

MICROFILM DIVIDER

OMB/RECORDS MANAGEMENT DIVISION

SFN 2053 (2/85) 5M



ROLL NUMBER

DESCRIPTION

4043

2001 SENATE NATURAL RESOURCES

SCR 4043

2001 SENATE STANDING COMMITTEE MINUTES

BILL/RESOLUTION NO. SCR 4043

Senate Natural Resources Committee

Conference Committee

Hearing Date 3-1-01

Tape Number	Side A	Side B	Meter #
1		X	20.2 - 33.3
2	X		33.4 - 42.0
Committee Clerk Signature <i>Janet James</i>			

Minutes:

SENATOR FISCHER opened the hearing on SCR 4043.

SENATOR KEN KROEPLIN, of District 23 and cosponsor of SCR 4043, A RESOLUTION RELATING TO THE STUDY OF THE FEASIBILITY AND DESIRABILITY OF PROMOTING CARBON SEQUESTRATION PROGRAMS IN THE STATE. He presenting written testimony by SENATOR ARRON KRAUTER of District 25 along with some proposed amendments prepared by Legislative Council (See attached testimony). It is his understanding the Lignite Energy Council is in support of these amendments.

Written testimony from BILL PFEIFER, representing the North Dakota Chapter of the Wildlife Society, in support of SCR 4043 was distributed to the Committee.

CLIFFORD PORTER presented written testimony (See attached testimony), on behalf of JOHN DWYER, of the Lignite Energy Council, in a neutral position of SCR 4043. He also presented proposed amendments and information on Carbon Dioxide emissions. (See attached).

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Senate Natural Resources Committee
Bill/Resolution Number SCR 4043
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There was on opposing testimony of SCR 4043.

SENATOR FISCHER closed the hearing on SCR 4043.

SENATOR FREBORG made a motion to amend SCR 4043 to change the word "direct" to "urge" and make the appropriate changes to reflect that change further in the resolution.

Discussion was held as to whether changing the verbiage of the resolutions would mean any of might not be considered as a priority and dismissed.

SENATOR CHRISTMANN second the motion.

SENATOR FISCHER called for a roll vote # 1 of SCR 4043. The vote indicated 6 YAYS, 0 NAYS AND 1 ABSENT.

SENATOR CHRISTMANN made a motion to adopt the amendments as prepared by the Legislative Council. (13120.0101)

SENATOR EVERY second the motion.

SENATOR FISCHER called for a roll vote # 2 of SCR 4043. The indicated 6 YAYS, 0 NAYS, AND 1 ABSENT.

SENATOR KELSH made a motion for a "DO PASS as AMENDED" of SCR 4043.

SENATOR CHRISTMANN second the motion.

SENATOR FISCHER called for a roll vote # 3 of SCR 4043. The vote indicated 6 YAYS, 0 NAYS, AND 1 ABSENT.

SENATOR EVERY will carry SCR 4043.

March 1, 2001
Prepared by the Lignite Energy Council

**Proposed Amendments
SCR 4043**

Page 1, remove lines 3 through 7 and insert in lieu thereof the following:

WHEREAS, CO₂ emissions from manmade activities account for about 4% of total CO₂ emissions worldwide;

WHEREAS, while the scientific community continues to debate the causation and extent of global warming from increased CO₂ emissions, it is prudent to take actions that reduce CO₂ emissions under voluntary, no-regrets policies;

And renumber accordingly.

PROPOSED AMENDMENTS TO SENATE CONCURRENT RESOLUTION NO. 4043

Page 1, replace lines 3 through 7 with:

"WHEREAS, carbon dioxide emissions from manmade activities account for approximately four percent of total carbon dioxide emissions worldwide; and

WHEREAS, while the scientific community continues to debate the causation and extent of global warming from increased carbon dioxide emissions, it is prudent to take actions that reduce carbon dioxide emissions under voluntary, no-regrets policies; and"

Renumber accordingly

REPORT OF STANDING COMMITTEE

SCR 4043: Natural Resources Committee (Sen. Fischer, Chairman) recommends **AMENDMENTS AS FOLLOWS** and when so amended, recommends **DO PASS** (6 YEAS, 0 NAYS, 1 ABSENT AND NOT VOTING). SCR 4043 was placed on the Sixth order on the calendar.

Page 1, replace lines 3 through 7 with:

"WHEREAS, carbon dioxide emissions from manmade activities account for approximately four percent of total carbon dioxide emissions worldwide; and

WHEREAS, while the scientific community continues to debate the causation and extent of global warming from increased carbon dioxide emissions, it is prudent to take actions that reduce carbon dioxide emissions under voluntary, no-regrets policies; and"

Renumber accordingly

2001 HOUSE NATURAL RESOURCES

SCR 4043

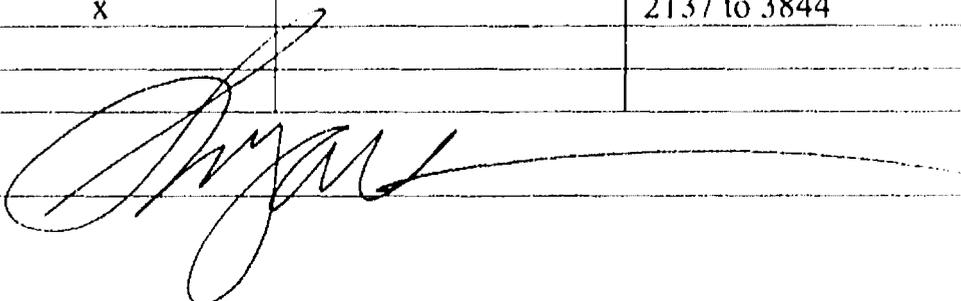
2001 HOUSE STANDING COMMITTEE MINUTES

BILL/RESOLUTION NO. SCR 4043

House Natural Resources Committee

Conference Committee

Hearing Date March 16, 2001

Tape Number	Side A	Side B	Meter #
2	x		2137 to 3844
Committee Clerk Signature 			

Minutes:

Chairman Earl Rennerfeldt, Vice Chair Jon O. Nelson, Rep. Brekke, Rep. DeKrey, Rep. Drovdal, Rep. Galvin, Rep. Keiser, Rep. Klein, Rep. Nottestad, Rep. Porter, Rep. Weiler, Rep. Hanson, Rep. Kelsh, Rep. Solberg, Rep. Winrich.

Chairman Rennerfeldt: I will open the hearing on SCR 4043.

Sen. Krauter - District 35: Introduces bill. (See written testimony).

Rep. Keiser: Who paid the Iowa Farmers?

Sen. Krauter: They are private contracts between those energy companies and those farmers.

Chairman Rennerfeldt: In other words they are paying because they don't have scrubbers and as much pollution coming this way? Compensate for their pollution?

