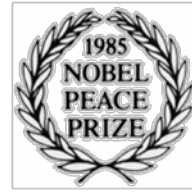




Physicians for
Social Responsibility



United States Affiliate of International Physicians for the Prevention of Nuclear War

**“COOKING THE EARTH:
Climate Change and the Threats to Human Health”**

**A PowerPoint Presentation by
Physicians for Social Responsibility
2009**

1. *[The PSR slide can be flashed briefly, or can be left on while the group assembles and sits down.]*

2. Hello, I'm _____ from Physicians for Social Responsibility. PSR is a national advocacy organization that has worked for more than forty years to prevent nuclear war and protect the environment. We're the U.S. affiliate of "International Physicians for the Prevention of Nuclear War," and in 1985 we shared the Nobel Peace Prize with them for highlighting the dangers of nuclear weapons.

My presentation today addresses another problem that puts the whole world at risk: global warming. I'm going to focus on what global warming means for health – not so much for polar bears as for you and me.

3. Coal might seem like a strange place to start a talk about global warming. When we think about coal – if we think about coal at all – we might remember it as the fuel that powered steamboats and the Industrial Revolution. Well our images are out of date.

4. Coal is back – and it's big. As a fuel being burned in power plants, coal today generates roughly half the electricity in the United States.

5. Unfortunately, power is not all that coal generates. Coal is also responsible for multiple, serious health problems. Coal combustion emits more than 60 dangerous pollutants. You probably know about some of them. Among the toxics that spew out of the smoke stacks are:

* mercury, which can cause brain damage in babies and developing fetuses, resulting in outcomes from learning disabilities and hyperactivity to mental retardation and autism;

* Nitrogen oxides and volatile organic compounds, the primary ingredients in smog; and
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* Particulate matter, tiny particles which can lodge deep in the lungs, and even pass into the bloodstream and travel to your other organs, where they can cause respiratory and cardiovascular disease, decreased lung function, increased risk of heart attack, cancer and premature death.

And that’s just the tip of the iceberg. There are more than 60 pollutants from coal. If you want to learn more about them, please let me know after this slide show. PSR has a separate presentation that goes into detail on the health risks from coal.

6. There are serious health impacts from coal throughout its life cycle, starting with coal mining, especially strip mining and mountaintop removal. Here’s what mountaintop removal is doing to the mountains and the people of Appalachia. To get at thin seams of coal, dynamite is used to destroy the upper layers of the mountain. After the mountain is dynamited, the rubble and rock are bulldozed off into adjacent valleys and streams. There, the rubble buries biologically crucial headwaters, releasing toxic levels of heavy metals into the remaining streams and groundwater and poisoning essential drinking water. According to the EPA, mountaintop removal has damaged or destroyed nearly 2,000 miles of streams in America’s oldest mountain range.

7. There are more health issues at the other end of the coal cycle, from the contaminated ash that is left over after coal is burned. We see in this slide what happened when a storage pond for coal ash burst in Tennessee in December 2008. It spewed 5.4 million cubic yards of wet coal ash over homes, farmland and rivers. The EPA tested water samples near the spill and found arsenic at more than 100 times the safe level for drinking water; prolonged exposure to such heavy concentrations has been shown to cause cancer. Water samples were also found to contain elevated levels of lead, thallium, barium, cadmium, chromium, mercury, and nickel. Since the spill, the EPA has made public a list of 26 communities in 10 states where residents are potentially threatened by coal ash storage ponds similar to one that flooded in Tennessee.

8. Then there is the other, less visible health threat from coal combustion: Global warming. The earth’s temperature is rising and rising fast. A majority of the world’s scientists share a general consensus that planetary warming is due primarily to human activity – especially, burning fossil fuels: petroleum, natural gas, and coal. In the coming slides I’m going to talk about how coal increases global warming, and the implications for human health. After that, I’ll talk about what it will take to curb global warming, and how you can help.

9. The consequences of global warming for human health are many, and in the words of the World Health Organization, “Overall... the health effects of a rapidly changing climate are likely to be overwhelmingly negative.”

