Premature Mortality from Proposed New Coal-fired Power Plants in Texas

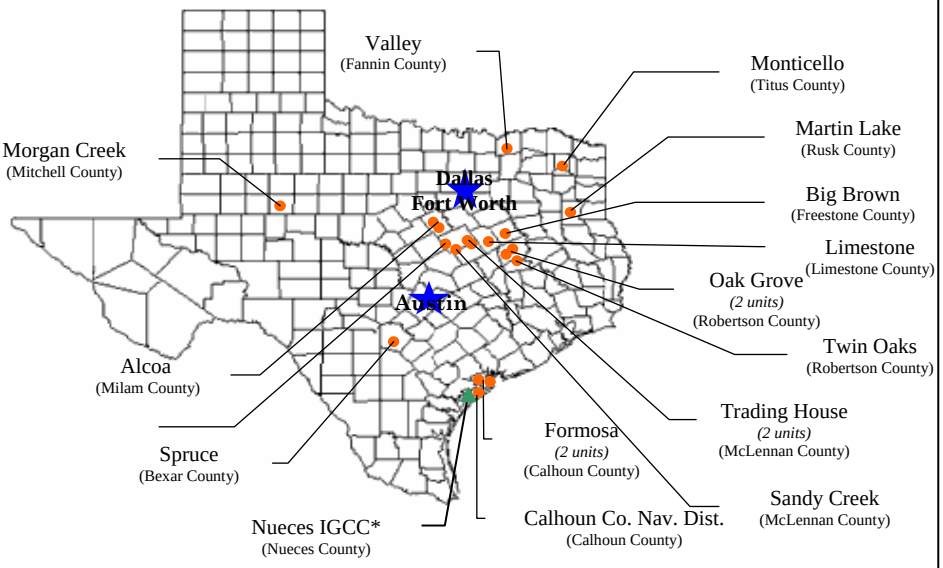
A research brief by Public Citizen's Texas Office and the Sustainable Energy and Economic Development (SEED) Coalition. November 2006.

EXECUTIVE SUMMARY

Premature mortalities are among the well-documented public health impacts caused by air pollution. Sulfur dioxide (SO2) and nitrogen oxide (NOx) pollution in particular are dangerous, because both kinds contribute to the formation of microscopic air pollution particles, known as particulates, that can be drawn deeply into the lungs. The 19 coal-fired power plant units studied in this research brief will emit over 100,000 tons of these two pollutants every year. This pollution will cause 240 premature mortalities per year and nearly 12,000 premature mortalities over the expected lifetimes of the plants. As the company with the largest number of new coal units planned, TXU dominates these figures. Pollution from TXU's proposed new units can be expected to cause 177 premature mortalities per year, and 8,869 premature mortalities over the lifetimes of the units.

The U.S. Environmental Protection Agency uses a value of approximately $6 million per mortality when calculating the economic impact of policies. Using that value, the annual cost in mortality of the proposed plants is $1.4 billion per year. The cost over the expected lifetimes of the plants is nearly $72 billion.

Locations of Proposed New Coal Plant Units



* Integrated Gasification Combined Cycle (IGCC) is currently the cleanest technology available for producing power from coal or petroleum coke.

FINDINGS

The analysis finds that the 19 coal-fired power plant units studied will emit 67,730 tons of SO2 and 33,521 tons of NOx per year. The Environmental Protection Agency's established methodology for determining health impacts for these pollutants indicates that this level of pollution will cause 240 premature mortalities per year, and 11,993 premature mortalities over the expected lifetimes of the plants.

The U.S. Environmental Protection Agency uses a value of approximately $6 million per mortality when calculating the economic impact of policies.[i] Using this value, the analysis finds that the economic costs associated with these mortalities are $1,439,140,000 per year, and $71,957,010,000 over the expected lifetimes of the plants.

