously reported epidemiologic studies that have examined the relationship between exposure from motorized traffic and childhood leukemia risk, as well as with studies related to adult lymphoid leukemia and other lymphoid malignancies.⁵⁵

Diesel emissions are also potentially problematic. According to a California Air Resource Board staff report, diesel particulate emissions represent about seventy percent of the potential cancer risk from vehicle traffic on a typical urban freeway.⁵⁶ The World Health Organization's International Agency for Research on Cancer (IARC) recently classified diesel engine exhaust as a carcinogen based on "compelling" evidence.⁵⁷ Dr. Christopher Portier, Chairman of the IARC Working Group recommended that exposure to this mixture of chemicals should be reduced worldwide.⁵⁸

Gas industry operations involve a tremendous number of trucks that may significantly increase diesel emissions. Heavy diesel trucks are required to transport materials related to the setup and construction of the drill pad, roads, drilling rig, completion equipment (e.g. pipes and wellheads), hydraulic fracture equipment, and drilling fluids.⁵⁹ According to a recent Energy Task Force Committee convened by Texas Department of Transportation (TXDOT), bringing a single gas well into production requires approximately 1,184 loaded diesel trucks.⁶⁰ An additional 353 trucks are required annually during production for each well.⁶¹ Thus, a single well pad, with six wells would generate about 2,118 truck trips annually, in addition to the approximately 1200 trucks needed to create the pad.⁶² Devon Energy

⁵⁴ Marco Vinceti et al., *Leukemia Risk in Children Exposed to Benzene and PM(10) From Vehicular Traffic: A Case-Control Study in an Italian Population*, 27 *Eur. J. Epidemiology* 781-90 (2012).

⁵⁵ *Id.* at 786.

⁵⁶ CAL. ENVTL. PROT. AGENCY, AIR QUALITY AND LAND USE HANDBOOK: A COMMUNITY HEALTH PERSPECTIVE 9 (2005), available at <http://www.arb.ca.gov/ch/handbook.pdf>.

⁵⁷ Press Release, Int'l Agency for Research on Cancer, Diesel Engine Exhaust Carcinogenic (June 12, 2012), available at http://press.iarc.fr/pr213_E.pdf.

⁵⁸ *Id.*

⁵⁹ N.Y. STATE DEPT. OF ENVTL. CONSERVATION, DIV. OF MINERAL RES., DRAFT SUPPLEMENTAL GENERIC ENVIRONMENTAL IMPACT STATEMENT ON THE OIL, GAS AND SOLUTION MINING REGULATORY PROGRAM 6-141—6-142 (2009), available at <ftp://ftp.dec.state.ny.us/dmn/download/OGdSGEISFull.pdf>.

⁶⁰ Presentation from John A. Barton, Exec. Dir. of Tex. Dep't of Transp., to Tex. Dep't of Transp. (Oct. 23, 2012), available at http://ftp.dot.state.tx.us/pub/txdot-info/energy/102312_txdot_presentation.pdf.

⁶¹ *Id.*

⁶² *Id.*

Corporation reports drilling up to 36 wells on one pad and 21 on another on the Barnett Shale.⁶³

In addition to the burden of diesel trucks, heavy, diesel-powered equipment runs continuously during the drilling and fracking operations.⁶⁴ In one incident investigated by the TCEQ, clouds of diesel emissions were reported for a three-day drilling period.⁶⁵ Two pairs of 460 horsepower engines and a third pair of 800-950 horsepower engines had been running continuously.⁶⁶ Emissions of nitrogen oxides were recorded at 380 parts per billion (ppb) on the neighboring property, far in excess of an EPA-proposed standard of 80-100 ppb averaged over one hour.⁶⁷ A complaint alleged that diesel odors got in the house and were at times so strong they prohibited local residents from going outside.⁶⁸ The complainant was concerned about the possibility of health effects.⁶⁹

This article will consider the extent to which state and federal regulatory programs are addressing concerns related to gas industry emissions in urban areas, and whether local governments should regulate and plan for gas industry emissions in local communities. Section I will discuss the state's exceptional, but reactive, and ultimately inadequate effort to monitor emissions and evaluate health effects, as well as the need for increased federal participation, improved monitoring infrastructure, and a regulatory framework to govern health effects assessment. Section II will explain how dispersed gas industry operations have been slipping through the cracks of a regulatory system focused on "major sources." Section III will discuss the new federal regulations for gas industry operations for both conventional ("criteria") pollutants and "hazardous air pollutants" and their failure to address cumulative impacts and malfunctions in urban areas. The fourth section will discuss the EPA's Urban Air Toxic Strategy and the regulatory framework in Texas for addressing hazardous air pollutants. Section V

⁶³ *Multi-well pads becoming the norm*, DEVON, <http://www.dvn.com/CorpResp/initiatives/Pages/Multi-wellPads.aspx#terms?disclaimer=yes> (last visited May 6, 2013).

⁶⁴ *Chemicals in Natural Gas Operations*, THE ENDOCRINE DISRUPTION EXCHANGE, <http://www.endocrinedisruption.com/chemicals.introduction.phpl> (last visited May 6, 2013). See also Letter from Ejaz Baig, Air Section Team Leader, Tex. Comm. on Env'tl. Quality to Christine Ruggiero 3-4 (Jan. 21, 2010), available at <https://docs.google.com/file/d/0BwwqoEQk60oNmYyZDZjMWEtZmQ1Mi00NjRjLTIINmEtZjhhMTFiMGViYjYw/edit?hl=en&pli=1>.

⁶⁵ Letter from Baig, *supra* note 64, at 3-4.

⁶⁶ *Id.* at 3.

⁶⁷ *Id.* at 5.

⁶⁸ *Id.* at 2.

⁶⁹ *Id.*

will discuss the new Texas rules applying uniquely to gas industry operations on the Barnett Shale and the exceptions that continue to leave communities vulnerable. The final section will discuss state preemption of local authority to engage in air quality planning and regulation and the need to encourage and authorize an expanded role for local governments.

I. AIR QUALITY MONITORING AND HEALTH EFFECTS ASSESSMENT

Overall, cancer incident rates are sobering. Approximately one in two men and women born today will be diagnosed with cancer during their lifetime.⁷⁰ Overall rates of childhood cancer increased 31 percent from 1975 to 2000,⁷¹ and generally continue to rise.⁷² Between 1975 and 2000, childhood lymphocytic leukemia increased 59 percent, brain cancer 48 percent, kidney cancer 43 percent, and bone cancer twenty percent.⁷³ The extent to which hazardous air pollutants contribute to these dismal statistics is difficult to evaluate. The EPA has estimated that 95 percent of all Americans face an increased risk of developing cancer from air toxics, specifically benzene, by breathing outdoor air.⁷⁴ The EPA has a monitoring network for toxic pollutants, tracking ambient levels of six priority toxics of concern at 22 locations nationwide.⁷⁵ According to the EPA, ambient monitoring data shows a general decrease in air toxics emissions nationwide, but that does not necessarily reflect reduced health risks in specific urban areas.⁷⁶ Data related to changes in emissions, concentrations of air toxics in the ambient air, and compliance with air toxics standards is limited and inconclusive.⁷⁷

The EPA has prepared a series of national air toxics assessments (NATA) based on a theoretical model of reported emissions (as opposed

⁷⁰ SEER Stat Fact Sheets, NATIONAL CANCER INSTITUTE, <http://seer.cancer.gov/statfacts/html/all.html> (last visited May 6, 2013).

⁷¹ SAMUEL EPSTEIN, CANCER-GATE, HOW TO WIN THE LOSING CANCER WAR 178 (2005).

⁷² Childhood Cancers, NATIONAL CANCER INSTITUTE, <http://www.cancer.gov/cancertopics/factsheet/Sites-Types/childhood>.

⁷³ EPSTEIN, *supra* note 71.

⁷⁴ U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-06-669, CLEAN AIR ACT: EPA SHOULD IMPROVE THE MANAGEMENT OF ITS AIR TOXICS PROGRAM (2006), *available at* <http://www.gao.gov/assets/260/250607.pdf>.

⁷⁵ The toxics include acrolein, arsenic, benzene, hexavalent, chromium, formaldehyde, and 1,3 butadiene. *Id.* at 31, 32 & n. 28.

⁷⁶ EPA OFFICE OF INSPECTOR GENERAL, KEY ACTIVITIES IN EPA'S INTEGRATED URBAN AIR TOXICS STRATEGY REMAIN UNIMPLEMENTED 34 (2010), *available at* <http://www.epa.gov/oig/reports/2010/20100623-10-P-0154.pdf> [hereinafter KEY ACTIVITIES].

⁷⁷ U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 74.

to actual monitored concentrations)⁷⁸ that estimate cancer risk due to exposure to hazardous air pollutants. The EPA cautions that “due to the extent of improvements in methodology, it is not meaningful to compare the assessments.”⁷⁹ Nevertheless, there is no positive change in the bottom line; the number of people estimated to be at risk due to exposure to hazardous air pollutants has only increased over the years. The EPA estimated that one to 25 people out of one million would have an increased likelihood of contracting cancer as a result of breathing air toxics from outdoor sources at 1999 hazardous air pollutant levels over the course of their lifetime.⁸⁰ The EPA’s assessment of 2002 data estimated the national average cancer risk from air toxics over the course of a lifetime at 36 in one million (roughly one in every 28,000 people) and raised that estimate to an average of fifty in one million (or one in every twenty thousand people) based on its assessment of 2005 data.⁸¹

The NATA are general nationwide assessments that cannot be used to identify exposures and risks for specific individuals, or to identify exposures and risks in small geographic regions where there may be hotspots at the census block level.⁸² The EPA has, however, made some general estimates of risk in urban areas. While acknowledging significant gaps in the methods, models and data,⁸³ after reviewing nine assessments in its 2000 report on urban air, the EPA estimated individual lifetime cancer risks from air toxics from multiple sources ranged from three in one thousand to two in one million, with a median of one in ten thousand.⁸⁴ The risk is especially elevated for children who are particularly vulnerable to hazardous air pollutant exposures

⁷⁸ TEX. COMM’N ON ENVTL. QUALITY, TCEQ GUIDELINES TO DEVELOP TOXICITY FACTORS 7 (2012), available at <http://www.tceq.texas.gov/publications/rg/rg-442.html>.

⁷⁹ *National Air Toxics Program Overview*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/ttn/atw/natamain/index.html>.

⁸⁰ See *National-Scale Air Toxics Assessment for 1999: Estimated Emissions, Concentrations and Risk – Technical Fact Sheet*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/ttn/atw/nata1999/natafinalfact.html> (last updated July 1, 2010).

⁸¹ *National-Scale Air Toxics Assessment for 2002- Fact Sheet*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/ttn/atw/nata2002/factsheet.html>; *Summary of Results for the 2005 National-Scale Assessment*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/nata2005/>.

⁸² *EPA Technology Transfer Network Air Toxics*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/nata/>.

⁸³ NATIONAL AIR TOXICS PROGRAM, *supra* note 50, at 1-4. The EPA qualified its risk assessment, noting significant gaps in methods, models and data that limit its ability to assess cancer and noncancer risks associated with cumulative exposure to mixtures of pollutants having different endpoints. *Id.*

⁸⁴ *Id.* at 2-9.

because of their daily activities, immature and developing metabolic systems, and their developing organ systems.⁸⁵

Information on health outcomes associated with changes in exposure to air toxics is very limited.⁸⁶ In its 2000 Integrated Urban Strategy Report, the EPA noted that “unless peer-reviewed, dose-response assessments can be obtained from other sources, significant uncertainty will be present in any risk assessments performed for these pollutants.”⁸⁷ According to a 2006 U.S. Government Accountability Office (GAO) report, limited information on “dose-response” relationships represents the greatest challenge for the agency in conducting a benefits assessment for the air toxics program.⁸⁸ Particularly lacking are studies related to human exposures.⁸⁹ In order to effectively evaluate its air toxics program, EPA must ultimately determine the extent to which reductions in exposure to air toxics have decreased the incidence of adverse health effects, including cancer and non-cancer illnesses.⁹⁰ Completing this analysis requires an estimate of the extent to which adverse health effects stem from exposure to air toxics, both before and after adopting air toxics regulations.⁹¹

The need for a coordinated approach to public health and environmental toxins has long been recognized at both the state and national level. In 1989, the Texas legislature adopted the Health Risk Assessment Act to require the Texas Department of State Health Services (DSHS) to coordinate agency programs, and develop a plan for intergovernmental cooperation, health risk assessment, public communication, and an integrated system to collect and manage information to prevent and control the adverse health effects of toxic substances.⁹² In 2001, the Texas Legislature went a step further and passed legislation to create the Texas Environmental Health Institute (TEHI or the Institute) as a joint venture between the Texas Department of Health, predecessor agency to the DSHS, and the Texas Natural Resources Conservation Commission, predecessor agency to the

⁸⁵ *Id.* at 2-6.

⁸⁶ U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 74, at 30.

⁸⁷ U.S. ENVTL. PROT. AGENCY, OFFICE OF AIR QUALITY, *supra* note 50, at 6-14. The EPA's Integrated Risk Information System (IRIS) lacks cancer risk estimates for thirteen of these hazardous air pollutants, and lacks non-cancer risk estimates for about two-thirds of these chemicals. *Id.*

⁸⁸ U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 74, at 28.

⁸⁹ *Id.* at 28.

⁹⁰ *Id.* at 27.

⁹¹ *Id.*

⁹² TEX. HEALTH & SAFETY CODE ANN. § 503.004 (West 2011).

TCEQ.⁹³ The legislation required a statewide plan to identify health conditions related or potentially related to environmental contamination; inform and educate citizens; identify funding opportunities; and conduct, coordinate, and pursue funding for research.⁹⁴ Noting a 2001 report by the Pew Environmental Health Commission, *America's Environmental Health Gap: Why the Country Needs a Nationwide Health Tracking Network*, that identified the lack of information on the relationship between exposure to low levels of environmental pollutants and adverse health conditions, the 2007 Progress Report states:

[N]o system exists in Texas at the State level to track many of the exposures and health effects that may be related to environmental hazards. While Texas does maintain various environmental, exposure, and disease tracking systems it lacks the ability to link these systems together. Because existing systems are not linked, it is difficult to study and monitor relationships among hazards, exposures, and health effects.⁹⁵

The 2007 Progress Report further discusses the need to encourage the development of geographic information systems (GIS) to integrate data about environmental hazards with data about diseases that are possibly linked to environmental contamination.⁹⁶ The 2013 Progress report discusses several disparate studies funded by the Institute.⁹⁷ The report also notes that the DSHS and the TCEQ have worked together to streamline the process of funding and that staff from both agencies regularly attend meetings of the Toxic Substances Coordinating Committee (TSCC), a committee that was created in 1989 to coordinate communication among agencies concerning efforts to regulate toxic substances.⁹⁸ However, the report does not identify any significant progress in creating a coordinated systematic approach to tracking public health in relation to toxic exposure. It explains that the Institute was established only as a “virtual entity” with its functions assigned to existing staff in the TDHS Environmental Epidemiology Division.⁹⁹ At

⁹³ TEX. HEALTH & SAFETY CODE ANN. § 427.001-05 (West 2011); *Texas Environmental Health Institute*, TEX. DEP'T OF STATE HEALTH SERVS., <http://www.dshs.state.tx.us/epitox/tehi.shtm> (last visited May 7, 2013).

⁹⁴ TEX. HEALTH & SAFETY CODE ANN. § 427.003 (West 2011).

⁹⁵ TEX. ENVTL. HEALTH INST., PROGRESS REPORT AND FUTURE DIRECTIONS 23 (2007).

⁹⁶ *Id.* at 23. *See also id.* at 25 (identifying funds provided to Texas State University to study a possible relationship between environmental and birth data in Dallas, and funding for Texas A & M to conduct an epidemiological study considering birth defects in relation to air emissions reported on the TRI and hazardous waste sites).

⁹⁷ TEX. ENVTL. HEALTH INST., PROGRESS REPORT 4,7 (2013).

⁹⁸ *Id.* at 4; TOXIC SUBSTANCE COORDINATING COMMISSION, <http://www.tsc.state.tx.us> (last updated Jan. 7, 2013).

⁹⁹ *Id.* at 2, 8 (2013).

least with regard to hazardous air pollution, as discussed in more detail below, the extent of cooperation and progress towards developing a systematic approach to evaluating public health in relation to toxic exposure remains limited.

Texas boasts the largest air monitoring network in the country, including 82 monitoring sites measuring for 146 air toxics.¹⁰⁰ Yet, the state has not promulgated clear standards by which to evaluate the monitoring values. Texas has only benchmarks called “air monitoring comparison values” (AMCVs).¹⁰¹ AMCVs are established by guidance document, not through the rulemaking process, and serve primarily to assist the agency in prioritizing its resources.¹⁰² The TCEQ explains that “[i]f predicted or measured airborne levels of a constituent do not exceed the comparison level, adverse health or welfare effects would not be expected to result. If ambient levels of constituents in air exceed the comparison levels, it does not necessarily indicate a problem, but rather, triggers a more in-depth review.”¹⁰³ Without clear and enforceable standards, or even a commitment to the designated benchmarks, there is no assurance of any particular level of protection.¹⁰⁴ The significance of measured air monitoring values are subject to interpretation, an interpretation which may be influenced by economic and political considerations.

In some areas, notably near the Houston Ship Channel, there is enough data for researchers to conduct studies that evaluate health effects in relation to exposure to hazardous air pollutants.¹⁰⁵ However, creating the necessary infrastructure to correlate health studies and air pollution emissions is particularly difficult for dispersed gas industry

¹⁰⁰ *Air Toxics*, TEX. COMM’N ON ENVTL. QUALITY, <http://m.tceq.texas.gov/toxicology/AirToxics.html> (last visited Apr. 10, 2013).

¹⁰¹ TEX. COMM’N ON ENVTL. QUALITY, GUIDANCE TO DEVELOP TOXICITY FACTORS 2 (2012), *available at* http://www.tceq.state.tx.us/assets/public/implementation/tox/peer_review/guidelines2012.pdf.

See also Air Monitoring Comparison Values, TEX. COMM’N ON ENVTL. QUALITY, http://www.tceq.state.tx.us/cgi-bin/compliance/monops/agg_amcvs.pl (last visited Apr. 10, 2103).

¹⁰² TEX. COMM’N ON ENVTL. QUALITY, TCEQ GUIDANCE TO DEVELOP TOXICITY FACTORS 2 (2012), *available at* http://www.tceq.state.tx.us/assets/public/implementation/tox/peer_review/guidelines2012.pdf

[hereinafter TCEQ GUIDANCE]. AMCV’s may be considered to help the agency prioritize its resources in the areas of permitting, compliance, and enforcement. *Id.*

¹⁰³ *Id.* at 265.

¹⁰⁴ *But see generally* OREGON DEPT’ OF ENVTL. QUALITY, Ambient Benchmarks for Air Toxics 340 246 0090, *available at* <http://www.deq.state.or.us/aaq/toxics/docs/abcRuleFinal.pdf> (last visited May 7, 2013) (establishing “goals”).

¹⁰⁵ KRISTINA M. WALKER ET AL., AN INVESTIGATION OF THE ASSOCIATION BETWEEN HAZARDOUS AIR POLLUTANTS AND LYMPHOHEMATOPOIETIC CANCER RISK AMONG RESIDENTS OF HARRIS COUNTY, TEXAS 2 (2007).

emissions. Facilities are spread throughout areas not previously well monitored for toxic air pollutants. As discussed in detail below, the state has made a considerable effort to conduct mobile monitoring on the Barnett Shale, the results of which are troubling, but the monitoring is spotty, sporadic, and not adequate to assess long term exposures levels. Texas has also established some long-term monitors, the results of which are more reassuring. Yet, considerable uncertainty remains concerning the adequacy of the standards and the sufficiency of the scope of chemicals evaluated. As discussed in the following section, the State, through the Texas Department of State Health Services, has also attempted two health studies on the Barnett Shale, but the studies fail evaluate air quality monitoring data or even proximity to emission sources. A close review of air quality monitoring and health effects studies on the Barnett Shale reveals a need to improve the air quality monitoring network, to strengthen coordination between health and environmental analysis, and to create publically accessible and transparent rules to guide health effects analysis and public communication.

A. Monitoring on the Barnett Shale, Accidents and Uncertainty

Starting in 2009, the TCEQ conducted several large, in-depth mobile monitoring surveys of air quality in the six counties surrounding Fort Worth.¹⁰⁶ According to TCEQ toxicologist Shannon Ethridge, TCEQ monitoring in the Barnett Shale has recorded “some of the highest benzene concentrations . . . monitored in the state.”¹⁰⁷ As discussed in more detail below, TCEQ monitoring has revealed values that exceed both short and long-term AMCVs. However, on its website devoted to public communication concerning the Barnett Shale, the TCEQ dismisses any significant concerns. The TCEQ explains that that air monitoring comparison values are only guidelines set to provide a margin of safety well below levels at which health effects are reported in scientific literature.¹⁰⁸ The TCEQ explains that the short-term air monitoring comparison value “is conservative and it is unlikely that adverse health effects would occur if someone were to be exposed to this concentration of benzene for a short period of time (one hour).”¹⁰⁹

¹⁰⁶ *A Commitment to Air Quality*, *supra* note 34.

¹⁰⁷ Pamela Percival, TCEQ concerned about emissions from Barnett Shale facilities, asks industry to help find and fix emissions problems, Basin Oil and Gas, February 2010 Issue No. 26, available at <http://web.archive.org/web/20120403041758/http://www.fwbog.com/index.php?page=article&article=205>.

¹⁰⁸ *A Commitment to Air Quality*, *supra* note 34.

¹⁰⁹ *Id.*

With respect to the long-term air monitoring comparison value, the TCEQ explains that “[s]omeone exposed to this level 24 hours a day for seventy years would not be expected to experience adverse health effects.”¹¹⁰ As described by David Brymer, the TCEQ Air Quality Division Director on National Public Radio, there is a “[l]ot of monitoring out there (in the Barnett Shale), lots of studies commissioned—done by us and other people—health studies, and they really haven’t found anything.”¹¹¹

According to TCEQ toxicologists, “if benzene levels from oil and gas facilities are below levels of concern, other air toxics should be as well.”¹¹² After surveying and taking samples at hundreds of sites, the TCEQ website summary reports that it found only two instances of benzene exceeding short-term levels of concern, both of which were corrected at the time of subsequent sampling.¹¹³ The two instances where benzene exceeded short-term standards were identified during TCEQ mobile monitoring at 94 sites in 2009.¹¹⁴ Benzene levels “required immediate action;” a compressor station measured 1,100 ppb, at approximately 200 yards from residences, and a well measured 15,000 ppb at five feet from the well.¹¹⁵ These values are many times higher than the short-term AMCV for benzene, which the TCEQ has set at 180ppv.¹¹⁶

During the same 2009 monitoring project, the TCEQ identified nineteen additional sites that “may require action by facility operators,” and 21 monitoring stations in twelve different geographic areas where benzene was detected above long-term, health-based comparison values.¹¹⁷ Noting concerns about cumulative exposure, the TCEQ’s Toxicology Department recommended long-term monitoring.¹¹⁸ The

¹¹⁰ *Id.*

¹¹¹ Dave Fehling, *Fracking’s Link to Smog Worries Some Texas Cities*, NPR (Aug. 7, 2012), <http://stateimpact.npr.org/texas/2012/08/07/frackings-link-to-smog-worries-some-texas-cities/>.

¹¹² *A Commitment to Air Quality*, *supra* note 34.

¹¹³ *Id.*

¹¹⁴ Memorandum from Shannon Ethridge, Toxicology Div., Tex. Comm’n on Env’tl. Quality, to Mark R. Vickery, Exec. Dir., Tex. Comm’n on Env’tl. Quality (Jan. 27, 2010), *available at* http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/2010.01.27-healthEffects-BarnettShale.pdf. *See also* John Sadlier, Deputy Dir., Tex. Comm’n on Env’tl. Quality, and Michael Honeycutt, Chief Toxicologist, Tex. Comm’n on Env’tl. Quality, Presentation on 2009 Barnett Shale study (2010), *available at* http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/presentations/2010.01.27-sadlier-bshaleUpdate.pdf (follow up monitoring confirmed repairs at the Targa and Devon sites; sites 8 and 7).