10. Here’s how global warming works: When we burn carbon-based fuels – petroleum, natural gas, and especially coal – millions of tons of carbon dioxide are released into the atmosphere. In the atmosphere, the carbon dioxide becomes part of a “blanket” of heat-trapping gases [cont.]

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around the earth. The more fossil fuels we burn, the thicker the blanket. The thicker the blanket, the more heat it holds in. That is the mechanism of global warming.

11. The heat-trapping blanket actually consists of several gases, known as greenhouse gases. The most abundant is carbon dioxide. You can see here that carbon dioxide, in blue, accounts for over four-fifths of U.S. emissions of greenhouse gases. Carbon dioxide is significant because it's so abundant, and because it persists in the atmosphere for a long time. Each molecule of carbon dioxide is likely to remain in the atmosphere for 100 years.

While carbon dioxide is the most abundant of the greenhouse gases, other gases are more powerful in their heat-trapping effects. For example, nitrous oxide is a very powerful heat-trapper; fortunately, its concentration in the atmosphere is small. Methane is 20 times more potent than carbon dioxide; however, its lifetime is shorter: Each molecule of methane is likely to persist in the atmosphere for only 10 years, compared to carbon dioxide's 100 years.

[References:

- (1) Energy Information Administration. *Emissions of Greenhouse Gases in the United States 2005*. Washington, D.C.: Office of Integrated Analysis and Forecasting, U.S. Department of Energy, 2006. Available at: <http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html>
 - (2) The Encyclopedia of the Earth. http://www.eoearth.org/article/Greenhouse_gas and http://www.eoearth.org/article/Nitrous_oxide
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12. Most of us know that when we drive our cars and SUVs or take an airplane, we're contributing to our "carbon footprint." But how many of us think of electricity as the major source of that carbon? As this graph shows, generating electricity is the single largest source of greenhouse gases in the U.S. Electricity generation creates a third of our greenhouse gas emissions.

Not only is the electricity sector a problem; coal is a special problem within that sector. That's because coal is "carbon-heavy": It releases more carbon per unit of energy generated than do other fuels like natural gas. That makes coal-fired power plants the single most important source of CO2 emissions in the United States.

13. Globally, the U.S. is the world's largest per capita producer of global warming gases. Although we make up less than 5 percent of the world's population, we are responsible for nearly 25 percent of the world's greenhouse gas emissions. That's almost 5 times more than our "fair share," if you assume that each person would contribute an equal amount to the problem. So you can see what an impact our energy-hungry way of life has on the planet.

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On an absolute basis, China recently passed us as the world’s largest greenhouse gas polluter, based largely on its increasing use of coal for electricity generation.

That’s a grave problem that has to be addressed. But China, India and other developing countries are less likely to reduce their emissions while the U.S. continues to emit greenhouse gases at our current rate. Once we have capped our own emissions, we can provide real leadership around the world, and countries like China and India will feel greater pressure to follow.

[References: U.S. Environmental Protection Agency. *U.S. Inventory of Greenhouse Gas Emissions and Sinks 1990-2006*. U.S. EPA, 2006. Available at: <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>.

14. With the world’s return to burning coal for electricity, plus the heavy use of petroleum, greenhouse gas emissions are way up, and we are seeing dangerous consequences. Land temperatures and surface ocean temperatures have started to rise around the world. Polar ice and glaciers are melting. As they melt, they expose more land and water, whose dark surfaces absorb more heat and trigger more melting. This creates a “positive feedback loop,” speeding up the warming.

15. Rising temperatures increase the evaporation from the ocean. When that additional water falls as precipitation, it creates more-intense hurricanes, storms, and snowfalls. It may sound illogical at first that global warming increases snowfall, but once you understand the mechanism of increased water vapor in the atmosphere, it makes sense.

As these changes in the world’s climate build up, the climate becomes chaotic; the life-giving systems of the earth go out of balance.

16. When the earth’s systems go out of balance, we face serious health consequences – and they are occurring already. We’ll look first at the health consequences from the direct effects of climate change: heat waves, extreme weather events, sea level rise, and flooding.

