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CLIMATE SCIENCE AND EPA'S GREENHOUSE GAS REGULATIONS

THURSDAY, MARCH 8, 2011

House of Representatives,

Subcommittee on Energy and Power,

Committee on Energy and Commerce,

Washington, D.C.

The subcommittee met, pursuant to call, at 10:02 a.m., in Room 2123, Rayburn House Office Building, Hon. Ed Whitfield [chairman of the subcommittee] presiding.

Present: Representatives Whitfield, Terry, Burgess, Scalise, McMorris Rodgers, McKinley, Gardner, Griffith, Rush, Inslee, and Waxman (Ex Officio).

Staff Present: Michael Beckerman, Deputy Staff Director; Maryam Brown, Chief Counsel, Energy and Power; Ben Lieberman, Counsel, Energy & Power; Dave McCarthy, Chief Counsel, Environment/Economy; Gib Mullan, Chief Counsel, CMT; Mary Neumayr,

Counsel, Oversight/Energy; Sean Bonyun, Deputy Communications Director; Andrew Powaleny, Press Assistant; Peter Spencer, Professional Staff Member, Oversight; Phil Barnett, Minority Staff Director; Greg Dotson, Minority Energy and Environment Staff Director; Jeff Baran, Minority Senior Counsel; Alexandria Teitz, Minority Senior Counsel, Environment and Energy; Karen Lightfoot, Minority Communications Director and Senior Policy Advisor; and Caitlin Haberman, Minority Policy Analyst.

Mr. Whitfield. We will call the meeting to order. And I want to thank our panel of witnesses. We appreciate your being here this morning very much. And of course, the title of today's hearing is Climate Science and the EPA's Greenhouse Gas Regulations.

This is our third hearing on the Energy Tax Prevention Act of 2011. The first two focused on the adverse impact that the Environmental Protection Agency's global warming regulatory agenda would have on jobs and the economy in America. We could have had other hearings on that as well, but we decided today to focus on the science.

I might say that I only brought one of my many books that questions global warming and the science on global warming. I am delighted to see that at least one member brought a number of books. I couldn't get all mine in the car. Anyway, that is the reason we have these hearings, is to hear both sides of the issue.

I might say also that we have had 24 hearings in the House of Representatives over the past 4 years relating to the science for climate change and/or global warming. One thing that really stuck out to me is that these computer models seem to have difficulty making seasonal or yearly forecasts and they certainly, according to many scientists, have great difficulty trying to forecast 100 years down the road.

Science serves to inform us about the nature of a problem.

And I look forward to listening to the presentation of all our witnesses today. But whether one thinks that science tells us that global warming is a serious problem which some scientists do, a minor problem which some scientists do, or hardly a problem at all which some scientists do, the real question before this committee is whether EPA's regulations under the Clean Air Act are a wise solution to the problem. And, in my view, clearly they are not.

In fact, one need not be a skeptic of global warming to be a skeptic of EPA's regulatory agenda. Case in point is EPA Administrator Lisa Jackson, and she warned us about how complex and costly greenhouse gas regulations under the Clean Air Act would be. Now, of course that was in 2009 and 2010, when the administration was trying to pass through Congress a cap-and-trade bill. It is only now that the cap-and-trade legislation was not adopted in the Congress that the administrator has changed her tune and emphasizes how reasonable and workable these rules would be.

I might also say that Administrator Jackson in testimony just a few weeks ago conceded that unilateral action by EPA would not make much of a difference, especially given the fact that China emits more greenhouse gases than the U.S., and its rate of emissions increases has become many times larger than ours in recent years. In fact, many people might be interested in knowing that carbon emissions actually fell 6 percent in 2009 in the

United States, and China was responsible during that year for 24 percent of global carbon emissions during that same year.

Of course, the rhetoric coming from the White House is that the sky is falling and carbon emissions are going through the roof. The number one reason for the reduction in carbon emissions is the downturn in our economy. So it is pretty obvious that these greenhouse regulations will have a major impact on our economy, mainly because we don't yet have an available technology to control carbon emissions on a commercial scale.

Thus far, only one global warming rule has been analyzed by EPA, and that is, the new motor vehicle standards. The Agency estimated that, as a result of that, they would be able to reduce the earth's future temperature by almost 1/100th of a degree by the year 2100. Not much progress. I want you keep that in mind, however, when you hear about these scary global scenarios.

Even if you believe every word of them, the Agency rules are no solution. In fact, they are counterproductive, because these unilateral regulations would impose an unfair disadvantage on domestic manufacturers and chase some of our manufacturing jobs to nations like China that have no such restrictions in place and no plans to institute them. Manufacturing jobs would go overseas to countries whose emissions per unit output are considerably higher. There is no question EPA rules are bad economic policy, but they may very well also be bad environmental policy.

