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Arizona Corporation Commissioners IRC Hearing

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Phoenix, Arizona

Good morning commissioners,

My name is Dr. Barbara Warren

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I am a physician and health educator, trained in internal medicine and with a Master's degree in Public Health. I've had 40 years of practice, administrative and teaching experience. I worked in Community Health, Preventive Medicine and briefly in Occupational Medicine. I led the organization and presentation of community based health education programs, including occupational health hazards and the Health Effects of Climate Change (November, 2008, U of A) and I have been a local and national Board member of Physicians for Social Responsibility for 26 years. This organization, that I represent today, addresses public education about the health concerns related to energy production and climate change as 2 of its principle missions.

I want to talk with you today about the **health** externalities of coal as an energy source in our communities. I will briefly review these with my slides and I have handouts for you that elaborate further on these comments. Additionally, Physicians for Social Responsibility made a national press release yesterday of a new monograph, outlining the health hazards of coal production and use across its spectrum. I offer copies of the Executive Summary of this document to you today also.

As you know, coal-fired power is one of the most polluting forms of energy available, particularly when compared to renewable energy alternatives such as wind, solar and geothermal power. Only by ignoring its very serious health and environmental impacts can coal-fired power be considered a low-cost energy source. Coal-fired power plants supply roughly 50 percent of the nation's electricity, but produce a disproportionate share of electric utility-related air pollution. In fact, coal plants emit approximately 87 percent of total utility-related nitrogen oxide (NOx) pollution, 94 percent of utility related sulfur dioxide (SO2) pollution and 98 percent of all utility-related mercury pollution. Coal plants remain the single largest source of sulfur dioxide, mercury and air toxic emissions and the second largest source of nitrogen oxide pollution. Once emitted, these pollutants combine to form secondary pollutants, such as ozone and particulate matter that pose an equally significant threat to public health.

What does this mean for the health of our communities in Arizona? All of the health conditions that I will discuss arise at a great cost to our society and directly impact each of us from direct exposures and illness to increases in our costs for health care. According to a study published in Ontario, the magnitude of these costs are estimated to amount to 9 cents/Khr of the cost of coal as an energy source. In a report this year by the Australian Academy of Technological Sciences and Engineering, conservative estimates are that the total health damage cost of just three coal-fired power station emissions are equivalent to an aggregated national health burden of around \$2.6 billion per annum. The details of all health costs are beyond the scope of my presentation, but they are available in the medical and public health literature.

The health effects of NOx exposure range from eye, nose and throat irritation at low levels of exposure to serious damage to the tissues of the upper respiratory tract, fluid build-up in the lungs and death at high exposure levels. In addition to the adverse effects of direct exposure, NOx emissions from coal plants also pose a very serious health risk as ozone precursors

Ozone pollution, or smog, is formed when NOx reacts with volatile organic compounds (VOCs) in the presence of sunlight. Smog is one of the nation's most pervasive air pollutants. Smog is a powerful respiratory irritant. At low levels of exposure, ozone can cause coughing, wheezing, shortness of breath and chest pain. At higher concentrations, breathing ozone can lead to more serious effects, including lung tissue damage, reduced lung capacity, asthma exacerbation, as well as increased risk of hospitalization for asthma, bronchitis and other chronic respiratory diseases and premature death.

Particulate matter is the most harmful pollutant produced by coal-fired power plants. While particulate matter is released directly from smokestacks to some extent, a much greater amount of particle pollution is formed from atmospheric reactions of SO2 and NOx.

As the source of nearly 60 percent of the nation's total SO₂ emissions, coal combustion is one of the most significant contributors to particulate pollution in the U.S. More than 93 million Americans live in areas where they are exposed to unhealthful short-term levels of particulate matter and more than 54 million people live in regions with harmful year-round levels of particulate matter. Inhaling particulate matter can result in a wide range of adverse health effects, including asthma attacks, lung tissue damage, stroke, heart attack and premature death. The public health burden of particle pollution is staggering; a recent study estimated that particulate matter from coal plants is responsible for nearly 24,000 premature deaths each year.