Sen. Krauter: In a simple form, it could be said that way, it is the credits that they are allowed to have and they basically make those payments to receive those credits.

Rep. Weiler: According to your testimony, it sounds like there is a great deal of money being paid to Iowa farmers and SD farmers. It is such a great idea, why is this a study resolution? Why don't we just do it? Why do we have to wait two years?

Sen. Krauter: It is not a process where we are involved in making the payments. During the Interim, as we traditionally do, have an agriculture committee that looks at issues. I think it is important that we bring this issue to the table to research and find out who are those companies, how are they making payments to farmers and how is it being done in SD, Iowa, so we can provide education to the farmers and ranchers in ND. So it is putting the process out there. You never know what comes out of those interim committees. Maybe there's some other things that the industry, like the Lignite Industry, can identify to make this work in harmony with what they are currently doing in the state.

Rep. Galvin: Is the main purpose of this bill to clear up the atmosphere? Or is it to create another source of income?

Sen. Krauter: Income for Land Owners.

Chairman Rennerfeldt: Anyone else care to testify in favor of this resolution?

Mark Sitz: I am here representing the members of the ND Farmers Union. We support SCR 4043. We recognize sequestration as a potential for our state farmers to draw income. It is something new, and I don't pretend to know all about it. Our farmers need every avenue for income and this has potential, so I hope you would put a Do Pass on SCR 4043.

Rep. Porter: Is it possible the way the program works, for no-till, low-till replanting of grass...is it possible then for a land owner not only to get a Federal CRP payment but to also get a carbon payment from another company? So they get a double payment?

Sitz: I would believe so, that that is an issue that could be brought out in a study.

Rep. DeKrey: In answer to Rep. Porters question, we are going to charge them to hunt, we are going to take the carbon payment, and the CRP payment, what's left?

Chairman Rennerfeldt: Anyone else care to testify in favor of this resolution? Any opposition to this resolution?

John Dwyer - Lignite Energy Council: I am here to point out to the committee that we are not opposed to this resolution. We did however amend it in the Senate. All I wanted to do is to go on record saying we fully support it, but we are not going to pay them. I am handing out a letter from George Bush. (See letter). We don't believe CO2 is a pollutant.

Rep. Keiser: You are not saying in the interim that we shouldn't study this, if we found a way to save the industry millions of dollars, you might be willing to give some back.

Dwyer: There are no scrubbers to remove CO2. You can't remove CO2. That is one of the problems with the whole CO2 approach. The economy approach you will have more emissions, that is why this whole Kyoto thing is flawed and that is why the Senate voted against it 95 to 0 because it only impacts industrialized countries. So I guess I don't agree with the premise of your statement. I can't imagine how it will save any money for our Industry. We are not opposed to this.

Vice Chair Nelson: Earlier we vote down the Kyoto Protocol and now we are going in and picking components out of the Protocol to study. Do you look at this as being somewhat contradictory?

Dwyer: I think the phrase under the second WHEREAS.....if we can reduce emissions it is fine. If the Kyoto Treaty calls for limitations, and that sort of thing. I think it is fine to study that sort of thing.

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House Natural Resources Committee
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(Written Testimony submitted by Bill Pfeifer - ND Chapter of the Wildlife Society in favor of SCR 4043)

Chairman Rennerfeldt: Any questions? I will close the hearing on SCR 4043.

COMMITTEE WORK

Rep. Solberg: I move a Do Pass recommendation on SCR 4043.

Rep. Winrich: I second.

Chairman Rennerfeldt: Any discussion? (some discussion). I have a motion for a Do Pass on SCR 4043. All in favor signify by saying Aye. Opposed? Motion carried by voice vote.

MOTION FOR A DO PASS ON SCR 4043

YES, 14 NO, 0

1 ABSENT AND NOT VOTING

PLACED ON CONSENT CALENDAR

CARRIED BY REP. SOLBERG

Date: 3/16/01
 Roll Call Vote #: 1

2001 HOUSE STANDING COMMITTEE ROLL CALL VOTES
 BILL/RESOLUTION NO. SCR 4043

House Natural Resources Committee

Subcommittee on _____

or

Conference Committee

Legislative Council Amendment Number _____

Action Taken DO Pass

Motion Made By Rep. Solberg Seconded By Rep. Winrich

Representatives	Yes	No	Representatives	Yes	No
Earl Rennerfeldt - Chairman			Lyle Hanson		
Jon O. Nelson - Vice Chairman			Scot Kelsh		
Curtis E. Brekke			Lonnie B. Winrich		
Duane DeKrey			Dorvan Solberg		
David Drovdal					
Pat Galvin					
George Keiser					
Frank Klein					
Darrell D. Nottestad					
Todd Porter					
Dave Weiler					

Total (Yes) 14 No _____

Absent 1

Floor Assignment Rep. Solberg

If the vote is on an amendment, briefly indicate intent:

Consent Calendar

Voice Vote

REPORT OF STANDING COMMITTEE (410)
March 16, 2001 11:55 a.m.

Module No: HR-45-5814
Carrier: Solberg
Insert LC: . Title: .

REPORT OF STANDING COMMITTEE

SCR 4043, as engrossed: Natural Resources Committee (Rep. Rennerfeldt, Chairman)
recommends **DO PASS** and **BE PLACED ON THE CONSENT CALENDAR** (14 YEAS,
0 NAYS, 1 ABSENT AND NOT VOTING). Engrossed SCR 4043 was placed on the
Tenth order on the calendar.

2001 TESTIMONY

SCR 4043

**Testimony of John W. Dwyer
President, Lignite Energy Council
on
Senate Concurrent Resolution 4043
March 1, 2001**

For the record, my name is John Dwyer, President of the Lignite Energy Council.

The issue of global warming, particularly the extent of global warming and the causation of global warming, has been debated in scientific circles for years. For every scientist that contends that CO₂ emissions from fossil fuels causes global warming, there is another scientist who points to the fact that CO₂ emissions were actually greater during cooling periods on this planet. We would also point out that CO₂ is not a pollutant, but rather, the backbone of life as we know it. Plants store CO₂, humans exhale CO₂, and many scientists in the agricultural community actually contend that more CO₂ emissions would enhance agriculture and the plants that they grow.

Thus, the Lignite Energy Council would disagree with the first two "Whereas" clauses of the resolution, lines 3 through 7.

However, the Council does believe that it makes sense to engage in voluntary, cost-effective efforts to reduce CO₂ emissions that are the result of increased efficiencies. This is what is often characterized as "no-regrets policies." Additionally, the Council has no problem with voluntary carbon sequestration programs, particularly if this will benefit agriculture.