17. As global temperatures get hotter, and with the *rate* of warming getting faster, heat waves are expected to become more intense, more frequent and longer-lasting. (1) The European heat wave of 2003 gives us a picture of what an overheated globe might be like. Temperatures reached 104 degrees Fahrenheit in France, and in Spain they reached 113 – as hot as Death Valley, in a country where most homes and buildings do not have air conditioning. According to the journal *Eurosurveillance* (published by the European Centers for Disease Prevention and Control), approximately 22,000 people died. (2) Other mortality estimates are even higher. Dr. Paul Epstein of the Center for Health and the Global Environment at Harvard Medical School calculated that the number of deaths might have been as high as 35,000. (3)

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[References:

- (1) Meehl GA and Tebaldi C. More Intense, More Frequent, and Longer Lasting Heat Waves in the 21st Century. *Science* (1994); 305: 994-997.
- (2) Kosatsky T. The 2003 European Heat Waves. *Euro Surveill.* (2005); 10: 148-149.
- (3) Epstein P. Climate Change and Human Health. *New Eng. J. Med.* (2005); 353: 1433-1436.

18. High temperatures also contribute to the formation of ground-level ozone pollution, or smog. Smog is the most pervasive air pollutant in the United States. An estimated one-third of Americans live in areas with unhealthy levels of ozone. This one-third of the U.S. population is put at risk for a variety of serious health problems: from coughing and wheezing, to asthma attacks, to other chronic respiratory diseases.

Ozone also affects the cardiovascular system and can increase the risk of heart arrhythmias (2) and heart attack. (3) Recent studies demonstrate that ozone exposure may lead to premature death. (4)

[References:

- (1) U.S. EPA. *Smog – Who Does it Hurt? What You Need to Know About Ozone and Your Health*. U.S. EPA Office of Air and Radiation, Washington, DC: 1999.
<http://www.epa.gov/airnow/health/smog.pdf>
- (2) Rich DQ, Mittleman MA, Link MS, et al. Increased Risk of Paroxysmal Atrial Fibrillation Episodes Associated with Acute Increases in Ambient Air Pollution. *Environ Health Perspec* 2006; 114:120-123.
- (3) Ruidavets J-B, Cournot M, Cassadou S, Giroux M, Meybeck M, Ferrières. Ozone Air Pollution is Associated with Acute Myocardial Infarction. *Circulation* 2005; 111:563-569.
- (4) Bell ML, Dominici F, and Samet JM. A Meta-Analysis of Time-Series Studies of Ozone and Mortality with Comparison to the National Morbidity, Mortality, and Air Pollution Study. *Epidemiology* 2005; 16: 436-445.

19. So, what is the connection between smog and global warming? Smog is formed when certain pollutants in the air -- nitrogen oxides and volatile organic compounds -- are exposed to heat. That is why smog is expected to increase with global warming. And where do the nitrogen oxides and volatile organic compounds come from? Largely from burning fossil fuels. In other words, coal contributes to smog in two ways: it increases global warming, and it emits the pollutants that form smog in the presence of heat.

20. As global temperatures rise, we'll experience more extreme weather. Hurricanes are expected to increase in intensity and duration. (1) Studies have shown that over the past 35 years, the number of hurricanes reaching categories 4 and 5 (on a five-point scale) has doubled. (2) In 2005, Hurricane Katrina struck New Orleans. It killed more than 1,500 people (3), displaced hundreds of thousands, and caused billions of dollars in damage. While New Orleans still struggles to rebuild, we have had other deadly and damaging hurricanes, like Hurricane Ike which ravaged Galveston in September 2008.

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Individual events cannot be specifically attributed to global warming. But we can take the increased frequency of damaging storms as a wake-up call, warning us of a future where similar storms could be – imagine this – common.

[References:

- (1) IPCC. Climate Change 2007: The Physical Science Basis, Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: <http://www.ipcc.ch>
- (2) Webster PJ, Holland GJ, Curry JA, and Chang H-R. Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment. *Science* (2005); 309: 1844-1846.
- (3) Hunter M. “Deaths of Evacuees Push Toll to 1,577.” *New Orleans Times-Picayune*, May 19, 2006.

21. As global warming increases, and as polar ice melts, the sea level rises. Over the past century, sea levels have risen by about 4½ to 8½ inches. Islands and coastal communities are already seeing their land submerged inch by inch, and are increasingly endangered by storm surges.

