2. FOSSIL FUELS - TOO DANGEROUS TO BURN

It does not matter which "fossil fuel" is burned, they all release products that are harmful and, in some cases, toxic. When these fuels are burned, they release carbon dioxide, our major greenhouse gas. Below are arguments to show why we should not be burning these valuable natural resources.

COAL

A. DEATHS FROM COAL MINING:

1. Dating from early US coal mining history there have been at least 623 **coal mine disasters** in which many hundreds of miners died. Some of these accidents may have been averted if all safety regulations would have been followed. A summary of coal mining data including accidents and deaths can be found at <http://www.usmra.com/saxsewell/historical.htm>)

2. There are actually more deaths from **black lung disease**, pneumoconiosis, than from mining accidents. From 1998 through 2004, a seven year stretch, 230 miners died from mining accidents whereas there were 6,279 black lung related deaths. This disease is basically limited to coal miners who breathe in coal dust that, on X-rays, "forms clusters of little white dots that get brighter and whiter as the disease turns into progressive massive fibrosis." <http://www.npr.org/templates/story/story.php?storyId=126021059>

B. DAMAGE FROM MOUNTAINTOP REMOVAL

On February 27, 2009, Earthjustice sent out the following information concerning Mountaintop Removal: A recent federal appeals court decision allows new mountaintop removal mining projects. This practice allows the coal industry to literally blast millions of tons of waste rock, dirt and vegetation off the tops of mountains to get at the thin coal seams that might be 300 to 1000 feet underneath and bulldoze the remaining fill into the valleys below. Mountaintop removal coal mining has already permanently buried more than 2,000 miles of streams … poisoned area drinking water … flattened hundreds of mountains … annihilated nearly 400,000 acres of lush forests. And mountaintop removal could destroy more than 1.4 million acres of land in the next decade, starting with these permits…" See <www.ilovemountains.org> or <http://www.earthjustice.org/our_work/campaigns/stop-mountaintop-removal.html>

In March 2010, the Environmental Protection Agency (EPA) proposed to veto a permit issued by the U.S. Army Corps of Engineers for the Spruce No. 1 mine in West Virginia—one of the largest mountaintop removal projects ever approved—on the grounds that mine operations would violate the Clean Water Act. Local residents have been challenging the approval of this mine for more than twelve years. "The proposed expansion of the mine would bury more than seven miles of headwater streams, directly impact 2,278 acres of forestland, and degrade water quality in nearby streams." - <http://www.treehugger.com/files/2010/05/stop-west-virginias-spruce-mountaintop-removal-coal-mine.php> This EPA veto would not only stop that expansion but their newly adopted guidelines "could significantly limit the irreversible damage

to Appalachian waterways caused by mountaintop removal which could protect drinking water supplies and ecosystems." - <http://unearthed.earthjustice.org/blog/2010-april/momentum-builds-against-mountaintop-removal-mining>

C. EMISSIONS FROM BURNING COAL

In a recent study, the Union of Concerned Scientists stated that in an average year, a typical coal burning plant generates:

1. 3,700,000 tons of carbon dioxide (CO_2), the primary human cause of global warming--as much carbon dioxide as cutting down 161 million trees. (Coal-fired power plants in the United States emit more heat-trapping carbon dioxide than any other source.)

2. 10,000 tons of sulfur dioxide (SO_2), which causes acid rain that damages forests, lakes, and buildings, and forms small airborne particles that can penetrate deep into lungs.

3a. 500 tons of small airborne particles, which can cause chronic bronchitis, aggravated asthma, and premature death, as well as haze obstructing visibility. (Fine particulate pollution from U.S. power plants cuts short the lives of approximately 24,000 people each year - 50 percent more than were murdered in this country in 2004. - UCS "earthwise" - winter 2008-09)

3b. Black Carbon (soot): besides being an air pollutant that fills lungs with particulates, Black Carbon "may be responsible for as much as 18% of the planet's warming, making it the No. 2 contributor to climate change after carbon dioxide, which accounts for 40%." Black carbon in the atmosphere absorbs sunlight and directly heats the atmosphere. It heats up the greenhouse gas blanket directly. "Unlike CO_2, which can hang around in the atmosphere for centuries — CO_2 that was emitted by the first coal-powered train is probably still in the air, warming the planet — black carbon has a relatively brief life span. It remains just a few weeks in the air before it falls to earth." <http://www.time.com/time/health/article/0,8599,1938379,00.html>

4. 10,200 tons of nitrogen oxide (NO_x), as much as would be emitted by half a million late-model cars. NO_x leads to formation of ozone (smog) which inflames the lungs, burning through lung tissue making people more susceptible to respiratory illness.