Finally, we would like to point out that the first two "Whereas" clauses, have the potential to adversely impact externality proceedings in Minnesota, which were reopened earlier this year. In these externality hearings, the state of North Dakota and the Lignite Energy Council have opposed classifying CO₂ as a pollutant and have opposed planning penalties on coal from CO₂ emissions. The State of North Dakota and the Lignite Energy Council were successful in

these positions in the first round of externality proceedings held in previous years and intend to continue that position in the current proceedings. Thus, with the amendments that we are offering, the Lignite Energy Council could support SCR 4043. The amendments would remove lines 3 through 7 and replace it with:

WHEREAS, CO₂ emissions from manmade activities account for about 4% of total CO₂ emissions worldwide;

WHEREAS, while the scientific community continues to debate the causation and extent of global warming from increased CO₂ emissions, it is prudent to take actions that reduce CO₂ emissions under voluntary, no-regrets policies;

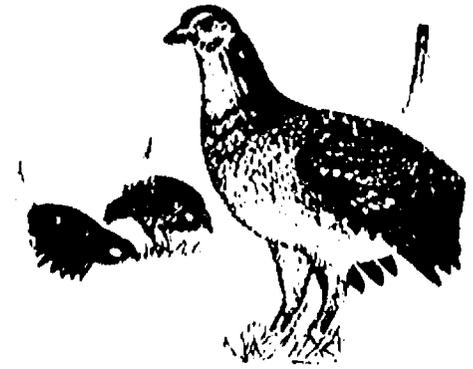
Thank you for your consideration. I will be happy to try and answer any questions.



North Dakota Chapter

THE WILDLIFE SOCIETY

P.O. BOX 1442 • BISMARCK, ND 58502



**TESTIMONY OF BILL PFEIFER
NORTH DAKOTA CHAPTER OF THE WILDLIFE SOCIETY
PRESENTED TO THE SENATE NATURAL RESOURCE COMMITTEE
ON SCR 4043, MARCH 1, 2001**

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I'm Bill Pfeifer speaking on behalf of the North Dakota Chapter of The Wildlife Society. The Wildlife Society supports SCR 4043 directing the Legislative Council to study the process of carbon sequestration.

Testimony for SCR 4043
March 1, 2001

Aaron Krauter
State Senator
District 35

Mr. Chairman and members of the Senate Natural Resources Committee. For the record my name is Aaron Krauter, State Senator from District 35. District 35 is made up of four, rural agricultural counties in southwestern North Dakota. Those counties are Adams, Hettinger, Grant and Sioux.

SCR 4043 is asking the legislative council to study carbon sequestration opportunities for land owners in the great state of North Dakota.

Let me first try to explain carbon sequestration as holding carbon in the soil in a way to reduce carbon dioxide (CO₂) in the atmosphere. Carbon is an essential element for almost all plant and animal life. Plants obtain carbon from CO₂. Animals, including humans, obtain carbon from plants and return CO₂ to the atmosphere.

Carbon flowed through this cycle more or less in balance until the late 1880's. Now the more recent higher levels of CO₂ in the atmosphere are believed by some to be a factor in potential global warming. Deforestation, soil tillage, wetland drainage and the burning of fossil fuels have decreased the fixed organic carbon and dramatically increased carbon dioxide in the atmosphere. In other words, as less carbon is trapped in soil and growing plants around the world, more CO₂ is released to the atmosphere.

Carbon sequestration methods include trapping carbon in plants, managing crops and soils to slow plant residue breakdown and reducing soil erosion. This is where we need to study this issue at great detail. Agricultural producers could soon be entering into carbon sequestration agreements that will pay farmers for common practices such as mulch-till, no-till and buffer establishment. There might also be payments for withdrawing land from annual production, reforestation, prairie restoration, and other farming practices.

Carbon sequestration agreements are private agreements. They can be between parties living in different countries, since atmospheric gases have no national boundaries. For example, a consortium of Canadian power companies is already paying some Iowa farmers for carbon credits. The carbon that the Iowa farmers sequester offset CO₂ emissions by the Canadian companies. These 400 Iowa farmers were paid \$8 million.

Governor Janklow from South Dakota has started a program with research from the South Dakota School of Mines and Technology to put his farmers at the forefront of carbon trading. With educated land practices, such as no-till, South Dakota estimates its farmers could get \$20 to \$30 an acre payments. In the range land areas, sequestration would be about \$3 to \$5 an acre.

All told officials from the South Dakota School of Mines and Technology estimate their states farmers could receive \$100 million to \$150 million a year of the next two decades.

Now this may sound pretty far fetched and some of you may have never heard of carbon sequestration before today, the fact remains that it is here in some states and is coming.

North Dakota has some of the largest supplies of lignite coal reserves and also have some of the cleanest and most environmentally safe coal fired power plants in the world. We are very proud of that and we must keep it that way. But we must not put our head in the sand and let this opportunity pass us by.

I am asking for your support to pass SCR 4043 so that landowner, farmers and ranchers in North Dakota can benefit from the opportunities that are out there.

I also have some amendments to offer to address some concern in the wording in lines 3 through 7. Please add these amendments to the study.



North Dakota Geological Survey

John P. Blumie, State Geologist

INDUSTRIAL COMMISSION

Edward T. Schafer - Governor, Chairman
Heidi Heitkamp - Attorney General
Roger Johnson - Commissioner of Agriculture

12 November 1999

John W. Dwyer
1016 East Owens Avenue
P. O. Box 2277
Bismarck, ND 58502

Dear John:

Yesterday on the local NPR station I heard an interview program, "Here and Now," dealing with global warming. The host, Rich Mattern, interviewed Drs. William Crossland, Dept. of Geology and Geophysics at UND, and Allan Kihm, Minot State University Dept. of Earth Sciences.

I expected to disagree with the premise presented (and I wasn't disappointed), but I was a little surprised at some of things that were said. Of course, the idea that mankind is responsible for warming, for the greenhouse effect, and for assorted other "problems," was accepted without question by both the people being interviewed and apparently by the interviewer, but I was surprised at the specificity of some of the charges. Both the Lignite Council and Basin Electric were singled out and named as entities that are providing mis-information about global warming (bringing in people like Fred Singer and Robert Balling). There was also considerable comment to the effect that the "scientists" who promote a dissenting point of view are "paid guns" of industry - both the oil and coal industries. Such people are "publishing their misinformation in popular journals rather than in refereed scientific journals as reputable scientists do" (my paraphrase).

A second major component of the program was the emphasis on an upcoming conference at UND next week, promoting the use of wind energy. Among the sponsors, apparently, is EERC. I have no problem with promoting wind energy - it's great, but it has severe limitations, especially when compared to the much-more-reliable lignite-generated electricity. One of the two men said that the coal industry is trying to stifle the development of wind-generated power.

I suppose it could be argued that the opinions being presented were simply that, the opinions of two people. Maybe no higher entity, EERC or whomever, is responsible for those opinions. Still, it seems a little misguided to me to be a major recipient of coal-industry money, which is provided through the auspices of the Lignite Energy Council, and to be associated with such derogatory remarks.