¹¹⁵ *Id.*

¹¹⁶ Memorandum from Ethridge, *supra* note 115.

¹¹⁷ *Id.* *See also* Sadlier & Honeycutt, *supra* note 115.

¹¹⁸ Memorandum from Ethridge, *supra* note 115.

TCEQ Toxicology Department expressed concern that the monitored concentrations of benzene could pose a long-term health risk to residents if the concentrations were representative of normal and prolonged ambient conditions.¹¹⁹ During mobile monitoring in Fort Worth in December 2009, Benzene was again detected above long-term, health-based comparison values near a gas facility in an industrial area,¹²⁰ as well as in background “airshed samples” taken in a residential area near a school.¹²¹

In 2010, the TCEQ conducted mobile monitoring at 38 of the 126 Fort Worth locations evaluated in 2009, as well as 59 additional locations.¹²² The TCEQ detected concentrations of benzene in three samples within 0.25 miles of residential property that could contribute to elevated long-term cumulative exposure if they are representative of typical ambient conditions.¹²³ The Toxicology Division recommended continued surveillance to evaluate whether these concentrations are representative of typical ambient conditions.¹²⁴

The TCEQ also conducted follow-up mobile monitoring at previously monitored sites in Denton, Hood, Johnson, Parker and Wise Counties.¹²⁵ At eleven of eighteen sites where benzene was elevated in 2009, benzene was again elevated during sampling in 2010.¹²⁶ One site was extremely high in comparison to the long-term comparison values of 1.4 ppb, measuring 95 ppb in 2009 and 93 ppb in 2010.¹²⁷ The TCEQ

¹¹⁹ *Id.*

¹²⁰ Memorandum from Shannon Ethridge, Toxicology Div., Tex. Comm’n on Env’tl. Quality (Apr. 26, 2010) (concerning the Health Effects Review of City of Fort Worth Review Canister Samples, which measured benzene levels at 3.5 ppv and 1.9 ppv, significantly over the long-term comparison value of 1.4 ppbv) [hereinafter Memorandum from Ethridge II].

¹²¹ *Id.* (reporting concentrations measured were 2.1 ppbv and 2.0 ppbv). The staff report noted that no source of benzene emissions could be identified and that the mobile monitoring team planned to re-sample VOCs at this location. *Id.*

¹²² Interoffice Memorandum from Shannon Ethridge, Toxicology Div., Tex. Comm’n on Env’tl. Quality, to John Sadlier, Deputy Dir., Tex. Comm’n on Env’tl. Quality (July 7, 2010) (concerning the Health Effects Evaluation of City of Fort Worth Follow-Up Survey Project), *available at* http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/samplingFtWorth/2010.07.07-HealthEffectsFollow-upApril%202010.pdf.

¹²³ *Id.* (stating that concentrations detected were 1.9 ppbv, 3.2 ppbv, and 6.3 ppbv; the detection limit was 2.5 ppb).

¹²⁴ *Id.*

¹²⁵ Interoffice Memorandum from Shannon Ethridge, Toxicology Div., Tex. Comm’n on Env’tl. Quality, to Mark Vickery, Exec. Dir., Tex. Comm’n on Env’tl. Quality (May 25, 2010), *available at* http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/healthEffects/2010.05.25-healthEffectsMemo.pdf (concerning the Health Effects Evaluation of Barnett Shale Follow-Up Survey Project).

¹²⁶ *Id.*

¹²⁷ *Id.*

discussed six facilities in detail, all of which were within 0.25 miles of residential property and were “of potential concern due to their contribution to long-term (i.e. lifetime) cumulative exposure levels.”¹²⁸ Monitored concentrations at these facilities were similar to concentrations detected during previous sampling events in 2009.¹²⁹

The TCEQ also reviewed data collected by Titan Engineering in a 2010 study funded by the Barnett Shale Energy Education Council, an organization founded by a consortium of leading Barnett Shale production companies.¹³⁰ Titan Engineering sampled ambient air at ten natural gas sites, including two compressor stations and eight completed wells.¹³¹ A Titan Engineering representative reportedly confirmed that operators were given three-to-four weeks of notice of the exact days of the testing, and at least one site that had produced condensate for thirty days prior to the testing was reported to have shut down on the day of testing.¹³² Even under these circumstances, however, benzene was reported downwind of one facility at levels that exceeded the long-term health based comparison value.¹³³ The TCEQ Toxicology Department recommended additional investigation.¹³⁴

By the end of 2011, TCEQ monitoring of benzene on the Barnett Shale revealed 117 samples with benzene levels exceeding the TCEQ’s long term air monitoring comparison value at 69 different facilities.¹³⁵ In many cases, these standards were exceeded at the same locations

¹²⁸ *Id.*

¹²⁹ *Id.*

¹³⁰ Interoffice Memorandum from Tony Walker, Reg’l Dir., Tex. Comm. on Env’tl. Quality, to Carla Kinslow (Jan. 28, 2011) (concerning Health Effects Review of Air Monitoring Data Collected by Titan Engineering from June 1-15, 2010 for Barnett Shale Energy Education Council), *available at* http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/healthEffects/2011.03.16-healthEffectsMemo.pdf. See BARNETT SHALE ENERGY EDUCATION COUNCIL, <http://www.bseec.org/content/ed-ireland> (identifying the founders of the organization).

¹³¹ TITAN ENGINEERING, INC., AMBIENT AIR QUALITY STUDY: NATURAL CASE SITES, CITIES OF FORT WORTH & ARLINGTON, TEXAS (July 2010), *available at* <http://www.barnettshalenews.com/documents/ntxairstudy/Barnett%20Shale%20Ambient%20Air%20Quality%20Study%20Titan%20Engr%20BSEEC%20July%202010r.pdf>.

¹³² FORT WORTH LEAGUE OF NEIGHBORHOODS, RECOMMENDATIONS FOR POLICY CHANGES FOR GAS DRILLING NEAR SCHOOLS 20-21 (Feb. 2011), *available at*, <http://www.barnettshalenews.com/documents/ntxairstudy/FWLNA%20Report%20For%20FWISD%20Recommendations%20For%20Drilling%20Near%20Schools%20Feb%202011.pdf> (with contributions from Dr. Melanie Satler et al.).

¹³³ Interoffice Memorandum from Walker, *supra* note 130 (values reported at 3.15 ppbv and 1.96 ppbv).

¹³⁴ *Id.*

¹³⁵ Letter from Rep. Lon Burnham, Tex. House of Rep., to Betsy Price, Mayor of the City of Fort Worth (Dec. 21, 2011), *available at* <http://blogs.star-telegram.com/files/lb-letter-to-mayor-price-on-tceq-air-monitoring-aqs—12.21.11-1.pdf>.

during follow up monitoring.¹³⁶ Further complicating matters, TCEQ sampling was reported not to have taken place at the time of highest production and may not reflect highest emission levels.¹³⁷ Calling into question the setback distances of many cities, Texas Representative Lon Burnam noted that some sampling sites were over 1000 feet from the well.¹³⁸

After assessing the results from a long-term monitoring effort, the TCEQ concluded that the ambient air on the Barnett Shale poses no “immediate” health concerns. TCEQ Chairman Bryan Shaw explains:

After several months of operation, state-of-the-art, 24-hour air monitors in the Barnett Shale area are showing no levels of concern for any chemicals. This reinforces our conclusion that there are no immediate health concerns from air quality in the area, and that when they are properly managed and maintained, oil and gas operations do not cause harmful excess air emissions.¹³⁹

However, given the mobile monitoring results, it is clear that these facilities are not always properly managed and maintained. Moreover, the network of 24-hour monitors is relatively sparse and would not capture all leaks and malfunctions.¹⁴⁰ The TCEQ monitoring network has seven monitors in the Barnett Shale area,¹⁴¹ yet there are 14,661 producing gas wells and a myriad of related facilities spread throughout the five thousand square mile Barnett Shale region.¹⁴² Only three of the existing monitors were specifically located in an effort to capture gas industry emissions and even these monitors were not necessarily located at the point of highest off-site emissions. Many factors are involved in

¹³⁶ Interoffice Memorandum from Ethridge, *supra* note 126.

¹³⁷ Press Release from Rep. Lon Burnam, Tex. House of Rep., “Dry Gas” a Threat and Existing Gas Well Set-back Requirements Insufficient (Feb. 4, 2010), available at <https://docs.google.com/file/d/0Bwsxa7SpCLLDOWFkZjAxOWItOWJkZi00NmY4LTkyYzgtZGIyNTM3YjA3YWw1/edit?hl=en>.

¹³⁸ *Id.*

¹³⁹ *A Commitment to Air Quality*, *supra* note 34.

¹⁴⁰ Eduardo Olaguer, *HARC’s Response to Energy In Depth*, HARC, <http://www.harc.edu/AirQualityClimate/ResponsetoEnergyinDepth/tabid/2632/Default.aspx> (last visited May 7, 2013).

¹⁴¹ *Texas in Vanguard of Nationwide Oil and Gas Energy Boom*, TEX. COMM’N ON ENVTL. QUALITY (Aug. 2012),

<http://www.tceq.texas.gov/publications/pd/020/2012-NaturalOutlook/texas-in-vanguard-of-natiowide-oil-and-gas-energy-boom>. The TCEQ now operates seven automated gas-chromatograph monitors in the area that post their results publicly on the TCEQ website, with another four to come online in the near future. *Id.*

¹⁴² Schlumberger, *supra* note 2; *Number of producing wells in the Barnett Shale 24 county area*, TEX. COMM’N ON ENVTL. QUALITY (Jan. 2012), http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/bsAnnualWellCount.pdf.

choosing monitoring site locations including practical considerations related to site access and suitability, and the location of potentially sensitive receptors like schools.¹⁴³

Some cities have engaged in their own monitoring to supplement the state's efforts. The TCEQ installed one monitor in Flower Mound to test for benzene and 45 additional VOCs in November 2010.¹⁴⁴ In addition, the City of Flower Mound began mobile air quality monitoring at several locations in 2010, hired a full time oil and gas inspector, and started conducting monthly testing with funds from permit fees.¹⁴⁵ According to reports from 2010 and 2011, there were no exceedances of the TCEQ's air monitoring comparison values. However, the city's consultant cautioned, "[w]hile the current ambient air observations appear to be consistent with urban ambient air and not indicative of significant releases or fugitive emissions from the nearby natural gas activities in and/or surrounding Flower Mound, the changing nature of the exploration, production, and transmission activities may necessitate periodic evaluation to provide additional confirmation."¹⁴⁶

The City of Fort Worth also hired its own consultants to conduct monitoring and modeling of existing shale gas industry operations.¹⁴⁷ Modeling was conducted over a two-month period at eight different locations.¹⁴⁸ Two monitoring stations were chosen to represent background and mobile sources, and the other six were located so as to measure emissions from fracking and flowback operations,¹⁴⁹ a well pad and compressor station,¹⁵⁰ active well pads,¹⁵¹ and an area with a high level of gas activity within a mile of dozens of natural gas wells.¹⁵² There were no exceedances of benzene as compared to the TCEQ's short-term air comparison values. The average levels were all well below the TCEQ's long-term comparison value¹⁵³ and were not unusually elevated when compared to levels currently measured by the

¹⁴³ E-mails from David W. Sullivan, Research Assoc., Ctr. for Energy and Env'tl. Res., Univ. of Tex., to author (Feb. 21, 2013, 11:27 EST) (on file with author).

¹⁴⁴ *Flower Mound Air Quality Monitoring Data Now Online*, THE CROSS TIMBERS GAZETTE (Nov. 22, 2010), <http://www.crosstimbersgazette.com/local-news/1220-flower-mound-air-monitor-data-now-online.html>.

¹⁴⁵ *Air Quality*, CITY OF FLOWER MOUND, <http://www.flower-mound.com/index.aspx?NID=930> (last visited May 7, 2013).

¹⁴⁶ *Id.* at 6.

¹⁴⁷ E. RESEARCH GROUP & SAGE ENVTL. CONSULTING, *supra* note 50.

¹⁴⁸ *Id.* at 2-1, 2-4, 2-6.

¹⁴⁹ *Id.* at 2-2.

¹⁵⁰ *Id.* at 2-8.

¹⁵¹ *Id.* at 2-10, 2-11.

¹⁵² E. RESEARCH GROUP & SAGE ENVTL. CONSULTING, *supra* note 50.

¹⁵³ *Id.* at p. 2-33–2-49.

TCEQ elsewhere in Texas.¹⁵⁴ The City of Fort Worth's consultants caution that the analysis is based strictly on the air samples collected at a limited number of sites in Fort Worth over a two-month time frame, and that it should not be used to make inferences about air quality during times when, and at locations where, samples were not collected.¹⁵⁵ Extensive point source testing revealed that the ambient air monitoring stations were far from some of the highest-emitting well pads.¹⁵⁶ Modeling based on the emissions from the highest-emitting well pads revealed one-hour average benzene concentrations greater than the TCEQ's short term health effects guidelines, but only marginally above those guidelines and the high concentrations "occurred no more than six hours per year" at the fence line within a few feet of the tanks.¹⁵⁷

In addition to comparing air quality monitoring results to TCEQ reference values, it is also important to consider the adequacy of the benchmark comparison values themselves. Research remains inconclusive as to whether there is a threshold below which exposure to a carcinogen like benzene can be safe.¹⁵⁸ According to the EPA's Integrated Risk Information System (IRIS), benzene is a known human carcinogen. IRIS reported that "[e]pidemiologic studies and case studies provide clear evidence of a causal association between exposure to benzene and acute nonlymphocytic leukemia (ANLL) and also suggest evidence for chronic nonlymphocytic leukemia (CNLL) and chronic lymphocytic leukemia (CLL)."¹⁵⁹ IRIS¹⁶⁰ has published a range of health effects comparison values for benzene as a carcinogen, each having equal scientific plausibility given the inherent uncertainties in the risk assessment of benzene and the limitations of the epidemiologic studies in determining dose-response and exposure data.¹⁶¹ The EPA presents a range of toxicity values for three different risk ranges: one case in ten thousand people, one case in one hundred thousand people,

¹⁵⁴ *Id.* at xiii.

¹⁵⁵ *Id.* at 5-23.

¹⁵⁶ *Id.* at 5-25.

¹⁵⁷ E. RESEARCH GROUP & SAGE ENVTL. CONSULTING, *supra* note 50, at 5-26, 5-30.

¹⁵⁸ Wendy E. Wagner, *The "Bad Science" Fiction: Reclaiming the Debate Over Science in Public Health and Environmental Regulation*, 66 LAW & CONTEMP. PROBS. 63, 111 (2003).

¹⁵⁹ U.S. ENVTL. PROT. AGENCY, BENZENE: TEACH CHEMICAL SUMMARY, U.S. EPA, TOXICITY AND EXPOSURE ASSESSMENTS FOR CHILDREN'S HEALTH, *available at* http://www.epa.gov/teach/chem_summ/BENZ_summary.pdf (last revised Feb. 27, 2009).

¹⁶⁰ *Integrated Risk Information System (IRIS)*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/IRIS/> (last updated May 8, 2013). The Integrated Risk Information System is a human health assessment program prepared and maintained by the EPA's National Center for Environmental Assessment (NCEA) within the Office of Research and Development (ORD). *Id.*

¹⁶¹ *Integrated Risk Information System, Benzene (CA SRN 71-43-2)*, U.S. ENVTL. PROTECTION AGENCY, <http://www.epa.gov/ncea/iris/subst/0276.htm> (last updated Jan. 24, 2013).

or one case in one million people.¹⁶² Although the TCEQ has chosen the middle level of protection, it has chosen the toxicity value at the lowest end of the range.¹⁶³ The TCEQ's AMCV for long-term exposure to benzene is three times less conservative than it would be if the TCEQ had chosen the toxicity value at the mid-level risk range and the same level of protection. It is over thirty times less conservative than the risk-based concentration at the high-level risk range, with protection at the level of one case in one million people.¹⁶⁴

Further increasing uncertainty, the EPA's benchmarks for hazardous air pollutants generally reflect health risks to adults, rather than potential risks to children or risks in adulthood stemming from childhood exposure.¹⁶⁵ Moreover, the benchmarks do not address the potential risk from very high, short-term exposures, such as those that might occur during equipment malfunction, or the potential risk from elevated exposures experienced during childhood.¹⁶⁶ It is not known if children are more susceptible to benzene poisoning than adults.¹⁶⁷ The IRIS toxicological review of benzene explains:

There are few data on the effects of direct exposure of children to benzene. However, some indirect evidence suggests that children may be susceptible to benzene-induced hematotoxicity. There is mounting evidence that key changes related to the development of childhood leukemia occur in the developing fetus. Several studies have reported that genetic changes related to eventual leukemia development occur before birth.¹⁶⁸

Also potentially problematic are unknown interactive effects of the many chemicals emitted by gas industry operations. Barnett Shale residents identified an increase in the total numbers of chemicals detected at one site from 7 to 65 before and after drilling through their

¹⁶² *Id.*

¹⁶³ Loren Raun, City of Houston Mayor's Office of Environmental Programming, Benzene Risk: Determining Carcinogenic Health Risk Concentration Levels for Benzene in Ambient Air at EPA, TCEQ and the City of Houston (Sept. 2008), available at <http://www.greenhoustontx.gov/reports/benzenerisk.pdf> (converting units and comparing values). Note that this memo discusses the TCEQ's effects screening levels (ESLs), and as explained below, for carcinogens, the ESL values are the same as the AMCV values.

¹⁶⁴ *Id.*

¹⁶⁵ U.S. ENVTL. PROT. AGENCY, AMERICA'S CHILDREN AND THE ENVIRONMENT, MEASURES OF CONTAMINANTS, BODY BURDENS, AND ILLNESSES 30 (Feb. 2003), available at http://www.epa.gov/ace/publications/ace_2003.pdf.

¹⁶⁶ *Id.*

¹⁶⁷ *Id.*

¹⁶⁸ U.S. ENVTL. PROT. AGENCY, TOXICOLOGICAL REVIEW OF BENZENE, NONCANCER EFFECTS 124 (Oct. 2002), available at <http://www.epa.gov/ncea/iris/toxreviews/0276tr.pdf#page=124>.

own air quality testing.¹⁶⁹ Chemical mixtures of concern include benzene, toluene, ethylbenzene, and xylenes.¹⁷⁰ After an in depth study of the interactive effects of benzene, toluene, ethylbenzene, and xylenes (“BTEX”), the U.S. Department of Health and Human Services concluded that no studies were available that directly characterize health hazards and dose-response relationships for mixtures of these chemicals, stating:

All four components can produce neurological impairment, and benzene can additionally cause hematological effects which may ultimately lead to aplastic anemia and development of acute myelogenous leukemia. Concern for the carcinogenicity of BTEX is also raised by evidence that ethylbenzene is carcinogenic. No studies were located that directly examined joint toxic actions of mixtures of benzene, toluene, ethylbenzene, and xylenes on the nervous system, but additive joint action is plausible.¹⁷¹

The EPA has identified benzene as a “national cancer risk driver,” and estimated that benzene accounts for about 25 percent of the cancer risk posed by air toxics across the nation.¹⁷² However, other potential health effects are also of concern. Texas Representative Lon Burnam compared the TCEQ mobile monitoring results for benzene from August 2009 through November 2011 to the Agency for Toxic Substances and Disease Registry (ATSDR) non-cancerous standards (particularly immunological),¹⁷³ and identified 43 samples exceeding the acute minimum risk level (MRL) (9ppb), 53 samples exceeding the intermediate MRL (5ppb), and 77 exceeding the chronic minimum risk

¹⁶⁹ Testimony of Sharon Wilson, Earthworks, before Dallas Drilling Task Force (Aug. 30, 2011), *available at*

http://www.dallascityhall.com/pdf/GasDrilling/Wilson_DallasTaskForce_083011pdf.pdf. See also *Cancer rates climb in Barnett Shale*, TXSHARON (Oct. 22, 2011), <http://www.texassharon.com/2011/10/22/cancer-rates-climb-in-barnett-shale/> (“In Argyle – Bartonville, the community did baseline testing when drilling was just starting. The results showed 7 detects of the 84 chemicals [the] TCEQ routinely tests for. Follow up testing, on the lot where the high school band practices–1/2 mile from the offending facility–showed 65 detects. We have asked many scientists to explain the increased risks when our children go from breathing 7 chemicals to breathing a cocktail of 65 different chemicals. None can explain that risk because that science has not happened yet.”).

¹⁷⁰ E. RESEARCH GROUP & SAGE ENVTL. CONSULTING, *supra* note 50, at 4-5, 4-6 (identifying gas industry emissions); U.S. DEP’T OF HEALTH & HUMAN SERVS., INTERACTION PROFILE FOR BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES (BTX), *available at* <http://www.atsdr.cdc.gov/interactionprofiles/IP-btex/ip05.pdf>.

¹⁷¹ U.S. DEP’T OF HEALTH & HUMAN SERVS., *supra* note 170.

¹⁷² U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 74, at 21.

¹⁷³ See U.S. DEP’T OF HEALTH & HUMAN SERVS., TOXICOLOGICAL PROFILE FOR BENZENE 21 (Aug. 2007), *available at* <http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf>.

levels (3ppb).¹⁷⁴ Three out of four dispersion modeling scenarios prepared by consultants for the City of Fort Worth also yielded benzene concentrations significantly above ATSDR's comparison values for non-cancerous standards deemed safe for acute and intermediate exposure.¹⁷⁵

Detailed reports of TCEQ mobile monitoring also reveal several instances where the monitoring results for chemicals other than benzene exceeded short term AMCVs, including situations that may have caused immediate effects, such as headache and nausea.¹⁷⁶ The chemicals exceeding short-term AMCVs included carbon disulfide, ethane, isopentane, and 1,2-dibromoethane¹⁷⁷ p-diethylbenzene¹⁷⁸ n-octane, n-pentane, and 1,2 dibromoethane (again)¹⁷⁹ and formaldehyde.¹⁸⁰ At the same location where TCEQ identified benzene concentrations at 15,000 ppbv in 2009, it also detected 35 other chemicals above short-term exposure levels at the wellhead.¹⁸¹

Dispersion modeling done by Fort Worth's consultants also revealed additional contaminants of concern including estimated acrolein and formaldehyde concentrations greater than the TCEQ's ESLs, but only for the "relatively few sites" with multiple, large-line compressor engines.¹⁸² The model output also suggested that estimated methylene chloride concentrations might exceed health-based screening levels, but the study noted that "this was based on a suspect measurement and is not a robust finding."¹⁸³ The report also evaluated modeled annual average concentrations in relation to a 200-foot setback for residences—the allowable setback in Fort Worth with a variance to the standard 600-foot setback requirement.¹⁸⁴ The highest annual average concentration of acrolein at locations at least 200 feet from fence lines predicted by the model (0.33 ppbv) was higher than the TCEQ's health-based, long-term ESL (0.066 ppbv).¹⁸⁵ The highest annual average concentration of

¹⁷⁴ Letter from Rep. Lon Burnam Tex. House of Rep. to The Honorable Betsy Price, City of Fort Worth, December 21, 2011, available at <http://blogs.star-telegram.com/files/lb-letter-to-mayor-price-on-tceq-air-monitoring-aqs---12.21.11-1.pdf>

¹⁷⁵ *Id.*

¹⁷⁶ Memorandum from Ethridge, *supra* note 114, at 2.

¹⁷⁷ *Id.*

¹⁷⁸ Memorandum from Ethridge II, *supra* note 120.

¹⁷⁹ Interoffice Memorandum from Ethridge, *supra* note 122.

¹⁸⁰ Formaldehyde at levels both upwind (100.3ppbv, 126.9ppbv) and downwind (68.8 ppbv and 114.1ppbv) of the facility exceeded the TCEQ's short-term AMCV 41ppbv. Interoffice Memorandum from Walter, *supra* note 130.

¹⁸¹ Memorandum from Ethridge, *supra* note 114, at 1.

¹⁸² E. RESEARCH GROUP & SAGE ENVTL. CONSULTING, *supra* note 50, at xiii-xiv.

¹⁸³ *Id.* at 5-25.

¹⁸⁴ *Id.* at 5-32.