The Energy Tax Prevention Act, far from being an attack on

global warming science, as some have suggested, is, in fact, a repudiation of a regulatory scheme that will harm the American economy and destroy jobs. It is also a repudiation of the attempt by unelected bureaucrats in government to bypass the will of Congress. Congress has spoken on this issue three specific times and each time has said no.

H.R. 910 is not about global science. It is about stopping regulation certain to do more harm than good, regardless of how one interprets the science. It is about a dangerous and job-destroying attempt to transform the economy in ways that Congress has repeatedly rejected.

As I said, we look forward to your testimony. At this time, I recognize the gentleman from Illinois for 5 minutes for his opening statement.

Mr. Rush. I want to thank you, Mr. Chairman. And I must also commend you for allowing us to hold this very important hearing today. Mr. Waxman and I, as well as our colleagues on this side of the aisle, were adamant in requesting that this hearing be held because we believe this subcommittee would be doing a disservice to all of our constituents as well as to the entire committee process if we were to proceed to marking up the Upton-Inhofe bill, which would repeal EPA's ability to regulate greenhouse gases, without first hearing from actual scientists about what the scientific evidence says regarding greenhouse gas emissions and their efforts and their effects on both climate

change and the overall public health.

Let us make no mistake about it. With respect to all of the witnesses that we will hear from today, that there is really no widespread debate among the scientific community on whether greenhouse gases contribute to climate change.

Mr. Chairman, I must note that it seems, though, from your opening statement, you are coming over to our side of the issue. On the one side, you have over 95 percent of respected scientists and scientific organizations worldwide, I might add, including the National Academy of Sciences, the American Association for the Advancement of Science, the American Geophysical Union, the American Meteorological Society, the U.S. Global Change Research Program, as well as the Intergovernmental Panel on Climate Change. All of these organizations are in agreement that man-made greenhouse gases do contribute to climate change, and these impacts can be mitigated through policy to curb these emissions.

On the other side, you have a very small, less than 5 percent, of the scientists in the community, who range from straight-out climate change denial to those who would dispute the certainty that the claims that human behavior is contributing to climate change.

I recognize that there is a real fear out there by those who believe the EPA's attempt to regulate greenhouse gases, even if it were only by the largest emitter, would lead to job loss in some very important sectors of our economy.

I represent Illinois, which is one of the largest coal States in the country, and I recognize that any policy regulating greenhouse gases will have a real consequence on the jobs and the economy in my State. And I sincerely believe, because the science tells me so, that these gases must be regulated because they have a serious and costly impact on somebody's health in my State and around the country. And as we look out for those people across this Nation that are being affected by the pollution associated with greenhouse gases, then we must find a way to sensibly address this issue in a balanced and in a measured way. For me, the cost of doing nothing outweighs the cost of action, because the science tells us that we cannot keep living by the status quo.

I believe we can enact sensible measures that will both protect the public's health and create new jobs so that we are not making our citizens choose between clean air to breathe and jobs to feed their families.

Mr. Waxman and I sent a letter to you dated September 17, Mr. Chairman, asking you work with us in drafting clean energy standards so we can move our Nation forward in creating new energy jobs and technologies that will put people to work, clean our air, and keep America on the forefront of the environmental protection industry, an industry that was projected to reach $700 billion last year.

Initially, Mr. Chairman, I would be happy to work with you on the clean coal industry, such as expanding programs like the

Future Gen project which just began operation in Morgan County, Illinois; and hopefully we will provide answers on whether coal demonstration can be expanded for commercial use. So I ask you, Mr. Chairman, and all my Republican colleagues, to remember to listen to what the science is telling us, and let's work together to move this country forward by creating a clean energy standard by working to promote clean coal initiatives, and by showing the American people that we can be serious about finding solutions and that we are not just here for political infighting and scorekeeping.

Mr. Chairman, I would, in just a moment -- I have here something that I think is very telling and a demonstration in fact. It comes from the USA Today. And the cartoon states: "What if it is a big hoax and we create a better world for nothing?" But what would we be creating? Energy independence, preserve rainforests, sustainability, green jobs, liveable cities, renewables, clean air, clean water, healthy children, et cetera, et cetera.

So, Mr. Chairman, even if it is a big hoax, it is a hoax that will provide many, many benefits for the American people. But I do believe that this is not a hoax. This is a real deal. The science says so and the scientists say so.

Thank you very much Mr. Chairman. I yield back the balance of my time.

Mr. Whitfield. Thank you, Mr. Rush.

At this time, I recognize for 5 minutes the gentleman from Texas, Mr. Burgess.