Premature Mortality from Proposed Coal Plants

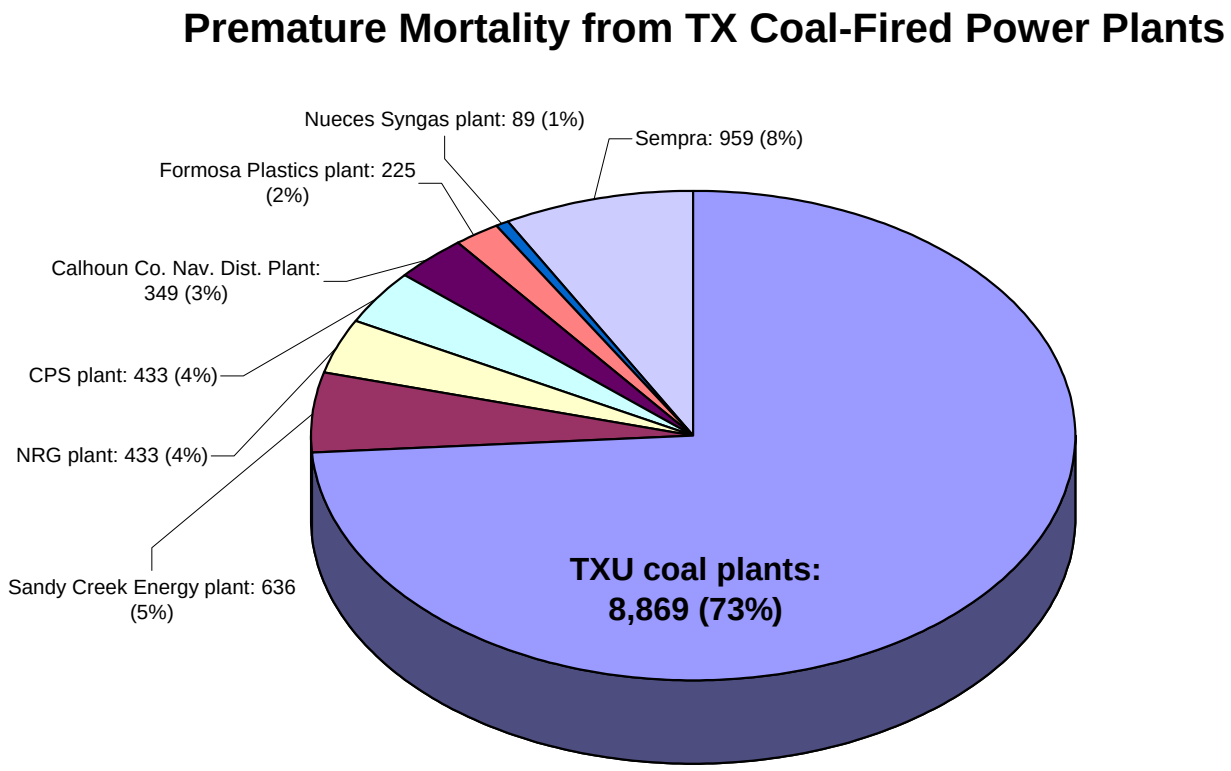
Plant / Unit	SO2 in tons/yr	NOx in tons/yr	Annual Mortalities	50 Year Cumulative Mortalities	Annual Mortality Cost (in $1,000s)	50 Year Cumulative Mortality Cost (in $1,000's)
TXU Oak Grove 1&2	15,086	6,286	51	2,571	$ 308,510	$ 15,425,520
TXU Tradinghouse 3&4	7,574	3,788	27	1,344	$ 161,336	$ 8,066,820
Sempra Twin Oaks 3	5,818	2,037	19	959	$ 115,029	$ 5,751,450
TXU Sandow 5 at Alcoa	5,186	2,593	18	921	$ 110,462	$ 5,523,090
TXU Lake Creek 3	3,787	1,894	13	672	$ 80,668	$ 4,033,410
TXU Big Brown 3	3,787	1,894	13	672	$ 80,668	$ 4,033,410
TXU Monticello 4	3,787	1,894	13	672	$ 80,668	$ 4,033,410
TXU Martin Lake 4	3,787	1,894	13	672	$ 80,668	$ 4,033,410
TXU Valley 4	3,787	1,894	13	672	$ 80,668	$ 4,033,410
TXU Morgan Creek 7	3,787	1,894	13	672	$ 80,668	$ 4,033,410
Sandy Creek Energy	3,585	1,793	13	636	$ 76,366	$ 3,818,280
NRG Limestone 3	2,103	1,752	9	433	$ 51,939	$ 2,596,950
CPS Spruce	2,102	1,752	9	433	$ 51,923	$ 2,596,140
Calhoun Co. Nav. Dist.	2,071	813	7	349	$ 41,843	$ 2,092,140
Formosa Plastics, 2 Units (low case*)	1,091	920	5	225	$ 27,058	$ 1,352,910
Nueces Syngas (IGCC)	392	423	2	89	$ 10,665	$ 533,250
Total	**67,730**	**33,521**	**240**	**11,993**	**$ 1,439,140**	**$71,957,010**