Burning coal also produces millions of pounds of toxic air emissions each year, making coal-fired power plants the largest source of air toxins in the U.S. In EPA smoke stack tests, coal plants were found to release 67 different air toxins, many of which are known or probable human carcinogens and neurotoxins that can harm brain development and irritate the respiratory system. Among the array of air toxins emitted by coal plants, mercury is the pollutant of greatest concern. In 2005, coal plants were responsible for more than 65 percent of all mercury air emissions.

After mercury is released to the air, it is deposited in bodies of water where it is converted to methyl-mercury (an organic form) that accumulates in fish tissues. Humans are exposed to mercury primarily through the consumption of contaminated fish. Methyl mercury's neurotoxic effects are particularly threatening to fetal and child development. Fetal exposure via the placenta can cause mental retardation and brain damage, while continued exposure in early childhood can result in learning disabilities and attention deficit disorders. Approximately one in six women of childbearing age now have unsafe levels of mercury in their blood and it is estimated that between 300,000 and 600,000 children are at serious risk of severe neurological and developmental impairment from mercury exposure each year. Though mercury poses the greatest threat to children, research shows that mercury exposure may increase the risk of coronary heart disease, particularly among men.

Many toxic chemicals are found in post coal combustion waste dumps or coal ash ponds. There are 600 of these toxic waste ponds in the U.S. with 67 documented cases of surface or groundwater contamination in at least 23 states. Arizona has 9 of the 44 most hazardous coal ash ponds in the U.S. Though poorly regulated, these ponds contain deadly brews of mercury, lead, arsenic, cadmium, selenium, chromium, sulfates, boron and others. These chemicals cause cancer, neurological disorders, and many other serious conditions, especially in children. There is a 900 times greater risk of cancer from coal toxic exposures than the EPA baseline and the risk is 10 times greater than smoking 1 pack of cigarettes a day. People living near coal plants have a greater risk of poisoning from these chemicals, but they may be exposed widely in communities and their water tables contaminated with flooding, as has occurred in Tennessee, Pennsylvania and Georgia. Post combustion waste dumps are often exposed to wind and the "scrubber sludge" is offered for distribution for asphalt production and other uses. I even was told (on a tour of our coal burning power plant) that this material can be or is used for compost in gardens!

Finally, coal-fired power plants are also a significant source of carbon dioxide emissions. In fact, per unit of energy produced, coal is the most carbon intense energy source, producing approximately 40 percent of total U.S. carbon dioxide pollution. While the carbon dioxide emissions produced by coal-fired power plants have no known direct effects on human health, they are a very significant contributor to global warming, which itself poses one of the greatest threats to public health in the long term. Global warming is already having a considerable impact world wide; the World Health Organization estimates that approximately 150,000 deaths annually can be attributed to climate change. Increased heat-related illness and death, flooding, drought and more pest and water borne disease are among the many health consequences expected in a warmer world.

It is essential that we in Arizona address the public health impacts of each of the energy sources we use and that we calculate the costs of these impacts in making our future decisions about energy.