I taped most of the program, although I didn't begin taping until some time into the program, when I realized what was being said.

One more comment I'd like to make: I recently personally co-authored and published an article (in *Environmental Geosciences*, a refereed journal!) that has gotten considerably favorable international attention (and unfavorable comments from some environmentalists). In our article we

point out that climate change is a natural and ongoing process, the magnitude of which far exceeds even most environmentalist's predictions for human-caused change. Just FYI, I'll include a copy of the text of a greatly condensed and simplified version of the article, which is being published next month by the Arizona Geological Survey. I'll probably also publish it in our own (non-refereed!) newsletter.

Sincerely,



John P. Bluemle
State Geologist

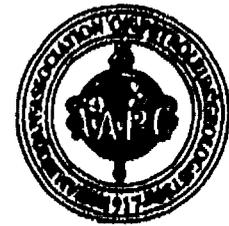
P.S. My secretary just called the radio station and they will be sending me a complete tape of yesterday's radio program.

P.P.S. We've invited Robert Balling to give a talk on climate change to our local geological society and he'll be coming sometime early next year. He is a "Distinguished Lecturer" of the American Association of Petroleum Geologists. It might be appropriate to publicize his talk beyond our local group.

P.P.P.S. I'll also enclose a copy of the recently released "Policy Statement" of AAPG, which I helped draft. It is the official position of AAPG, a group of about 30,000 geologists. As such, I think it is much more credible than some of the other long lists of "scientists" who have signed onto policy statements (including Kyoto accord) about global warming - such lists of scientists include mainly people who don't have any notion at all of the facts relating to the problem.

Policy Statement:

Climate Change Policy



The American Association of Petroleum Geologists, an International organization of over 30,000 earth scientists, supports expanding scientific climate research into the basic controls on climate, specifically including the geological aspects of climate change. This research should be undertaken by appropriate federal agencies involved in climate research and their associated grant and contract programs. Such support includes major research efforts into potential effects of decreasing as well as increasing temperatures and the mitigation of such effects. This research is important to sustain the ability of agriculture to feed the growing global population as well as to understand the effects of a colder climate upon society.

Geologists who study past climate variations understand that current climate warming projections fall well within documented natural variations in past climate. Therefore, for scientific reasons, the American Association of Petroleum Geologists does not support placing a carbon tax upon fossil energy sources as a tool to reduce carbon dioxide emissions, nor do we support any implementation of the Kyoto Protocol prior to Senate ratification.

Rationale

One of the most contentious debates in American public policy today encompasses proposals to restrict emissions of the minor atmospheric gas carbon dioxide in order to mitigate a perceived human influence on global climate. Current proposals (Kyoto Protocol signed by the executive branch of the U.S. government, but not ratified by Congress) would federally tax crude oil at the rate of about \$43.50 per barrel (1). No reduction in existing levels of carbon dioxide in the atmosphere would result from this massive transfer of wealth from the private sector into the federal government.

Recognizing the potential impact on the United States and world economy of such taxation and restriction of energy use, it is important that greenhouse theories be tested thoroughly and quickly.

Scientific examination of the government case for such draconian taxation does not support the supposition of human-induced global climate change; in fact, the study resulted in recognition that the supposition is neither provable nor disprovable. The following

observations are germane to the position:

1. Scientific research has been stimulated by the proposal. Recently published research results do not support the supposition of an anthropogenic cause of global climate change (2).
2. Detailed examination of current climate data strongly suggests that current observations do not correlate with the assumptions or supportable projections of human-induced greenhouse effects.

Background

Geologists know:

1. Climate is constantly changing, and has varied significantly over human history. Climate changes over any time scale chosen, whether as small as a decade or as long as a geologic era.
2. Natural variability has been demonstrated to exceed any supportable estimate of human-induced variability.
3. Earth is still emerging from the Little Ice Age (A. D. 1250 - 1850). Significant rises in global temperature are a predictable consequence. The current level of global warming is real and natural.
4. Geologic controls on climate are significant. Long term changes can be demonstrated to occur congruently with geologic tectonic changes. Little is truly understood of the controls on short term changes. Solar variability, for instance, is significant in centennial to millennial changes, among other possible controls that should be examined.
5. Attempts to engineer Earth's very complex climate before understanding natural controls on climate are risky, if not impossible.

Summary

Science requires that all aspects of theory be investigated and that assumptions be tested.

Human-induced global temperature influence is a supposition that can be neither proved nor disproved. It is unwise policy to base stringent controls on energy consumption through taxation to support a supposition that cannot be substantiated.

Climate naturally varies constantly, in both directions, at varying rates, and on many scales. Warming events have been historically good for most human society, while cold events have been deleterious to much of society. It is vital that climate research to examine the effects of a colder climate also be supported. Critical target areas of this research should include the potential impact of climate change on food production. Further research should concentrate on mitigation techniques to combat

any serious effects of either colder or warmer climate, naturally or artificially caused, on the ability of the world to feed itself.

The AAPG urges that any actions to implement or to ratify the Kyoto Protocol and any future declarations of climate policy be delayed until there is better understanding of present climate and the impacts of policy implementation, as well as some provision for mitigating errors in policy. There is no current viable substitute for petroleum-based fuels in the world's energy budget and economy.

1. The Energy Information Administration has estimated that implementation of the Kyoto Protocol would result in a carbon tax of \$348 per ton of carbon (E.I.A. SR/OIAF/98-30). Murphy Oil Company estimates of about .12 ton of carbon per barrel of oil (or 8 barrels per ton of carbon) (Oil and Gas Journal, Nov. 2, 1998, p.30) results in an estimated \$43.50 carbon tax per barrel of oil.
2. All geologists who are interested in the climate debate probably should read two books:
 - Moore, Peter D., Bill Chaloner, and Phillip Stott, 1996, *Global environmental change*: Blackwell Science, Oxford, England, 244 p.
 - Lamb, H. H., 1995, *Climate, History, and the Modern World*: 2nd Ed., Routledge, NY, 433 p.
 - Three recent papers of interest to scientists are:
 - Bluemle, J. P., J. M. Sabel, and W. Karlen, 1999, *Rate and Magnitude of Past Global Climate Changes*: Environmental Geosciences, v. 6, n. 2, p. 63-75.
 - Fischer, H., M. Wahlen, J. Smith, D. Mastolanni, and B. Deck, 1999, *Ice Core Records of Atmospheric CO₂ Around the Last Three Glacial Terminations*: Science, v. 283, p.1712-1714.
 - Fan, S., M. Gloor, J. Mahiman, S. Pacala, J. Sarmiento, T. Takahashi, and R. Tans, 1998, *A Large Terrestrial Carbon Sink in North America Implied by Atmospheric and Oceanic Carbon Dioxide Data and Models*: Science, v. 282, p. 442-446.