Dr. Burgess. I thank the chairman for calling the hearing. I want to thank the witnesses for being here with us today. It is likely to be a very lively discussion. And some of you we have seen before, some of you this will be your first time here. So we are all looking forward to it.

The science is important. We talk a lot of times about the consensus from the International Panel on Climate Change at the U.N., but science by consensus is fraught with some danger, and certainly Copernicus and Galileo, if they were still living, could testify to that effect.

My opinion, for what it is worth, is that the science behind global temperature changes is not settled. And the fact that we have this panel of experts in front of us today, who, I suspect at some point, will disagree with each other, is indicative of that.

Now, I do know this. We have had these hearings before, going back a number of years. In 2008, we saw very, very high energy prices, and those were the harbinger of a very significant economic collapse. As a consequence, carbon emissions in this country went down; but I don't want to do that again. And energy prices are on the way back up. We have done nothing in the meantime to protect the American people from the effect of those high energy prices. And I rather expect, if past is prelude, we may see yet another reduction in carbon emissions, but it will be

brought because of another jolt through the American economy.

And what would the effect -- and the Administrator of the EPA, in fact, has testified to this effect. If Administrator Jackson's efforts are successful and if we were to ever pass Waxman-Markey and those efforts were to be successful, how do we do this by ourselves when it is, in fact, a global climate change that we are talking about?

So even if we do all of the things that have been suggested by the Administrator of the EPA, all of the things suggested by Ranking Member Waxman and Mr. Markey, without similar measures by other countries, we are damaging our own country and we are not saving anybody in the process.

Now, weather and climate are complex phenomena affected by a host of variables. In the 1970s, we have all seen the cover of Time Magazine. The earth was cooling and the next Ice Age was on the way. It was the consensus of scientists at that time that that was fact and there was no point in debating it any further. And, we have a very significantly different set of variables to contend with today.

Part of our issue today is, what is the role of the scientists in this debate? Are they there to function as a gatekeeper? Or, in fact, are they a broker for putting up the particular type of information, climate sensitivity to models and the way that has been interpreted over time, the role that these have had in the existing impacts in our public policy in regards

to carbon and carbon regulation and the environment.

We have got a great panel of witnesses. I look forward to a lively interchange. I would like, since I am the chairman now, to yield the remaining time to Mr. Griffith from Virginia.

Mr. Griffith. Thank you, Mr. Chairman. I may just have to speak loud. Dr. Roberts is a constituent, and it is the first time that I have had a constituent testify in front of a committee on which I have served. So welcome particularly to you, Dr. Roberts.

And then I would also say to you, Mr. Chairman, and to the others that being a Virginian and proud of the good things we have done in our history, although not perfect, we have done a lot of great things in the Commonwealth of Virginia, and sometimes that means standing alone, like when we were the only government in the world that recognized the rights to religious freedom. And I am often reminded, when folks show up and say, well, 95 percent are going this way and everybody but you is going that way that, Virginia chose a different course on religious freedom, and now the world recognizes that we were right. Just because you might be in the minority doesn't always mean you are wrong.

Thank you, Mr. Chairman. I yield my time back.

Mr. Whitfield. Thank you. Also, we have discovered the problems, Mr. Waxman, for the difficulty of speaking. We hit the "mute all" button, and nobody was allowed to speak. So we have now corrected that problem, and I will recognize the ranking

member of the full committee, Mr. Waxman, for his 5-minute opening statement.

Mr. Waxman. Well, I am glad you found the scientific way to have all the microphones working, Mr. Chairman.

Today's hearing is a crucial opportunity for this committee to understand what is at stake before it considers legislation to block action on climate change. Our health and lives, our economic strength, our national security, all are threatened by climate change.

As we will hear today from some of the world's leading experts, human-induced climate change is happening. We are already seeing its effects and harm from climate changes growing. Members of Congress have the responsibility to consider the threats facing the Nation and making careful choices about how to address them. We owe that to our constituents and to future generations.

I am disappointed that this hearing is happening only because committee Democrats insisted on it, but I commend the majority for agreeing to our request.

We now have the opportunity to hear the scientists explain the scope and magnitude of harm from climate change. I hope the members of this committee are willing to listen.

The Upton-Inhofe bill would overturn EPA's scientific finding that greenhouse gas emissions endanger health and the environment. That determination was based on the science we will hear about

today.

The Upton-Inhofe bill would remove EPA's authority to protect the American public from carbon pollution and the impacts of climate change. The bill would legislate a scientific finding out of existence, and it would remove the administration's main tools to address one of the most critical problems facing the world today.