Thank you for the opportunity to speak with you

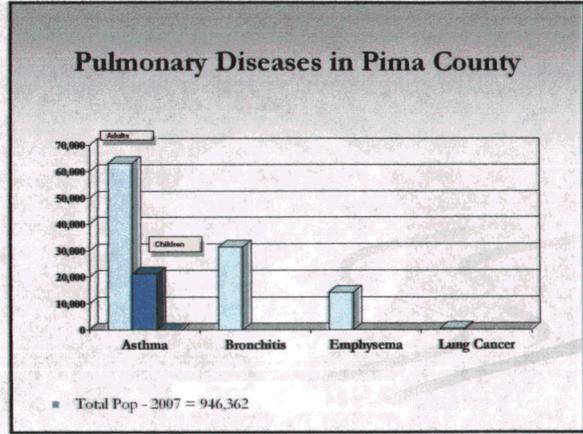
Coal Pollutants: Deadly



Healthy Airway Inflamed Airway



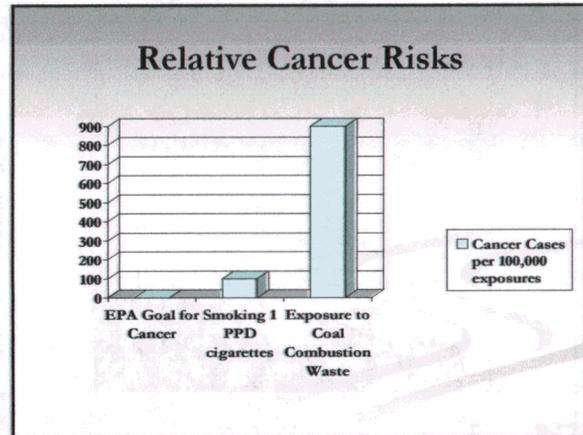
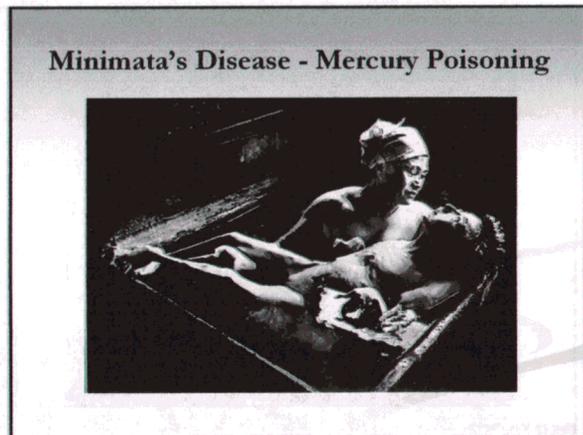
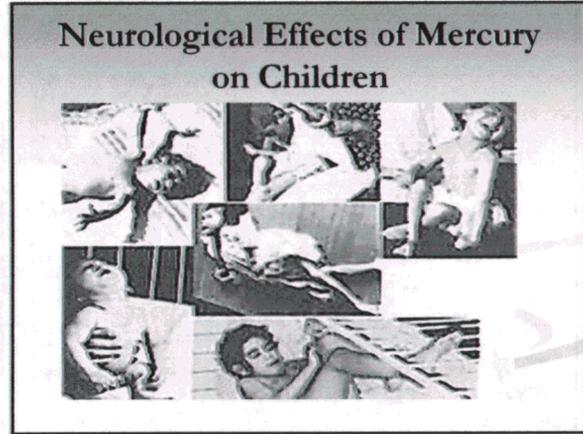