(This information was prepared and reviewed by certain scientific members of the Governmental Affairs Committee of the Division of Professional Affairs, a Division of the American Association of Petroleum Geologists, for use by its members and other interested parties.)

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Last Updated Thu Oct 28 19:34:06 1999

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GLOBAL WARMING: A GEOLOGICAL PERSPECTIVE

John P. Bluemle, State Geologist and Director
North Dakota Geological Survey

The average surface temperature of Earth is increasing. Continued increase could cause profound impacts on Earth and its inhabitants (Figure 1).

The average surface temperature increased from the mid-1880s until about 1940, declined until about 1980, and has been increasing since then (Figure 2). Some believe that the current warming rate is unusually high, is being caused by the burning of fossil fuels that produce carbon dioxide (CO₂), creating a "greenhouse effect," and can be slowed or even reversed. To evaluate the significance of the current warming, one must compare it with temperatures and variations that occurred prior to human activities. If the current warming is greater than in the past, human activities may be a cause. If past temperatures and variations were comparable to or larger than the current warming, however, human activities may not be significant.

Two colleagues and I reviewed published articles to compare past temperatures and variations with the current warming. Much research has been done on this subject in the past 30 years, especially the last decade. Scientists have completed investigations in widely distributed parts of the world and used varied methods to interpret past temperatures and changes. Independent research has been done on topics such as glacial advance and retreat, ice cores, pollen distribution, lichen growth, tree rings, sediment layers in glacial lakes, sediment on the sea floor, the composition of sea shells and corals, and the composition of cave deposits. Information about past temperatures, variations, and trends is summarized below.

Temperature variations during the Ice Age. The global temperature declined at least 10°C during the Ice Age (Pleistocene Epoch), which began two to three million years ago. In addition, the temperature cooled 15-20°C in central Europe in the 55 million years or so that preceded the Pleistocene (Figure 3).

Extensive continental glaciation took place in North America and northern Europe during the Pleistocene. Ice sheets advanced and retreated repeatedly, reaching as far south as the Missouri and Ohio Rivers in the United States. At least six major glacial advances and retreats occurred in North Dakota. Each major glacial and interglacial episode lasted about 100,000 to 200,000 years, during which the temperature decreased roughly 10°C during glaciation and increased by a comparable amount during the interglacial period.

Studies of ice cores from Greenland indicate that temperatures there rose and fell abruptly during the Pleistocene. On two occasions between 135,000 and 110,000 years before present (BP), temperatures dropped from 2°C warmer than they are today to 5°C cooler in less than a few centuries. In one instance the temperature dropped 14°C in a decade and returned to its former level 70 years later.

During the Wisconsinan glacial maximum, between 20,000 and 14,000 years BP, glacial ice covered about 27 percent of Earth's land surface. During that time, sea level was about 130 m lower than it is today. Sea level rose to current levels when the ice melted. Only about ten percent of the land surface is covered by ice today.

The most recent interglacial age. We are living in the most recent of many interglacial ages. Geologists call it the Holocene Epoch. Frequent and rapid climate fluctuations have occurred throughout the Holocene, which began about 13,000 – 10,000 years BP and includes all of recorded history. Ice core studies show that, about 9500 years ago, temperatures in Greenland

changed from warmer than today to full glacial severity within 100 years. All glacial ice in North Dakota had probably melted by 8000 years BP; the Scandinavian ice sheet had almost completely disintegrated before about 7000 years BP. The last remnants of the once huge Laurentide ice sheet in the Hudson Bay region had melted by 5000 years BP.

Temperatures have fluctuated rapidly during the last 2000 years, although not to the extent they did during the Pleistocene interglacial periods. A time of relatively warm temperatures, the Medieval Warm Period (Figure 4), is well documented in Europe and the western hemisphere between about 1100 and 600 years ago (900-1400 AD). It was followed immediately by a period of cooling from about 600 years ago until 200 years ago (1400 to 1800 AD) that included a particularly cold interval, the Little Ice Age, between 400 and 250 years BP (1600-1750 AD).

The entirety of Holocene climatic history can be characterized as a sequence of 10 or more global-scale "little ice ages," fairly irregularly spaced, each lasting a few centuries, and separated by global warming events.

Direct instrumental measurements. Direct instrumental measurements indicate that the average temperature at the Earth's surface increased about 0.8°C from 1866 until 1998 (Figure 2). During this same time, the concentration of CO₂ in the atmosphere increased from 280 to 353 parts per million volume. Because this period of time very nearly coincides with the industrial revolution, the supposition arose that the warming was caused by human activities. Most of the warming, however, took place before most of the CO₂ increase occurred. Statistical analyses of the climate record since 1860 show that significant interannual and interdecadal variability occurred. This suggests that the warming had causes other than an increase in greenhouse gases alone.

The increase in temperatures recorded by direct measurements may be part of a longer-term warming trend that began after the Little Ice Age and before the Industrial Epoch. Many poorly understood factors influence atmospheric CO₂ concentrations. For example, because the current increase follows a 300-year warming trend, the observed increases in CO₂ are of a magnitude that can be explained by oceans giving off gases naturally as temperatures rise.

Conclusions. A review of research on past temperatures and variations led us to the following conclusions:

1. Climate is in continual flux: the average annual temperature is usually either rising or falling and the temperature is never static for a long period of time.
2. Observed climatic changes occurred over widespread areas, probably on the global scale.
3. Climate changes must be judged against the natural climatic variability that occurs on a comparable time scale. The Little Ice Age, Medieval Warm Period, and similar events are part of this natural variability. These events correspond to global changes of 1-2°C.
4. Global temperatures appear to be rising, irrespective of any human influence, as Earth continues to emerge from the Little Ice Age. If the temperature increase during the past 130 years reflects recovery from the Little Ice Age, it is not unreasonable to expect the temperature to rise another 2 to 2.5 degrees Celsius to a level comparable with that of the Medieval Warm Period about 800 years ago. The Holocene Epoch, as a whole, has been a remarkably stable period with few extremes of either rising or falling temperatures, as were common during Pleistocene glacial and interglacial periods. Nevertheless, the Holocene has been, and still is, a time of fluctuating climate.

5. Climatic changes measured during the last 100 years are not unique or even unusual when compared with the frequency, rate, and magnitude of changes that have taken place since the beginning of the Holocene Epoch. Recent fluctuations in temperature, both upward and downward, are well within the limits observed in nature prior to human influence.