The premise of this radical legislation, as stated by its lead Senate sponsor, is that climate change is a hoax. So before we act on this legislation, the members of this committee must decide: Do we act because the personal opinions of Senator Inhofe; or, do we accept the vast body of scientific understanding, based on multiple lines of evidence across multiple scientific disciplines, which says that the climate change is real and dangerous?

None of us would hesitate in our own lives. If my doctor had told me I had cancer, I wouldn't scour the country to find someone to tell me that I didn't need to worry about it. Just because I didn't feel gravely ill yet, I wouldn't assume that my doctor was falsifying the data. And if my doctor said he didn't know how long I had to live, I wouldn't say, well, if he is uncertain about that, he is probably wrong about the whole thing. I would try to get a second opinion from the best expert I could find about the diagnosis. But I would never call the findings of the medical experts a hoax.

Most of us don't substitute our own judgment for that of experts when it comes to medicine, nuclear engineering, building bridges, designing computer security, trying to figure out how to turn the microphones on in the committee room. The experts on climate change include atmosphere, chemists and physicists, meteorologists, biologists, statisticians, computer scientists, paleontologists, and geologists, thousands of highly-trained professionals, who have published tens of thousands of research papers in the world's top scientific peer-reviewed journals. To reject that body of research by experts is breathtakingly irresponsible.

Chairman Upton and Chairman Whitfield, I am not wedded to the language of last year's energy bill. I am willing to work with you on new approaches and creative ideas. We can start from a blank piece of paper. I am prepared to meet with you without preconditions for as long as it takes to find the basis for common ground. But we need to find a way to work across party lines to address this threat to our health, our economic prosperity, and our national security. We have an opportunity to act now to forestall great harm to our Nation and our world if we don't address this challenge, we do not meet our moral obligations to our children and to the future, and history will not judge us kindly.

I yield back the balance of my time.

Mr. Whitfield. Thank you, Mr. Waxman. And now we are

prepared to hear the testimony of the panel. I would like at this point to introduce the panel.

First, we have Dr. Richard Somerville, who is a Professor Emeritus Of Scripps Institution of Oceanography, University of California, San Diego; we have Dr. John Christy, who is Director, Earth System Science Center, University of Alabama, Huntsville; we have Dr. Christopher Field, who is the Director, Department of Global Ecology, Carnegie Institution of Washington in Stanford, California; we have Dr. Roger Pielke, Sr., who is senior research scientist, Cooperative Institute for Research in Environmental Sciences at the University of Colorado; we have Dr. Francis Zwiers, who is the Director, Pacific Climate Impacts Consortium, University of Victoria, Victoria, British Columbia; we have Dr. Knute Nadelhoffer, who is the Director, University of Michigan Biological Station, University of Michigan; and we have Dr. Donald Roberts, who is Professor Emeritus at the Uniformed Services University of the Health Sciences in Bethesda, Maryland.

We welcome all of you. And you will each have 5 minutes for your statement, and then we are going to open it up to the panel for questions. And we look forward to your testimony.

STATEMENTS OF RICHARD SOMERVILLE DISTINGUISHED PROFESSOR EMERITUS, SCRIPPS INSTITUTION OF OCEANOGRAPHY; JOHN R. CHRISTY, DIRECTOR, EARTH SYSTEM SCIENCE CENTER, UNIVERSITY OF ALABAMA; CHRISTOPHER FIELD, DIRECTOR, DEPARTMENT OF GLOBAL ECOLOGY, CARNEGIE

INSTITUTION OF WASHINGTON; KNUTE NADELHOFFER, DIRECTOR, UNIVERSITY OF MICHIGAN BIOLOGICAL STATION, UNIVERSITY OF MICHIGAN; ROGER PIELKE, SR., SENIOR RESEARCH SCIENTIST, COOPERATIVE INSTITUTE FOR RESEARCH IN ENVIRONMENTAL SCIENCES, UNIVERSITY OF COLORADO AT BOULDER; DONALD ROBERTS, PROFESSOR EMERITUS, UNIFORMED SERVICES, UNIVERSITY OF THE HEALTH SCIENCES; AND FRANCIS W. ZWIERS DIRECTOR, PACIFIC CLIMATE IMPACTS CONSORTIUM UNIVERSITY OF VICTORIA.

Dr. Somerville, you are recognized for 5 minutes.

STATEMENT OF RICHARD SOMERVILLE

Mr. Somerville. Mr. Chairman and members of the subcommittee, I appreciate this opportunity to testify concerning the science of climate change. Since 1979, I have been a professor at Scripps Institution of Oceanography, University of California at San Diego. Today, however, I am speaking on my own behalf as a climate scientist.