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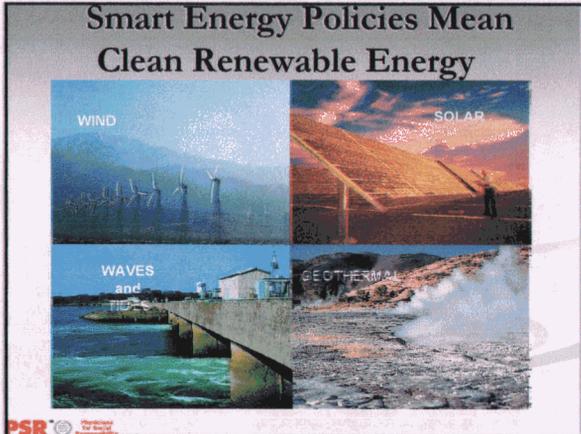
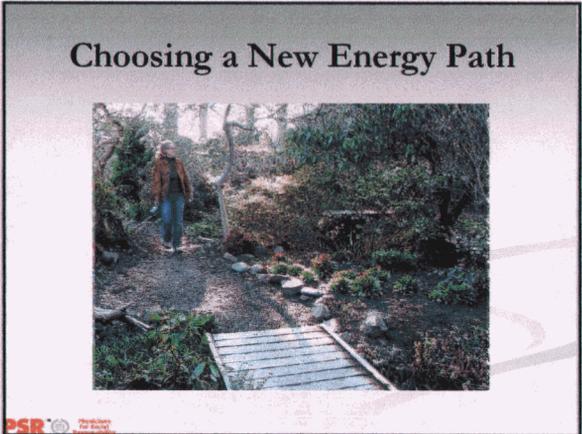
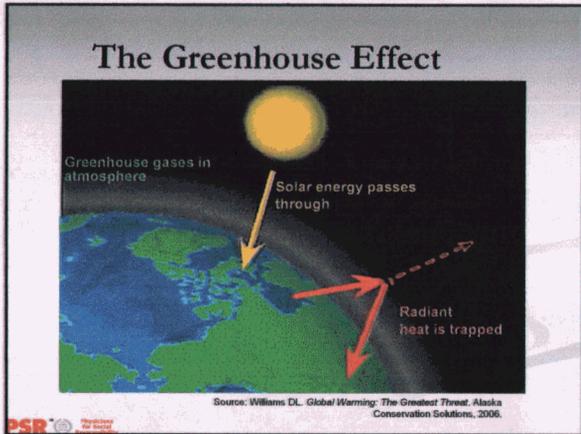
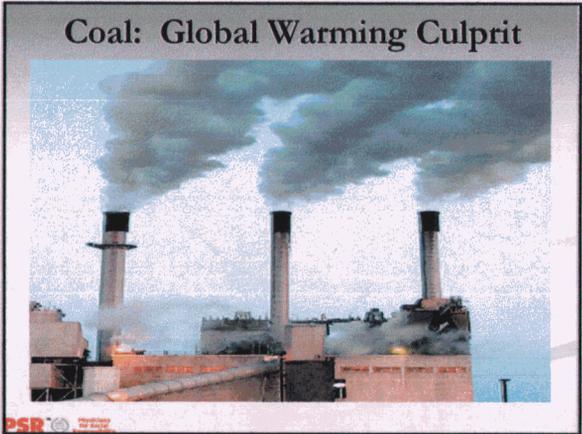
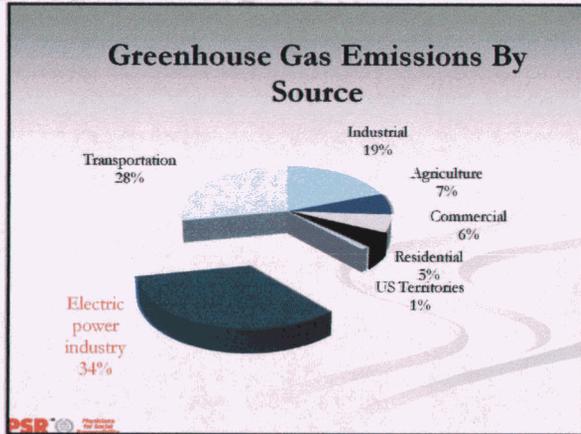
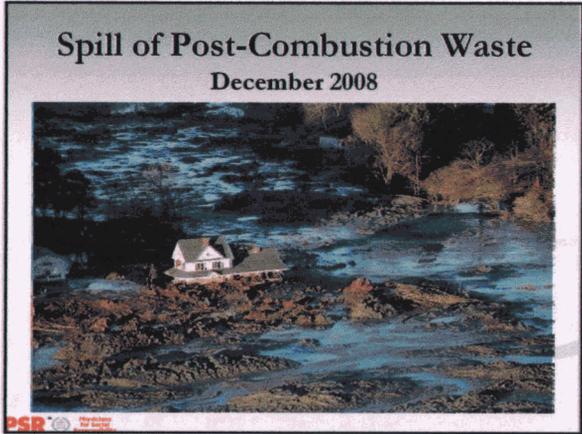