5. 720 tons of carbon monoxide (CO), which causes headaches and place additional stress on people with heart disease.

6. 220 tons of hydrocarbons, volatile organic compounds (VOC), which form ozone.

7. 170 pounds of mercury (Hg) (a potent neurotoxin), where just 1/70th of a teaspoon deposited on a 25-acre lake can make the fish unsafe to eat.

8. 225 pounds of arsenic (As, which will cause cancer in one out of 100 people who drink water containing 50 parts per billion.)

9. 114 pounds of lead (Pb), 4 pounds of cadmium (Cd), other toxic heavy metals and trace amounts of uranium (U). [Heavy metals have recently been re-examined: "Coal burning leaves toxic heavy metal legacy in the Arctic" - McConnel & Edwards - April 11, 2008. Their research found highly toxic thallium (Tl), cadmium (Cd) and lead (Pb) in the Arctic and are concerned with the bioconcentration effects of these toxic metals from coal burning especially in the northern hemisphere.]

D. ASH

According to the Union of Concerned Scientists "earthwise" Winter 2008-09: "The burning of coal generates more than 120 million tons of ash, slag, and sludge annually - roughly the same amount as all municipal solid waste disposed in U.S. landfills each year."

1. COMPOSITION: Coal ash is composed primarily of oxides of silicon, aluminum, iron, calcium, magnesium, titanium, sodium, potassium, arsenic, mercury, and sulfur plus small quantities of uranium and thorium. Fly ash is primarily composed of non-combustible silicon compounds (glass) melted during combustion. Tiny glass spheres form the bulk of the fly ash. - <http://www.ornl.gov/info/ornlreview/rev26-34/text/colmain.html>

2. DISPOSAL:

a. **COAL ASH PONDS:** Because coal ash impoundments have "high" or "significant" potential to cause loss of human life, environmental damage, or damage to infrastructure, the U.S. EPA announced plans on February 4, 2010, to make coal ash impoundments safer.

Coal-fired power plants generate more than 130 million tons of fly ash, bottom ash, boiler slag, and flue gas desulfurization gypsum each year.

Coal ash came to national attention on December 22, 2008, when an impoundment holding disposed ash waste generated by the Tennessee Valley Authority Kingston power plant in Tennessee broke, spilling 5.4 million cubic yards of ashy sludge over land and rivers. See: <http://www.ens-newswire.com/ens/feb2010/2010-02-05-093.html>

The cleanup has cost $231 million to the end of 2009.

In addition to the action plans, EPA released assessment reports on the structural integrity of 40 more coal ash impoundments at 16 facilities across the country.

Most of the 40 impoundments have a rating of "high" or "significant" hazard potential.

A high hazard potential rating means if an impoundment fails, it can cause loss of human life.

A significant hazard potential rating means impoundment failure can cause economic loss, environmental damage, or damage to infrastructure.

Ash from burned coal contains arsenic and heavy metals but labeling coal ash as hazardous could lead to a federal disposal standard to replace varying state regulations.

b. **LANDFILLING ASH:** When ash ponds are not used, burnt coal wastes are often dumped into unlined landfills or underground mines (See: <http://www.earthjustice.org/library/reports/earthjustice_waste_deep.pdf>), where toxic metals leach into drinking water supplies.

c. **RECYCLING ASH:** Reusing waste products is a good method of pollution prevention. It not only saves landfill space but also can be an economical benefit to a company. Ash can be recycled into cement and cement products - even highways, or as a filler material in the making of bricks.