To date, the great preponderance of experts agree on the following facts: One, the essential findings of mainstream climate science are firm; the world is warming. There are many kinds of evidence: Air temperatures, ocean temperatures, melting ice, rising sea levels, increasing water vapor in the atmosphere, twice as many new high temperature records as new low temperature records, and much more. Many lines of evidence also clearly

demonstrate that most of the observed warming is due to human activities.

Two, the greenhouse effect is well understood. It is as real as gravity. We have known for 150 years that adding man-made carbon dioxide to the atmosphere will amplify the natural greenhouse effect and trap heat. We know carbon dioxide is increasing. We measure that. We know the increase is human caused. We analyze the chemical evidence for that.

Three, our climate predictions are coming true. Many recently observed climate changes like rising sea levels are occurring at the high end of the predicted ranges. Some changes, like disappearing arctic summer sea ice, are happening faster than the anticipated worst case. Urgent global action is needed if climate disruption is to be limited to moderate levels, like the 3.6 degrees Fahrenheit or 2 degree Celsius target above pre-industrial 19th century temperatures, a target not set by scientists, but by governments and agreed to by the G-8 and G-20 nations and the European Union.

Four, the standard skeptical or contrarian arguments have been refuted many times over in technical papers published in the peer-reviewed scientific research literature. Nobody today should be impressed by these discredited claims.

Five, science has its own high standards. Science works by qualified scientists doing careful research and publishing it in well-reviewed scientific journals. It doesn't work by

opinion-makers on the Internet or television or by bloggers or op ed pieces.

Six, the leading scientific organizations of the world, including National Academies of Science and professional scientific societies, have carefully evaluated the results of climate science and endorsed these results. If the world is to confront the challenge of climate change wisely, it must first learn what science has discovered, then accept that, and then act.

We are already experiencing impacts of climate change today on health, safety, food, water, and security. Some further climate change is inevitable, but how much is up to us. This problem is solveable. The future lies in our hands. We have the technology. We must find the will. The road forks now.

We can choose a little more warming with relatively mild impacts or a lot more warming with serious consequences. If we, the world, continues on the current course of increasing emissions, there will be a lot more impacts. We and our children and grandchildren will experience more floods, droughts, and heat waves. We will see severe impacts on food, water, energy, and security as global climate is disrupted.

Humanity can choose today among three courses of action. One, to reduce emissions; two, to adapt to the impacts; and, three, to suffer. How much of each depends on what we choose to do. The more we reduce the emissions, the less adapting and suffering will be required.

The future is not necessarily bleak. It is not too late to avoid the worst impacts of manmade climate change. But this is an urgent issue, and the urgency is scientific and not political or ideological. We have a window of opportunity in which to act. It closes soon. If humanity can greatly reduce the global emissions of manmade greenhouse gases like carbon dioxide and do it fast, then we can greatly reduce the risks of dangerous climate change. These will require that these emissions peak not in 50 or 100 years, but in 5 or 10 years and then decline rapidly so that global emissions are about 80 percent lower by mid century. The sooner we start, the lower the cost and the greater the chance of success.

Reducing emissions can be done in many ways, and the low-hanging fruit is to quickly improve energy efficiency. This also has many immediate benefits: Reducing dependence on imported oil, improving health, creating jobs, making cities cleaner and more liveable.

Our Nation's economic competitiveness depends on innovation. If this country takes reducing heat-trapping emissions seriously, we can lead in developing and producing the clean energy technologies of the future, rather than clinging to the dirty energy sources of the past.

I look forward to answering your questions. Thank you.

Mr. Whitfield. Thank you, Dr. Somerville.

[The prepared statement of Mr. Somerville follows:]

******** INSERT 1-1 ********

Mr. Whitfield. At this time, Dr. Christy, you are recognized for 5 minutes.

STATEMENT OF JOHN CHRISTY

Mr. Christy. Chairman Whitfield, Ranking Member Rush, and members, thank you for this opportunity to discuss climate change. I am John Christy, Alabama's State climatologist and Professor of Atmospheric Science at the University of Alabama in Huntsville. My research actually involves building climate data sets from scratch to answer questions about what the climate is doing and to test assertions from model theory. In this verbal testimony, I will briefly address six points that are detailed in my written testimony.

One, extreme events. It is popular now to claim extreme events are somehow caused by humans. The earth is very large, the weather is very dynamic, and extreme events will occur somewhere every year. A quick analysis shows that, A, floods in England in 2000 and Australia in 2010 have been exceeded several times in the past; B, snowstorms in the eastern U.S. occur as part of natural circulation processes; and, C, the recent Russian heat wave and related flooding in Pakistan were due to blocking systems which occur without appeal to human causes. Natural, unforced climate variability explains these events.