The Intergovernmental Panel on Climate Change projects that global warming could cause an additional 7- to 23-inch rise in sea level by the end of this century. (1) That would expose millions more people to the risk of storm surges. (2) Other researchers anticipate even greater rises in sea level, in part because land-based ice sheets in Greenland and Antarctica are melting much faster than predicted. Scientists have projected that this melting could contribute to sea level rise ranging from 20 to 55 inches by the end of the century. (2)

[References:

- (1) IPCC. Climate Change 2007: The Physical Science Basis, Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: <http://www.ipcc.ch>
- (2) Rahmstorf S. A Semi-Empirical Approach to Projecting Future Sea-Level Rise. *Science*; Published online December 14, 2006; 10.1126/science.1135456

22. If those higher-end projections are correct – if we experience, for example, a 1-meter rise in sea level (about three feet) – this slide shows what would happen to the Northeast U.S. Virtually every major urban area along the Atlantic coast would experience some coastal inundation and loss of land.

[Source: Weiss and Overpeck, The University of Arizona.

23. Flooding is likely to become more common with increased global warming. As we saw, the rise in global temperatures increases the amount of water vapor in the atmosphere. The result is more intense downpours. When the downpours overpower the ability of the earth to [continued]

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absorb the water, flooding results. The number of major flood events has increased on every continent over the past 50 years, including North America. This photo is from Cedar Rapids, Iowa in June 2008.

The increase in floods is not entirely attributable to global warming -- land use change, deforestation and other variables also contribute. But research has found that the increase in the frequency of flooding is consistent with climate models of rising world temperatures. (1)

[References:

(1) Milly PCD, Wetherald RT, Dunne KA and Delworth TL. Increasing Risk of Great Floods in a Changing Climate. *Nature* (2002); 415: 514-517.

24. Ironically, besides triggering extreme storms and precipitation, global warming will also change rainfall patterns, leading in some regions to more frequent and more severe drought. Drought is already expanding in regions as diverse as the Sahel, Australia, and the southwest U.S. Here's one face of drought.

25. Here's another: This photo was taken in Elephant Butte, New Mexico.

According to the National Center for Atmospheric Research, the proportion of the Earth's land mass stricken by severe drought has more than doubled since the 1970s. Human-caused global warming is identified as the primary cause. (1) Climate models predict that in the future, 30 percent of the world's land surface could be affected by extreme drought by the end of this century, compared to 1 percent today. (2)

The impact of extreme drought in almost one-third of the world's land mass is unthinkable. It would have devastating effects on access to clean water, on health, and on the food supply.

[References:

(1) Dai A, Trenberth KE, and Qian T. A Global Dataset of Palmer Drought Severity Index for 1870–2002: Relationship with Soil Moisture and Effects of Surface Warming. *Journal of Hydrometeorology* (2004); 5: 1117-1130.

(2) Burke EJ, Brown SJ, Christidis N. Modeling the Recent Evolution of Global Drought and Projections for the Twenty-First Century with the Hadley Center Climate Model. *Journal of Hydrometeorology* (2006); 7: 1113-1125.

26. We have seen the immediate impacts on health of heat, extreme weather events, floods and drought. In addition, global warming is producing a series of what health professionals call secondary impacts. The spread of water-borne diseases is one secondary impact.

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Water is essential to life and healthy, yet it is already a scarce resource for many people: Over 1 billion people lack access to safe drinking water, and nearly 2.5 billion people lack access to

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adequate sanitation. Global warming is likely to exacerbate the situation. Extreme precipitation events and flooding will wash chemicals, pesticides, sewage and other contaminants into rivers, streams and reservoirs. The shrinkage of mountain snowpacks will reduce the flow of major rivers. As a result, the global burden of water-related disease and death is likely to worsen.