¹⁸⁵ *Id.* at 5-32.

formaldehyde predicted by the modeling analysis beyond 200 feet from a fence line (4.34 ppbv) was also higher than the TCEQ's health-based, long-term ESL (2.7 ppbv).¹⁸⁶ Fort Worth's consultants concluded, however, that for the overwhelming majority of sites evaluated, the modeling analysis indicates that Fort Worth's six hundred-foot setback distance is adequate.¹⁸⁷ As to any exceedances of state comparison values, the consultant also noted that the estimated air pollution levels did not reach levels that "have actually" been found to cause symptoms or illness among exposed populations.¹⁸⁸

According to the TCEQ, there are layers of conservatism incorporated into their ESLs and AMCVs.¹⁸⁹ The TCEQ incorporates uncertainty factors into the development of its reference values that account for differences between animal species and humans, variability within the human species, and uncertainties related to the applicability and completeness of the available data.¹⁹⁰ The uncertainty factors are generally considered protective although "the true range of variability among the population for a response to a given chemical is often unknown."¹⁹¹ The TCEQ attempts to identify specific sensitive subgroups for each substance from the available scientific literature, it recognizes that it "may not identify all conditions that result in adverse health effects following exposure to chemicals."¹⁹² Since uncertainty factors are incorporated, exceeding reference values does not necessarily indicate that an adverse health effect would occur.¹⁹³ However, the inverse must also be true: monitoring values within the reference values may not be adequate to protect public health.

Given the limits of our current state of knowledge about the chemicals employed by the shale gas industry, their possible interactive effects, and effects on children, especially during critical developmental stages, there is inherent uncertainty as to the universe of risk drivers associated with gas industry emissions. Even on a chemical-by-chemical basis, it is not clear that TCEQ monitoring has captured all emissions of potential concern. The chemicals selected for monitoring at the TCEQ's 24-hour monitoring sites, were selected based on their

¹⁸⁶ E. RESEARCH GROUP & SAGE ENVTL. CONSULTING, *supra* note 50, at 5-36.

¹⁸⁷ *Id.* at xiii-xiv.

¹⁸⁸ *Id.*

¹⁸⁹ TOXICOLOGY DIV., TEX. COMM'N ON ENVTL. QUALITY, GUIDELINES TO DEVELOP TOXICITY FACTORS 5, 9 (2012), available at <http://www.tceq.texas.gov/publications/rg/rg-442.html>.

¹⁹⁰ *Id.* at 5.

¹⁹¹ *Id.*

¹⁹² *Id.*

¹⁹³ *Id.*

status as ozone precursors and may not represent the universe of chemicals of concern for gas industry operations.¹⁹⁴ The TCEQ also operates a Community Air Toxics Monitoring Network (CATMN) program that regularly collects 24-hour canister samples, which are analyzed for around one hundred chemicals. However, the sites were established long before the shale gas boom, are located generally in residential areas near other industries,¹⁹⁵ and may still fail to capture all chemicals of concern for shale gas operations.

The chemicals selected for mobile monitoring were chosen by TCEQ chemists and permit engineers based on their understanding of the chemicals likely to be involved and the limits of their analytical tools.¹⁹⁶ However, it is very difficult at this point to even identify all the toxins that may be associated with gas industry operations. Although many states, including Texas, have recently adopted disclosure laws, exceptions for “trade secrets” continue to interfere with scientific analysis of these chemicals.¹⁹⁷ A recent study by Theo Colburn and several colleagues, which attempted to comprehensively evaluate chemicals in products used by the industry, found ingredient information for only fourteen percent of the 944 products identified; for 43 percent of the products, less than one percent of the total product composition was available.¹⁹⁸ In another study conducted by Colburn, weekly air quality sampling for one year near a well pad in rural western Colorado detected methylene chloride, a toxic solvent not reported in products used in drilling or hydraulic fracturing. Methylene chloride was detected 73 percent of the time, several times in high concentrations.¹⁹⁹ Residents and gas field workers have reported that this chemical solvent is stored on well pads for cleaning purposes.²⁰⁰ This chemical has many health effects, including endocrine disruption.²⁰¹ Other drilling and fracking fluids that have been identified

¹⁹⁴ E-mails from Sullivan, *supra* note 143.

¹⁹⁵ *Id.*

¹⁹⁶ E-mail from Michael E. Honeycutt, Dir., Toxicology Div., Tex. Comm’n on Env’tl. Quality to author (Feb. 26, 2012) (on file with author).

¹⁹⁷ See 16 TAC § 3.29(c)(1)(B). See also Mike Soraghan, *Hydraulic fracturing: Two-thirds of frack disclosures omit “secrets”*, ENERGYWIRE (Sept. 26, 2012), <http://www.eenews.net/public/energywire/2012/09/26/1>.

¹⁹⁸ Theo Colborn et al., *Natural Gas Operations from a Public Health Perspective*, 17 Human and Ecological Risk Assessment 5, 1039, 1046 (2011).

¹⁹⁹ COLBORN, ET AL., *supra* note 8, at 2 (the well pad included 16 vertical (directional) gas wells had been drilled, hydraulically fractured and put into production during the course of the study).

²⁰⁰ *Id.* at 10.

²⁰¹ *Id.* at 2. See also *Methylene Chloride*, U.S. DEP’T OF LABOR, <http://www.osha.gov/SLTC/methylenechloride/> (last visited May 28, 2013) (“Methylene chloride is a solvent which is used in many different types of work activities, such as paint stripping,

include many carcinogens and endocrine disrupting chemicals that may have latent long-term health effects, and chemicals that can affect the sensory organs and bodily systems.²⁰² Health effects may not surface for decades and could span generations.²⁰³

B. State Health Effects Studies: Inadequate Guidelines and Communication

i. Texas Department of State Health Services Cancer Cluster Study

In 2010, in Flower Mound, Texas, a low-density residential community near Dallas, there was concern about the possibility of a childhood leukemia cluster and possible links to chemicals associated with gas industry emissions.²⁰⁴ According to a news report, five child and two adult cases of leukemia occurred within a short period of time among residents who lived within four miles of each other.²⁰⁵ One father of a young leukemia patient reported that shortly after he and his wife first learned that their daughter was diagnosed with leukemia, other children in their neighborhood were also diagnosed.²⁰⁶

Acknowledging that benzene has generally been shown to have an association with leukemia and non-Hodgkin's lymphoma in the scientific literature, the Texas Department of State Health Services (DSHS) agreed to evaluate cancer rates in Flower Mound.²⁰⁷ Other cancers of concern included breast cancer and childhood brain/central

polyurethane foam manufacturing, cleaning, and degreasing. Employees exposed to methylene chloride are at increased risk of developing cancer, adverse effects on the heart, central nervous system and liver, and skin or eye irritation.”).

²⁰² Colborn et al., *supra* note 198, at 1039. The study identified 944 products used in gas industry operations. Many of the ingredients used in these products were not available. *Id.* Using the 632 chemicals that were reported in these products, this study completed a health effects analysis on 353 of these chemicals for which an American Chemical Society's Chemical Abstract Service (CAS) classification system number was available. *Id.*

²⁰³ *Id.* at 1049.

²⁰⁴ TEX. DEP'T OF STATE HEALTH SERVS., SUMMARY OF INVESTIGATION OF SPECIFIC CANCER OCCURRENCES WITHIN ZIP CODES 75022 AND 75028 3 (2010), available at www.dshs.state.tx.us/epitox/consults/flower_mound32010.pdf [hereinafter *DSHS Investigation Summary*]. See also TEX. DEP'T OF STATE HEALTH SERVS., UPDATED SUMMARY REPORT OF TEXAS DEPARTMENT OF STATE HEALTH SERVICES INVESTIGATION OF SPECIFIC CANCER OCCURRENCES WITH ZIP CODES 75022 AND 75028 (2011), available at <http://tx-flowermound.civicplus.com/DocumentCenter/Home/View/465> [hereinafter *DSHS Updated Investigation Summary*].

²⁰⁵ *WFAA-TV Broadcast*, *supra* note 18.

²⁰⁶ Jack Fink, CBS 11 News, Report Concludes No Cancer Clusters in Flower Mound, April 28, 2011, <http://dfw.cbslocal.com/2011/04/28/report-concludes-no-cancer-clusters-in-flower-mound/>

²⁰⁷ *DSHS Investigation Summary*, *supra* note 204, at 1.

nervous system cancer.²⁰⁸ At the conclusion of the study, the DSHS found no evidence of a “cancer cluster” for any of the cancers investigated except for breast cancer for which the increased cases were attributed to population growth.²⁰⁹ However, a close examination of the study (as reflected in an initial and an updated report)²¹⁰, and the guidelines for cluster investigations reportedly relied upon, reveals that the study was not carefully designed to investigate cancer cases in relation to the time and location of exposure to potentially toxic emissions. The following discussion identifies issues appropriate for a public discussion and rulemaking to guide future analysis of health impacts where the relationship between toxic exposures and public health are at issue.²¹¹

The DSHS study references the 1990 Guidelines for Investigating Clusters of Health Events, prepared by the Centers for Disease Control and Prevention (CDC) (the “Guidelines”).²¹² The Guidelines are very general and were intended to “supplement, rather than supplant, existing state and local plans for evaluating clusters.”²¹³ However, DSHS staff confirmed that no other publicly accessible rules or policy documents guided the analysis.²¹⁴ The Guidelines recommend that the investigator select the epidemiologic or statistical approach according to the circumstances of the study.²¹⁵ The Guidelines explain that the approach taken to investigate a suspected cluster of health events depends on “the nature of the cluster, the data available, and the questions being asked.” The Guidelines define the term “cluster” as an unusual aggregation, real or perceived, of health events that are grouped together “in time and space” and that are reported to a health agency.²¹⁶ They identify the importance of carefully choosing the relevant time and geographic unit for analysis. The Guidelines explain that health events occur in space and time continua, thus yielding optimal and suboptimal units for displaying patterns. “[T]he choice of a geographic area that is too small

²⁰⁸ *Id.*

²⁰⁹ *DSHS Updated Investigation Summary*, *supra* note 204, at 1, 5-6.

²¹⁰ *DSHS Investigation Summary*, *supra* note 204, at 1.

²¹¹ Maria T. Morandi, Ph.D., CIH, and John Laycock, graduate research assistant, reviewed and evaluated the DSHS reports. Review and comments also received from Anthony Apostolides, D.Phil.

²¹² *DSHS Updated Investigation Summary*, *supra* note 204, at 9 (citing GUIDELINES FOR INVESTIGATING CLUSTERS OF HEALTH EVENTS, CTRS. FOR DISEASE CONTROL & PREVENTION (1990)).

²¹³ GUIDELINES FOR INVESTIGATING CLUSTERS OF HEALTH EVENTS, CTRS. FOR DISEASE CONTROL & PREVENTION 2 (1990), available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/00001797.htm> [hereinafter *CDC Guidelines*].

²¹⁴ E-mails from Brenda Mokry, Tex. Dep’t of State Health Servs., to author (Nov. 26-27, 2012) (on file with author).

²¹⁵ *CDC Guidelines*, *supra* note 212, at 4.

²¹⁶ *Id.* at 2.

or too large, or of a time period that is too short or too long, may result in insufficient statistical power to indicate a cluster.”²¹⁷

In its investigation of cancer incidence rates in Flower Mound, the DSHS did not design the study in relation to the specific question at issue; that is, whether there may be a relationship between cancer cases in the community and gas industry emissions. The DSHS study does not discuss the relative location of the cancer cases within the city, whether there was any apparent clustering near gas industry operations, roadways or other sources of benzene exposure, or whether the chosen geographic units of analysis may have split the area of apparent interest. In choosing the appropriate geographic area for analysis, the Guidelines suggest that mapping the data may be helpful.²¹⁸ However, the DSHS chose instead to complete the statistical analysis of cancer rates for two entire ZIP code areas, which may or may not have divided the actual area of concern.²¹⁹ Each ZIP code covers approximately half the city, 14.5 and 16.5 square miles.²²⁰ The study also evaluated the two ZIP codes together, but that analysis risked masking any clustering within a large 31 square mile area.

The study provides no rationale or explanation for the chosen geographic units of analysis. Given that Flower Mound is a low-density community, it is possible that smaller geographic units of analysis may have proved problematic for a robust statistical analysis. However, the Guidelines identify statistical techniques that can be appropriate for small data sets.²²¹ There is no discussion in the DSHS report as to whether an alternate approach based on smaller, more appropriately defined geographic units may have been possible in Flower Mound. By contrast, researchers at the University of Texas who identified increased rates of childhood leukemia based on proximity to the source of emissions used air quality monitoring data and modeling to estimate ambient benzene and 1,3 butadiene levels at the census tract level, and evaluated cancer incident statistics, also at the census tract level. Using

²¹⁷ *Id.* at 11.

²¹⁸ *Id.*

²¹⁹ DSHS *Updated Investigation Summary*, *supra* note 204.

²²⁰ See *Flower Mound, Texas (TX) Zip Code Map—Locations, Demographics*, CITY-DATA.COM, <http://www.city-data.com/zipmaps/Flower-Mound-Texas.html> (last visited Apr. 9, 2013) [hereinafter *Zip Code Map*].

²²¹ CDC *Guidelines*, *supra* note 213 (“Combinatorial methods are often used for small amounts of data. Other commonly used statistical approaches include chi-square tests of observed versus expected frequencies (based on the Poisson distribution for low-frequency data) and Poisson regression (used for comparison of rates) If the . . . standard approaches cannot be used in an investigation of clusters because the number of health events is too small, data on the population at risk are unavailable, or space-time clustering is suspected, numerous statistical tests are available for use in detecting spatial, temporal, and space-time clusters.”).

these smaller geographic areas (there are fifteen census tracts in Flower Mound),²²² the University of Texas researchers were able to compare the risk of acute lymphocytic leukemia among children living within two miles of the Houston Ship Channel to those living more than ten miles away, finding an increased risk of 56 percent.²²³ This study also compared children living in areas with the lowest estimated 1,3-butadiene levels to children in areas with the highest levels, finding a 153 percent increased risk of developing any kind of leukemia.

As stated in the Guidelines, in addition to selecting appropriate geographic units for analysis, defining the relevant time frame for analysis is critical when investigating potential exposure-effects relationships.²²⁴ The DSHS's study does not present any consideration or discussion of the timing of gas industry operations in the area, or the timing of any apparent spikes in cancer rates. The DSHS studied cancer incident rates over the course of two, ten-year periods, first evaluating the period from 1998 to 2007, and then updating the analysis to include 1999 to 2008. The DSHS then compared incident rates in Flower Mound to statewide incidence data for the same period.²²⁵ The study does not identify the date that gas industry operations began in Flower Mound in relation to the two ten-year periods of analysis. One blog report suggests that gas industry operations may not have started until 2004,²²⁶ and news reports refer to several diagnoses within a "short time" thereafter, including the diagnoses of four-year-old children.²²⁷

The DSHS also compared the average rate of cancer during two three-year periods, 2007 to 2009 and 2008 to 2010, to ten-year averages from 1998 to 2007 and 1999 to 2008, in the same geographic areas of Flower Mound.²²⁸ Again, the choice of time periods is not fully explained. The DSHS study does not provide any information as to whether there may have been spikes in leukemia rates over any one or two-year period, which would then have been diluted by averaging. The Guidelines mention pooling across geographic areas or time, but the discussion relates to situations where the number of health events is

²²² US CENSUS BUREAU, DENTON COUNTY TEXAS CENSUS TRACT BOUNDARY MAP (2010), available at http://www2.census.gov/geo/maps/dc10map/tract/st48_tx/c48121_denton/DC10CT_C48121_001.pdf.

²²³ WALKER ET AL., *supra* note 105.

²²⁴ *Id.* at 6.

²²⁵ See *DSHS Investigation Summary*, *supra* note 204.

²²⁶ *Cancer Rates Climb*, *supra* note 169.

²²⁷ *WFAA-TV Broadcast*, *supra* note 17.

²²⁸ *DSHS Investigation Summary*, *supra* note 204, at 1.

too small to show meaningful rates.²²⁹ The DSHS study explains its decision to extend the analysis over a three-year period only in relation to a desire to “protect patient confidentiality with such a small area of analysis (ZIP codes) and some rare cancer sites.”²³⁰ Given the actual size of the ZIP code areas (14.5 and 16.5 square miles),²³¹ and the anonymity of the data, the state’s concerns are not compelling. The DSHS Data Release Policy indicates that approval is required by the DSHS Institutional Review board to release ZIP code level counts that include fewer than three years of combined data, but it does not provide any information as to the requirements for approval.²³²

Aside from the question of patient confidentiality, the DSHS is wary of short time periods. The DSHS study states: “It should be noted that because of large year-to-year variation in the number of cases that may occur, it is impossible to draw any definitive conclusions from only three years of data.”²³³ While this may be correct, if increased cancer incidence is related to an acute exposure episode, then averaging over longer time periods would tend to dilute associations that may indicate a possible relationship between emission spikes and cancer incident spikes, and that could provide a basis for further study or adoption of precautionary measures. An exploration of possible approaches through a public discussion and rulemaking may lead to the identification of techniques that could be used to perform this analysis without compromising confidentiality concerns.

Although relevant to the question of possible exposure to gas industry emissions, time and duration of residence in the community prior to diagnosis are not clearly described in the study or factored into the analysis. The DSHS reports that there were five cases of childhood

²²⁹ *DSHS Investigation Summary*, *supra* note 204, at 10. See also *CDC Guidelines*, *supra* note 213 (discussing different types of statistical techniques that may be used for small amounts of data).

²³⁰ *DSHS Investigation Summary*, *supra* note 204, at 1. See also TEX. HEALTH & SAFETY CODE § 81.046 (West 2011) (generally providing for confidentiality of health information except for statistical purposes if released in a manner that prevents identification, or with the consent of each person identified, and in certain other circumstances); TEX. HEALTH & SAFETY CODE § 116.0213 (“Reports, records, and information . . . that relate to an epidemiologic or toxicologic investigation of human illnesses or conditions and of environmental exposures that are harmful or believed to be harmful to the public health are not public information”); TEX. HEALTH & SAFETY CODE § 161.022(b) (“The identity of a person whose condition or treatment has been studied is confidential and may not be revealed”).

²³¹ *Zip Code Map*, *supra* note 220.

²³² TEX. DEP’T OF STATE HEALTH SERVS., TEXAS CANCER REGISTRY DATA RELEASE 3, available at <http://www.dshs.state.tx.us/tcr/researchers.shtm>. See also *Policy Statement*, TEX. DEP’T OF STATE HEALTH SERVS.,

<https://www.dshs.state.tx.us/irb/IrbPolicy.shtm> (last visited Sept. 2, 2011).

²³³ *DSHS Updated Investigation Summary*, *supra* note 204, at 5.

leukemia (all subtypes) and two brain/CNS cancers from 2007 to 2009.²³⁴ The study also notes that there were two additional cases of childhood cancer, but the patients did not reside in Flower Mound “at the time of diagnosis.”²³⁵ The study does not explain why it chose the “time of diagnosis” as the reference period, instead of the time and duration of residence in relation to gas industry emissions. Community members reported that there was a family “excluded in the data.”²³⁶ At the end of the study, the tables summarizing the results include a notation that: “TCR has heard from parents of two children diagnosed prior to moving to Flower Mound *or* diagnosed after moving elsewhere.”²³⁷ The DSHS’s vague reference does not specify whether cases excluded from the study were diagnosed after exposure in Flower Mound. Given the short timeframe for analysis and the small numbers of children involved, it would not seem difficult for the state to have chosen multiple units for analysis to explore spatial and temporal clustering that might be explained by an exposure source. It is not clear why such information was not used to inform the DSHS’s analysis. The Guidelines recommend obtaining identifying information on persons affected, including the date of diagnosis and the length of time in residence at the site of interest.²³⁸

The study also fails to provide any rationale for selection of the reference population. The Guidelines note that “the reference population must be chosen carefully to ensure its appropriateness.” The Guidelines recommend that if a temporal cluster is being assessed, the occurrence in that time period can be evaluated in the context of “previous” or “subsequent” periods, but they do not suggest that overlapping periods would be appropriate.²³⁹ The Guidelines also explain that if a spatial cluster is being assessed, the occurrence in the geographic area could be compared with those in adjacent areas or with other areas of similar size.²⁴⁰ The Guidelines do not suggest using the same geographic area during overlapping periods of time. However, the study’s comparison of the average rates of cancer during the three-year period from 2007 to 2009 to cancer rates in Flower Mound during the ten-year period from 1998 to 2007, as well as the comparison of average

²³⁴ *DSHS Investigation Summary*, *supra* note 204, at 2.

²³⁵ *Id.*

²³⁶ Jack Fink, *Report Concludes No Cancer Clusters in Flower Mound*, CBS DFW (Apr. 28, 2011), <http://dfw.cbslocal.com/2011/04/28/report-concludes-no-cancer-clusters-in-flower-mound/>.

²³⁷ *DSHS Investigation Summary*, *supra* note 204, at 16 (emphasis added).

²³⁸ *Id.* at 6.

²³⁹ *Id.*

²⁴⁰ *Id.*

rates of cancer in Flower Mound for the three-year period from 2008 to 2010 to ten year averages in Flower Mound from 1999 to 2008, include overlapping time periods (2007 and 2008, respectively) in the same geographic areas of Flower Mound.²⁴¹ Any apparent spike in cancer rates may have fallen on both sides of the comparison. Nevertheless, the state found the average annual number of cases of all age acute leukemias, non-Hodgkin's lymphoma and breast cancer were "somewhat higher" from 2007 to 2009, but noted that the comparison does not take into account population growth that occurred in this area.²⁴²

In another departure from what might be expected, the DSHS's ten-year statistical analysis diverged from typical scientific practice in choosing the level of certainty. Although scientific convention generally defines statistical significance using the 95 percent confidence interval,²⁴³ the State's ten-year statistical analyses were based on the 99 percent confidence interval.²⁴⁴ A study based on this level of certainty would not conclude that elevated cancer rates were "significant" unless it was 99 percent sure that the findings were not due to chance, allowing only a one in hundred chance that the conclusion could be in error. The DSHS study does not convincingly explain the reason for selection of the 99 percent confidence interval. According to the author of the DSHS study, the decision as to the level of confidence interval was driven solely by internal agency policy that the agency was unwilling to release upon request.²⁴⁵ As a point of comparison, in the study of emissions and leukemia rates near the Houston Ship Channel, the University of Texas researchers used the 95 percent confidence interval as the limit of statistical significance for their analysis.²⁴⁶ The DSHS itself also employed the 95 percent confidence interval in a study responding to concerns about air emissions from a local metal smelter in El Paso.²⁴⁷ That study relied on school districts as the geographic unit

²⁴¹ *DSHS Investigation Summary*, *supra* note 204, at 1-2; *DSHS Updated Investigation Summary*, *supra* note 204, at Update at Executive Summary, page 2, 5.

²⁴² *DSHS Investigation Summary*, *supra* note 204, at 2.

²⁴³ *NVE Inc. v. Dep't of Health & Human Servs.*, 436 F.3d 182 (3d Cir. 2006) (comparing scientific to legal standards).

²⁴⁴ *DSHS Investigation Summary*, *supra* note 204, at 4.

²⁴⁵ Telephone Interview with Brenda Mokry, Epidemiology Studies & Initiatives Branch (Nov. 25, 2010); E-mail from Brenda Mokry to author (Nov. 26, 2012) (on file with author) (confirming telephone conversation).

²⁴⁶ WALKER ET AL., *supra* note 105, tbls.7, 8 (identifying significance threshold as .05).