Two, the underlying temperature trend. An updated analysis of the underlying trend of global atmospheric temperature over the past 32 years, which accounts for volcanos and El Ninos, shows that an atmospheric warming rate of only 9/100ths of a degree have has occurred per decade. This is the same value published in my 1994 analysis, which covered only 15 years then. This rate is one third of that suggested by climate model theory.

Three, patterns of warming. Continued research on surface temperature changes over land indicates nighttime warming but little daytime change. This is a classic feature that arises from land use change, not greenhouse gas warming.

For the tropical atmospheric temperature, several new studies verify our earlier work that observations and models do not agree about the rate of tropical warming.

Four, climate sensitivity and feedback. New research addresses a question fraught with uncertainty and contention: How sensitive is the climate system to extra greenhouse gases? My colleague, Dr. Roy Spencer, has shown that for time periods for which this quantity can be assessed, the observations indicate the earth has strong negative feedbacks that mitigate warming impulses. No model reproduces these type of feedbacks, and so this is a clue as to why models tend to show more warming than is observed when they add CO2.

Five, consensus science. Widely publicized reports, purportedly by thousands of scientists, are often

misrepresentative of our science and contain overstated confidence in their assertions. Very few scientists actually control the content of these reports, and they rarely represent the full range of scientific opinion and uncertainty that attends our relatively murky science.

I understand the House has approved an amendment to defund the IPCC. I describe our proposal in my written testimony that, should the IPCC be funded by taxpayers, then 10 percent should be set aside for a written report by credentialed scientists who have consistently found the IPCC to have underrepresented critical issues, such as the evidence for low climate sensitivity, the importance in natural unforced variability, and a focus on metrics that are of little value in understanding the greenhouse effect.

And finally, number six, impact of emission control measures. Five years ago, I testified before the Oversight and Investigation Subcommittee chaired by you, Congressman Whitfield. At that time, I calculated the impact of CO2 emissions if we built 1,000 1.4 gigawatt nuclear power plants, and that they were added by 2020. That is not going to happen. But using the average climate model sensitivity, I demonstrated that global temperatures would change very little. But with the new evidence that the climate is less sensitive to CO2 increases, the impacts will be even tinier. Developing countries will dominate emissions growth as they seek to rise out of poverty, a goal we cannot and should not subvert, which requires low-cost energy which is today carbon-based.

Thank you. And I will be happy to answer questions at the appropriate time.

Mr. Whitfield. Thank you, Dr. Christy.

[The prepared statement of Mr. Christy follows:]

******** INSERT 1-2 ********

Mr. Whitfield. Dr. Field, you are recognized for 5 minutes.

Mr. Field. Thank you, Chairman Whitfield, Mr. Rush, and distinguished members of the committee. It is a pleasure to speak with you today. And I want to congratulate you on the initiative to consider climate sciences and its importance for the country and the future.

I am a professor of environmental earth system science at Stanford University and director of the Carnegie Institution's Department of Global Ecology. I have worked on climate change-related issues for the past 25 years. And I want to start with two key foundational points. The first is that climate warming over the last century is unequivocal and primarily human caused. The second is climate changes are already occurring in the United States and they are projected to grow in the future.

It is important to realize that the world has convened a large number of scientific organizations, several in the United States, coordinated by the U.S. Global Change Research Program, by the National Academy of Sciences, or internationally by the Intergovernmental Panel on Climate Change. And in each of these consortia, there has been a aggressive comprehensive effort to consolidate views across the spectrum of climate science. We haven't looked at institutions that have been put together to reflect one perspective or another. And when we see as what appears as consensus statements, these are overviews of the

positions of the wide range of climate scientists, including the full diversity of positions and the measured statements that come from these assessments are in fact reflecting the entire diversity across the spectrum of legitimate science.

What I would like to do in my comments is focus specifically on relatively recent research on the sensitivity of key sectors in the United States to climate change. My distinguished colleagues who focus more on atmospheric science will talk about where we are headed with the climate and where we have been, but what I want to do is talk about sensitivity that is observed from data, not based on simulations, that takes advantage of the fact that, for example, the U.S. Department of Agriculture has been surveying crop fields very, very carefully over the last more than 100 years. And I want to focus on two important sectors for the United States. The first is yields of agriculture and their sensitivity to climate change; the second is wildfires in the west and its sensitivity to climate change.

By looking at the summary of global agriculture yields over the last 50 years or so, we can see that agriculture is one of the triumphs of human ingenuity. We have been able to increase crop yields by 1 percent to 2 percent per year over many decades, but there is increasing evidence that we are doing this with an anchor or climate change that is pulling us back. By looking at the year-to-year variations in climate change, we can see that for several of the world's major food crops, there has been a negative

effect of warming that is occurring on our ability to increase yields, such that for crops including wheat, corn, and barley, we are seeing a decrease globally that means that something like 40 million tons of food production has been foregone as a consequence of the climate changes that have already occurred.