Editors note: This article was summarized from "Rate and Magnitude of Past Global Climate Changes," which was published in *Environmental Geosciences*, volume 6, number 2, 1999, pages 63-75. The authors are John P. Bluemle (State Geologist of North Dakota, Bismarck, ND), Joseph M. Sabel (geologist with the U.S. Coast Guard in Oakland, CA), and Wibjörn Karlén (Professor of Physical Geography at the University of Stockholm, Sweden). In the *Environmental Geosciences* article the authors include citations to more than 70 peer-reviewed reports.

Bluemle earned a B.S. degree from Iowa State University, M.S. from Montana State University, and Ph.D. in geology from the University of North Dakota. He has worked on the glacial geology, geomorphology, and economic geology of the northern Great Plains and Williston Basin for nearly 40 years. Bluemle, who has worked at the North Dakota Geological Survey since 1962, has been State Geologist and Director since 1991.

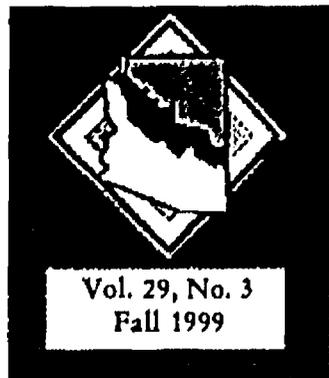
Figure 1. Many glaciers in North America and Scandinavia, including the two in this photograph (Isfallsglaciären and Storglaciären in the Tarfala Valley in Sweden), have receded since the early eighteenth century. Note the distance between the frontal moraines (arrows) and the ice. If global warming continues, glaciers and ice caps will melt, sea level will rise, and many population centers will be submerged. There would likely be an increase in icebergs, which would endanger maritime commerce. The list of possible effects of continued global warming is long and uncertain.

Figure 2. Direct instrumental temperature measurements show that the average temperature at Earth's surface increased from 13.8°C in 1866 to 14.6°C in 1998. Note that the temperature increased from about 1885 until 1940, decreased until about 1978, and has been increasing since then. Modified from a graph provided by the Goddard Institute for Space Studies.

Figure 3. Temperature fluctuation (mean annual temperatures) in central Europe during the past 60 million years. Except for a peak about 50 million years ago, temperatures decreased about 15°C prior to the Pleistocene Epoch, which began about three million years ago. At that time glacial conditions began and temperatures fluctuated widely, ranging from full glacial to interglacial conditions. The modern condition is approximately +4 to +5 degrees Celsius. Graph is modified and adapted from Anderson, B. G. and Borns, H. W., 1997, *The ice age world*: Oslo, Scandinavian University Press.

Figure 4. This graph shows the Sargasso Sea surface temperature, which was derived from oxygen isotope ratios. This is an indicator of evaporation and, therefore, a proxy for sea-surface temperature. The Sargasso Sea is a two-million-mi² body of water in the North Atlantic Ocean that lies roughly between the West Indies and the Azores from approximately 20-35°N. It is relatively static through its vertical column so that potential interference from mixing with other water masses and sediment sources is minimal. The isotopic ratios are derived from biotic debris

that has precipitated onto the sea floor. Wide and abrupt variations in temperature are indicated. The relative temperature variations of the Little Ice Age (LIA) and the Medieval Warm Period (MWP) are prominently recorded in the data. Note that the temperature has been increasing since about 300 years before present (1700 A.D.) The horizontal line is the average temperature for this 3000-year period. After Keigwin, L. D., 1996, The Little Ice Age and Medieval Warm Period in the Sargasso Sea: *Science*, v. 274, p. 1504-1508.



Arizona Geology

Published Quarterly by the Arizona Geological Survey



The State agency
for geologic information

MISSION

To inform the public about geologic processes, materials, and resources in Arizona and assist citizens, businesses, governmental agencies, and elected officials in making informed decisions about managing Arizona's land, water, mineral, and energy resources.

GOALS

- Inform the public about geologic processes, materials, and resources in a timely, courteous manner.
- Map and describe the bedrock and surficial geology of Arizona.
- Investigate and document geologic processes and materials that might be hazardous to the public or have adverse impact on land use and resource management.
- Administer the rules, regulations, and policies established by the Arizona Oil and Gas Conservation Commission.

Global Warming: A Geological Perspective

John P. Blumle
State Geologist and Director
North Dakota Geological Survey

The average surface temperature of Earth is increasing. Continued increase could cause profound impacts on Earth and its inhabitants (Figure 1).

The average surface tem-

perature increased from the 1880s until about 1940, declined until about 1980, and has been increasing since then (Figure 2). Some believe that the current warming rate is unusually high, is being caused by the burning of fossil fuels that produce carbon dioxide (CO₂), creating a "greenhouse effect,"

and can be slowed or even

reversed. To evaluate the significance of the current warming, one must compare it with temperatures and variations that occurred prior to human activities. If the current warming is greater than that in the past, human activities may be a cause. If temperatures and

(continued on page 2)



Figure 1. Many glaciers in North America, Scandinavia, and Sweden have receded since the early eighteenth century, including the two in this photograph, Isfallsglaciären and Storglaciären in the Tarfala Valley in Sweden. Note the distance between the frontal moraine (arrow) and the ice. If global warming continues, glaciers and ice caps will melt, sea level will rise, and many population centers will be submerged. There would likely be an increase in icebergs, which would endanger maritime commerce. The list of possible effects of continued global warming is long and uncertain.

Pete - use
arrow please.
at each corner

Global Warming (continued)

GOVERNOR
JANE DEE HULL

**ARIZONA
GEOLOGICAL
SURVEY**
September 1999

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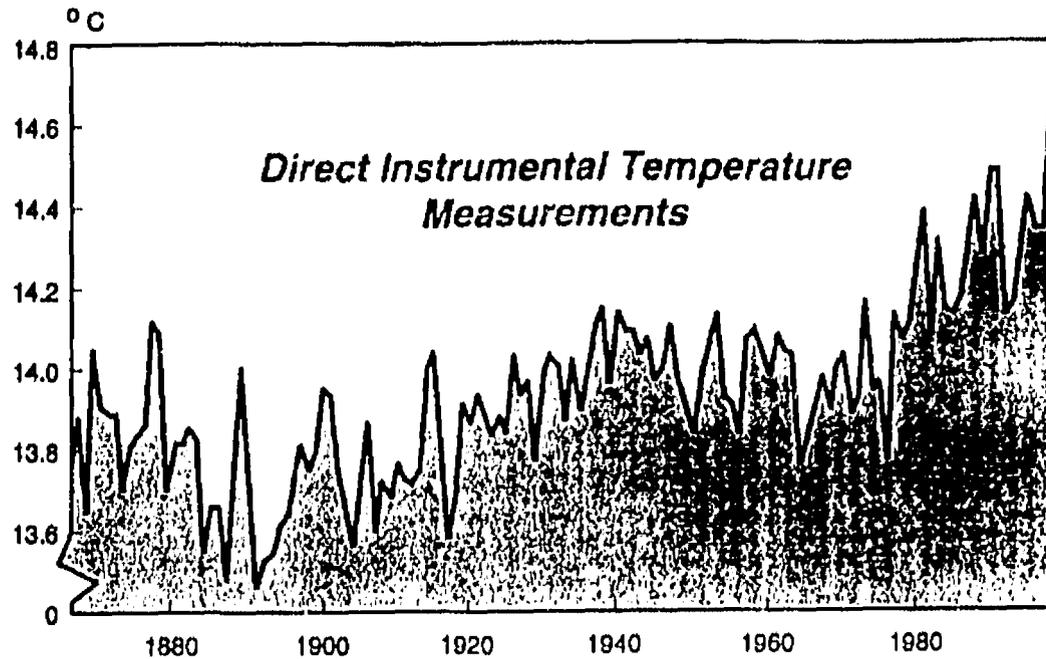


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variations in the past were comparable to or larger than the current warming, however, human activities may not be significant.