27. Here in the United States, contamination of recreational waters from extreme weather events is a significant means of disease transmission. Ear, nose, and throat, respiratory, and gastrointestinal illnesses are commonly associated with recreational swimming in fresh and oceanic waters. Other, potentially more severe waterborne diseases are also transmitted in recreational waters, although with less frequency, such as hepatitis. (2)

A study of water contamination of the Great Lakes projected that as extremely heavy precipitation events become stronger, there will be a resulting greater potential for flooding and sewer overflow, with a corresponding greater potential for waterborne diseases. It stated, “The Great Lakes, which serve as a drinking water source for more than 40 million people, are particularly susceptible to fecal pollution and can become reservoirs for waterborne diseases.”(3)

[References:

(1) United Nations. *Water for People, Water for Life – The United Nations World Water Development Report*. UN Educational Scientific and Cultural Organization-World Water Assessment Program. Paris: UNSESCO Publishing/Berghahn Books, 2003. Available: <http://www.unesco.org/water/wwap/>.

(2) Patz J et al. “Climate Change and Waterborne Disease Risk in the Great Lakes Region of the U.S.” *Am J Prev Med* 2008;35(5). August 2008.

(3) Patz J et al. “Climate Change and Waterborne Disease Risk in the Great Lakes Region of the U.S.” *Am J Prev Med* 2008;35(5). August 2008.

28. The spread of diseases carried by insects is another secondary impact of global warming. Mosquitoes, ticks, fleas, black flies and sandflies are all hosts to infectious agents such as protozoa, bacteria and viruses. These agents carry diseases that they transmit to humans, including malaria, dengue fever, West Nile Virus, Lyme disease, even plague.

Because they are cold-blooded, many disease-carrying insects are highly sensitive to temperature changes. Consider the mosquito, which transmits malaria, dengue fever, and West Nile virus. In higher temperatures, mosquitoes reproduce more rapidly, extend their breeding season, and bite more frequently, and the pathogens they carry mature more rapidly to an infectious state.

About one million people around the world die from malaria each year. (2) As global warming continues, some estimates predict that as many as 90 to 200 million additional people may be at risk of malaria by the second half of this century. (3) Since rising temperatures can expand the mosquitoes’ range to higher elevations and more northern latitudes, areas like the southern United States could potentially be put at risk.

[References:

(2) Greenwood BM, Bojang K, Whitty C, Targett GAT. Malaria. *Lancet*. 2005; 365: 1487-1498.

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(3) Van Lieshout M, Kovats RS, Livermore MT, Martens P. Climate Change and Malaria: Analysis of the SRES Climate and Socio-Economic Scenarios. *Global Environmental Change*. 2004; 14: 87 – 99

29. Reduced agricultural productivity and food security are also potential secondary impacts from climate change. The combined effects of heat stress, drought, and flooding are expected to reduce crop yields and livestock productivity. That’s true here in the United States as well as in the developing world. Corn, for example, the most important crop in the U.S., is vulnerable to global warming: (1)

* High temperatures shorten corn’s reproductive lifecycle, giving the grain less time to mature and thus decreasing yield.

* Some weeds and pests proliferate more successfully in response to increased temperature and humidity. That may require greater reliance on chemicals like pesticides, resulting in greater costs, both financial and environmental.

* Ground-level ozone has been shown to have “significant adverse effects” on crop yields, pasture and forest growth. In addition to slowing growth, ozone has also been shown to be toxic to soybeans, wheat, peanuts and cotton. (2) As you know, ozone is anticipated to rise due to global warming.

Worldwide, climate change could put 30 million to as many as 200 million additional people at risk of hunger by mid- to late century. (5) This spike in world hunger would be a grave challenge to world health.

[References:

(1) and (2): Telleen-Lawton, T. Hotter Fields, Lower Yields: How Global Warming Could Hurt America’s Farms.(2009) Environment America Research & Policy Center.

(5) Stern N, Peters S, Bakhshi V, et al. *Stern Review: The Economics of Climate Change*. HM Treasury, London

30. Hurricanes and floods, sea level rise, drought, and hunger aren’t a thing of the future – they are affecting us now, and they have already created a crisis of human displacement. It has been estimated that 25 million people have already been displaced for environmental reasons – more than the approximately 21 million refugees that have fled war and persecution. A new term for these displaced people has already been coined: “environmental refugees.”

Environmental refugees, like the refugees of war, are likely to face massive public health problems: lack of clean drinking water, sanitation and shelter; hunger and malnutrition;

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vulnerability to infectious and vector-borne illnesses; and vulnerability to physical abuse and severe psychological stress.