²⁴⁷ *El Paso Multiple Sclerosis (MS) Study*, TEX. DEP'T OF STATE HEALTH SERVS., <http://www.dshs.state.tx.us/epitox/elpasostudy.shtm>

of analysis, found a statistically significant twofold increased risk of MS in one neighborhood, and recommended further study.²⁴⁸

A reevaluation of the data presented in the DSHS study using the 95 percent confidence interval reveals a statistically significant difference with more observed cases as compared to the number of expected cases of lymphoid leukemia in all male children in ZIP code 75022 from 1998 to 2007,²⁴⁹ and a statistically significant difference in non-Hodgkin's lymphoma in all age male children for the same time period in ZIP code 75028.²⁵⁰ There was also an increase at the edge of significance for all ages of male non-Hodgkin's lymphoma for 1999 to 2008 in ZIP code 75028.²⁵¹ Although these differences could be due to some factor unrelated to gas industry emissions, the probability that "significant" findings at the 95 percent confidence interval are due to chance is very small; there is a one in twenty chance that the difference is random.²⁵²

The CDC's Guidelines state only that agencies "should be flexible in their methods of analysis and tests of statistical significance," but do not specify what might be considered appropriate confidence intervals. The Guidelines independently discuss the importance of considering the possibility of subsequent litigation, and recommend that members of public health agencies understand that legally establishing a cause and effect relationship requires only a preponderance of the evidence.²⁵³ The Guidelines shy away from assigning any significance to the findings, cautioning that rare diseases may occasionally "cluster" in a way that is statistically significant, but such occurrence may be a statistical phenomenon not related to exposure.²⁵⁴ Of course, it is also possible that the "cluster" is related to exposure. If the concern is truly

²⁴⁸ *Id.*

²⁴⁹ The lower bound of the 95% confidence interval of the standardized mortality ratio (SIR) for lymphoid leukemia in male children in the 1998-2007 period is 1.2 at the 95% compared to 0.7 for the 99% lower confidence bound of the SIR. *DSHS Investigation Summary, supra* note 204, at 10 tbl. 1; Memorandum from John Laycock, to author (Sept. 27, 2012) (on file with author); E-mail from Maria Morandi to author (Feb. 19, 2012) (on file with author).

²⁵⁰ The lower bound of the 95% confidence interval of the standardized mortality ratio (SIR) for non-Hodgkin's Lymphoma in male children in the 1998-2007 period is 1.0 at the 95% compared to 0.9 for the 99% lower confidence bound of the SIR. *DSHS Investigation Summary, supra* note 204, at 14 tbl. 5; Memorandum from Laycock, *supra* note 249; E-mail from Morandi, *supra* note 249.

²⁵¹ The lower bound of the 95% confidence interval is at .99 at the 95% as opposed to 0.87 for the lower bound of the 99% confidence interval of the SIR. *DSHS Updated Investigation Summary, supra* note 204, at 14 tbl. 5; Memorandum from Laycock, *supra* note 249; E-mail from Morandi, *supra* note 249.

²⁵² *NVE Inc. v. Dep't of Health & Human Servs.*, 436 F.3d 182 (3d Cir. 2006) (discussing scientific standard).

²⁵³ *CDC Guidelines, supra* note 213, at 1-4.

²⁵⁴ *Id.* at 6.

public health, then the focus should be on adopting appropriate scientific methods, not the potential for subsequent litigation.

The combination of the limitations in temporal and geographic units of analysis, and a higher barrier than customary for the confidence interval, biased the study towards a finding that there is no cancer cluster. A more nuanced and transparent analysis might report results for multiple levels of confidence to allow for full appreciation of the range of risk and consideration of precautionary measures, perhaps even where the risk falls short of “significance” at the 95 percent confidence interval.²⁵⁵ In other contexts, as a society, we have chosen to vary the level of certainty depending on whether it is more important to avoid a false positive, or a false negative. In civil law, the applicable standard is “more probable than not,” yet in criminal law, the level of certainty is guilty “beyond a reasonable doubt.” The criminal standard seeks to avoid an error that would send an innocent man to prison more than an error that would allow a guilty man to remain free. By analogy, setting the confidence interval at 99 percent in the context of this study suggests that we are most concerned with avoiding an error that mistakenly maligns industry, rather than avoiding an error that mistakenly dismisses the concern that children are suffering increased rates of cancer.

The state did find increased rates of breast cancer, even while using the 99 percent confidence interval, but then dismissed this finding on the basis of speculation without performing further substantive analysis. Although the initial report notes that, “due to inherent limitations” it is “not possible to determine with any degree of certainty why the number of breast cancer cases is higher than expected in these areas,” the updated report concludes that it is “likely” explained by population growth.²⁵⁶ However, the data and charts included in the study indicate that the increase in breast cancer far exceeds the rate of increase in population.²⁵⁷ The population increased 41 percent from 1998 to 2008,²⁵⁸ and presumably not all of this population (including both men and children) was at a significant risk for breast cancer. Yet, the breast cancer rate more than tripled, rising from thirteen to 45 cases per year during the same time period.²⁵⁹ There is no assessment as to how long

²⁵⁵ E-mail from Maria T. Morandi, Assistant Professor, Univ. of Tex., School of Public Health, to author (Feb. 14, 2013) (on file with author).

²⁵⁶ *DSHS Updated Investigation Summary*, *supra* note 204, at 1.

²⁵⁷ *Id.* at 2.

²⁵⁸ *Id.*

²⁵⁹ *Id.* at 17.

those diagnosed with breast cancer had lived in Flower Mound.²⁶⁰ Instead of carefully evaluating this issue, the DSHS's study dismisses the possibility of a relationship to environmental contaminants, noting that "research does not show a link between breast cancer risk and environmental pollutants."²⁶¹ Yet, several studies have associated benzene with increased breast cancer risk.²⁶² The EPA's IRIS specifically identifies breast cancer as one of the cancers that may be associated with benzene exposure based on experimental animal data.²⁶³ Some epidemiological studies have also found benzene exposure to be related to an elevated risk of breast cancer and that benzene administration to laboratory mice induces mammary tumors.²⁶⁴ Also of concern, in 2009 the Texas Cancer Registry showed that six counties in the western Dallas-Fort Worth area had the highest incidence of invasive breast cancer in the state.²⁶⁵

The Guidelines explain the importance of separating two concurrent issues: whether an excess of disease has actually occurred and whether the excess can be linked etiologically to some exposure.²⁶⁶ The Guidelines note that there are three stages of analysis: a preliminary investigation to quickly determine from available data whether an excess may have occurred; case evaluation to assure that a biological basis exists for further work; and an occurrence investigation for the purpose of obtaining a more detailed description of the cluster.²⁶⁷ In this case, having found no "cancer cluster," the DSHS did not progress significantly beyond that first step. However, the Guidelines caution that the health agency must recognize that these activities are often interrelated and may occur in parallel, and that a linear approach is often not possible.²⁶⁸

The study itself explains: "[w]hile these types of investigations can be used to investigate whether the amount of cancer in a community is more than expected, they cannot determine either the cause of the cancers or whether the cancers are associated with any environmental or

²⁶⁰ Although there may be some restrictions on the public availability of this data, there is no indication of any effort to request voluntary reporting on this issue.

²⁶¹ *DSHS Updated Investigation Summary*, *supra* note 204, at 8.

²⁶² JANET GRAY, STATE OF THE EVIDENCE: THE CONNECTION BETWEEN BREAST CANCER AND THE ENVIRONMENT 58 (6th ed. 2010), *available at* <http://www.breastcancerfund.org/assets/pdfs/publications/state-of-the-evidence-2010.pdf>.

²⁶³ *Integrated Risk Information System, Benzene*, *supra* note 161.

²⁶⁴ GRAY, *supra* note 262.

²⁶⁵ *See supra* note 18.

²⁶⁶ *CDC Guidelines*, *supra* note 213, at 7.

²⁶⁷ *Id.*

²⁶⁸ *Id.*

other risk factors.”²⁶⁹ Even a well-designed study would not, of course, prove cause and effect, yet the question of whether there is an association between increased cancer rates and gas industry emissions is the very question that the community sought to address. At the beginning, the study acknowledges that “community concerns were prompted by fears that benzene was coming from area gas drilling and could be causing cancer.”²⁷⁰ The study also confirms that benzene “has been shown to have an association with leukemia and non-Hodgkin’s lymphoma in the scientific literature.”²⁷¹ The Guidelines explain that an etiologic investigation would be expected to contribute to epidemiologic and public health knowledge, including the possible “demonstration that an association does or does not exist between exposure and disease.”²⁷² Identification of such an association in the suburban community of Flower Mound, Texas would justify additional monitoring and consideration of precautionary measures wherever gas industry emissions are in close proximity to residential areas.

Given the gravity of the concerns, there is a need for a public discussion and rulemaking process to establish standards to guide studies of health “clusters,” and to provide guidance as to a how best to communicate the results to the public to increase transparency. The study announces its use of a 99 percent confidence interval, for example, but it does not translate the meaning and significance of that choice to the community. It seems very unlikely that the public would be satisfied with aborting further study or consideration of precautionary measures upon a finding that the State was not 99 percent certain that there was a childhood leukemia cluster. The State’s conclusions created a false sense of security and the study results dominate public perception. CBS news ran a story with the heading, “Report Concludes No Cancer Clusters in Flower Mound.”²⁷³ The City of Flower Mound’s website also includes a reassuring summary of the State’s findings, without mentioning the very limited conclusions that can be drawn from an analysis at the 99 percent confidence interval and a study design that is based on time and geographic units of analysis that are not carefully tailored to more accurately address the real question posed by the community.²⁷⁴ The website summary refers to the

²⁶⁹ DSHS Investigation Summary, *supra* note 204, at 3.

²⁷⁰ DSHS Updated Investigation Summary, *supra* note 204, at 1.

²⁷¹ DSHS Updated Investigation Summary, *supra* note 204, at 3.

²⁷² CDC Guidelines, *supra* note 213.

²⁷³ Fink, *supra* note 236.

²⁷⁴ Air Quality, CITY OF FLOWER MOUND, <http://www.flowermound.com/index.aspx?NID=930> (last visited May 10, 2013) (indicating that the Texas

tripling of breast cancer rates as “slight,” and concludes: “[t]he Texas Department of State Health Services (TDSHS) report identifies no evidence of cancer clusters within Flower Mound and brings closure to a 2010 cancer rate study conducted within the Town.”²⁷⁵

ii. Texas Department of State Health Services Study, Other Health Effects

The Texas Department of State Health Services also conducted a study in Dish, Texas, in response to citizen concerns about various health effects.²⁷⁶ The state collected blood and urine samples from 28 of 225 people living in and around Dish.²⁷⁷ The state concluded that, “although a number of VOCs were detected in some of the blood samples; the pattern of VOC values was not consistent with a community-wide exposure to airborne contaminants.”²⁷⁸ The state noted that “other sources of exposure may explain many of the findings.”²⁷⁹ Again, given its limitations, the study may serve more as a vehicle to placate community concerns than to truly evaluate the health effects of emissions from gas industry operations in DISH, Texas.

The state noted that some of the compounds that were found in “a few people” at higher levels than 95 percent of the general U.S. population are commonly found in consumer products like moth balls, deodorizers, metal cleaners, degreasers and lubricants.²⁸⁰ However, the report provides no information as to whether any of these products were used by DISH residents, or whether the residents of DISH used more of these products than 95 percent of the general U.S. population. The study does not present any comparison of the chemicals tested in the blood and urine as compared to the chemicals found in the air or the fracking fluid or any other chemicals used on site. There is no information as to whether the chemicals in the fracking fluid have been disclosed. The report concludes that “[i]n most instances staff was not able to definitely identify exposure sources.”²⁸¹ The concluding section notes, “[o]ne metabolite, AMCA, was higher than the levels measured

Department of State Health Services (TDSHS) report identifies no evidence of cancer clusters within Flower Mound).

²⁷⁵ *Id.*

²⁷⁶ FINAL REPORT, *supra* note 2.

²⁷⁷ *Id.* See also John Hamilton, *Town’s Effort to Link Fracking and Illness Falls Short*, NPR, available at <http://www.npr.org/2012/05/16/152204584/towns-effort-to-link-fracking-and-illness-falls-short> (identifying number of residents in DISH).

²⁷⁸ FINAL REPORT, *supra* note 2, at 1.

²⁷⁹ *Id.*

²⁸⁰ *Id.*

²⁸¹ *Id.* at 10.

in the TXDSSH staff and the levels published in the analytical methods papers. The reason for this difference is not known.”²⁸²

The report is based on a small sample, and it does not provide any information as to whether those tested had exposures representative of the population as a whole. It does not offer proximity analysis by place of residence nor place of work in relation to recent fracking, drilling or gas production activity, surface impoundments or other possible sources of volatilizing chemicals. Missing is any discussion of source, pathway and receptors that takes into account variation in source concentrations, likely plume or drift considerations, micro climate considerations, proximity of sensitive receptors and variation in exposure due to time of day. The report notes that air sampling was conducted in August, October and November 2009, but that the site visit was conducted in December. The report recommends that the investigation should be repeated during the summer months when the temperatures and volatilization rates are higher and when people indicate that the odors are present.²⁸³ No follow up study has been reported.

The report specifically notes the following limitations:

VOCs only stay in the body for a short time (several hours); therefore these measurements only reflect ongoing or recent exposures, and not historical exposures. Second, this was a onetime sampling event; thus, it could not consider variations in factors such as season, temperature, wind conditions, and natural gas operations. Third, [they] could not identify with any degree of certainty a source for all of the exposures. Fourth, the urinary metabolite AMCA is not completely specific and can form through other metabolic pathways. Lastly, it is not possible to determine potential health risks based on the levels found in the blood.²⁸⁴

Yet, the TCEQ website omits any discussion of the study limitations and suggests that the study resolves issues in DISH, stating: “[t]est results showed that the exposure of DISH residents to VOCs was similar to that of the general U.S. population, and that exposure to certain contaminants was no higher than that of the general U.S. population.”²⁸⁵ Consistent with the report, the summary further remarks that the study found that the only residents who had higher levels of benzene in their blood were smokers and noted that cigarette smoke

²⁸² *Id.* at 11.

²⁸³ *Id.* at 12.

²⁸⁴ *Id.* at 2.

²⁸⁵ *A Commitment to Air Quality*, *supra* note 34.

contains benzene.²⁸⁶ There is no mention of the fact that the study reveals information relevant only to a small window of time coinciding with the testing, or the need for additional follow up and analysis.

In sum, given the State's very limited effort to investigate health effects in relation to possible exposure to gas industry emissions, emissions in excess of AMCVs identified during mobile monitoring, limited stationary air quality monitoring, questions concerning the adequacy of the scope of chemicals evaluated, limited knowledge about the toxic chemicals employed in the gas industry, uncertainty about "safe" levels especially for children, and possible interactive effects, we have no sound data by which to dismiss health concerns raised by residents. The following sections consider the extent to which the CAA permitting programs are structured to protect public health in urban areas on the Barnett Shale.

II. OIL AND GAS FACILITIES, DISPERSED OPERATIONS, SLIPPING UNDER FEDERAL "MAJOR SOURCE" REGULATIONS

Gas industry operations have been largely slipping under EPA regulations because they do not qualify as "major sources" of air pollution.²⁸⁷ Although connected by pipelines, oil and gas facilities are often spread out over large areas where well sites are dispersed and far from natural gas processing plants.²⁸⁸ Although these facilities have been subject to some state and federal regulation as minor sources, as discussed in more detail below, these facilities have been able to proliferate in urban areas in Texas with little regulatory oversight and no offsetting emission reductions as would be required for the location of major sources in areas that fail to meet the National Ambient Air Quality Standards (NAAQS).

The CAA focuses on "major sources" and establishes increasingly difficult requirements for these sources depending on the level of compliance with the NAAQS.²⁸⁹ The CAA requires the EPA to promulgate NAAQS for six common air pollutants, known as "criteria pollutants," including particulate matter, ground-level ozone, carbon

²⁸⁶ *Id.*

²⁸⁷ Memorandum from William Wehrum, Acting Assistant Adm'r, U.S. ENVTL. PROT. AGENCY, to Reg'l Adm'r 2-3 (Jan 12, 2007) (discussing source determinations for oil and gas industries).

²⁸⁸ *Id.*

²⁸⁹ TEX. COMM'N ON ENVTL. QUALITY, AIR POLLUTION CONTROL, HOW TO CONDUCT A POLLUTION CONTROL EVALUATION (2011), *available at* http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/airpoll_guidance.pdf. *See also* Texas Clean Air Act, TEX. HEALTH & SAFETY CODE § 382.001 (West 2011).

monoxide, sulfur oxides, nitrogen oxides, and lead.²⁹⁰ Each state then has the primary responsibility of establishing a state implementation plan (SIP) and ensuring that its air quality meets the NAAQS.²⁹¹ The 1990 Amendments to the CAA established detailed requirements for “nonattainment areas.”²⁹² Technology-based standards for new and modified major sources differ by geographic area depending on how well the air quality conforms to NAAQS.²⁹³ To avoid a construction moratorium on new “major stationary sources” of pollution and on “major modifications” of existing major sources in nonattainment areas,²⁹⁴ states must demonstrate “reasonable further progress” to meeting the NAAQS which may include emission reductions from existing sources.²⁹⁵ The EPA classifies nonattainment areas based on the severity of the area’s pollution, from “marginal” to “extreme.”²⁹⁶ In addition to more stringent technology-based requirements, sufficient offsetting emissions reductions must be obtained so that the emission levels from the offsets and the plan provisions represent reasonable further progress from the pre-permit levels.²⁹⁷ Emission reductions must assure that the total tonnage of increased emissions from the new or modified “major sources” are offset by an equal or greater reduction in emissions of the same air pollutant from the same or other sources in the area.²⁹⁸ In ozone nonattainment areas, the CAA mandates increasingly stringent offset ratios as the ozone classification increases.²⁹⁹

Title V of the CAA requires all “major sources” of air pollution to obtain an operating permit.³⁰⁰ The EPA defines a major source to include “any stationary facility or source of air pollutants” which exceeds certain threshold emission levels.³⁰¹ Multiple pollutant-emitting activities can be aggregated together and considered a single stationary

²⁹⁰ Clean Air Act (“CAA”), 42 U.S.C. § 7409 (1977). See also *What Are the Six Common Air Pollutants*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/air/urbanair/> (last updated Apr. 20, 2012).

²⁹¹ 42 U.S.C. § 7410(a)(1) (2006); 42 U.S.C. § 7407(a) (2006).

²⁹² 42 U.S.C. §§ 7501-08 (2006).

²⁹³ TEX. COMM’N ON ENVTL. QUALITY, FACT SHEET – PSD AND NONATTAINMENT, available at <http://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheet-psd-na.pdf>.

²⁹⁴ 42 U.S.C. § 7410(a)(2)(I) (2006).

²⁹⁵ 42 U.S.C. § 7502 (b)(3). In areas that have already achieved the NAAQS, a state must also implement a Prevention of Significant Deterioration (PSD) program to ensure that the air quality is not affected by the new source. *Prevention of Significant Deterioration (PSD) Basic Information*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/NSR/psd.html>.

²⁹⁶ 42 U.S.C. § 7511(a) (2006).

²⁹⁷ 42 U.S.C. § 7503(a)(1)(A) (2006).

²⁹⁸ 42 U.S.C. § 7503(c)(1) (2006).

²⁹⁹ CAA § 182(a)(4), (b)(5), (d)(2); 42 U.S.C. § 7511a(a)(4), (b)(5), (d)(2) (2006).

³⁰⁰ 42 U.S.C. § 7661a(a); *Definitions of Select Permitting Terms*, U.S. ENVTL. PROT. AGENCY, available at <http://www.epa.gov/region9/air/permit/defn.html#stationarysource>.

³⁰¹ 40 C.F.R. § 71.2 (2010).

source under Title V if they: (1) are under common control; (2) are located on one or more contiguous or adjacent properties; and (3) belong to the same major industrial grouping.³⁰² Pollutant-emitting activities are otherwise considered separate stationary sources and their emissions cannot be aggregated to meet the major source threshold for which a Title V permit is required.³⁰³ Dispersed oil and gas facilities do not meet the regulatory requirements for aggregation.³⁰⁴ In the oil and gas industry, land ownership and control are complicated by subsurface and surface property rights often owned and leased by different entities and by drilling and exploration activities contracted to third parties.³⁰⁵ Operators of production facilities typically control only the surface area necessary to operate the physical structures used in oil and gas production, and not the land between the drill sites.³⁰⁶

The Sixth Circuit Court of Appeals recently rejected the EPA's attempt to aggregate emissions from separately located oil and gas facilities pursuant to the EPA's Title V permitting program.³⁰⁷ In that case, the wells themselves were located over an area of approximately forty-three square miles at varying distances from the plant—from five hundred feet to eight miles away—and the company did not own the property between the individual well sites or the property between the wells and the plant.³⁰⁸ None of the well sites shared a common boundary with each other, nor did any of the well sites share a common boundary with the production plant.³⁰⁹ The closest flare (used to burn off natural gas waste to relieve pressure on the gas collection equipment) was located approximately one half-mile from the plant.³¹⁰ If the emissions of sulfur dioxide from the plant and any one production well could have been combined, they would have exceeded the regulatory threshold to qualify as a “major source.”³¹¹ The EPA considered the “nature of the relationship between the facilities” and the “degree of interdependence between them,” concluding that the plant,

³⁰² See, e.g., 40 C.F.R. § 52.21(b)(5) (1978) (noting a “stationary source” includes “any building, structure, facility, or installation which emits or may emit a regulated [air] pollutant.”). See also 40 C.F.R. § 71.2 (2010).

³⁰³ *Summit Petroleum Corp. v. EPA*, 2012 U.S. App. LEXIS 16345, at *7 (6th Cir. 2012) (rejecting final EPA determination that facilities were “adjacent” because they were “truly related,” and rejecting aggregation of sour gas wells and sweetening plant into a single and major source under the Title V permitting plan).

³⁰⁴ *Id.*

³⁰⁵ Memorandum from Wehrum, *supra* note 287, at 2-3.

³⁰⁶ *Id.*

³⁰⁷ *Summit Petroleum Corp.*, 2012 U.S. App. LEXIS 16345, at *2.

³⁰⁸ *Id.* at 3.

³⁰⁹ *Id.*

³¹⁰ *Id.*

³¹¹ *Summit Petroleum Corp.*, 2012 U.S. App. Lexis 16345, at *2.

wells, and flares worked together as a single unit that produced a single product and that there was no evidence that the emissions sources were not “truly interdependent.”³¹² However, the Sixth Circuit reasoned that the plain meaning of the term “adjacent” required physical proximity, and rejected the EPA’s conclusion that, given this functional interrelationship, Summit’s facilities should be considered “one emission source.”³¹³

In addition to requirements related to criteria pollutants, major sources are also subject to technology-based standards and residual risk review for certain “hazardous air pollutants.”³¹⁴ Under CAA section 112(n)(4)(A), governing the regulation of hazardous air pollutants, aggregation of emissions from any oil and gas exploration or production wells and equipment for the purpose of major source determination is specifically prohibited:

[E]missions from any oil or gas exploration or production well (with its associated equipment) and emissions from any pipeline compressor or pump station shall not be aggregated with emissions from other similar units, whether or not such units are in a contiguous area or under common control, to determine whether such units or stations are major sources, and in the case of any oil or gas exploration or production well (with its associated equipment), such emissions shall not be aggregated for any purpose under this section.³¹⁵

As discussed in detail in the following sections, depending on emission levels, dispersed oil and gas facilities are still subject to permitting and performance requirements. The EPA may adopt New Source Performance Standards for both minor and major sources,³¹⁶ and the State, pursuant to its SIP, may also regulate minor sources.³¹⁷ All new or modified pollution sources must receive a pre-construction permit under an approved SIP.³¹⁸ Depending on the level of emissions,

³¹² *Id.* at 16-17.

³¹³ *Id.* at 17.

³¹⁴ Section 112 of the Clean Air Act designates over 100 pollutants as hazardous and directs the Administrator of the EPA to list all categories of major sources of hazardous air pollutants and to establish emissions standards. 42 U.S.C. § 7412(b)(1), (c)(1), (d)(2) (2006).

³¹⁵ 42 U.S.C. § 7412(n)(4) (2006). *See also* 40 CFR 63.761 (20) (defining “major source”).

³¹⁶ 42 U.S.C. § 7411 (2006).

³¹⁷ *Texas v. EPA*, 690 F.3d 670 (5th Cir. 2012). *See also* TEX. COMM’N ON ENVTL. QUALITY, MAJOR NEW SOURCE REVIEW – APPLICABILITY DETERMINATION 1 (2008), *available at* http://www.tceq.state.tx.us/assets/public/permitting/air/Guidance/NewSourceReview/fnsr_app_de term.pdf.

³¹⁸ 40 C.F.R. § 51.160 (2011). *See also* TEX. COMM’N ON ENVTL. QUALITY, FACT SHEET - AIR QUALITY PERMITTING (2012), *available at* http://www.tceq.texas.gov/assets/public/permitting/air/factsheets/permit_factsheet.pdf. There is a category for de minimis facilities where no registration or authorization is required, there are

oil and gas facilities may be authorized by a permit by rule, a standard permit, a case-by-case New Source Review (NSR) permit, or a combination of these authorizations.³¹⁹ However, review is much more limited for dispersed facilities than for major sources, and there are no requirements for offsetting emissions in areas like Dallas-Fort Worth that are already failing to meet National Ambient Air Quality Standards.