* Formosa Plastics is building a coal-fired merchant power plant. Formosa indicated a range of possible SO2 emissions in its permit. The low SO2 figure is used throughout this report. The high SO2 figure reported in the Formosa permit is 6,518 tons of SO2 per year. If Formosa's plant were to emit at this higher level, mortalities on this table would increase to 12,725.

TXU in the lead

Most of these mortalities will be associated with pollution from TXU's 11 new proposed coal plant units, plus the company's Sandow unit at the Alcoa plant. According to TXU's permit filings, new units will emit 50,568 tons of SO2 per year and 24,031 tons of NOx per year. This pollution can be expected to cause 177 premature mortalities per year, and 8,869 premature mortalities over the expected lifetimes of the plants. Thus, pollution from TXU's units will be responsible for 73% of the premature mortalities expected from all the proposed coal units studied in this research brief.

The economic costs associated with these mortalities, according to the EPA calculation, are $1,064,318,000 per year, and $53,215,890,000 over the expected lifetimes of the plants.



Data presented: Company name. For each company shown, the lifetime premature deaths expected from proposed plants, and the percentage of all premature deaths expected from new units that are expected due to that company's proposed plants.

POWER PLANT POLLUTION

Individuals dying prematurely from exposure to particulate matter lose an average of 14 years of life.

Despite progress in reducing particulate air pollution over the last decade, Texans are still suffering from its adverse health effects. Over the past several decades, medical researchers examining air pollution and public health have shown that air pollution is associated with a host of serious adverse human health effects, including asthma attacks, heart attacks, hospital admissions, and premature death.[ii] The adverse health consequences of breathing air pollution caused by emissions from utility power plants are severe and well documented in the published medical and scientific literature.[iii]

One of the air pollutants most carefully studied in the last decade is fine particles. Fine particles, such as those that result from power plant emissions, can bypass the defensive mechanisms of the lung and become lodged deep in the lung where they can cause a variety of health problems. Indeed, the latest evidence indicates that short-term exposures cannot only cause respiratory damage, but also cardiac effects, including increasing the risk of heart attacks.[iv] Moreover, long-term exposure to fine particles increases the risk of cardiac, respiratory, and lung cancer death and has been estimated to shorten life expectancies of people living in the most polluted cities relative to those living in cleaner cities.[v] [vi] In recent years, researchers have documented fine particle-related mortality at low concentrations, demonstrating that there is no lower threshold for premature death from the long-term inhalation of particles.[vii]

WHAT ARE FINE PARTICLES?

Fine particles are a mixture of harmful pollutants (e.g. soot, acid droplets, metals) that originate primarily from combustion sources such as power plants, diesel trucks, buses, and cars. In 1997 EPA set national health standards for fine particles (referred by EPA as "PM2.5" or particulate matter smaller than 2.5 microns (2.5 millionths of a meter in diameter – less than one-hundredth the width of a human hair and smaller). Fine particles are either soot emitted directly from these combustion sources or formed in the atmosphere from power plant sulfur dioxide (SO2) or nitrogen oxides (NOx) emissions. Among airborne particles, the smallest (fine) combustion particles are of gravest concern because they are so tiny that they can be inhaled deeply and be absorbed into the bloodstream, thus evading the human lung's natural defenses.