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(1) Conisbee M, Simms A. *Environmental Refugees: The Case for Recognition*. New Economics Foundation. London, UK; 2003.

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SOLUTION SLIDES:

31. By burning fossil fuels, we are altering the planet’s climate. It sounds terrible, but – surprisingly -- that fact is actually reason for optimism. If human activity were *not* the primary driver of global warming, there would be little we could do to stop it – and that would be a terrifying prospect.

But because our consumption of fossil fuels is warming the Earth, we *can* address this crisis. We can shift the whole way we think about and use energy. Break the patterns of the past. Slow, stop and reverse our emissions of the gases that cause global warming, and build a pathway into a cleaner, safer world.

32. What we have to do is reduce our consumption of energy from fossil fuels, and shift from fossil fuels to clean, safe alternatives. For starters there are small steps that each of us can take to conserve energy and use it efficiently.

Conserving energy means, don’t use it if you don’t need to. Turn off the lights when you leave the room; drive less, and carpool, bike, take the bus, and walk more; and hang the clothes to dry on a clothesline on sunny days. Not only do these steps conserve energy; they also encourage a healthy lifestyle.

33. Boosting our energy efficiency means getting more out of the energy we do use. We get the same results from less energy, if we: use compact fluorescent light bulbs; buy Energy Star appliances; make our next car a hybrid; and insulate your homes.

34. Those individual steps are a good start, but we if we want to reduce carbon emissions on a big enough scale, we have to change policies. Some examples of policies that make a difference are:

* establishing programs for energy audits and funding energy retrofits, like insulation, in homes, businesses, schools and local government buildings;

* updating the energy conservation code for construction of new buildings; [continued]

* supporting public transportation and smart growth; and

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* setting state and federal “renewable energy standards” to require that utility companies buy a larger portion of their electricity from renewable sources.

35. We need to fund the development and implementation of clean, carbon-free alternative fuels such as wind power, solar, geothermal, and wave and tide.

36. But the most important step we can take – the one with the greatest impact – is stopping the single biggest source of carbon dioxide: coal-fired power plants. That is why Physicians for Social Responsibility launched the “Code Black” campaign. Code Black raises the medical voice against the construction of new coal-fired plants.

37. Through Code Black, PSR’s national office and its chapters work to stop new coal plants before they are built:

* We support the stop-coal movement by bringing it medical information about coal’s impact on human health and global warming.

* In states where decisions are being made about whether to build a new coal plant, PSR mobilizes health professionals to provide expert testimony at public hearings on the health impacts of coal for cardio and respiratory disease, cancer and neurological development.

* We talk about the costs that coal-related diseases generate through additional emergency room visits, hospital admissions, and premature deaths.

* And we discuss the health implications of global warming.

This information, presented in the respected voice of health professionals, affects the decisions states make about whether to issue air quality and water quality permits for new coal plants. With our allies in the environmental movement, PSR is successfully stopping new coal plants before they are built.

38. What this means is, we *can* stop the flow of global warming gases into the atmosphere. We can do that at the personal level, by reducing our carbon footprint, and as a society, by ending our reliance on coal and expanding clean, safe renewable energy. You can help us share that vital message in a couple of ways:

* Invite us to present this slide show in your school or university, your health care facility, workplace, or religious community.

[continued]

* Educate yourself. PSR offers a wealth more information on coal, global warming and health at www.psr.org. Click on “Code Black.”



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* Order our poster, bumper stickers, tee shirts and educational materials to share your concerns about coal with the community.

* *[PSR chapters: Add an invitation to the audience to participate in anti-global warming actions your chapter is currently organizing, such as “Sign our sign-on letter for health professionals” or “Immediately after this slide show, let us help you write a brief letter to the editor of our local paper...”]*

39. And please join Physicians for Social Responsibility in taking action to protect health and preserve our beautiful green planet, for ourselves, our kids and future generations. Sign up before you leave to get our action alerts and to hear about our events. The sign-up sheet is... *[Optional: Promote your other upcoming activities and explain how people can participate.]* Thank you.

40. We have time now for questions – does anyone have any questions?