Two colleagues and I reviewed published articles to compare past temperatures and variations with the current warming. Much research has been done on this subject in the past 30 years, especially the last decade. Scientists have completed investigations in widely distributed parts of the world and used varied methods to interpret past temperatures and changes. Independent research has been done on topics such as glacial advance and retreat, ice cores, pollen distribution, lichen growth, tree rings, sediment layers in glacial lakes, sediment on the

sea floor, the composition of sea shells and corals, and the composition of cave deposits. Information about past temperatures, variations, and trends is summarized below.

Temperature variations during the Ice Age. The global temperature declined at least 10°C during the Ice Age (Pleistocene Epoch), which began two to three million years ago. In addition, the temperature cooled 15-20°C in central Europe in the 55 million years or so that preceded the Pleistocene (Figure 3).

Extensive continental glaciation took place in North America and northern Europe during the Pleistocene. Ice sheets advanced and retreated repeatedly, reaching as far south as the Missouri

and Ohio Rivers in the United States. At least six major glacial advances and retreats occurred in North Dakota. Each major glacial and interglacial episode lasted about 100,000 to 200,000 years, during which the temperature decreased roughly 10°C during glaciation and increased by a comparable amount during the subsequent interglacial period.

Studies of ice cores from the Greenland ice cap indicate that temperatures there rose and fell abruptly during the Pleistocene. On two occasions between 135,000 and 110,000 years before present (BP), temperatures dropped from 2°C warmer than they are today to 5°C cooler in less than a few centuries. In one instance

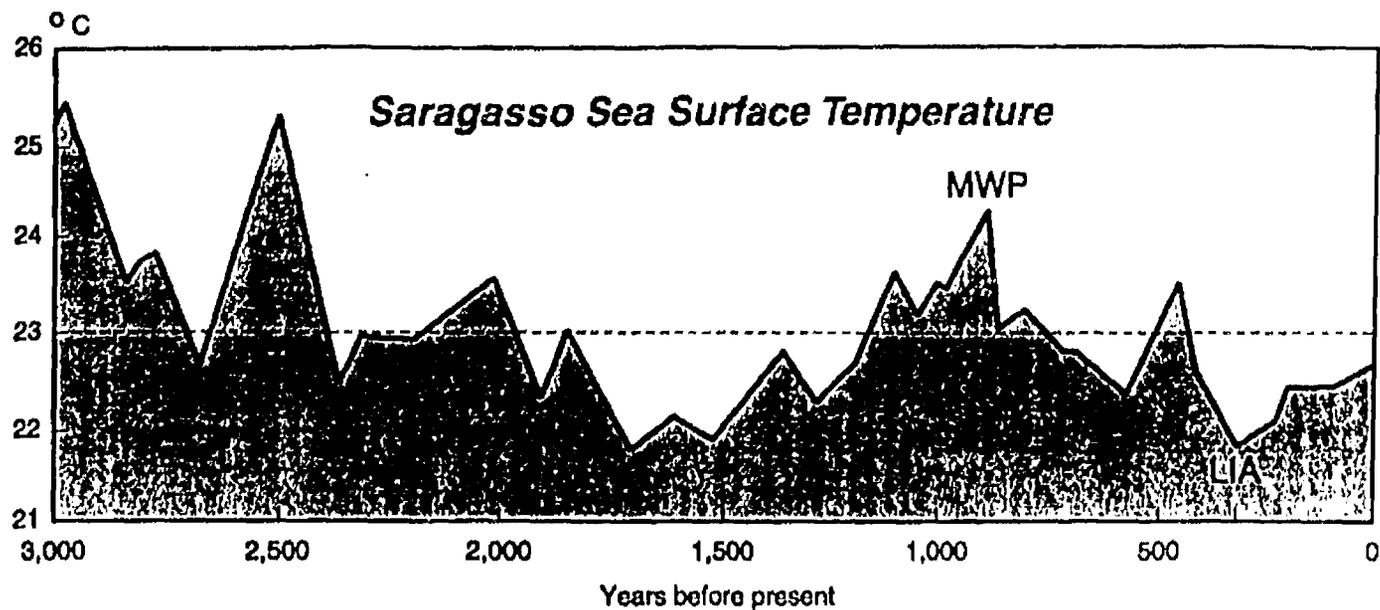


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Glacier Bay along the southeastern coast of Alaska retreated between 1787, when its position was first recorded, and 1794.

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Testimony for SCR 4043
March 16, 2001

Aaron Krauter
State Senator
District 35

Chairman Rennerfelt and members of the House Natural Resources Committee. For the record my name is Aaron Krauter, State Senator from District 35. District 35 is made up of four, rural agricultural counties in southwestern North Dakota. Those counties are Adams, Hettinger, Grant and Sioux.

SCR 4043 is asking the legislative council to study carbon sequestration opportunities for land owners in the great state of North Dakota.

Let me first try to explain carbon sequestration as holding carbon in the soil in a way to reduce carbon dioxide (CO₂) in the atmosphere. Carbon is an essential element for almost all plant and animal life. Plants obtain carbon from CO₂. Animals, including humans, obtain carbon from plants and return CO₂ to the atmosphere.

Carbon flowed through this cycle more or less in balance until the late 1880's. Now the more recent higher levels of CO₂ in the atmosphere are believed by some to be a factor in potential global warming. Deforestation, soil tillage, wetland drainage and the burning of fossil fuels have decreased the fixed organic carbon and dramatically increased carbon dioxide in the atmosphere. In other words, as less carbon is trapped in soil and growing plants around the world, more CO₂ is released to the atmosphere.

Carbon sequestration methods include trapping carbon in plants, managing crops and soils to slow plant residue breakdown and reducing soil erosion. This is where we need to study this issue at great detail. Agricultural producers could soon be entering into carbon sequestration agreements that will pay farmers for common practices such as mulch-till, no-till and buffer establishment. There might also be payments for withdrawing land from annual production, reforestation, prairie restoration, and other farming practices.