The state of the science on fine particles and health has undergone thorough review, as reflected in the 2003 U.S. Environmental Protection Agency (EPA) Criteria Document for Particulate Matter.[viii] Since EPA set the fine particle standard in 1997, hundreds of new published studies, taken together, robustly confirm the relationship between fine particle pollution and severe adverse human health effects. In addition, the new research has provided plausible biological mechanisms for the serious impacts associated with fine particle exposure.[ix]

While all of us are at risk from exposure to power plant pollution, the elderly, people with lung and heart disease, and children are at greatest risk. Young children need healthy lungs to play, learn, and grow into strong adults. School-age kids find participating in sports and even studying difficult when battling respiratory problems such as asthma. Studies estimate that tens of thousands of elderly people die each year from existing levels of fine particle pollution from power plants and other sources.[x] These fine particles are also associated with tens of thousands of hospital admissions annually.[xi] Many of these involve elderly people already suffering from lung or heart disease. Respiratory ailments can rob the elderly of the full enjoyment of their sunset years. Breathing fine particles can also hurt individuals of any age with heart disease, emphysema, asthma, and chronic bronchitis by forcing them to require additional medical treatment. People struggling with these ailments try to cope by limiting their exposure to respiratory irritants in their environment, but they cannot control the quality of the outdoor air they breathe.

METHODOLOGY

This research brief focuses on the premature mortalities that 19 planned coal-fired power plant units are projected to cause during their expected lifetime operations. MSB Energy Associates [xii] performed the analysis using the Environmental Protection Agency's published methodology for calculating the health benefits of air quality improvements[xiii]. The emissions figures used for this analysis come from the permit applications filed for each power plant or unit, and were collated by Public Citizen's Texas office and the Sustainable Energy and Economic Development (SEED) Coalition. The data reported from the analysis indicates the annual SO2 and NOx emissions from each plant or unit and the annual mortalities associated with that level of pollution. Since coal-fired

power plants can be expected to operate for approximately fifty years, a cumulative figure has been calculated to reflect the premature mortalities associated with the plant's lifetime operation.

ABOUT THIS REPORT

Public Citizen's Texas office and the Sustainable Energy and Economic Development (SEED) Coalition produced this report based on an analysis commissioned by Clear the Air and performed by MSB Associates.

Public Citizen's Texas office
Tom "Smitty" Smith
1002 West Ave
Austin, Texas 78701
512-477-1155

Sustainable Energy and Economic Development (SEED) Coalition
Karen Hadden
1801 Westlake Dr. #209
Austin, Texas 78746
512-797-8481