Health Effects and Costs of Coal Plant Particle Pollution

Annual U.S. Incidence rates

Premature Death	23,600
Heart Attacks	38,200
Asthma Attacks	554,000
Hospital Admissions	21,850
Emergency Room Visits	26,000
Lost Work days	3,186,000







Coal-Fired Power Plants: Understanding the Health Costs of a Dirty Energy Source

Ignoring Public Health in the Rush to Coal

Mounting concern about U.S. dependence on foreign oil and rising energy prices has sparked a rush to build a fleet of new coal-fired power plants. With more than 100 new plants on the drawing board around the country, coal proponents argue that tapping into our nation's large reserves of coal is necessary for improving U.S. energy security and essential to providing cheap electricity in the face of rising energy demand. However, only by ignoring its very serious health and environmental impacts can coal-fired power be considered a low-cost energy source. Setting aside the fact that coal has little practical utility as a transportation fuel and therefore will have a negligible impact on our nation's addiction to oil, coal-fired power is one of the most polluting forms of energy available, particularly when compared to renewable energy alternatives such as wind, solar and geothermal power.

Dirty Power, Dirty Air — Pollution from Coal-Fired Power

Coal-fired power plants supply roughly 50 percent of the nation's electricity,¹ but produce a disproportionate share of electric utility-related air pollution. In fact, coal plants emit approximately 87 percent of total utility-related nitrogen oxide (NOx) pollution, 94 percent of utility-related sulfur dioxide (SO₂) pollution and 98 percent of all utility-related mercury pollution (see Figure 1).² Even when compared across economic sectors, coal plants remain the single largest source of sulfur dioxide, mercury and air toxic emissions and the second largest source of nitrogen oxide pollution.^{2,3} Moreover, once emitted, these pollutants combine to form "secondary pollutants" such as ozone and particulate matter that pose an equally significant threat to public health. While it is impossible to precisely quantify, the contribution to ozone and particulate matter pollution from coal-fired power is undoubtedly very large.

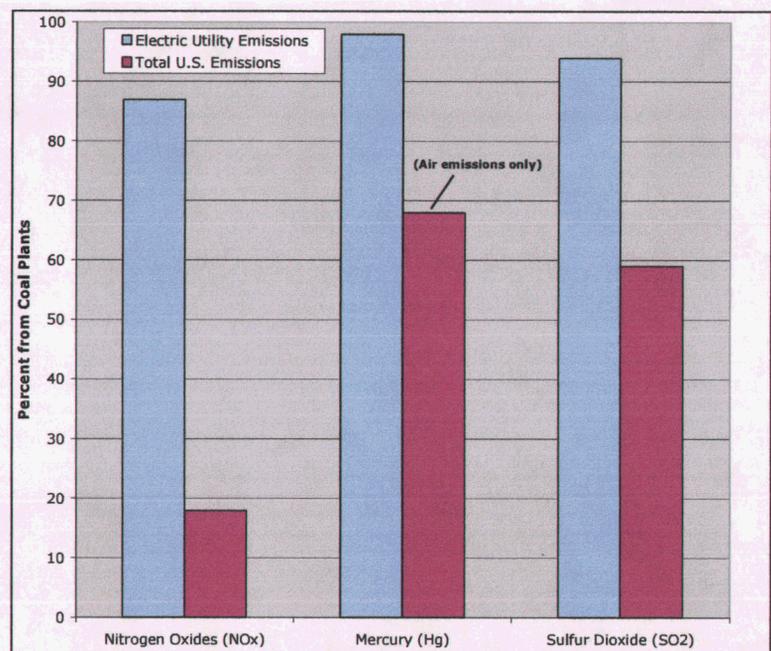


Figure 1. Coal Plant Emissions of NOx, Mercury and SO₂

NOx and Ozone Pollution

Coal-fired power plants are the second largest source of NOx pollution after automobiles, producing 18 percent of total U.S. NOx emissions.² The health effects of NOx exposure range from eye, nose and throat irritation at low levels of exposure to serious damage to the tissues of the upper respiratory tract, fluid build-up in the lungs and death at high exposure levels.⁴ In addition to the adverse effects of direct exposure, NOx emissions from coal plants also pose a very serious health risk as ozone precursors.