E. EFFECTS ON HUMAN HEALTH

The Sierra club states that coal-fired power plants are linked to 22,000 avoidable deaths annually in the United States. <http://wisconsin.sierraclub.org/Issues/warming.asp>

X-ray studies of coal miners in the US show evidence of black lung disease in about one of every 20 coal miners. The medical definition of black lung disease is; "A chronic occupational lung disease contracted by the prolonged breathing of coal mine dust. The silica and carbon in the coal dust cause black lung disease. About one of every 20 miners studied in the US has X-ray evidence of black lung disease, a form of pneumoconiosis." <http://www.medterms.com/script/main/art.asp?articlekey=9818>

"Coal combustion emissions damage the respiratory, cardiovascular, and nervous systems and contribute to four of the top five leading causes of death in the U.S." - (Coal's Assault on Human Health - A Report from Physicians For Social Responsibility - November 2009 <http://www.psr.org/assets/pdfs/coals-assault-executive.pdf>)

The John Muir Chapter of the Sierra club states that "mercury pollution from coal-fired power plants has contaminated every lake, river, and waterway in Wisconsin. Soot pollution from coal-fired power plants has been linked to over 550,000 asthma attacks, 38,000 heart attacks, and 22,000 avoidable deaths annually in the United States. Over 2.1 million people live in areas that contain unhealthy levels of soot or smog." http://wisconsin.sierraclub.org/Issues/warming.asp

Coal contributes to the following major health effects:

1. Asthma exacerbations;
2. Asthma development;
3. Chronic Obstructive Pulmonary Disease (COPD);
4. Stunted lung development;
5. Infant mortality (relevant organ system uncertain; may be respiratory);
6. Lung cancer;
7. Cardiac arrhythmias;
8. Acute myocardial infarction;
9. Congestive heart failure;
10. Ischemic stroke;
11. Developmental delay;

In early June of 2010, "the EPA proposed new regulations that clamp down on smog and particle pollution - or soot - in the eastern United States starting in 2012. The cost of adding scrubbers and other controls is estimated at $2.8 billion annually by 2014. The EPA says that the price will be offset by $120 billion a year in health benefits, avoiding up to 36,000 in

premature deaths and 240,000 cases of aggravated asthma." (Milwaukee Journal Sentinel - Thomas Content & Lee Bergquist - July 11, 2010)

Approximately one-third of all mercury emissions attributed to human activity comes from coal-fired plants. "Babies born each year with cord blood concentrations of mercury >5.8μg/L, the level above which mercury exposure has been shown to reduce IQ: 637,233 (15.7% of all babies born)." <http://www.psr.org/assets/pdfs/coals-assault-executive.pdf>

PETROLEUM

A. DEATHS IN THE PETROLEUM INDUSTRY:

It appears that most available statistics combine fatalities from both the petroleum industry and the gas industry and most of the data take us only through the year 2006.

However, combined statistics show that "at least 598 workers died on the job (well drilling or field servicing) between 2002 and 2007, according to the Bureau of Labor Statistics. During that period, the number of deaths per year rose by around 70 percent, from 72 victims in 2002 to 125 in 2006 and a preliminary count of 120 in 2007." (Associated Press - 9/10/2008)

These statistics do not include fatalities in the oil and gas **production** industry (e.g. refining), which is classified separately by the federal government. (Sammons & Associates, P.C.)

B. DAMAGE FROM PETROLEUM DRILLING

It is apparent that there is not much need to detail damage from some of our major petroleum catastrophes especially since BP's disaster in the Gulf of Mexico. A short list includes:

1. BP's April 20, 2010, Deepwater Horizon offshore oil disaster: <http://www.realtruth.org/articles/100602-002-analysis.html?s_kwcid=TC|7308|bp%20oil%20spill||S|e|5258092997&gclid=CODs_eX_5KICFcl25Qod7TEJxw>

2. The Exxon Valdez oil spill which occurred in Prince William Sound in Alaska on March 24, 1989. The Exxon Valdez oil tanker spilled an estimated 10.8 million gallons (250,000 barrels) of crude oil. Some estimates are far higher. <http://www.evostc.state.ak.us/Files.cfm?doc=/Store/Event_Documents/SAK-DOL_FactSheet.pdf&> or <http://en.wikipedia.org/wiki/Exxon_Valdez_oil_spill>

3. On February 15, 1996, off the Welsh coast the Sea Empress, a supertanker, ran aground at port of Milford Haven, Wales, and spewed out 70,000 tons of crude oil (that's approximately 140,000,000 pounds, or 20,000,000 gallons, or 476,190 barrels of crude). It created a 25-mile slick.