APPENDIX 1: Emissions from Proposed Coal-Burning Power Plants

Emissions from Proposed Coal Burning Power Plants*

Power Plants	Permit #	Status	Mega-watts	CO_2** Tons/yr	SO_2		NO_X (forms Ozone)		Particulate Matter		Mercury lb/yr
					Tons/yr	lb/MMBtu	Tons/yr	lb/MMBtu	Tons/yr	lb/MMBtu	
CPS Spruce San Antonio, Bexar Co.	70492	12/28/05 Permit issued	750	7.4 mil	2,102	0.06	1,752	0.05	771	0.022	133
Sandy Creek Energy Riesel, McLennan Co.	70861	7/18/06 Permit granted – on appeal	800	7.5 mil	3,585	0.10	1,793	0.05	1,434	0.04	136
Calhoun Co. Nav. Dist. Point Comfort, Calhoun Co.	45586	Hearing Requested	303	2.6 mil	2,071	0.179	813	0.07	597	.051	70
TXU's Oak Grove 1 & 2 (2 units) Bremond, Robertson Co.	76474	8/23/06 SOAH recommended denying permit	1,600	16.5 mil	15,086	0.192	6,286	0.08	3,144	0.04	1,440
TXU's Sandow 5 at Alcoa Rockdale, Milam Co.	48437		581	5.4 mil	5,186	0.2	2,593	0.1	1,037	0.04	192
Twin Oaks Power 3 Bremond, Robertson Co.	76381	Revised Draft Permit	680	6.1 mil	5,818	0.20	2,037	0.06 – 0.14	1,018	0.068	860
Formosa Plastics (2 units) Point Comfort, Calhoun Co.	76044	Application filed	300	3 mil	1,091 – 6,518	0.083 – 0.496	920	0.07	446	0.034	78
TXU's Tradinghouse 3 & 4 (2 units) Waco, McLennan Co.	78762	Hearing Requested	1,716	15.9 mil	7,574	0.10	3,788	0.05	3,030	0.04	320
TXU's Lake Creek 3 Riesel, McLennan Co.	78751	Hearing Requested	858	8 mil	3,787	0.10	1,894	0.05	1,515	0.04	160
TXU's Big Brown 3 Fairfield, Freestone Co.	78759	Hearing Requested	858	8 mil	3,787	0.10	1,894	0.05	1,515	0.04	160
TXU's Monticello 4 Mount Pleasant, Titus Co.	78744	Hearing Requested	858	8 mil	3,787	0.10	1,894	0.05	1,515	0.04	160
TXU's Martin Lake 4 Tatum, Rusk Co.	78750	Hearing Requested	858	8 mil	3,787	0.10	1,894	0.05	1,515	0.04	160
TXU's Valley 4 Savoy, Fannin Co.	78763	Hearing Requested	858	8 mil	3,787	0.10	1,894	0.05	1,515	0.04	160
TXU's Morgan Creek 7 Colorado City, Mitchell Co.	78761	Hearing Requested	858	8 mil	3,787	0.10	1,894	0.05	1,515	0.04	160
NRG's Limestone 3 Jewett, Limestone Co.	79188	Application filed	745	7.4 mil	2,103	0.06	1,752	0.05	1,402	0.04	140
Nueces IGCC Plant*** Corpus Christi, Nueces Co.	80024	Application filed	600	4.7 mil	392	0.008	423	0.05	147	0.006	86
TOTALS			13,257	124.5 mil	67,730 - 73,157	-------	33,521	-------	22,116	--------	4,415

* All emissions data, except CO_2 emissions, derived from TCEQ permits or permit applications.
** CO_2 emissions data derived from EPA report: "Environmental Footprints and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies (July 2006)
*** IGCC is currently the cleanest technology available for producing power from coal or petroleum coke.

Provided as a courtesy by Public Citizen and the Sustainable Energy and Economic Development (SEED) Coalition (October 10, 2006)

APPENDIX 2: HEALTH EFFECTS OF POWER PLANT POLLUTANTS

Pollutant	What is it?	How is it produced?	Health effects	Most vulnerable populations
Ozone	Ozone is a highly corrosive, invisible gas.	Ozone is formed when nitrogen oxides (NOx) react with other pollutants in the presence of sunlight.	Rapid shallow breathing, airway irritation, coughing, wheezing, shortness of breath. Makes asthma worse. May be related to premature birth, cardiac birth defects, low birth weight and stunted lung growth.	Children, elderly, people with asthma or other respiratory disease. People who exercise outdoors.
Sulfur Dioxide (SO_2)	SO_2 is a highly corrosive, invisible gas. Sulfur occurs naturally in coal.	SO_2 is formed in the gases when coal is burned. SO_2 reacts in the air to form sulfuric acid, sulfates, and, in combination with NOx, acidic particles.	Coughing, wheezing, shortness of breath, nasal congestion and inflammation. Makes asthma worse. SO_2 gas can de-stabilize heart rhythms. Low birth weight, increased risk of infant death.	Children and adults with asthma or other respiratory disease.
Particulate Matter (PM) Soot	A mixture of small solid particles (soot) and tiny sulfuric acid droplets. Small particles are complex and harmful mixtures of sulfur, nitrogen, carbon, acids, metals and airborne toxics.	Formed with SO_2 and NOx in the atmosphere.	PM crosses from the lung into blood stream resulting in inflammation of the cardiac system, a root cause of cardiac disease including heart attack and stroke leading to premature death. PM exposure is also linked to low birth weight, premature birth, chronic airway obstruction and remodeling and sudden infant death.	Elderly, children, people with asthma.
Nitrogen Oxides (NOx)	A family of chemical compounds including nitrogen oxide and nitrogen dioxide. Nitrogen occurs naturally in coal.	NOx is formed when coal is burned. In the atmosphere can convert to nitrates and form fine acidic particles. Reacts in the presence of sunlight to form ozone smog.	NOx decreases lung function and is associated with respiratory disease in children. Converts to ozone and acidic PM particles in the atmosphere.	Elderly, children, people with asthma.
Mercury	A metal that occurs naturally in coal.	Mercury is released when coal is burned.	Developmental effects in babies that are born to mothers who ate contaminated fish while pregnant. Poor performance on tests of the nervous system and learning. In adults may affect blood pressure regulation and heart rate.	Fetuses and children are directly at risk. Pregnant women, children and women of childbearing age need to avoid mercury exposure.
Carbon Dioxide	Coal has the highest carbon content of any fossil fuel.	Carbon dioxide is formed when coal is burned.	Indirect health effects may be associated with climate change including the spread of infectious disease, higher atmospheric ozone levels and increased heat and cold-related illnesses.	People of color, children, people with asthma.