III. THE NEW FEDERAL RULES, LIMITED SCOPE

Following a lawsuit with several environmental groups, the EPA recently adopted the first federal limits on air emissions from oil and gas exploration and production operations focusing specifically on hydraulic fracturing operations.³²⁰ These rules create New Source Performance Standards (NSPS) for new and modified sources of certain criteria pollutants, and national emission standards for hazardous air pollutants (NESHAPS) for major sources.³²¹ The EPA expects the new rules to improve outdoor air quality, protect against cancer risk from air toxics emissions, and reduce health effects associated with exposure to ground-level ozone (smog), including increased asthma attacks, hospital admissions and emergency room visits, and premature death.³²² Although a significant step forward, the new rules do not address all potentially toxic chemicals associated with gas industry emissions, all emissions sources associated with gas industry operations, cumulative risk, or malfunctions in urban areas.

The new rules create NSPS for volatile organic compounds (VOCs) and sulfur dioxide from natural gas processing plants and for VOCs from hydraulic fracturing, pneumatic controllers, compressors, and storage tanks.³²³ The new rules also require “reduced emission

“Permit by Rule and Standard Permit” authorizations where facilities are required to meet standard criteria, and there are “New Source Review Permits” where technical review includes an analysis of the off-property health impacts (using effects screening levels as guidance, as discussed below), a determination of best available control technology, and applicability of any source category or emission-based state and federal regulation. *Id.*

³¹⁹ 35 Tex. Reg. 6937, 6938 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (proposed Aug. 13, 2010).

³²⁰ U.S. ENVTL. PROT. AGENCY, OVERVIEW OF FINAL AMENDMENTS TO AIR REGULATIONS FOR THE OIL AND NATURAL GAS INDUSTRY, *available at* <http://www.epa.gov/airquality/oilandgas/pdfs/20120417fs.pdf> (last visited May 10, 2013) [hereinafter EPA OVERVIEW OF FINAL AMENDMENTS].

³²¹ *Id.* (including: a new source performance standard for VOCs; a new source performance standard for sulfur dioxide; an air toxics standard for major sources of oil and natural gas production; and an air toxics standard for major sources of natural gas transmission and storage).

³²² *Id.*

³²³ EPA OVERVIEW OF FINAL AMENDMENTS, *supra* note 320. *See also* U.S. ENVTL. PROT. AGENCY, OIL AND NATURAL GAS SECTOR: NEW SOURCE PERFORMANCE STANDARDS AND NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS REVIEW, FINAL RULE 2

completions” (RECs), also known as “green completions,” that use special equipment to separate the gas and liquid hydrocarbons from the fracking fluids and other materials that flow back out of the well during an initial three-to-ten day period.³²⁴ Some states, such as Wyoming and Colorado, already require green completions, as do some cities, including Fort Worth and Southlake on the Barnett Shale.³²⁵ The RECs are expected to yield a nearly 95 percent reduction in VOCs emitted from new hydraulically fractured gas wells,³²⁶ but will only apply to wells fractured or refractured after January 1, 2015.³²⁷ The new rules revise NESHAPS for certain major sources at oil and gas production facilities and natural gas transmission and storage.³²⁸ The NESHAPS lower the leak detection for valves and establish Maximum Achievable Control Technology (MACT) that creates performance standards for emissions of benzene, ethylbenzene, toluene, and xylene (“BTEX”) chemicals for “small” glycol dehydration units.³²⁹

The NSPS focus on criteria pollutants and apply only to new and modified sources.³³⁰ Although the NSPS are expected to have significant health benefits, including additional “co-benefits” of reducing hazardous air pollutants,³³¹ the standards are driven by considerations of cost and available technology, not public health.³³²

(2012), available at <http://www.epa.gov/airquality/oilandgas/pdfs/20120417finalrule.pdf> [hereinafter PREPUBLICATION VERSION OF FINAL RULE] (the prepublication version of the Final Rule, 40 C.F.R. Part 63, signed by EPA Administrator Lisa P. Jackson on April 17, 2012).

³²⁴ *Id.* at 2-3.

³²⁵ *Id.*

³²⁶ EPA OVERVIEW OF FINAL AMENDMENTS, *supra* note 320.

³²⁷ *Id.* Until that time, newly fractured and refractured wells are only required to use flares to reduce emissions of VOC's. *Id.*

³²⁸ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 22. See also Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 76 Fed. Reg. 52,738, 52,744 (Aug. 23, 2011) (codified at 40 C.F.R. pt. 60 and 40 C.F.R. pt. 63) (“The oil and natural gas operations can generally be separated into four segments: (1) Oil and natural gas production, (2) natural gas processing, (3) natural gas transmission and (4) natural gas distribution.”).

³²⁹ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 18-19, 68. See also *id.* at 9 (defining BTEX). Glycol dehydration units are used in treating natural gas to remove water vapor. TEX. COMM’N ON ENVTL. QUALITY, 2011 EMISSIONS INVENTORY GUIDELINES APPENDIX A—TECHNICAL SUPPLEMENTS A-3 (Feb. 2012).

³³⁰ 40 C.F.R. § 51.160 (2011).

³³¹ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 19.

³³² In setting or revising a performance standard, CAA § 111(a)(1) provides that performance standards are to “reflect the degree of emission limitation achievable through the application of the BSER [best system of emission reduction] which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.” PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 9, 26. The EPA first identifies available technology and its practical effectiveness, then evaluates its costs, secondary air benefits or “disbenefits” resulting from energy requirements, and nonair quality impacts. 76 Fed. Reg. 52738 at 52741

The EPA specifically recognized that air quality changes associated with air toxics and VOC reductions can be highly localized,³³³ but there was no analysis of the possibility of hot spots in localized areas. The EPA implicitly recognized the possibility in noting that it was unable to model health benefit estimates due to uncertainties about future locations of oil and gas emissions.³³⁴ As discussed in detail below, some risk assessment and modeling was performed for the NESHAPS, but the analysis still did not take into consideration cumulative emissions or the possibility of hot spots in urban areas. The review was necessarily limited to consideration of chemicals identified as “hazardous air pollutants” which do not include all potentially toxic emissions associated with gas industry operations.

Relatively few chemicals are regulated as hazardous air pollutants. The 1970 Clean Air Act required the EPA to prepare a list of pollutants “which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness.”³³⁵ Employing this health-based standard, the EPA listed only eight hazardous air pollutants during the following twenty years and many of those were listed only after litigation against the agency.³³⁶ Congress itself identified 189 substances as hazardous air pollutants in the 1990 Amendments of the CAA.³³⁷ The difficulty in identifying hazardous air pollutants for health-based regulation has been attributed in part to the difficulty of resolving uncertainty in the face of significant economic disruption and regulating pollutants that threaten to cause very grave health effects at minimal exposure levels.³³⁸ Many hazardous air pollutants are considered to be “non-threshold” pollutants, meaning that no human exposure to them is safe, and there is limited data and high uncertainty in determining a “safe” exposure.³³⁹ Depending on risk management goals, some ambient standards may have to be so stringent that the controls are exceedingly expensive, and, in some cases, not yet known.³⁴⁰

Although the 1990 amendments required the EPA to periodically review the list and add other substances, and despite a multitude of new

³³³ EPA OVERVIEW OF FINAL AMENDMENTS, *supra* note 320, at 3.

³³⁴ *Id.*

³³⁵ *Sierra Club v. EPA*, 353 F.3d 976, 979 (D.C. Cir. 2004).

³³⁶ Victor Flatt, *Gasping for Breath: The Administrative Flaw of Federal Air Pollution Regulation and What we can Learn from the States*, 34 *ECOLOGY L. Q.* 102, 114 (2007).

³³⁷ *Id.*

³³⁸ PLATER ET AL., *ENVIRONMENTAL LAW AND POLICY: NATURE, LAW AND SOCIETY* 575 (3rd ed. 2004).

³³⁹ *Id.*

³⁴⁰ *Id.*

chemicals on the market,³⁴¹ the EPA has not added any new chemicals to the list in the last two decades.³⁴² After some delisting activity, the hazardous air pollutant list was reduced to 187 substances.³⁴³ According to a 2006 GAO Report, “[the] EPA has not met the act’s requirement to review and update, as appropriate, the list of regulated air toxics, despite evidence that potentially harmful chemicals remain unregulated.”³⁴⁴ A comparison of just some of the volatile chemicals used in gas industry operations to the EPA’s list of hazardous air pollutants reveals many toxic chemicals not regulated under the CAA.³⁴⁵ Chemicals associated with gas industry operations yet falling outside regulatory purview include endocrine disrupting chemicals.³⁴⁶ As discussed above, endocrine disrupting chemicals can be problematic at very low levels of exposure and can have unpredictable delayed, life-long effects on individuals and their offspring.³⁴⁷ Chemicals that interfere with endocrine function have been found to affect male and female reproduction, neuroendocrinology, thyroid function, metabolism and obesity, breast development, breast cancer, prostate cancer, and cardiovascular endocrinology.³⁴⁸ New research suggests that exposure to endocrine-disrupting chemicals may play a role in both the diabetes and the obesity epidemics in the United States.³⁴⁹

For those chemicals that have been identified as hazardous air pollutants, in the 1990 Amendments to the CAA, Congress largely abandoned its attempt to establish standards through a health-based assessment, and retained only a limited “residual risk” assessment as a

³⁴¹ Roberto Binetti et al., *Exponential Growth of New Chemicals and Evolution of Information Relevant to Risk Control*, 44 ANN IST SUPER SANITÀ 13-15 (2008), available at http://www.iss.it/binary/publ/cont/ANN_08_04%20Binetti.1209032191.pdf.

³⁴² *Id.* at 15. See also U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 74.

³⁴³ Flatt, *supra* note 336, at 114.

³⁴⁴ U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 74, at 4.

³⁴⁵ Colborn et al., *supra* note 198, at 1039, 1052 tbl 3. Table 3 was compared to the TDEX spreadsheet of products, chemicals and their health effects to isolate the chemicals that are volatile. *Multi-State Spreadsheet, TDEX, available at* <http://www.endocrinedisruption.com/files/MultistateSpreadsheet3-29-11States.xls>. Volatile chemicals identified in gas industry operations were then compared to EPA’s Hazardous Air Pollutant list. *The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants*, U.S. ENVTL. PROT. AGENCY, available at <http://www.epa.gov/ttnatw01/orig189.html>.

³⁴⁶ *Id.*

³⁴⁷ *Id.* at 1049 (identifying approximately 60% of these chemicals studied as endocrine disrupting chemicals).

³⁴⁸ EVANTHIA DIAMANTI-KANDARAKIS, ET AL., ENDOCRINE-DISRUPTING CHEMICALS: AN ENDOCRINE SOCIETY SCIENTIFIC STATEMENT 1 (2009), available at http://www.endo-society.org/journals/scientificstatements/upload/edc_scientific_statement.pdf.

³⁴⁹ Thaddeus Schug, *NTP Workshop Investigates Links between Chemicals and Obesity*, NAT’L INST. OF ENVTL. HEALTH SCI. (Feb. 2011), <http://www.niehs.nih.gov/news/newsletter/2011/february/science-ntp-workshop/>.

secondary plan.³⁵⁰ In addition to requiring technology-based standards for major sources and major modifications based on the maximum achievable control technology (MACT),³⁵¹ Congress required that the EPA consider whether residual risks remain that warrant more stringent standards for the MACT-controlled sources in a given category or subcategory “in order to provide an ample margin of safety” to protect public health or prevent an adverse environmental effect.³⁵² As interpreted in practice by the EPA, this approach to regulating toxic emissions has also met with limited success.³⁵³

The CAA requires that the EPA “promulgate” health-based standards to regulate residual risk unless the technology based-standard reduces “lifetime excess cancer risks to the individual most exposed to emissions from a source in the category or subcategory to less than one in one million.”³⁵⁴ The EPA’s interpretation of “promulgate,” upheld by the Court of Appeals for the D.C. Circuit in 2008, is that the agency is obliged to conduct a rulemaking to consider residual risks for sources that emit carcinogens, but is not required to actually adopt substantive standards at any particular risk level.³⁵⁵ Left undisturbed by the 1990 Amendments to the CAA, however, the EPA established some benchmarks for setting standards.³⁵⁶ The EPA’s policy approach before the 1990 amendments, defined the upper end of the range of acceptability as approximately a one in ten thousand estimated risk of contracting cancer following a lifetime exposure at the maximum, modeled long-term ambient concentration of a pollutant.³⁵⁷ The EPA explained that it was not adopting “a rigid line for acceptability,” and that it intended to consider a series of other health measures and factors, including cumulative risks:

³⁵⁰ NRDC v. EPA, 529 F.3d 1077, 1080 (D.C. Cir. 2008) (citations omitted).

³⁵¹ 42 U.S.C. § 7412 (2006). See also *Sierra Club v. EPA*, 353 F.3d 976, 980 (D.C. Cir. 2004). In setting the technology-based standards, EPA first identifies the minimum MACT “floor” by examining the performance of the best performing sources in a category. Next, the EPA sets even more stringent standards if they are achievable in light of costs and other factors. These “beyond-the-floor” standards are distinct from the risk-based limits to be set eight years later. *Id.*

³⁵² *Sierra Club*, 353 F.3d at 980 (citing 42 U.S.C. § 7412(f)(2)(A) (2006)). See also U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 74 (although the analysis is required within eight years of promulgating technology based standards, EPA now performs both the residual risk assessment and the technology review during one concurrent process).

³⁵³ U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 74, at 1.

³⁵⁴ 42 U.S.C. § 7412(f)(2)(A) (2006).

³⁵⁵ NRDC v. EPA, 529 F.3d 1077, 1081, 1083 (D.C. Cir. 2008).

³⁵⁶ The statute specifically provides that it “shall not be construed as affecting, or applying to the Administrator’s interpretation of this section, as in effect before the date of enactment of the Clean Air Act Amendments of 1990.” 42 U.S.C. § 7412(f)(2)(A) (2006) (citing 54 Fed. Reg. 38,044 (Sept. 14, 1989)).

³⁵⁷ 54 Fed. Reg. 38,044 (Sept. 14, 1989).

These include the overall incidence of cancer or other serious health effects within the exposed population, the numbers of persons exposed within each individual lifetime risk range and associated incidence within, typically, a 50 km exposure radius around facilities, the science policy assumptions and estimation uncertainties associated with the risk measures, weight of the scientific evidence for human health effects, *other quantified or unquantified health effects, effects due to co-location of facilities, and co-emission of pollutants.*³⁵⁸

In practice, however, according to the 2006 review by the GAO, the EPA has limited the scope of its residual risk program only to those emission points within facilities that must comply with the MACT standard, even where other emission points at the same facility may also release toxic emissions.³⁵⁹

In its recent rulemaking for gas industry operations, the EPA completed both a technology-based assessment, and a residual risk assessment in one contemporaneous rulemaking for gas industry operations, but did not consider cumulative emissions. The residual risk assessment was narrowly focused on the incremental emissions from the major source category subject to the regulation. The EPA did evaluate a fifty kilometer exposure radius around facilities, but estimated only the “incremental individual lifetime cancer risks associated with emissions from the source category,” with no evaluation of cumulative emissions from “area sources” not subject to the MACT standard.³⁶⁰ Although the EPA referred to its analysis as a “facility-wide risk assessment,” the EPA explained that emission sources that were not likely to be considered major sources were excluded from consideration.³⁶¹

The EPA estimated “incremental individual lifetime cancer risks associated with emissions from the source category” as the sum of the risks for each of the carcinogenic HAP emitted by the modeled source, then estimated cancer incidence and the distribution of individual cancer risks by summing these risks.³⁶² The EPA concluded that the total estimated cancer incidence “from this source category,” would subject 120,000 people to cancer risks at or above one in one million, the equivalent of one case every fifty years.³⁶³ Although the risk exceeded

³⁵⁸ *Id.* (emphasis added).

³⁵⁹ U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 74, at 11.

³⁶⁰ 76 Fed. Reg. 52738, 52771 (Aug. 23, 2011) (codified at 40 C.F.R. pt. 60 and 40 C.F.R. pt. 63). *See also* PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 29, 75.

³⁶¹ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, 218-19 (responding to comment concerning additional sources not addressed by the rule).

³⁶² 76 Fed. Reg. at 52771.

³⁶³ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 76.

the statutory standard of one in one million, the EPA did not evaluate cumulative risks or adopt health-based standards. The EPA concluded that “the level of risk associated with the Oil and Natural Gas Production source category MACT standards is acceptable.”³⁶⁴

The EPA also evaluated acute exposure risks scenarios related to hazardous air pollutants. The CAA does not identify specific non-cancer exposure risk levels. To assess risk of non-cancer health effects from chronic exposures, the EPA summed risks for each of the hazardous air pollutants that affect a common target organ system, identified a total organ specific hazard index for comparison with reference values from the EPA’s IRIS database, the ATSDR, and the California EPA’s Chronic Reference Exposure Levels (REL).³⁶⁵ The EPA concluded that the REL for benzene had been exceeded, but found this risk acceptable because the modeling uses worst-case scenarios and because of the “generally sparse populations” near the facilities with the highest estimated one-hour exposures.³⁶⁶ The EPA identified thirteen cases in the source category (out of approximately a thousand facilities) where the REL is exceeded by more than a factor of two.³⁶⁷ “Since margins of safety are incorporated to address data gaps and uncertainties, exceeding the acute REL does not automatically indicate an adverse health impact.”³⁶⁸ The EPA concluded that there was no excessive risk, and defaulted to the technology-based “MACT standards.”³⁶⁹

The EPA specifically noted that “oil and gas production facilities are typically not sited in urban areas.”³⁷⁰ However, the risk assessment does not account for the location of new facilities subject to regulation, changes in neighboring land uses, or cumulative emissions. Moreover, to the extent that gas industry operations do locate in urban areas, the community will also bear the burden of any leaks and malfunctions. The EPA noted that the Clean Air Act does not require that emissions during periods of malfunction³⁷¹ be factored into development of the

³⁶⁴ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 79 (emphasis added).

³⁶⁵ 76 Fed. Reg. at 52772; PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 12-13 (defining REL and TOSHI). *Id.* at 77 (discussing the REL).

³⁶⁶ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 78

³⁶⁷ *Id.* at 77.

³⁶⁸ 76 Fed. Reg. at 52,772.

³⁶⁹ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 65.

³⁷⁰ *Id.* at 219.

³⁷¹ EPA regulations define malfunction under 40 C.F.R. § 63.2 (2010) as “sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or unusual manner” Under 40 CFR § 60.2 (2010), the EPA defines the term as “any sudden, infrequent, and not reasonably preventable

standards.³⁷² The EPA explains that, while “continuous” standards are required, the EPA must also account for the practical realities of technology and incorporate some level of flexibility.³⁷³ There is an affirmative defense to civil penalties for violations that are proven to be beyond the control of the source.³⁷⁴

The EPA recognized that compliance assurance for this industry can be very difficult and burdensome given widely dispersed emission sources.³⁷⁵ In an effort to facilitate monitoring, the new rules require electronic submission of select performance test data using a standardized format and a publicly accessible database and self-certification of compliance.³⁷⁶ However, the EPA decided not to take the additional step of requiring publicly accessible electronic submission of annual compliance reports (noting the lack of reporting programs or electronic databases that may be used for this purpose without significant modification).³⁷⁷ And while the EPA’s rules require periodic reporting of important compliance and safety events such as malfunctions,³⁷⁸ there is no requirement that this type of information be reported to an electronically available and publicly accessible database.³⁷⁹ Although initially proposed, the EPA also ultimately decided not to require industry-funded third-party verification to assure compliance.³⁸⁰

Defending its narrow risk assessment, the EPA explained that area sources in urban areas are regulated under CAA Section 112(k) and the Urban Air Toxic Strategy. Section 112(c)(3) and 112(k)(3)(B) of the CAA requires the EPA to identify at least thirty hazardous air pollutants

failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner.”)

³⁷² PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 96 (“The EPA has determined that CAA sections 111 and 112 do not require that emissions that occur during period of malfunction be factored into development of the CAA section 111 or 112 standards.”).

³⁷³ *Id.* at 102.

³⁷⁴ *Id.*

³⁷⁵ Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Review, 76 Fed. Reg. 52,738, 52,750 (Aug. 23, 2011) (codified at 40 C.F.R. pt. 60 and 40 C.F.R. pt. 63); PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 109.

³⁷⁶ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 206, 233; 40 C.F.R. § 63.775(g) (2011) (requiring submission of required performance tests and creating a special process where the reporting may disclose confidential business information).

³⁷⁷ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 233.

³⁷⁸ 40 C.F.R. § 63.775(e) (2011) (annual or semi-annual reporting required).

³⁷⁹ PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 493, 494; 40 C.F.R. § 63.775(b)(6) (2011) (requiring the number, duration, and brief description of each type of malfunction, as well as any actions taken to minimize emissions and correct the malfunction).

³⁸⁰ 76 Fed. Reg. at 52,750; PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 109.

which present the greatest threat to public health in the largest number of urban areas as a result of emissions from area sources, and to ensure that ninety percent of the emissions of the area source of hazardous air pollutants are subject to regulation.³⁸¹ This strategy again relies on a technology-based approach—standards based on generally available control technologies (GACT) or management practices (“methods, practices, and techniques which are commercially available and appropriate . . . considering economic impacts and the technical capabilities of the firms to operate and maintain the emissions control systems”), not comprehensive health-based standards.³⁸² The EPA set standards for area source oil and gas production facilities in 2007, but only for TEG dehydration units (the most significant source at that time),³⁸³ not for any other type of dehydration unit, emission sources, or equipment leaks.³⁸⁴ As discussed in more detail in section IV below, the EPA also relies on state and local government regulation as part of its Urban Air Toxic Strategy, but Texas has not been a particularly strong partner, and regulating hazardous air pollutants in urban areas remains complex at all levels of government.

IV. EPA’S URBAN AIR TOXIC STRATEGY, STATE REGULATION STANDARDS AND UNCERTAINTY

In the 1990 Amendments to the CAA, Congress specifically recognized that hazardous air pollutants “may individually or in the aggregate” present significant health risks in urban areas, given the number of people exposed and the risks of carcinogenic and other adverse health effects from hazardous air pollutants. Congress expressed its concern that “the amount and complexity of air pollution brought about by urbanization, industrial development, and the increasing use of motor vehicles, has resulted in mounting dangers to the public health and welfare,” and announced that air pollution prevention and control would be “the primary responsibility of States and local governments.”³⁸⁵ Consistent with this statutory directive, the

³⁸¹ National Emission Standards for Hazardous Air Pollutants for Source Categories from Oil and Natural Gas Production Facilities, 72 Fed. Reg. 26, 27 (Jan. 3, 2007) (codified at 42 C.F.R. pt. 63) (Hazardous air pollutants associated with oil and natural gas production facilities include benzene, toluene, ethylbenzene and mixed xylenes and n-hexane, but only benzene is listed as one of the 30 area source hazardous air pollutants).

³⁸² *Id.* at 27 (citing CAA § 112(d)(5) and SEN. REP. NO. 101-228, at 171 (1989)). *See also* KEY ACTIVITIES, *supra* 76, at 3-4.

³⁸³ 72 Fed. Reg. at 28 (at the time these sources represented 47 percent of the nationwide urban area source benzene emissions).

³⁸⁴ “Other types of dehydration units or other emission points (e.g. equipment leaks) at area source oil and gas natural gas production facilities are not part of the affected source.” *Id.*

³⁸⁵ Clean Air Act, 42 U.S.C. § 7401 (2006).