Carbon sequestration agreements are private agreements. They can be between parties living in different countries, since atmospheric gases have no national boundaries. For example, a consortium of Canadian power companies is already paying some Iowa farmers for carbon credits. The carbon that the Iowa farmers sequester offset CO₂ emissions by the Canadian companies. These 400 Iowa farmers were paid \$8 million.

Governor Janklow from South Dakota has started a program with research from the South Dakota School of Mines and Technology to put his farmers at the forefront of carbon trading. With educated land practices, such as no-till, South Dakota estimates its farmers could get \$20 to \$30 an acre payments. In the range land areas, sequestration would be about \$3 to \$5 an acre.

All told officials from the South Dakota School of Mines and Technology estimate their states farmers could receive \$100 million to \$150 million a year of the next two decades.

Now this may sound pretty far fetched and some of you may have never heard of carbon sequestration before today, the fact remains that it is here in some states and is coming.

North Dakota has some of the largest supplies of lignite coal reserves and also have some of the cleanest and most environmentally safe coal fired power plants in the world. We are very proud of that and we must keep it that way. But we must not put our head in the sand and let this opportunity pass us by.

I am asking for your support to pass SCR 4043 so that landowner, farmers and ranchers in North Dakota can benefit from the opportunities that are out there.

THE WHITE HOUSE
WASHINGTON

March 13, 2001

The Honorable Chuck Hagel
United States Senate
Washington, D.C. 20510

Dear Senator Hagel:

Thank you for your letter of March 6, 2001, asking for the Administration's views on global climate change, in particular the Kyoto Protocol and efforts to regulate carbon dioxide under the Clean Air Act. My Administration takes the issue of global climate change very seriously.

As you know, I oppose the Kyoto Protocol because it exempts 80 percent of the world, including major population centers such as China and India, from compliance, and would cause serious harm to the U.S. economy. The Senate's vote, 95-0, shows that there is a clear consensus that the Kyoto Protocol is an unfair and ineffective means of addressing global climate change concerns.

As you also know, I support a comprehensive and balanced national energy policy that takes into account the importance of improving air quality. Consistent with this balanced approach, I intend to work with the Congress on a multipollutant strategy to require power plants to reduce emissions of sulfur dioxide, nitrogen oxides, and mercury. Any such strategy would include phasing in reductions over a reasonable period of time, providing regulatory certainty, and offering market-based incentives to help industry meet the targets. I do not believe, however, that the government should impose on power plants mandatory emissions reductions for carbon dioxide, which is not a "pollutant" under the Clean Air Act.

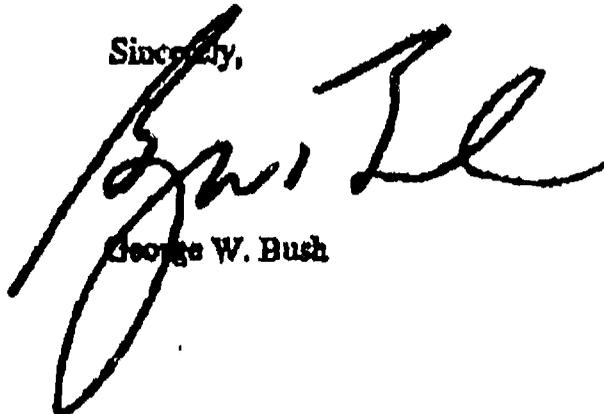
A recently released Department of Energy Report, "Analysis of Strategies for Reducing Multiple Emissions from Power Plants," concluded that including caps on carbon dioxide emissions as part of a multiple emissions strategy would lead to an even more dramatic shift from coal to natural gas for electric power generation and significantly higher electricity prices compared to scenarios in which only sulfur dioxide and nitrogen oxides were reduced.

This is important new information that warrants a reevaluation, especially at a time of rising energy prices and a serious energy shortage. Coal generates more than half of America's electricity supply. At a time when California has already experienced energy shortages, and other Western states are worried about price and availability of energy this summer, we must be very careful not to take actions that could harm consumers. This is especially true given the incomplete state of scientific knowledge of the causes of, and solutions to, global climate change and the lack of commercially available technologies for removing and storing carbon dioxide.

Consistent with these concerns, we will continue to fully examine global climate change issues - including the science, technologies, market-based systems, and innovative options for addressing concentrations of greenhouse gases in the atmosphere. I am very optimistic that, with the proper focus and working with our friends and allies, we will be able to develop technologies, market incentives, and other creative ways to address global climate change.

I look forward to working with you and others to address global climate change issues in the context of a national energy policy that protects our environment, consumers, and economy.

Sincerely,



George W. Bush

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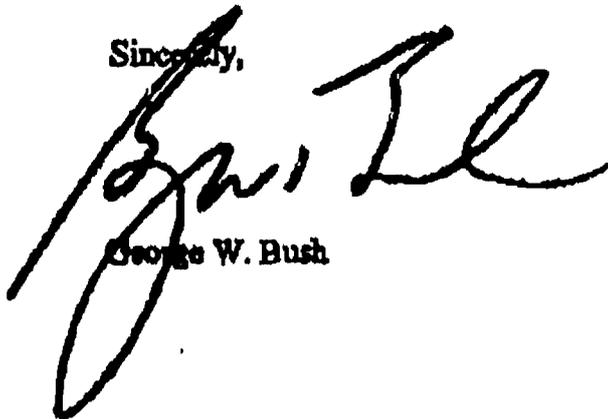
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Sincerely,

A handwritten signature in black ink, appearing to read "George W. Bush". The signature is stylized and cursive, with a large loop at the end.

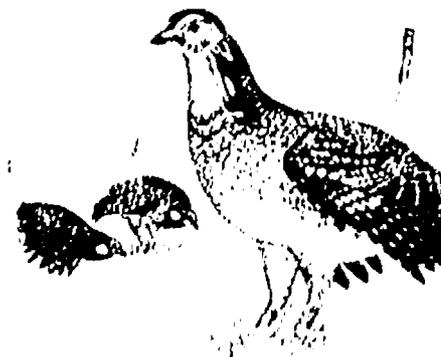
George W. Bush



North Dakota Chapter

THE WILDLIFE SOCIETY

P.O. BOX 1442 • BISMARCK, ND 58502



**TESTIMONY OF BILL PFEIFER
NORTH DAKOTA CHAPTER OF THE WILDLIFE SOCIETY
PRESENTED TO THE HOUSE NATURAL RESOURCE COMMITTEE
ON SCR 4043, MARCH 16, 2001**

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I'm Bill Pfeifer speaking on behalf of the North Dakota Chapter of The Wildlife Society. The Wildlife Society supports SCR 4043 directing the Legislative Council to study the process of carbon sequestration.