For each of these crops, we see a sensitivity to warming, based on observations, not simulations, of something like 10 percent yield loss for each 1.8 degrees Fahrenheit of warming. In terms of 2002 ag yields, this 40 million tons of foregone productivity represents an economic loss of about $5 billion.

Recently, Wolfgang Schlenker and John Roberts have explored the climate sensitivity of U.S. agriculture using incredibly detailed data set that has allowed them to, with much higher precision, assess the sensitivity of U.S. crops. And what they find is that for corn, soybeans, and cotton, there is a profound sensitivity to warming such that at a threshold that is about 82 for corn, 84 for soybeans, and about 90 for cotton, you see a very steep drop-off in productivity as temperatures rise above that. There is no question that temperatures are at these thresholds and exceeding them relatively frequently.

With wildfires, we see a pattern where warmer, longer summers increase the probability of wildfires. And what we have seen by summarizing wildfire data is that in the United States a warming of 1.8 Fahrenheit increases on average the area in the west that has burned from 1.3 million acres per year to 4.5 million acres

per year. These are profound effects that indicate, based on observations, the deep sensitivity of U.S. activities.

Mr. Whitfield. Thank you very much, Dr. Field.

[The prepared statement of Mr. Field follows:]

******** INSERT 1-3 ********

Mr. Whitfield. And Dr. Pielke, you are recognized for your 5-minute opening statement.

STATEMENT OF ROGER PIELKE

Mr. Pielke. Thank you. I have worked throughout my career to improve environmental issues, including air quality, by conducting research, teaching, and also providing scientifically rigorous information to policymakers. At the State level, I served two terms on the Colorado Air Quality Control Commission, where we developed the oxygenated fuels program through reduce carbon dioxide emissions from vehicles, promulgated regulations to mandate strict controls on wood and coal burning in residential fireplaces and stoves, and on asbestos concentrations in the air.

In my testimony today and in more detail in my written testimony, I have four main points.

First, research has shown that a focus on just carbon dioxide and a few other greenhouse gases as the dominant human force on climate is too narrow and misses other important influences.

Two, the phrases global warming and climate change are not the same. Global warming is a subset of climate change.

Three, the prediction or projection of reasonable weather including extremes decades into the future is far more difficult than commonly assumed. As well, the attribution of a string of

events to a particular subset of climate force scenes is scientifically incomplete if the research ignores other relevant human and natural causes of extreme weather events.

And, four, the climate science assessments of the IPCC and CCSP, as well as the various statements issued by the AGU, AMS, and NRC are completed by a small subset of climate scientists who are often the same individuals.

Decisions about government regulation are ultimately legal, administrative, legislative, and political decisions. As such, they can be informed by scientific considerations but they are not determined by them. In my testimony, I seek to share my perspectives on the science of climate based on my work in this field over the past four decades.

First, the production of multi-decadal climate predictions of reasonable impacts whose skill cannot be verified until decades from now is not a robust scientific approach. Models themselves are hypotheses. The steps of hypotheses written with respect to climate predictions are, first, make a prediction; quantitatively the prediction with real-world observations, that is test the hypothesis; and, three, communicate the assessment of the scale of the prediction.

There is no way to test that a hypothesis with a multi-decadal global climate model forecast for decades from now as step two as a verification of the skill of these forecasts is not possible until decades pass.

There has also been a misunderstanding of the relationship between global warming and climate variability and longer term change. Global warming is typically defined as an increase in the global average surface temperature. A better metric is the global annual average heat content measured in Joules. Global warming involves the accumulation of heat and Joules within the components of the climate system. This accumulation is dominating by the heating and cooling within the upper layers of the ocean.

Climate change, in contrast, is any multi-decadal or longer alteration in one or more physical, chemical, and/or biological components of the climate system. Climate change involves, for example, changes in fauna and flora, snow cover, and so forth, which persists for decades and longer. Climate variability can then be defined as changes which occur on shorter time periods.

With respect to climate change. In 2009, 18 fellows of the American Geophysical Union accepted an invitation to join me in a paper where we discuss three different mutually exclusive hypotheses with respect to the climate system.

Hypothesis 1. Human influence on climate variability and change is of minimal importance, and natural causes dominate climate variations and changes on all time scales. In coming decades, the human influence will continue to be minimal.

Hypothesis 2(a). Although the natural causes of climate variations and changes are undoubtedly important and human influences are significant and involve a diverse range of

first-order climate forcings, including but not limited to the human input of carbon dioxide. Most, if not all, of these human influences on regional and global climate will continue to be of concern for the coming decades.