EPA relies on state and local governments as a key component of its Urban Air Toxics Strategy.³⁸⁶

Many states have developed more comprehensive programs for the regulation of hazardous air pollution than the federal program.³⁸⁷ Based on an assessment of data from the Toxic Release Inventory (TRI), the states with the largest percentage of reductions in air toxics (Rhode Island, California, Massachusetts, Connecticut and Michigan) have reduced their air toxics to only nine to fourteen percent of their 1988 total.³⁸⁸ The State of Texas has reduced air toxics to less than forty percent of its 1988 total.³⁸⁹ Although the magnitude of this reduction may still seem relatively impressive, the TRI upon which the percentage reductions are calculated includes only emissions from certain industries and above certain emission levels.³⁹⁰ Oil and gas industries are not required to report emissions to the TRI.³⁹¹ Even without consideration of oil and gas industry emissions, Texas remains the largest producer of hazardous air pollutants.³⁹²

State governments have an important role, not just in the regulation of “hazardous air pollutants,” but also the regulation of other potentially toxics chemicals. Some states have significantly expanded the federal list of 187 hazardous air pollutants.³⁹³ California regulates 748 pollutants.³⁹⁴ Connecticut has established ambient air quality standards for 850 chemicals.³⁹⁵ However, the universe of potentially hazardous chemicals is vast and identifying “safe” levels for many chemicals is a difficult job at any level of government. Although there are an exponentially increasing number of chemicals on the market, there is no

³⁸⁶ NATIONAL AIR TOXICS PROGRAM, *supra* note 50, at ES-7. *See also* KEY ACTIVITIES, *supra* note 76, at 10 (identifying the year 2000 urban strategy report as the most recent report submitted to Congress; EPA failed to submit a second report as required by the CAA).

³⁸⁷ Flatt, *supra* note 336.

³⁸⁸ *Id.* at 170.

³⁸⁹ *Id.*

³⁹⁰ *Id.* (noting substantial reductions in air toxics based on data from the toxic release inventory (TRI)). *See also*

What is the Toxic Release Inventory?, U.S. ENVTL. PROT. AGENCY, <http://tri.supportportal.com/link/portal/23002/23021/Article/23159/What-is-the-Toxics-Release-Inventory> (last updated Mar. 4, 2013).

³⁹¹ *Is My Facility's Six-Digit NAICS Code a TRI-Covered Industry?*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/tri/coveredindustries/index.html> (last updated Nov. 2, 2012) (oil and gas industry not listed as an industry subject to TRI reporting).

³⁹² Flatt, *supra* note 336, at 170.

³⁹³ 42 U.S.C. § 7412(b) (2006) (list of hazardous air pollutants); 40 C.F.R. §§ 63.60–63.63 (2011) (revisions).

³⁹⁴ Flatt, *supra* note 336, at 125.

³⁹⁵ *Id.* at 129 (internal citations omitted).

comprehensive regulatory program to ensure basic toxicity tests.³⁹⁶ As of the most recent Integrated Urban Strategy Report,³⁹⁷ the EPA had not completed health effects assessments for many of the 33 hazardous air pollutants that it had identified as presenting the greatest threat to public health in the largest number of urban areas.³⁹⁸ Capacity to evaluate and regulate chemicals based on possibly interactive effects is even more limited. As discussed above, chemicals may have synergistic effects when combined, but there is limited information available from which to assess risks associated with cumulative exposure.³⁹⁹ The EPA has recognized significant gaps in methods, models and data that limit its ability to assess risks associated with cumulative exposure to mixtures of pollutants having different endpoints.⁴⁰⁰ The EPA has also acknowledged that associations between air pollution and increased illness and death in humans are unlikely to be the result of exposure to a single compound.⁴⁰¹

The EPA's Urban Air Toxics Strategy aims to reduce both cancer and non-cancer health risks, including birth defects and reproductive effects associated with air toxics from small industrial/commercial sources.⁴⁰² Yet, as discussed above, there is only limited statutory guidance for risks related to cancer. Determining appropriate risk levels for endocrine disrupting chemicals is even more complicated. A regulatory determination is required not only as to the appropriate level of protectiveness, but also as to the health impacts of concern. It is now understood that endocrine disruption may lead to health effects not historically regulated as "reproductive toxicity."⁴⁰³ Chemicals that interfere with endocrine function have been found to affect "male and female reproduction, neuroendocrinology, thyroid function, metabolism and obesity, breast development, breast cancer, prostate cancer, and

³⁹⁶ Wendy Wagner, *Using Competition-Based Regulation to Bridge the Toxics Data Gap*, 83 IND. L. J. 629, 634 (2008). See also Roberto Binetti et al., *supra* note 341, at 13-15.

³⁹⁷ KEY ACTIVITIES, *supra* note 76, at 10 (identifying the year 2000 urban strategy report as the most recent report submitted to Congress; EPA failed to submit a second report as required by the CAA).

³⁹⁸ NATIONAL AIR TOXICS PROGRAM, *supra* note 50, at 6-14 (EPA's Integrated Risk Information System (IRIS) lacks cancer risk estimates for 13 of these hazardous air pollutants, and lacks non-cancer risk estimates for about 2/3's of these chemicals).

³⁹⁹ *Id.* at 1-4.

⁴⁰⁰ *Id.*

⁴⁰¹ *Id.* at 6-22.

⁴⁰² *Id.* at ES-2.

⁴⁰³ DIAMANTI-KANDARAKIS ET AL., *supra* note 348, at 294; Rachael Rawlins, *Restructuring Regulatory Review of Endocrine-Disrupting Chemicals under California's Proposition 65: Lessons from the Review of BPA*, forthcoming NYU Survey of American Law.

cardiovascular endocrinology.⁴⁰⁴ Progress in identifying, and classifying endocrine disrupting chemicals has advanced since Congress identified hazardous air pollutants for regulation in 1990, however, our legal system still lags in its ability to evaluate and regulate these chemicals.⁴⁰⁵

The TCEQ has established “effects screening levels” (ESLs) based on health, welfare, odor, and vegetation for thousands of chemicals, including chemicals with limited toxicity data.⁴⁰⁶ The TCEQ explains that health-based ESLs for about eight hundred chemicals have been set based on occupational exposure limits divided by safety factors to protect the general population.⁴⁰⁷ Where occupational exposure limits are not available, the TCEQ has derived chemical-specific ESLs using standard toxicity methods and comparisons to chemicals with existing ESLs.⁴⁰⁸ Although the TCEQ has broad authority to make adjustments based on health concerns during the permitting process,⁴⁰⁹ the agency’s standard practice is to consider the ESLs as nonbinding guidelines. The ESLs are “short-term (hourly) and long-term (annual) health effects guidelines,” used to assess the protectiveness of chemical-specific emission rate limits on a facility-by-facility basis.⁴¹⁰ According to the TCEQ, if predicted airborne levels exceed an ESL that generally does not mean that the permit must be denied, but that more in-depth review is required to determine if “adverse health or welfare effects” are expected to occur.⁴¹¹ Terms and standards are left undefined. The

⁴⁰⁴ Evanthia Diamanti-Kandarakis et al., *Endocrine-Disrupting Chemicals: An Endocrine Society Scientific Statement*, 30 *ENDOCRINE REVS.* 293, 293 (2009).

⁴⁰⁵ See Rachael Rawlins, *Teething on Toxins: In Search of Regulatory Solutions for Toys and Cosmetics*, 20 *FORDHAM ENVTL. L. REV.* 8-9 (2009).

⁴⁰⁶ TCEQ GUIDANCE, *supra* note 102.

⁴⁰⁷ TEX. COMM’N ON ENVTL. QUALITY, USES OF EFFECTS SCREENING LEVELS (ESLS) AND AIR MONITORING COMPARISON VALUES (AMCVS) REVISED 1 (2010), *available at* <http://www.tceq.texas.gov/assets/public/implementation/tox/monitoring/amecv/document.doc> [hereinafter USES OF ESLs AND AMCVS].

⁴⁰⁸ *Id.*

⁴⁰⁹ See TEX. HEALTH & SAFETY CODE § 382.0518 (2011) (requiring for preconstruction permits no indication that emissions will “contravene the intent of this chapter, including protection of the public’s health and physical property”); TEX. HEALTH & SAFETY CODE § 382.085 (2011) (“a person may not cause, suffer, allow, or permit the emission of any air contaminant or the performance of any activity that causes or contributes to, or that will cause or contribute to, air pollution”); TEX. HEALTH & SAFETY CODE ANN. § 382.003(3) (2011) (“Air pollution” is broadly defined as “the presence in the atmosphere of one or more air contaminants or combination of air contaminants in such concentration and of such duration that (A) are or may tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property; or (B) interfere with the normal use or enjoyment of animal life, vegetation, or property.”).

⁴¹⁰ TCEQ GUIDANCE, *supra* note 102.

⁴¹¹ *Id.* at 11.

Galveston-Houston Association for Smog Prevention reports that the TCEQ routinely issues permits for sources whose emissions exceed the effects screening levels.⁴¹²

Given the uncertainty as to safe levels of toxic pollutants and potential interactive effects, safety is not assured even where predicted levels meet the TCEQ's ESLs. Moreover, as chemical specific, facility-by-facility, benchmarks, the ESLs do not directly account for cumulative emissions. The TCEQ explains that its method for deriving ESLs addresses cumulative and aggregate exposures by using layers of conservative assumptions and modeling that assumes that the facility is operating at full capacity at all times.⁴¹³ The TCEQ explains that, for chemicals other than carcinogens, the ESLs used in air permitting are seventy percent lower than the inhalation reference values that the TCEQ uses for air monitoring (where there are multiple sources of chemical exposure).⁴¹⁴ Although, for carcinogens, the TCEQ uses the same level of "conservatism" in both settings.⁴¹⁵ The TCEQ explains that:

[I]n the event that multiple facilities in an area emit the same chemicals, it is very unlikely that the maximum concentrations of emissions from other facilities emitting the same chemicals would occur at the same place. It is also very unlikely that the maximum concentrations of emissions from multiple chemicals from a facility and other facilities (if any) would occur at the same time and place.⁴¹⁶

In urban areas on the Barnett Shale, the possibility of "hot spots" may not be so unlikely given the presence of mobile sources emitting many of the same chemicals, the rapid proliferation of gas industry operations, and the potential for multiple wells on the same pad site. The risk has not been thoroughly evaluated, and may be especially elevated in urban areas where emissions occur in close proximity to places where children live and play.

Consistent with new statutory requirements, the TCEQ has identified some areas of concern for "hot spots" and has developed Air Pollutant

⁴¹² GALVESTON-HOUSTON ASSOC. FOR SMOG PREVENTION ET AL., A ROADMAP FOR REDUCING PETROCHEMICAL INDUSTRY TOXIC EMISSIONS IN THE LONE STAR STATE 3 (2008), available at <http://airalliance.ehclients.com/images/uploads/houton-we-have-a-problem-executive-summary.pdf>.

⁴¹³ Uses of ESLs and AMCVs, *supra* note 407. See also TCEQ GUIDANCE, *supra* note 102, at 5, 9.

⁴¹⁴ Uses of ESLs and AMCVs, *supra* note 407.

⁴¹⁵ *Id.*

⁴¹⁶ TCEQ GUIDANCE *supra* note 102, at 8-9.

Watch List Areas based on monitoring data⁴¹⁷ but the program has not been applied to gas industry emissions. In some cases, the TCEQ conducts a more focused review for chemicals of concern in these areas.⁴¹⁸ For certain types of projects with significant emissions (not including dispersed gas industry operations, as discussed below), agency policy is to require equivalent reductions where companies request an increase in emissions of a contaminant of concern in these areas.⁴¹⁹

V. NEW STATE RULES FOR THE BARNETT SHALE, OUTSTANDING ISSUES IN URBAN AREAS

Historically, gas industry operations have been operating with little oversight from the TCEQ. Most oil and gas sites in Texas have operated under a permit by rule (PBR) that does not require individual authorization, registration or submission of emissions inventories.⁴²⁰ Through a special inventory, the TCEQ has only recently begun a serious effort to determine the location, number, and type of emissions sources at oil and gas operations.⁴²¹ PBRs are intended for insignificant

⁴¹⁷ H.B. No. 1981, 2011 Leg., 82d Sess. (Tx. 2011) (codified at TEX. HEALTH & SAFETY CODE § 382.0161 (West 2011)). The legislation also requires the TCEQ to develop an online publically accessible database for reporting emissions events, and to provide information to legislators and representatives. *Id.*

⁴¹⁸ *About the Air Pollutant Watch List*, TEX. COMM'N ON ENVTL. QUALITY, available at http://www.tceq.texas.gov/toxicology/AirPollutantMain/APWL_index.html#announce (last updated Mar. 10, 2013). See also TEX. COMM'N ON ENVTL. QUALITY, MODELING AND EFFECTS REVIEW APPLICABILITY (2009), available at <http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/mera.pdf>; *Air Pollutant Watch List*, TEX. COMM'N ON ENVTL. QUALITY, <http://www.tceq.texas.gov/toxicology/AirPollutantMain/APWL.html> (last updated Mar. 10, 2013).

⁴¹⁹ TEX. COMM'N ON ENVTL. QUALITY, PERMIT APPLICATION GUIDANCE FOR COMPANIES LOCATED IN AN AIR POLLUTANT WATCH LIST AREA, available at <http://tceq.com/assets/public/implementation/tox/apwl/permitguid/permitguid.pdf> (last visited May 14, 2003).

⁴²⁰ BARNETT SHALE ENERGY EDUC. COUNCIL, SUMMARY OF TCEQ ACTIONS RELATING TO THE BARNETT SHALE 3, 13 (2009), available at <http://www.bseec.org/sites/all/pdf/airquality/08.pdf> (most facilities were operating under 30 TEX. ADMIN. CODE § 106.352 (2011)). See also TEX. COMM'N ON ENVTL. QUALITY, NORTH/CENTRAL TEXAS AND GULF COAST AERIAL SURVEYS OIL & GAS PARTNERSHIP UPDATE, available at http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/partnershipUpdate.pdf (last visited May 14, 2013) [hereinafter AERIAL SURVEYS].

⁴²¹ *Barnett Shale Emissions: Data Collection and Analysis*, TEX. COMM'N ON ENVTL. QUALITY, <http://www.tceq.texas.gov/airquality/barnettshale/bshale-data> (last visited May 13, 2013).

sources;⁴²² however, there has been no system in place for routine verification of emissions. Although there are some rules for recordkeeping,⁴²³ the operators themselves conduct testing and monitoring of their own facilities.⁴²⁴ Aerial surveys of the Gulf Coast and North Texas conducted by the TCEQ in 2007 revealed emission plumes with estimated emissions far in excess of the regulatory limits.⁴²⁵ Testing conducted by a private consultant for Fort Worth in 2010 also identified several sites that had emissions rates that exceeded the regulatory thresholds.⁴²⁶

The TCEQ recently adopted new rules for the 23 county area of the Barnett Shale. The new rules apply at sites with increased emissions, either where there are new or modified facilities that have the potential to increase emissions or where maintenance, start-up and shutdown activity at existing sites results in increased emissions.⁴²⁷ As for existing operations, the new rules require only registration and notification as to whether the site is operating under a PBR or a historical exemption by January 1, 2013.⁴²⁸ The new rules address dispersed industry operations by requiring all oil and gas facilities that are operationally dependent and located within a quarter mile from the new facilities, or groups of facilities that have the potential to increase

⁴²² 30 TEX. ADMIN. CODE § 106.1 (1996).

⁴²³ The general requirements for permits by rule state that records must maintain “sufficient information” to demonstrate compliance. 30 TEX. ADMIN. CODE § 106.8(c) (1996). New rules specific to the Barnett Shale, discussed below, contain more explicit record keeping requirements. 30 TEX. ADMIN. CODE § 106.352(j) (2011).

⁴²⁴ See FORT WORTH LEAGUE OF NEIGHBORHOODS, *supra* note 132.

⁴²⁵ Out of 20 sites evaluated through additional testing, 14 had emissions in excess of permit limitations, with VOC emissions at one facility at 574 tons per year (tpy) (over 20 times the limit) and several well over 100 tpy. AERIAL SURVEYS, *supra* note 420, at 14. The rule under which most of these facilities were purportedly operating limited emissions to 25 tpy of VOCs or sulfur dioxide and 250 tpy of nitrogen oxides and carbon monoxide. *Id.* at 31 (reprinting the then current rule 30 TEX. ADMIN. CODE § 106.352 (2011)).

⁴²⁶ Sites with excess emissions included a processing facility, three compressor stations, and one well pad.

E. RESEARCH GROUP & SAGE ENVTL. CONSULTING, *supra* note 50, at xiii.

⁴²⁷ Oil and Gas Handling and Production Facilities, 30 TEX. ADMIN. CODE § 106.352(i) (2011) (“After January 5, 2012, all emission from planned MSS activities and facilities must be considered for compliance with applicable limits of this section.”).

⁴²⁸ 36 Tex. Reg. 943, 944 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (eff. Feb. 18, 2011); Tit. 30, § 106.352(c), (f) (2011). See also Interoffice Memorandum from Steve Hagle, Deputy Dir., Office of Air, Tex. Comm’n on Env’tl. Quality, to Comm’rs, Tex. Comm’n on Env’tl. Quality (May 11, 2012), available at http://www.tceq.texas.gov/assets/public/legal/rules/rule_lib/proposals/12020106_pex.pdf (discussing a proposal that would extend the deadline for notifying the TCEQ about facility location and method of authorization to January 5, 2015).

emissions, to be permitted under one authorization.⁴²⁹ Although most sites will still be eligible for a PBR (level 1⁴³⁰ or level 2⁴³¹) or a standard permit,⁴³² the new rules generally require notice prior to construction or modification of a site (with exceptions for certain small operations).⁴³³ The new rules also include operating specifications and emissions limitations, as well as a list of best management practices.⁴³⁴

Although initially proposed on a statewide basis, the TCEQ reasoned that the Barnett Shale area has the greatest number of wells located in close proximity to the greatest number of residents.⁴³⁵ The agency explained that the changes are particularly critical for urban areas, and

⁴²⁹ 30 TEX. ADMIN. CODE § 106.352(b)(6) (2011). See also 36 Tex. Reg. 943, 949 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (eff. Feb. 18, 2011).

⁴³⁰ Tit. 30, § 106.352(b)(6)(F) (“All facilities at an OGS registered under this section must collectively emit less than or equal to 250 tons per year (tpy) of nitrogen oxides (NO_x) or carbon monoxide (CO); 15 tpy of particulate matter with less than 10 microns (PM₁₀); 10 tpy of particulate matter less than 2.5 microns (PM_{2.5}); and 25 tpy of volatile organic compounds (VOC), sulfur dioxide (SO₂), hydrogen sulfide (H₂S), or any other air contaminant except carbon dioxide, water, nitrogen, methane, ethane, hydrogen, and oxygen”).

⁴³¹ Tit. 30, § 106.352(h). “Emission Limitations. The OGS must have the potential of less than the following emissions after any recovery or controls. If control or recovery units are necessary to meet the limitations of this subsection, the devices must meet the specifications and requirements of Table 12. (1) Total VOCs are limited to 200 lb/hr and 250 tpy, and include the following: (A) 20 lb/hr and 10 tpy benzene; (B) 35 lb/hr toluene and 10 tpy toluene; (C) 19 lb/hr xylene and 10 tpy xylene; and (D) 3 lb/hr and 10 tpy formaldehyde. (2) Sulfur compounds are limited to the following: (A) 6 lb/hr and 15 tpy H₂S; and (B) 12 lb/hr and 50 tpy SO₂. (3) Products of combustion are limited to the following: (A) 53 lb/hr and 250 tpy NO_x; (B) 57 lb/hr and 250 tpy CO; and (C) 4 tpy PM₁₀/PM_{2.5}.”

⁴³² TEX. COMM’N ON ENVTL. QUALITY, TCEQ AIR RULES – OPPORTUNITY FOR INFORMAL COMMENT (2010), available at http://msmtx.com/assets/docs/2010_04_14_TCEQ_report_FINAL.pdf [hereinafter INFORMAL COMMENT ON AIR RULES]. See also TEX. COMM’N ON ENVTL. QUALITY, DETERMINING WHICH AUTHORIZATION IS MOST APPROPRIATE FOR OIL AND GAS OPERATIONS (2013), available at <http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/tables-og-scen.pdf>.

⁴³³ Tit. 30, § 106.352(c)(4)(c); TEX. COMM’N ON ENVTL. QUALITY, OIL AND GAS HANDLING AND PRODUCTION FACILITIES NOT REQUIRED TO NOTIFY OR REGISTER, available at <http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/fact-sheet-reg.pdf> (last visited May 14, 2013). The types of facilities which would not require notification or registration are typically wellheads, pump-jacks, Christmas trees, and metering stations. Emissions associated with the smallest of these facilities are mainly from fugitive components, while slightly larger facilities can have additional sources, such as separators, tanks, and/or engines. *Id.*

⁴³⁴ Tit. 30, §106.352.

⁴³⁵ 35 Tex. Reg. 6937 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (proposed Aug. 13, 2010) (“These changes are expected to be effective for new sites in the Barnett Shale on February 1, 2011 and across the remainder of the state on January 5, 2012”); 36 Tex. Reg. 943 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (eff. Feb. 18, 2011); Tit. 30, §106.352 (2011) (identifying Archer, Bosque, Clay, Comanche, Cooke, Coryell, Dallas, Denton, Eastland, Ellis, Erath, Hill, Hood, Jack, Johnson, Montague, Palo Pinto, Parker, Shackelford, Stephens, Somervell, Tarrant, and Wise).

that narrowing the scope of application would help ensure that the agency has the ability to implement the rules in an efficient and effective manner.⁴³⁶ However, in many ways, the new rules are not appropriately tailored to address concerns in growing urban areas. As explained below, the new rules do not fully address problems related to cumulative emissions, sensitive receptors, encroaching development, and existing facilities in urban areas.

The rules require a fifty-foot setback from a property line or sensitive receptor (whichever is closer),⁴³⁷ including any building that is in use as a single or multi-family residence, school, day-care, hospital, business, or place of worship.⁴³⁸ Fifty feet may seem very close, but the TCEQ explains that certain facilities and releases, “if small enough,” are protective and acceptable at small distances, and that there is an additional health effects review (explained further below).⁴³⁹ Even this minimum setback, however, is not uniformly applicable. The setback does not apply where the structure is “occupied or used solely by the owner or operator of the OGS facility, or the mineral rights owner of the property.”⁴⁴⁰ The TCEQ explains that “the lessor is assumed to have agreed to the placement of the facilities.”⁴⁴¹ The justification would appear to presume that the lessor has some understanding of potential health risks, which may or may not be accurate. The setback requirement does not apply to previously existing facilities, even if modified or replaced.⁴⁴² Regardless of the presence of sensitive receptors, the operator is required only to “consider” moving the facilities, “to the extent that good engineering practice will permit.”⁴⁴³ The setback is measured at the time that the equipment is installed, and oil and gas facilities will be “grandfathered” if other structures later encroach on the setback.⁴⁴⁴ The new rules do not require any periodic reconsideration and there is no restriction on new uses moving into the previously defined setback areas.⁴⁴⁵

⁴³⁶ 36 Tex. Reg. at 947. *See also* Interoffice Memorandum from Hagle, *supra* note 428.

⁴³⁷ 30 TEX. ADMIN. CODE § 106.352(e)(2) (2011). *See also* Interoffice Memorandum from Hagle, *supra* note 428, http://www.tceq.texas.gov/assets/public/legal/rules/rule_lib/proposals/12020106_pex.pdf (discussing a proposal that would allow compliance with a local ordinance to meet all TCEQ separation requirements, including separation from a property line).

⁴³⁸ Tit. 30, § 106.352(b)(2) (2011).

⁴³⁹ 36 Tex. Reg. at 1066.

⁴⁴⁰ *Id.*

⁴⁴¹ INFORMAL COMMENT ON AIR RULES, *supra* note 432.

⁴⁴² Tit. 30, § 106.352(e)(2)(C).

⁴⁴³ *Id.*

⁴⁴⁴ *Id.*

⁴⁴⁵ *Id.* *See also* Background and Summary of the Proposed Rules, 35 Tex. Reg. 6,938 (Aug. 13, 2010) (declining recommendations for periodic renewal of PBR registrations, TCEQ

Where the emissions exceed certain levels, applications must include estimates of the maximum hourly and total annual emissions based on worst-case operations (meaning “reasonable,” not “absolute” worst case operational and meteorological scenarios),⁴⁴⁶ and a demonstration of “protectiveness.”⁴⁴⁷ The required impact evaluation appears to treat the ESL for benzene as a regulatory standard. It requires that “compliance” with the hourly and annual ESL for benzene be “demonstrated” at the nearest receptor within a quarter or half-mile of a project, depending on the level of emissions.⁴⁴⁸ If the project emissions are above specified levels, the applicant must also demonstrate that the projected impacts do not exceed federal ambient air standards for nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and hydrogen sulfide (H₂S) at any property-line within a quarter or half-mile of a project, depending on the level of emissions.⁴⁴⁹ The rules require additional controls where necessary to meet the emission limitations at a nearby receptor.⁴⁵⁰ However, review for “protectiveness” may be bypassed if there are no existing nearby “receptors,”⁴⁵¹ and no periodic reconsideration is required regardless of changes in neighboring land use.