[i] Environmental Protection Agency, *Guidelines for Preparing Economic Analyses,* (September 2000). Http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html/$file/Guidelines.pdf.

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[iii] Abt Associates, *The Particulate-Related Health Benefits of Reducing Power Plant Emissions,* (October 2000). Available online at: http://www.catf.us/publications/reports/Abt_PM_report.php; Levy, J., and Spengler, J., *Estimated Health Impacts of Criteria Pollutant Air Emissions from the Salem Harbor and Brayton Point Power Plants,* Harvard School of Public Health (May 2000). Available online at: http://www.hsph.harvard.edu; Levy, J.I. et al., *Using CALPUFF to Evaluate the Impacts of Power Plant Emissions in Illinois: Model Sensitivity and Implications,* 36 Atmospheric Environment 1063–1075 (2002); Levy, J. et al., *The Importance of Population Susceptibility for Air Pollution Risk Assessment: A Case Study of Power Plants Near Washington, DC,* 110 Env. Health Persp. (No. 12) 1253 (December 2002); Levy, J. et al., *Estimation of Primary and Secondary Particulate Matter Intake Fractions for Power Plants in Georgia,* Environ. Sci. Technol. 37,5528-5536 (2003).

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[v] Brunekreef, B., *Air Pollution and Life Expectancy: Is There a Relation?* 54 Occup. Environ. Med. 781–84 (1997).

[vi] U.S. EPA, OAR, "Final Report to Congress on Benefits and Costs of the Clean Air Act, 1970 to 1990", EPA 410-R-97-002 (October 1997) at I-23.

[vii] Vedal, Sverre, Brauer, Michael, White, Richard, and Petkau, John, *Air Pollution and Daily Mortality in a City with Low Levels of Pollution,*111 Environ Health Perspectives 45–51 (2003).

[viii] U.S. EPA, "Fourth External Review Draft of Air Quality Criteria for Particulate Matter Vols. 1 and 2," EPA/600/P-99/002aD (June 2003). Available online at: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=58003

[ix] Peters, Annette, and Pope, C.A., *Cardiopulmonary Mortality and Air Pollution,* 360 The Lancet 1184 (October 19, 2002); Nemmar, A., Hoet, P.H.M., Vanquickenborne, B., Dinsdale, D., Thomeer, M., Hoylaerts, M.F., Vanbilloen, H., Mortelmans, and L. Nemery, B., *Passage of Inhaled Particles Into the Blood Circulation in Humans* 105 Circulation 105:411-414 (2002); Brook, Robert D., Brook, Jeffrey R., Urch, Bruce, Vincent, Renaud, Rajagopalan, Sanjay, and Silverman, Frances, 105 Circulation 1534-1536 (2002).

[x] Wilson, Richard, and Spengler, John, eds. *Particles in Our Air: Concentrations and Health Effects* (1999) p. 212.

[xi] Ibid.

[xii] http://www.msbnrg.com/

[xiii] U.S. Environmental Protection Agency Internal Memorandum, Bryan Hubbell to Sam Napolitano, July 2, 2001.