4. On July 26, 2010, 840,000 gallons of oil (from a 30-inch Enbridge tar sands pipeline) poured into Kalamazoo River in southern Michigan, and officials are saying the oil should be reaching Lake Michigan by August 1st. The pipeline normally carries about 8 million gallons of

oil per day from Griffith, Indiana, to Sarnia in Ontario, Canada. The spill is claimed to be “the largest oil spill in the Midwest. <http://www.daylife.com/topic/Kalamazoo_River>

5. A long list of Oil Spills and Disasters can be found at:
<http://www.infoplease.com/ipa/A0001451.html>

C. EMISSIONS FROM BURNING PETROLEUM

Petroleum products give off the following emissions when they are burned as fuel:
<http://www.eia.doe.gov/kids/energy.cfm?page=oil_home-basics>

1. Carbon dioxide (CO_2);
2. Carbon monoxide (CO);
3. Sulfur dioxide (SO_2);
4. Nitrogen oxides (NO_X) and Volatile Organic Compounds (VOC);
5. Particulate matter (PM);
6. Lead and various air toxics such as benzene, formaldehyde, acetaldehyde, and 1,3 butadiene may be emitted when some types of petroleum are burned.

Nearly all of these byproducts have negative impacts on the environment and human health.

D. EFFECTS ON HUMAN HEALTH

1. Carbon dioxide is a greenhouse gas and a source of global warming;

2. Carbon monoxide is highly toxic to humans and animals in high quantities;

3. SO2 causes acid rain, which is harmful to plants and to animals that live in water, and it worsens or causes respiratory illnesses and heart diseases, particularly in children and the elderly;

4. NOX and VOCs contribute to ground-level ozone, which irritates and damages the lungs;

5. PM results in hazy conditions in cites and scenic areas, and, along with ozone, contributes to asthma and chronic bronchitis, especially in children and the elderly. Very small, or “fine PM” is also thought to cause emphysema and lung cancer;

6. Lead can have severe health impacts, especially for children, and air toxics are known or probable carcinogens.

NATURAL GAS

Most data concerning natural gas are generally combined with data from the petroleum industry because of the 452,768 natural gas wells producing at the end of 2007, more than

18.7 trillion cubic feet of natural gas were produced from Gas Wells whereas an additional 5.8+ trillion cubic feet (nearly 25%) were produced from Oil Wells. <http://www.eia.doe.gov/pub/oil_gas/natural_gas/feature_articles/2009/ngprod2009/ngprod2009.pdf>
Raw natural gas that comes from petroleum crude oil wells is typically termed ***associated gas***. Because of this overlapping of production of natural gas with petroleum, this article will not attempt to separate data pertaining to A and B:

A. DEATHS FROM NATURAL GAS PRODUCTION

The fatality rate for oil and gas workers in the U.S. between 2002 and 2007 was more than 29 deaths per 100,000 workers, or about seven times the average for all occupations, according to the Centers for Disease Control and Prevention.
During that period, the rate climbed from about 25 deaths per 100,000 workers in 2002, peaking at more than 32 in 2006 before falling back to about 28 in 2007. -(Associated Press updated 9/10/2008)

B. EMISSIONS FROM THE COMBUSTION OF NATURAL GAS

<http://www.naturalgas.org/environment/naturalgas.asp>

Natural gas is the cleanest of all the fossil fuels. Composed primarily of methane, the main products of combustion of natural gas are carbon dioxide and water vapor, the same compounds we exhale when we breathe. But there are other chemicals that are created when natural gas is burned such as nitrogen dioxide, carbon monoxide, fine particulates, polycyclicaromatic hydrocarbons, volatile organic compounds (including formaldehyde) as well as other chemicals. <http://www.environmentalhealth.ca/summer01gas.html>

Chemists might write the following to represent the combustion of methane - [g] refers to gaseous form, [l] refers to liquid form and KJ represents kilojoules of energy:

$$CH_4[g] + 2\ O_2[g] \rightarrow CO_2[g] + 2\ H_2O[l] + 891\ kJ$$

To see a summary of statistics for Natural Gas in the United States from 2003 - 2007, see: <http://www.eia.doe.gov/pub/oil_gas/natural_gas/feature_articles/2009/ngprod2009/ngprod2009.pdf>

Source: Duke Energy Gas Transmission Canada

C. CLEANING UP NATURAL GAS:

1. **Importance of CO_2 emissions**: In absolute terms, Natural Gas does contribute substantially to global carbon emissions, and this contribution is projected to grow. According to a 2004 IPPC Fourth Assessment Report, natural gas produced about 5,300 million tons of CO_2 emissions per year, while coal and oil produced 10,600 and 10,200 respectively. In addition, natural gas itself is a greenhouse gas which has a radiative forcing twenty times greater than carbon dioxide.