As discussed above, the ESL review is a chemical-specific, facility-by-facility review that does not directly consider cumulative emissions from pre-existing or future sources. Moreover, the impacts analysis for both the ELSs and NAAQS is required only for net emission increases.⁴⁵² Where the net increase is relatively small, the analysis may be further limited to “project-only increases” and avoid consideration of all “source contributions” within a quarter-mile of the project.⁴⁵³ If the emissions fall under certain thresholds, no health effects review is required.⁴⁵⁴ In effort to avoid “emission creep,” the TCEQ has placed

explained that it has already determined that these emissions will not significantly contribute to air pollution and that if it later decides that the emissions are no longer insignificant, it will update the PBR).

⁴⁴⁶ 36 Tex. Reg. 943, 1070 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (eff. Feb. 18, 2011).

⁴⁴⁷ See tit. 30, § 106.352(k); tit. 30, § 106.352(g)(2). See also 36 Tex. Reg. at 1079.

⁴⁴⁸ Tit. 30, § 106.352(k)(1)(B).

⁴⁴⁹ Tit. 30, § 106.352(k)(1)(A).

⁴⁵⁰ See 36 Tex. Reg. at 1143.

⁴⁵¹ Tit. 30, § 106.352(k)(3). See also 36 Tex. Reg. at 1079.

⁴⁵² Tit. 30, § 106.352(k)(1) (the analysis is done on a contaminant-by-contaminant basis, and only for any project net emission increases).

⁴⁵³ See 36 Tex. Reg. at 983 (noting consistency with minor source review permitting procedures and citing the Scope of Modeling and Effects Review for Air Permits guidance document last revised in July 2009).

⁴⁵⁴ See 36 Tex. Reg. at 983; Tit. 30, § 106.352(k)(5)(B)(i) (if a project’s air contaminant maximum predicted concentrations are equal to or less than the significant impact level as defined in Chapter 101 relating to general air quality rules). See also tit. 30, § 106.352(k)(3).

some restriction on applications for multiple small projects within one sixty-month period without a more comprehensive review based on the ESLs.⁴⁵⁵ There is also a nod to non-attainment review that could possibly require offsetting emissions. The rules provide that emissions “shall not exceed the applicable limits for a major source category or major modification,” including requirements applicable to nonattainment review. However, these requirements are only triggered when emissions exceed a *de minimis* threshold test that may not be appropriate for relatively dispersed and rapidly proliferating gas industry operations.⁴⁵⁶

There is little assurance that oil and gas emissions will not collectively burden urban areas already saturated with excessive emissions and hot spots near children and other sensitive populations. The TCEQ conducted a modeling analysis at the time of the rulemaking, but it accounted only for “sources at all oil and gas production sites,”⁴⁵⁷ without considering emissions from oil and gas wells or other sources of area wide or localized emissions.⁴⁵⁸ The TCEQ noted that it had reviewed hundreds of permit registrations and reports and established what it believed to be reasonable emission rates and site-wide caps based on the conservative predictions.⁴⁵⁹ Nevertheless, the scientific analysis falls short.

The TCEQ initially proposed prohibiting the use of the new PBR in situations where gas industry operations may emit pollutants of concern in an Air Pollutant Watch List (APWL) area.⁴⁶⁰ However, the TCEQ ultimately eliminated this as a regulatory requirement.⁴⁶¹ The agency

⁴⁵⁵ 36 Tex. Reg. at 1071. *See id.* at 983; Tit. 30, § 106.352(k)(5)(A)(ii) (if a project’s air contaminant maximum predicted concentrations combined with project increase for that contaminant over a 60-month period are equal to or less than 25% of the appropriate ESL no further review is required.”).

⁴⁵⁶ Tit. 30, § 106.352(h)(1) (citing to tit. 30, § 116.12 (requiring that emissions “shall not exceed the applicable limits for major stationary sources or major modifications”), but also citing to regulatory standards, including Tit. 30, § 116.12(12), a *de minimis* threshold test.).

⁴⁵⁷ 36 Tex. Reg. at 950 (“Generic modeling was conducted to account for sources at all oil and gas production sites”). *See also* 36 Tex. Reg. at 943, 952 (the modeling analysis document can be found through the Air Permits Remote Document Server, in the New Source Review General (NSRG) library under document number 10989).

⁴⁵⁸ Tit. 30, § 106.352(k)(1) (“all impacts evaluations must be completed on a contaminant-by-contaminant basis for any net emissions increases resulting from a project”). *See also* Letter from Ramon Alvarez, Senior Scientist, Env’tl. Def. Fund to Chairman & Comm’rs, Tex. Comm’n on Env’tl. Quality (Jan. 21, 2011), *available at* <http://blogs.edf.org/texascleanairmatters/files/2011/02/Letter-to-TCEQ-on-Wells.pdf>.

⁴⁵⁹ 36 Tex. Reg. at 952.

⁴⁶⁰ 35 Tex. Reg. 6937, 6972, 6949 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (proposed Aug. 13, 2010).

⁴⁶¹ 36 Tex. Reg. at 1014. The TCEQ noted this decision in response to a comment from a representative of the Texas Pipeline Association that it would be inappropriate and unfair because

noted its intention to continue its policy and practice of evaluating projects located in APWL areas,⁴⁶² however, especially given the dispersed nature of gas industry operations, and development into areas not well monitored for hazardous air pollution, localized hot spots may escape review.

The final rules strengthen requirements for monitoring and recording, but still fall short of requirements in other state and local programs where stationary sources must submit standardized annual emission reports and certify their accuracy.⁴⁶³ The new rules establish some requirements for sampling and “unit monitoring” (i.e., weekly monitoring of the temperature of the air condenser exhaust and “spot checks of temperature”). Where a control or method is relied upon for emission reductions, the TCEQ’s new rules require that records be maintained and made readily available upon request.⁴⁶⁴ It is not clear, however, that the TCEQ has the time and manpower to make those requests on a regular basis.

The TCEQ initially proposed an extensive program for monitoring fugitive emissions in response to reports of open-ended pipes and seriously leaking components.⁴⁶⁵ The agency’s initial proposal included at least yearly visual and olfactory inspections and monitoring with a portable analyzer. The TCEQ noted the common availability and well-established standards and guidelines for portable analyzers.⁴⁶⁶ As an alternative, the TCEQ would also have allowed optical gas imaging instruments, such as the GasFind infrared camera, which it described as a new tool that is very much in use by both regulatory agencies and companies.⁴⁶⁷ In addition to revealing leaks, the GasFind infrared camera would have provided some indication of the quantity of emissions given its minimum detection limits.⁴⁶⁸ Although described as “basic fugitive monitoring” and an important part of the rule at the time of the initial proposal,⁴⁶⁹ the TCEQ ultimately decided that these fugitive emission monitoring requirements were too stringent. In the

the listing is determined by the Toxicology Division, not pursuant to a TCEQ rulemaking, and because the commentator was not aware of any other industries subject to limitations based on this listing.

⁴⁶² *Id.*

⁴⁶³ U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 74, at 39.

⁴⁶⁴ *Id.* See also tit. 30, § 106.352(j).

⁴⁶⁵ 35 Tex. Reg. 6937, 6950 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (proposed Aug. 13, 2010).

⁴⁶⁶ *Id.* See also tit. 30, § 106.352(e)(6); 35 Tex. Reg. at 6972, 6973 (the proposed rule would also allow the use of optical gas imaging instrument such as the GasFind infrared camera).

⁴⁶⁷ See 35 Tex. Reg. at 6951.

⁴⁶⁸ *Id.*

⁴⁶⁹ *Id.*

final rule, the TCEQ opted for only a quarterly physical inspection to “ensure that any gross leaks are immediately addressed.”⁴⁷⁰ The only element “immediately” required, however, is the tagging and noting of the leak in a log, and even that would be pursuant to a quarterly inspection.⁴⁷¹ At manned sites, the rule provides thirty days for leak repair. At unmanned sites, the grace period is up to sixty days after the leak is found.⁴⁷² In some cases, the leak may continue indefinitely “until the next shutdown” if it would otherwise create more emissions than the repair would eliminate.⁴⁷³ The TCEQ noted the “potential” remote location of the facilities, in justifying its time limits for repair.⁴⁷⁴ Yet, the very justification for this rulemaking was the critical need in urban areas.

Shale gas operations in urban areas are already a reality on the Barnett Shale. Nonetheless, the rulemaking fails to fully address potential land use conflicts for new facilities and places a considerable burden on communities already suffering the effects of rapid and unplanned proliferation of shale gas industry operations. In its initial proposal, the TCEQ explained: “this rulemaking is necessary to ensure that authorizations for OGS are improved for enforceability, updated based on current scientific information, and to properly regulate all operations.”⁴⁷⁵ In the preamble to the final rule, the TCEQ explained that a significant amount of fugitive emissions come from sources that are not regulated under the previous PBR and standard permit and that the previously existing rules are “not adequate to ensure public health and welfare.”⁴⁷⁶ The TCEQ identified the following as existing sources of unregulated emissions: open tank hatches, tank seal issues, tank integrity problems, pressure relief valves, vent stacks, unit flares, truck loading and unloading activities, vent gaskets, leaking vent flare arrestor caps, dirty flare arrestor caps, heater treater pressure relieve valves, vessel fittings, controller boxes, vent control valves, gun barrel separators, glycol dehydrators, and blowdown valves.⁴⁷⁷

In grandfathering existing facilities, the rulemaking leaves communities already suffering the impacts of existing gas operations

⁴⁷⁰ See 36 Tex. Reg. 963 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (eff. Feb. 18, 2011).

⁴⁷¹ Tit. 30, § 106.352(e)(5)(B).

⁴⁷² *Id.*

⁴⁷³ 35 Tex. Reg. at 6951.

⁴⁷⁴ *Id.*

⁴⁷⁵ 35 Tex. Reg. at 6937.

⁴⁷⁶ 36 Tex. Reg. at 944.

⁴⁷⁷ *Id.*

without adequate protection. The TCEQ acknowledged the deficiencies of the previous regulatory system, stating:

Essentially, Texas is applying 25-year old rules to an industry where science and technology are evolving on a daily basis. Not only has science and technology allowed us to tap into previously unattainable resources, it has also allowed us to better understand the effect of oil and gas drilling and production operations have on public health and the environment. Again, the most up-to-date science and emission detection systems have greatly evolved over the past 25 years. Unfortunately, our laws have not.⁴⁷⁸

In defense of its decision not to further regulate existing facilities, the TCEQ cited legal constraints, but policy is more likely the true justification. The TCEQ reasoned that, because statutes are presumed to have prospective effect, the same presumption should apply when the legislature delegates rulemaking authority to an administrative agency.⁴⁷⁹ The Code Construction Act explicitly establishes this presumption for both statutes and administrative rules.⁴⁸⁰ The TCEQ cites the Texas Third Court of Appeals decision in *All Saints Health System v. Texas Workers' Compensation Commission*, a case that concerned applying new rules to a past activity.⁴⁸¹ As explained by the court, a retroactive law is one that takes away or impairs vested rights acquired under existing laws.⁴⁸² A new rule is retroactive, only if it attaches new legal consequences to events completed before its enactment.⁴⁸³ Applying new rules to ongoing activities is a different issue. New rules are often applied to ongoing activities under the state and federal Clean Air Acts.⁴⁸⁴ TCEQ permits generally have expiration

⁴⁷⁸ *Id.*

⁴⁷⁹ 35 Tex. Reg. at 6940 (citing TEX. CONST. art. 1, § 16, and TEX. GOV'T CODE §311.022 (1985)).

⁴⁸⁰ TEX. GOV'T CODE § 311.002 (2012). *See also* Bowen v. Georgetown Univ. Hosp., 488 U.S. 204, 208 (1988) (“a statutory grant of legislative rulemaking authority will not, as a general matter, be understood to encompass the power to promulgate retroactive rules unless that power is conveyed by Congress in express terms”).

⁴⁸¹ *All Saints Health Sys. v. Tex. Workers' Compensation Comm'n*, 125 S.W.3d 96, 104 (Tex. App. 2003) (reasoning that the law prohibits agencies from making “a retrospective inquiry to determine whether a prior rate was reasonable and imposing a surcharge when rates were too low or a refund when rates were too high.”).

⁴⁸² *Id.* (citing BLACK'S LAW DICTIONARY 1184 (5th ed. 1979) (defining the term “retroactive law”).

⁴⁸³ *Nat'l Mining Ass'n v. Dep't of Labor*, 292 F.3d 849, 860 (D.C. Cir. 2002) (emphasis added). *See also* *Mobile Relay Assocs. v. FCC*, 457 F.3d 1, 11 (D.C. Cir. 2006) (explaining “[r]etroactive rules ‘alter[s] the past legal consequences of past actions’” (quoting *Bowen*, 488 U.S. at 219 (Scalia, J., concurring))).

⁴⁸⁴ *See* PREPUBLICATION VERSION OF FINAL RULE, *supra* note 323, at 25 (“ . . . CAA section 112 standards are issued for new and existing stationary sources, standards of performance are

dates.⁴⁸⁵ The TCEQ has specific statutory authority to impose conditions more stringent than the existing permit during renewal if the commission determines that more stringent conditions are necessary to avoid a condition of air pollution or to ensure compliance with state or federal standards.⁴⁸⁶ Although the TCEQ's general policy is to reissue permits without additional requirements or any impacts modeling demonstration, where there are specific violations or complaints associated with the operation of the facility, the TCEQ will consider imposing additional constraints.⁴⁸⁷ Especially given local preemption, as discussed in the following section, the TCEQ's decision to grandfather existing facilities burdens communities with industrial operations subject only to outdated and inadequate regulatory control.

VI. LOCAL REGULATION, LIMITED AUTHORITY AND PREEMPTION

Air pollution at a given location may be affected by urban background air pollution, historic land use patterns, the prevalence of freeways and other transportation corridors, the concentration of industrial and commercial businesses, and local meteorology and terrain.⁴⁸⁸ In addition to relying on the State, the EPA's Urban Toxics

issued for new and modified stationary sources.”). See also *Section 111 (d) Plans*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/region7/air/rules/111d.htm> (last updated Mar. 14, 2013) (“Section 111(d) of the Act requires states to develop plans for *existing* sources of noncriteria pollutants (i.e., a pollutant for which there is no national ambient air quality standard) whenever the EPA promulgates a standard for a new source.”); *CAA Section 111(d)/129 Delegation*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/reg5oair/toxics/delegation/111d-129/index.html> (last updated June 28, 2012) (“sections 111(d) and 129 require the Agency to establish Emission Guidelines for existing units”); TEX. COMM’N ON ENVTL. QUALITY, AIR POLLUTION CONTROL 9 (2011), *available at* http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/airpoll_guidance.pdf (“During the review of an application for a permit renewal, the level of emission control cannot be relaxed and must be enforceable. If a condition of air pollution has been documented, additional control requirements may be necessary.”); *Air Permits*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/region9/air/permit/pmfaq.html#faq6> (last updated Sept. 18, 2012) (“If laws change and additional requirements under the Clean Air Act become applicable to a source with a Title V permit, the permit must be revised. If three or more years remain prior to the expiration of the Title V permit, the permit must be reopened and revised. If two years or less remain, the changes can be made when the permit is renewed, at the end of its five year term.”).

⁴⁸⁵ TEX. COMM’N ON ENVTL. QUALITY, FORM PI-1R INSTRUCTIONS, GENERAL APPLICATION FOR AIR PERMIT RENEWALS 8 (2012), *available at* <http://www.tceq.texas.gov/assets/public/permitting/air/Forms/NewSourceReview/10254.pdf> (“Permits originally issued or renewed prior to December 1, 1991 have a 15-year term and permits originally issued or renewed after December 1, 1991 have a 10-year term.”).

⁴⁸⁶ TEX. HEALTH & SAFETY CODE § 382.055 (West 2007).

⁴⁸⁷ Interoffice Memorandum from Victoria Hsu, Dir., New Source Review Permitting Div., Tex. Comm’n on Env’tl. Quality to Permit Engineers (Mar. 10, 1997), *available at* <http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/Historical/rnew1125.txt>.

⁴⁸⁸ CAL. ENVTL. PROT. AGENCY, *supra* note 56.

Strategy relies on local and community-based initiatives to address multimedia and cumulative risks within urban areas.⁴⁸⁹ The CAA does not “preclude or deny the right of any State *or political subdivision*” to adopt emissions standards or limitations so long as they are not “less stringent” than the SIP approved by the EPA.⁴⁹⁰ The EPA explains that these governments, specifically municipal offices other than pollution control departments, have the most experience with local air pollution issues, the ability to act more quickly, and can lend their expertise and knowledge to address and resolve air toxics concerns that are unique to cities.⁴⁹¹

Some states, including California, have called upon local governments to include air quality issues in their planning and zoning actions.⁴⁹² The California Air Resources Board (ARB) cautions that cumulative air pollution impacts can occur if land uses do not adequately provide setbacks or otherwise protect sensitive individuals from light or heavy industrial sources, truck idling and traffic congestion, and from indirect sources such as warehousing facilities that are located in a community or neighborhood.⁴⁹³ The ARB has created a handbook for local governments that provides information on health protective distances to separate roadways and polluting facilities from sensitive receptors based on health effects studies, air quality modeling and monitoring studies.⁴⁹⁴ The recommended distance is five hundred feet from freeways, as well as urban roads with over one hundred thousand vehicles per day, and rural roads with over fifty thousand vehicles per day.⁴⁹⁵ For some facilities, including distribution centers, rail yards, and chrome platers, the recommended setback is one thousand feet.⁴⁹⁶

Although Texas cities have authority to supervise compliance with State standards,⁴⁹⁷ in direct opposition to the approach taken in California, Texas has barred cities from openly planning and regulating so as to address localized air quality concerns. The State’s new rules for the Barnett Shale explicitly state that they do “not relieve” the owner or operator from complying with any other “applicable” laws, including

⁴⁸⁹ NATIONAL AIR TOXICS PROGRAM, *supra* note 50, at ES-7.

⁴⁹⁰ 42 U.S.C. § 7416 (1977) (emphasis added).

⁴⁹¹ NATIONAL AIR TOXICS PROGRAM, *supra* note 50, at 4-22.

⁴⁹² CAL. ENVTL. PROT. AGENCY, *supra* note 56, at 39.

⁴⁹³ *Id.*

⁴⁹⁴ *Id.*

⁴⁹⁵ *Id.* at 6.

⁴⁹⁶ *Id.*

⁴⁹⁷ TEX. HEALTH & SAFETY CODE ANN. § 382.113 (West 2011).

local regulations.⁴⁹⁸ However, the Texas Clean Air Act requires municipal ordinances to be consistent with the TCEQ's rules and orders.⁴⁹⁹ A city "may not make unlawful a condition or act approved or authorized" by the TCEQ.⁵⁰⁰

Given the TCEQ's narrow interpretation of its regulatory jurisdiction, municipal air quality requirements related to "mining" or "down-hole" activities may be fair game. The TCEQ interprets its regulatory authority to extend only to regulation of equipment located downstream of a well, and not oil and gas exploration activities. "Mining" is excluded from the definition of facilities subject to regulation under the Texas Clean Air Act (TCAA).⁵⁰¹ The TCEQ interprets this to generally exclude drilling activities.⁵⁰² The TCEQ explains that well completions, re-completions, and workovers all involve actions taken by operators in the well or "down hole" and are considered part of the drilling process, and therefore beyond the jurisdiction of the air permits program.⁵⁰³ Many cities on the Barnett Shale have adopted "green completion" standards for drilling activities.⁵⁰⁴

State preemption creates an awkward situation for cities understandably concerned about the emissions from gas industry operations. Cities are faced with a choice of either refraining from substantive regulatory action, or hiding their true objectives. Under

⁴⁹⁸ *Id.* § 106.352(a)(3).

⁴⁹⁹ *Id.* § 382.113(b).

⁵⁰⁰ *Id.* See also TEX. CONST. art. XI, § 5 (no ordinance of a home-rule city "shall contain any provision inconsistent with the Constitution of the State, or of the general laws enacted by the Legislature of this State.").

⁵⁰¹ TEX. HEALTH & SAFETY CODE ANN. § 382.003(6) (West 2011) ("Facility" means a discrete or identifiable structure, device, item, equipment, or enclosure that constitutes or contains a stationary source, including appurtenances other than emission control equipment. A mine, quarry, well test, or road is not considered to be a facility."). See also *id.* § 382.003(13) ("Well test" means the testing of an oil or gas well for a period of time less than 72 hours that does not constitute a major source or major modification under any provision of the federal Clean Air Act (42 U.S.C. Section 7401 et seq.).").

⁵⁰² 35 Tex. Reg. 6937, 6941 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (proposed Aug. 13, 2010); 30 TEX. ADMIN. CODE § 106.352(b) (2013). But see Letter from Ramón Alvarez, Senior Scientist, Env'tl. Def. Fund, to Bryan Shaw, Chairman, Tex. Comm'n on Env'tl. Quality, et al. (Jan. 11, 2011), available at <http://blogs.edf.org/texascleanairmatters/files/2011/02/Letter-to-TCEQ-on-Wells.pdf>.

⁵⁰³ Letter from Ramón Alvarez, Senior Scientist, Env'tl. Def. Fund, to Bryan Shaw, Chairman, Tex. Comm'n on Env'tl. Quality, et al. (Jan. 11, 2011), citing TCEQ, Chapter 106- Permits by Rule, Rule Project No. 2010-018-106-PR, p.278. John Laycock, Summary of Local Ordinance Requirements (reviewing ordinances of cities with significant fracking activity and populations over 40,000) (on file with author).

⁵⁰⁴ John Laycock, Summary of Local Ordinance Requirements (reviewing ordinances of cities with significant fracking activity and populations over 40,000) (on file with author); See also, e.g., Town of Flower Mound Oil and Gas Ordinance § 34-427(23), available at <http://www.flower-mound.com/DocumentCenter/View/900>.

these circumstances, cities cannot openly and appropriately plan based on information related to air quality. Both Denton and Dallas have made substantial revisions to their gas drilling ordinances in the past year and both cities appointed gas drilling task forces to guide this process.⁵⁰⁵ In both cases, concerns about air quality were raised. In Denton, the task force discussed whether a requirement for vapor recovery units would conflict with the TCEQ's guidelines.⁵⁰⁶ The draft ordinance eventually proposed explicitly applies only to facilities not regulated by the TCEQ.⁵⁰⁷ The City of Flower Mound also prohibits gas burning or venting to the atmosphere, but not if allowed "by law" or permitted by the TCEQ.⁵⁰⁸ The Dallas task force heard an entire presentation on preemption, at the end of which a task force member noted the use of "whereas" clauses to distinguish between legislating for air quality specifically or something else.⁵⁰⁹

A recent case involving differing state and municipal setback requirements for rock concrete crushing facilities, *Southern Crushed Concrete, LLC v. City of Houston*, provides support for Texas cities to create setback requirements for shale gas industry operations regulated by the TCEQ, so long as the rationale is unrelated to air quality concerns.⁵¹⁰ In that case, the Houston Court of Appeals reasoned that a permit from the TCEQ represented that body's determination that the proposed facility will not have an unacceptably adverse effect on air quality, either because it complied with the Act's requirements, including distance limitations, or because the proposed facility fell within an exemption to the Act's requirements.⁵¹¹ The court nevertheless upheld the city's denial of the municipal permit based on a finding that the state and local setback requirements served different purposes and were not inconsistent with the meaning of the statute.⁵¹²

⁵⁰⁵ See *Dallas Drilling Task Force*, DALLAS CITY HALL, http://www.dallascityhall.com/gasDrilling_task-force.html (last visited May 14, 2013). See also *Gas Drilling Task Force*, CITY OF DENTON, <http://www.cityofdenton.com/departments-services/departments-g-p/gas-well-inspections/gas-drilling-task-force> (last visited May 14, 2013).