Ozone pollution, also known as smog, is formed when NOx reacts with volatile organic compounds (VOCs) in the presence of sunlight. With an estimated one-third of the U.S. population living in areas with unhealthy levels of ozone,⁵ it is one of the nation's most pervasive air pollutants. Smog is a powerful respiratory irritant that can cause an array of health problems. At low levels of exposure, ozone can cause coughing, wheezing, shortness of breath and chest pain. At higher concentrations, breathing ozone can lead to more serious effects, including lung tissue damage, reduced lung capacity, asthma exacerbation, as well as increased risk of hospitalization for asthma, bronchitis and other chronic respiratory diseases.⁶ Recent studies demonstrate that ozone exposure also may lead to premature death.⁷

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Particulate Matter

Particulate matter is, perhaps, the most harmful pollutant produced by coal-fired power plants. While particulate matter is released directly from smokestacks to some extent, a much greater amount of particulate pollution is formed from atmospheric reactions of SO₂ and NO_x. As the source of nearly 60 percent of the nation's total SO₂ emissions,² coal combustion is one of the most significant contributors to particulate pollution in the U.S. According to the American Lung Association, more than 93 million Americans live in areas where they are exposed to unhealthy short-term levels of particulate matter and more than 54 million people live in regions with harmful year-round levels of particulate matter.⁵ Inhaling particulate matter can result in a wide range of adverse health effects, including asthma attacks, lung tissue damage, stroke, heart attack and premature death.⁸ The public health burden of particulate pollution is staggering; a recent study estimated that particulate matter from coal plants is responsible for nearly 24,000 deaths each year (see Figure 2).⁹

Health Effect	Incidence
Premature Death	23,600
Heart Attacks	38,200
Asthma Attacks	554,000
Hospital Admissions	21,850
Emergency Room Visits	26,000
Lost Work days	3,186,000

Figure 2. Health Impacts of Coal Plant Particulate Pollution

Air Toxics and Mercury

Burning coal also produces millions of pounds of toxic air emissions each year, making coal-fired power plants the largest source of air toxics in the U.S. In EPA smoke stack tests, coal plants were found to release 67 different air toxics, many of which are known or probable human carcinogens and neurotoxins that can harm brain development and irritate the respiratory system.¹⁰ Among the array of air toxics emitted by coal plants, mercury is the pollutant of greatest concern. In 2005, coal plants were responsible for more than 65 percent of all mercury air emissions.³

After mercury is released to the air, it is deposited in bodies of water where it is converted to methylmercury (an organic form) that accumulates in fish tissues. Humans are exposed to mercury primarily through the consumption of contaminated fish. Methylmercury's neurotoxic effects are particularly threatening to fetal and child development. Fetal exposure via the placenta can cause mental retardation and brain damage, while continued exposure in early childhood can result in learning disabilities and attention deficit disorders.¹¹ Approximately one in six women of childbearing age now have unsafe levels of mercury in their blood and it is estimated that between 300,000 and 600,000 children are at serious risk of severe neurological and developmental impairment from mercury exposure each year.¹² Though mercury poses the greatest threat to children, research shows that mercury exposure may increase the risk of coronary heart disease among men.¹¹

Coal Power and Global Warming

In addition to the enormous quantity of criteria pollutants produced by coal combustion, coal-fired power plants are also a significant source of carbon dioxide emissions. In fact, per unit of energy produced, coal is the most carbon-intensive energy source, producing approximately 40 percent of total U.S. carbon dioxide pollution.¹³ While the carbon dioxide emissions produced by coal-fired power plants have no known direct effects on human health, they are a very significant contributor to global warming—which itself poses one of the greatest threats to public health in the long term. Global warming is already having a considerable impact world wide; the World Health Organization estimates that approximately 150,000 deaths annually can be attributed to climate change.¹⁴ Increased heat-related illness and death, flooding, drought and more pest and water borne disease are among the many health consequences expected in a warmer world.

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