2. **Removal of Nonhydrocarbon gases:** Water vapor, hydrogen sulfide, nitrogen, and helium must be removed from the natural gas. Some of these products have minimal economic value.

3. **Removal of other Hydrocarbon gases from Natural Gas:** Carbon dioxide, ethane, propane, butane and pentane must be removed before natural gas is delivered into pipelines. <http://www.eia.doe.gov/pub/oil_gas/natural_gas/feature_articles/2009/ngprod2009/ngprod2009.pdf>

D. EFFECTS ON HUMAN HEALTH

Generally speaking natural gas is the cleanest of all of the fossil fuels. However, it important to note that natural gas is not just plain methane (CH_4). There are other contaminants that can be very unhealthy if taken into the body. i.e. Carbon Monoxide; Nitrogen Oxides; Sulfur Dioxides; and some particulates.

The British medical journal, The Lancet, reported in1996 that the use of domestic gas appliances, particularly gas stoves, was linked to increased asthma, respiratory illness, and impaired lung function especially in young women. Women using gas stoves had double the respiratory problems of women cooking on electric stoves. The same study showed that using extractor fans which vented the cooking fumes outside did not reduce adverse effects of gas. For more details, see: <http://www.environmentalhealth.ca/summer01gas.html> or <http://www.naturalgas.org/environment/naturalgas.asp>

E. BENEFICIAL USES OF NATURAL GAS

Uses of natural gas *(For more information, see: Ammonia production, Petrochemicals, Haber process, and <http://www.hydrogen.energy.gov/pdfs/doe_h2_production.pdf>)*

1. Power generation
2. Domestic use
3. Transportation fuel
4. Fertilizer
5. Hydrogen production
6. Aviation
7. Other: as a feedstock in the production of petrochemicals

F. ECONOMIC BENEFITS FROM NATURAL GAS

<http://en.citizendium.org/wiki/Natural_gas>

A dramatic increase in drilling, spurred by record-breaking oil and natural gas prices. The number of workers in oil and gas jobs shot up from 290,000 in 2002 to 428,000 in 2007. In July 2002, 740 land-based oil and gas rigs were operating in the United States; today, there are about 2,000. - (Associated Press updated 9/10/2008)

COMPARING COAL, PETROLEUM & NATURAL GAS

Coal and oil are composed of much more complex molecules, with a higher carbon ratio and higher nitrogen and sulfur contents. This means that when combusted, coal and oil release higher levels of harmful emissions, including a higher ratio of carbon emissions, nitrogen oxides (NO_x), and sulfur dioxide (SO_2). Coal and fuel oil also release ash particles into the environment, substances that do not burn but instead are carried into the atmosphere and contribute to pollution. The combustion of natural gas, on the other hand, releases very small amounts of sulfur dioxide and nitrogen oxides, virtually no ash or particulate matter, and lower levels of carbon dioxide, carbon monoxide, and other reactive hydrocarbons.

Fossil Fuel Emission Levels
- Pounds per Billion Btu of Energy Input

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Source: EIA - Natural Gas Issues and Trends 1998

IN SUMMARY

No matter which fossil fuel is burned, all of them are deleterious to our environment and our health. Burning of coal provides the most pollutants, then petroleum and petroleum-products and finally natural gas.

If we are really concerned with cleaning up our planet and providing ourselves with a healthier environment, WIPL believes that we should follow these priorities:

1. **Conservation**: don't use energy when it's not needed;

2. **Efficiency**: use highly efficient appliances, engines, etc.;
a. Develop **Distributed energy** technologies;
b. Use **cogeneration** techniques;
c. **Recycle** materials;

4. **Renewables**: Use all forms of renewable energy sources with an eye on our biggest energy supplier located 93,000,000 miles from Earth whose energy is expected to last another 4,500,000,000 years;

5. **Phase out burning of fossil fuels** as soon as possible - our Earth can't take much more of its pollution;

6. Develop a **Renewable Hydrogen Economy** for providing heat and electrical energy for industrial, commercial, residential and for zero emissions transportation purposes. Fuel cells are to be a part of this economy and hydrogen is to be produced from renewable resources of which there are many.