⁵⁰⁶ Minutes, Denton Gas Well Task Force 3 (Jan. 9, 2012) <http://www.cityofdenton.com/Modules/ShowDocument.aspx?documentid=11112>.

⁵⁰⁷ City of Denton, Tex., Draft Gas Well Ordinance, § 35.22.5(2)(n)(1) (applying only to "facilities not included under Rule§106.352 of TAC Title 30, Part 1, Chapter 106, Subchapter O; or its successor regulation.").

⁵⁰⁸ Town of Flower Mound, Tex., Oil and Gas Ordinance, § 34-427(20), available at <http://www.flower-mound.com/DocumentCenter/View/900>.

⁵⁰⁹ *Dallas Drilling Task Force Meeting* (Oct. 4, 2011), http://www.dallascityhall.com/audio/GasDrilling_100411.wav.

⁵¹⁰ 2010 WL 4638417 (Tex. App. Houston 14th Dist. Nov. 17, 2010).

⁵¹¹ *Id.* at *7.

⁵¹² *Id.* at *6.

The municipal setback requirements concerned land uses and residential property values, not air quality.⁵¹³

Many cities on the Barnett Shale have adopted setback restrictions for gas industry operations. In a review of local regulations in Barnett Shale cities with populations over forty thousand, setbacks for shale gas operations from sensitive uses including residences, schools, churches, parks, public buildings, and hospitals standards varied from three hundred to 1,500 feet.⁵¹⁴ The City of Flower Mound's ordinance specifically adopts findings concerning reductions in property value due to proximity to gas drilling and production activities (including wells, compressor stations and collection facilities) that could serve to justify its setback limitations.⁵¹⁵ Although the ordinance includes a very long section related to purpose and findings, and despite the fact that Flower Mound has hired its own consultant to conduct regular air quality monitoring, the ordinance does not discuss any significant air quality concerns.⁵¹⁶ In addition to property values, other possible justifications include concerns related to visual impacts, noise, and truck traffic. However, to the extent that cities are justifying setbacks based on reasons unrelated to air quality, discussion and analysis may be truncated with no explicit consideration of regional or localized emissions based on the proximity to highways, existing oil and gas facilities, or other sources, or explicit consideration of the zone of impact for upsets and malfunctions.

Some cities on the Barnett Shale are also taking it upon themselves to enforce TCEQ ordinances. The Texas Health and Safety Code specifically grants local governments power to investigate whether air contaminants meet levels set by the TCEQ,⁵¹⁷ make recommendations to the TCEQ,⁵¹⁸ and enforce ordinances that are consistent with the TCEQ's rules and orders.⁵¹⁹ Given the complexity of air quality regulation and shale gas industry emissions, the undertaking is a considerable burden. The City of Grand Prairie requires operators to comply with an approved leak detection and compliance plan, and authorizes its Environmental Services Department to hire third party

⁵¹³ *Id.* at *7.

⁵¹⁴ Laycock, *supra* note 504.

⁵¹⁵ *Id.* at 3-4.

⁵¹⁶ *Id.* at 1-12. *See also id.* at 6 (discussing only favorable findings concerning air quality evaluations in 2010 and 2011 that included quarterly evaluations at several locations and found no exceedances of TCEQ's air monitoring comparison values; but omitting concerns and qualifications expressed by the City's consultant).

⁵¹⁷ TEX. HEALTH & SAFETY CODE § 382.111 (West 2011).

⁵¹⁸ *Id.* § 382.112.

⁵¹⁹ *Id.* § 382.113.

experts to conduct air quality testing to ensure compliance with state and federal regulations.⁵²⁰ The City of Flower Mound also requires compliance with state and federal emission regulations.⁵²¹ If there are two or more notices of violation (“as determined”)⁵²² by the TCEQ or the EPA, within twelve months, the City requires an emission compliance plan that may include requirements for on-site emission monitoring, periodic reporting, and pollution control equipment to ensure compliance with state and federal regulations.⁵²³

State law also authorizes cities to use their power to abate nuisances to protect air resources,⁵²⁴ and the TCEQ rules themselves also specifically address nuisance conditions. Cities may use their powers to abate nuisance conditions to regulate odors, smoke, and dust from in-plant roads, work areas, traffic, and other activities.⁵²⁵ As discussed below, some cities have engaged in air quality monitoring efforts that could potentially support enforcement action. However, lacking any clear standards, nuisance law is not a very effective vehicle by which to attempt to regulate hazardous air pollutants, especially where “safe” levels are subject to debate, health impacts may be latent, and causation is complicated. In 2007, the Mayor of Houston attempted to move forward with a plan to simplify and strengthen the city’s ability to use nuisance law to address air quality concerns. He proposed a measure that would set specific numeric thresholds for what constitutes a “nuisance.”⁵²⁶ However, the proposal was politically and legally challenged as an attempt to impose stricter standards than those promulgated by the TCEQ and has not emerged as a regulatory measure.⁵²⁷ In 2008, the Mayor sent comments to the TCEQ requesting

⁵²⁰ GRAND PRAIRIE, TEX., MUNICIPAL CODE, art. XIX, § 13-515(a)(41)(d), *available at* <http://www.gptx.org/modules/ShowDocument.aspx?documentid=4742>.

⁵²¹ Town of Flower Mound Oil and Gas Ordinance § 34-422(h), *available at* <http://www.flower-mound.com/DocumentCenter/View/900>.

⁵²² It is not clear if the state or federal government must have undertaken an enforcement action or if the violations can be “determined” in some other way.

⁵²³ TEX. HEALTH & SAFETY CODE ANN. § 382.113.

⁵²⁴ *Id.* § 382.115. The rules also include opacity limitations. *See* 30 TEX. ADMIN. CODE § 101.4 (2013).

⁵²⁵ 30 TEX. ADMIN. CODE § 101.4 (2013).

⁵²⁶ *See* Memorandum from Dan Wolterman, Chairman, Houston Reg’l Air Quality Task Force, to the Bd. of Dirs., Greater Houston P’ship (Oct. 3, 2007), *available at* <http://www.houston.org/pdf/resolutions/archive/Houston%20Regional%20Air%20Quality%20Task%20Force%20Report%2010.03.07.pdf>; GREATER HOUSTON P’SHIP, RESOLUTION OF THE BOARD OF DIRECTORS IN SUPPORT OF THE HOUSTON REGIONAL AIR QUALITY TASK FORCE REPORT (2007), *available at* <http://www.houston.org/pdf/resolutions/archive/Houston%20Regional%20Air%20Quality%20Task%20Force%20Report%2010.03.07.pdf>.

⁵²⁷ Charles Kuffner, *Another front in the air quality battle*, OFF THE KUFF (May 22, 2008, 8:43 AM),

a lower ESL for 1,3-butadiene, arguing that the EPA and relevant studies support a lower level, and that the TCEQ is failing to consider the cumulative risk from other carcinogenic air toxics prevalent in Houston.⁵²⁸

CONCLUSION

Shale gas industry operations have operated in Texas with little regulatory oversight and no offsetting emission reductions in areas that fail to meet the National Ambient Air Quality Standards. Although new rules have recently been adopted at both the federal and state level, the regulatory programs are not well designed to ensure health and safety in urban areas. There are no ambient air quality standards for hazardous air pollutants. The federal and state governments both pursued an approach based largely on available technology as opposed to a health based assessment. Neither regulatory program evaluated cumulative risk in urban areas, nor the possibility of localized hot spots. The EPA relies on its technology-based Urban Air Toxic Strategy to address area sources. The EPA also relies on the participation of state and local governments. However, the Texas state government is not a particularly strong partner, and local governments in Texas are largely preempted from participation. Residents have complained of health effects consistent with exposure to emissions of chemicals involved in shale gas industry operations which have not been comprehensively evaluated. Given the complexity of the science and the dearth of clear, transparent, and enforceable standards, stretched studies and limited statistical analysis have been allowed to provide potentially false assurances.

Although generally effective at reducing statewide and regional air pollution, the incremental, category-by-category, source-by-source approach to risk assessment at the state and federal level does not directly address community health impacts from multiple emission sources.⁵²⁹ Based only on a narrow consideration of the risk associated with the major sources under consideration, the EPA accepted risk levels that dipped below its own benchmarks, some of which it justified based on the “generally sparse population” near existing facilities. Yet, the EPA has no control over the future location of facilities subject to

<http://offthekuff.com/wp/?p=3159>. See also Brandt Mannchen, *Air Pollution Flares Up in Houston*, SIERRA CLUB HOUSTON GROUP NEWS (Apr. 3, 2007), <http://www.houston.sierraclub.org/news/2007/0403.htm>.

⁵²⁸ Letter from Bill White, Mayor of Houston, to Michael Honeycutt, Manager, Toxicology Section, Tex. Comm'n on Env'tl. Quality (July 11, 2008).

⁵²⁹ CAL. ENVTL. PROT. AGENCY, *supra* note 56, at 53.

regulation, changes in neighboring land uses, or cumulative emissions. To the extent that gas industry operations continue to locate in urban areas, the community will also bear the burden of leaks and malfunctions, which are not factored into risk assessment and for which industry is not held accountable. There are no federally required setbacks or health based standards for hazardous air pollutants to ensure safety in urban areas.

Although undoubtedly better than the previous situation of uncontrolled proliferation of shale gas industry operations, the new State rules for shale gas operations on the Barnett are still not well tailored to address concerns in growing urban areas. The TCEQ did not conduct a comprehensive risk assessment and the new rules do not fully address problems related to encroaching development and existing facilities. Some review for “protectiveness” will be required at the time of permitting, but the review is limited to a facility specific, chemical-by-chemical, incremental evaluation of increased emissions. The review is not certain to address all potentially problematic chemicals, and does not ensure that oil and gas emissions will not collectively burden urban areas where emissions may already be exceeding safe levels. There is no periodic reconsideration, and no restriction on new land uses moving into the previously defined setback areas.

Air Quality monitoring on the Barnett Shale suggests that, with adequate supervision, the shale gas industry can operate within TCEQ standards. Presumably, the TCEQ will be better able to monitor existing facilities now that registration will be required; however, even for new facilities, the record keeping requirements fall short of the state of practice by failing to require submission of standardized annual emission reports with certification as to their accuracy. After review and evaluation of several state programs, Victor Flatt found that states with the largest air toxics percentage reductions were those that required sources to self-monitor and report and those that had a credible method to check whether this was being accomplished.⁵³⁰ The TCEQ’s new rules require that records be maintained and made readily available upon request,⁵³¹ but it is not clear if the TCEQ has the time and workforce to make those requests on a regular basis. The final TCEQ rules also fall short of the “basic fugitive monitoring” initially proposed. Moreover, many existing sources of fugitive emissions remain

⁵³⁰ Flatt, *supra* note 336, at 107.

⁵³¹ See 36 Tex. Reg. 943, 965, 1143 (to be codified at 30 TEX. ADMIN. CODE § 106.352) (eff. Feb. 18, 2011); 30 TEX. ADMIN. CODE § 106.352(e)(8) (2011). See also *id.* §§ 106.152(m), 106.352(j).

unregulated and, even for regulated sources, leaks and malfunctions may continue without penalty for days or even months.

Local governments could consider whether it is within the scope of their existing enforcement authority to require the “basic fugitive monitoring” that was initially proposed by the TCEQ and emission reports with certification as their accuracy. Especially given the increased risks in urban areas, local governments could also reconsider the EPA’s initial proposal to require third-party certification as well other options identified during the rulemaking process, including the use of social media to provide timely public notification and creating a centralized database to allow full public access to all compliance information.⁵³² However, monitoring and enforcement authority alone is not enough given uncertainty about the adequacy of TCEQ standards, grandfathered facilities, and the possibility of hot spots as well as leaks and malfunctions that may continue for periods of unknown duration. It would also be reasonable for the State to consider granting additional legislative authority, not just in the area of enforcement (if necessary), but also the authority to engage in air quality planning and regulation beyond the TCEQ’s minimum standards.

Residents on the Barnett Shale have complained of a multitude of health effects that are consistent with the health effects of chemicals associated with shale gas industry operations. Although these reports are only “anecdotal evidence,” in the absence of better evidence, some medical professionals have suggested moving forward with caution. As explained by Dr. Adam Law, this is precisely the type of evidence doctors rely on in compiling “patient history.”⁵³³ In December 2010, the Council of the Medical Society of the State of New York requested a moratorium on shale gas operations in New York until valid information is available to evaluate the process for potential effects on human health and the environment.⁵³⁴ In his open letter, Dr. Law notes the dearth of peer-reviewed publications in the scientific or medical literature addressing the effects of gas operations on human health.⁵³⁵ As an endocrinologist, he notes, in particular, concerns about possible exposure to endocrine disrupting chemicals.⁵³⁶ As discussed above,

⁵³² Oil and Natural Gas Sector: New Source Performance Standards and National Emissions Standards for Hazardous Air Pollutants Reviews, 76 Fed. Reg. 52750 (Aug. 23, 2011) (codified at 40 C.F.R. pt. 60 and 40 C.F.R. pt. 63).

⁵³³ ADAM LAW, HEALTH IMPACTS OF HYDRAULIC FRACTURING TECHNIQUES 2, available at http://www.gasdrillingtechnotes.org/uploads/7/5/7/4/7574658/nys_assembly_013_adam_law.pdf (last visited May 14, 2013).

⁵³⁴ *Id.* at 1.

⁵³⁵ *Id.*

⁵³⁶ *Id.* at 3.

these chemicals are potentially problematic at extremely low exposure levels.

The state of Texas could consider following California's lead in adopting an *Air Quality and Land Use Handbook* and further include not only roadways and industrial sources, but also oil and gas operations as sources that need setbacks as a precautionary measure. Texas has already recognized the importance of setbacks, adopting a fifty-foot setback for gas industry operations and the possibility of additional setbacks based on a "protectiveness review," but it does not ensure the integrity of these setbacks over time. At a minimum, it would seem reasonable for Texas to encourage local governments to restrict new uses from moving into setback areas previously defined by the State. The burden need not necessarily fall on neighboring property owners. New programs could be explored, such as the possibility of industry purchase of development rights that would restrict property to more compatible uses for the duration of shale gas industry operations.

Air quality planning should also consider the possibility of "hot spots" given the potential clustering of gas industry operations near mobile sources in urban areas, especially given that gas industry operations emit some of the same chemicals that can be problematic from heavily traveled urban roadways alone. Cities do not currently have the regulatory authority to establish ambient urban air quality standards for hazardous air pollutants or to require offsets before permitting additional sources in areas where air quality is already at the limit of those standards. In his review, Victor Flatt identified clear and enforceable standards for acceptable health risks, ideally ones specified by statute to avoid obstructive pressures, as among the most important components of a successful program.⁵³⁷ In Texas, there are generally no enforceable statutory or administrative ambient standards for hazardous air pollutants. The recent rulemaking for the Barnett Shale appears to have transformed the ESL for benzene into a standard, but no other ESLs are binding. Without clear and enforceable ambient standards, the interpretation of Barnett Shale monitoring results that exceed the TCEQ air monitoring comparison values may be influenced by economic and political considerations. At a minimum, Texas could consider allowing cities to adopt the TCEQ's AMCVs as standards.

Considering uncertainty as to the adequacy of the AMCVs, and the sensitive populations exposed in urban areas, it would also be reasonable to grant cities authority to adopt ambient air quality standards more stringent than the state's benchmark values. Cities

⁵³⁷ Flatt, *supra* note 336, at 172.

could look to state lists, or to the EPA's IRIS to assist in developing standards and to expand the list of toxic chemicals regulated. Although identifying and regulating toxic emissions through health-based standards is very difficult, some states have managed to identify and regulate substantially more chemicals than the 187 listed as federal "hazardous air pollutants." Given the inherent difficulty of the task, it is also important for the EPA to work to identify all toxic emissions associated with gas industry operations, to expand and improve the list of hazardous air pollutants, and to work toward establishing ambient air quality standards for hazardous air pollutants. However, especially where trade secrets dominate chemical disclosure requirements, it will be difficult to identify all problematic chemicals, and uncertainty will remain as to the adequacy of standards and the possibility of unknown interactive effects.

In the 1990 Amendments to the CAA, Congress announced a national goal of reducing the incidence of cancer attributable to exposure to hazardous air pollutants emitted by stationary sources by no less than 75 percent.⁵³⁸ The EPA has been unable to demonstrate any significant progress towards this goal.⁵³⁹ The EPA does not currently have the data necessary to assess the extent to which incremental reductions in exposure to air toxics affect an average person's chance of developing adverse health effects.⁵⁴⁰ In its year 2000 Integrated Urban Strategy Report, the EPA identified several deficiencies in its current approach, including the need to improve the ambient air toxics monitoring network, to improve health effects risk assessment for urban hazardous air pollutants, and to establish more effective techniques for communicating those risks to the public.⁵⁴¹ At that time, the EPA recognized the importance of establishing a risk-based air toxics program. The EPA has more recently expressed uncertainty as to whether nationwide risk-based health limits are the best approach to reducing risks in urban areas given complexities associated with such an approach and the varying nature of air toxics risks in urban areas.⁵⁴² However, in 2010, the EPA Office of Inspector General expressed its opinion that, without a minimum federally required risk-based program, state and local agencies are unlikely to implement programs to adequately address health risks from urban air toxics.⁵⁴³

⁵³⁸ 42 U.S.C. § 7412(k) (1999).

⁵³⁹ U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 74, at 1.

⁵⁴⁰ *Id.* at 25.

⁵⁴¹ NATIONAL AIR TOXICS PROGRAM, *supra* note 50, at 1-5, 1-6.

⁵⁴² KEY ACTIVITIES, *supra* note 76, at 14, 37.

⁵⁴³ *Id.* at 9.

Texas's exceptional, but reactive and ultimately inadequate effort to respond to citizen concerns on the Barnett Shale reflects a continuing need for across-the-board improvement in monitoring, health-based assessment, and public communication as a standard component of the air quality regulatory program. Additional monitoring is essential if the nation is going to make progress in its ability to assess health effects of exposure to hazardous air pollutants and cumulative emissions. In his article, Victor Flatt notes the decreasing costs of monitoring equipment and recommends consideration of continuous monitoring requirements. The City of Southlake also recognizes the importance of monitoring. Although the Southlake Oil and Gas Well Drilling and Production Ordinance has not yet been applied in practice (as wells have yet to be drilled),⁵⁴⁴ it requires baseline air testing as well as continuous air monitoring following the commencement of fracking and until all wells are abandoned.⁵⁴⁵ In addition to this approach, local governments might also consider extending the monitoring period to include drilling operations given that toxic chemicals have also been associated with this stage of operations. The TCEQ reports the costs of its monitors in the range of \$250,000 for the first year and \$100,000 per year thereafter.⁵⁴⁶ Cities could fully explore costs and consider requiring extensive monitoring that could record all significant releases in urban areas.

Although it is difficult to determine causal relationships, a developing a body of research that draws associations between health effects and toxic emissions may eventually result in a body of evidence to support health-based regulation of toxic emissions. A simple start to evaluating health effects might be to create local internet-based reporting sites where people could record purported adverse reactions to gas industry operations, including the dates and times, that could possibly serve as a source of information for later evaluation in relation to air quality monitoring data.⁵⁴⁷ Especially considering the potential inter-generational effects of hormone disrupting chemicals, another possibility might be to develop a program to collect blood samples for

⁵⁴⁴ Interview with Ken Baker, Dir. of Planning, City of Southlake (Aug. 2012).

⁵⁴⁵ Southlake, Tex., Ordinance No. 880-B, § 9.5-242(q) (Oct. 18, 2011).

⁵⁴⁶ *A Commitment to Air Quality*, *supra* note 34.

⁵⁴⁷ See *Emissions from Blessing well 8/18/10*, *supra* note 10 (Zoe G. Nance posted: "Please help, please help me. I have been getting headaches, nausea, burning my throat and eyes beginning in the end of May beginning of June. . . . I would like the abc alliance to compile a list of symptoms caused by the oil and gas industry. I would like to see these symptoms with a place, forum, so we can collect data on how many people have adverse reactions to the drilling. Besides, me (I'm glad I'm not alone). Days and times, if possible. I have actually even gotten these sores, I have had them twice on my skin, they've been there for a couple of weeks, and they don't heal and sometimes they're bloody scabs.").

future research. Researchers today are searching for environmental causes of breast cancer, for example, by examining toxic chemicals stored in inter-generational blood samples.⁵⁴⁸ The 2007 Progress Report from the Texas Environmental Health Institute notes that it has developed the capacity to perform biological testing in appropriate cases as “funds permit.” Given the historic difficulty of developing health-based regulation for hazardous air pollutants, significant participation is required at all levels of government: federal, state, and local.

As the EPA explained in its Integrated Urban Strategy Report, it is also important to effectively communicate the results of health risk assessments to those participating in the policy-making process and to various members of the public who may not have technical or scientific backgrounds.⁵⁴⁹ The EPA explained:

For example, the general public needs to be provided with information and the tools to protect their families and communities from exposure to air toxics. Unless a common understanding on the meaning of the assessments is reached between scientists preparing the assessments and persons using the assessments to affect policy, the overall process of risk assessment/risk management may be defeated, sometimes with costly consequences.”⁵⁵⁰

The DSHS has also recognized the importance of public communication. The 2007 Progress Report for the TEHI notes that it has established a Community Involvement Liaison and a Health Educator to serve “as a bridge between the health assessment staff and the interested public.”⁵⁵¹ However, the health studies conducted on the Barnett Shale suggest that standards are still needed to guide public reporting on scientific findings and statistical analysis. The uncertainty inherent in studies and standards should also be made clear and accessible to the public and to local governments so that it may be considered in making appropriate and protective land use decisions.

Consideration should also be given to developing a more transparent and a coordinated approach to health effects assessment and toxic

⁵⁴⁸ Stephanie M. Lee, *Breast cancer ties to environment probed*, S.F. CHRON. (Feb. 26, 2013), <http://www.sfgate.com/health/article/Breast-cancer-ties-to-environment-probed-4310594.php#ixzz2MFgdQvu3> (discussing a project involving more than 15,000 Bay Area mothers and their offspring started in 1959 to track women and their blood samples. This cross-generational data has led to hundreds of studies on the long-term effects of environmental and lifestyle factors on pregnancy, birth weight, infant mortality and diseases).

⁵⁴⁹ NATIONAL AIR TOXICS PROGRAM, *supra* note 50, at 6-23.

⁵⁵⁰ *Id.*

⁵⁵¹ TEX. ENVTL. HEALTH INST., *supra* note 95, at 15.

emission monitoring, rather than one undertaken by separate health and environmental agencies working in isolation. The Texas state legislature should consider transforming the Texas Environmental Health Institute from a “virtual entity,” into a real state regulatory agency with publicly accessible standards and sufficient funding, authority, and direction to develop a systematic approach to tracking public health in relation to environmental exposure. If the driving question is the health effects of toxic emissions, studies must be carefully designed to evaluate health effects during time periods and within geographic areas that relate to toxic exposure. Appropriate study design and confidence intervals should be a question for public discussion. Little is learned from turning a blind eye and announcing there is no cancer cluster where the level of certainty falls below 99 percent. In an investigation of the relationship between toxic exposure and childhood cancer rates, it may even be appropriate to consider lowering the standard scientific confidence interval and taking precautionary action where we are even less than 95 percent certain that there is a cancer cluster. Such findings should signal and lead to coordinated investigations by all key state and local agencies of all plausible emission sources related to a known type of cancer, a careful analysis of plausible pathways, and an analysis of exposure scenarios as suggested by the CDC cancer cluster guidelines.

In sum, Texas should consider authorizing and encouraging local level air quality planning for industrial activities in urban areas. Care should be taken to separate these facilities from sensitive receptors and “hot spots” already burdened with excessive hazardous air emissions. Given the difficulty of the task, there is also an important role for the state and federal government in working to establish ambient health-based standards for hazardous air pollutants, as well as standards for health-based assessment and public communication. The uncertainty inherent in any standards should be made clear and accessible to local governments so that it may be considered in making appropriate and protective land use decisions. Modeling the existing federal program for conventional air pollutants, consideration should be given to allowing local governments to have the power to establish ambient air quality standards, emissions limitations, monitoring, reporting, and offsets.