Hypothesis 2(b). Although the natural causes of climate variation and change are undoubtedly important, the human influences are significant and dominated by the emissions in the atmosphere of greenhouse gases, the most important of which is carbon dioxide. The adverse effect of these gasses on regional and global climate constitutes the primary climate issue for the coming decades.

Hypothesis 2(b), the one with the CO2 dominance, is the IPCC perspective. In our EOS paper we concluded, however, that only hypothesis A has not been refuted. Hypotheses 1 and 2(b) are inaccurate characterizations of the climate system.

In our 2009 paper, we concluded, in addition to greenhouse gas emissions, the other first order forcings are important to understand the earth's climate. These forcings are spatially heterogeneous and include effects of aerosols on clouds and associated precipitation, the use of aerosol deposition, and reactive carbon in the roles of land use and land cover change. Among their effect is the role in altering atmospheric and ocean circulations away from what they would be in a natural climate system. As with CO2, the length of time that they affect the climate or estimated on multi-decadal time scales are longer.

We concluded, therefore, the cost benefit analysis regarding the mitigation of carbon dioxide and other greenhouse gases need to be considered along with other human climate forces in a broader environmental context, as well with respect to the role on the climate system.

Unfortunately, the 2007 IPCC assessment did not significantly acknowledge the importance of these and other human climate forcings in altering regional and global climate and their effects on predictability at the regional scale.

A major conclusion indicated from these studies is that regional atmospheric and ocean circulation features produce extreme events, not a global annual average surface temperature anomaly. It is the multi-decadal change and the statistics of these circulation features in response --

Mr. Whitfield. You can complete.

Mr. Pielke. In response to natural and human forcings and feedbacks which must be skillfully predicted, this level of predictive scale has not been achieved even in hindcasts of past decades.

And my last point is policymakers and the public rarely encounter this broader view of the climate system, in part, due to the limited number of scientists who are leading climate assessments. As just one example, I present my experience with the first CCS report, and my experience is documented in a public comment.

In the executive summary of that report, I stated: The processes for completing the CCS report excluded valid scientific perspectives under the charge of the committee. The editor of the report systematically excluded a range of views on the issues of understanding reconciling lower atmospheric temperature trends.

Future assessment committees need to appoint members with a diversity of views who do not have a significant conflict of interest with respect to their own work. Such committees should be chaired by individuals committed to the presentation of a diversity of perspectives and unwilling to engage in strong-arm tactics to enforce a narrow perspective. Any such committee should be charged with summarizing all relevant literature, even if inconvenient or which presents a view not held by certain members of the committee.

Finally, I have proposed a new approach in the climate committee based on a bottom-up resource-based perspective. There are five broad areas that we can use to define a need for this assessment.

Mr. Whitfield. Okay. Thanks.

[The prepared statement of Mr. Pielke follows:]

******** INSERT 1-4 ********

Mr. Whitfield. Dr. Zwiers, you are recognized for 5 minutes.

STATEMENT OF FRANCIS ZWIERS

Mr. Zwiers. Thank you, Chairman. Thank you, Mr. Rush. Thank you, committee members. I am privileged as a Canadian to be able to speak to this body. It is truly an honor to be able to do so.

I have trained as a statistician, I have spent all of my career applying the tools of statistics to problems in climate research, and I have held various positions in climate research enterprises. I am currently a professor at the University of Victoria.

There is a growing body of literature available that examines both the observed changes in temperature and precipitation extremes. These are events that, of course, do happen all the time. A 100-year event at a particular location is expected to recur at that location once every 100 years. The question that we are posing to ourselves in this literature is whether or not humans influencing the climate system are tilting the odds and are increasing the likelihood of an event from a one-in-100-year event to perhaps a more frequent event. And this is the kind of evidence that the literature seems to be turning up. The literature shows that extreme warm temperatures seem to becoming

more likely over time and extreme cold temperatures seem to be becoming less likely over time, and very intense precipitation is becoming more likely. And these are phenomena that we are generally observing at operational meteorological observing stations basically throughout the world where the data are available.

These are changes that are expected with an overall warming climate. We have observed the shift to warmer temperatures. We understand a lot about the causes of those rises. The warming climate leads to increases in the likelihood of extreme warm temperatures. It leads to decreases in the likelihood of extreme cold temperatures. We have observed both of those phenomena. It leads to increases in the amount of water vapor that is held by the free atmosphere, something that has also been observed, and that creates conditions that would allow more intense precipitation events to occur, something that we are beginning to see in observations as well.

Climate models simulate extreme events, and climate models simulate changes in extreme events that correspond more or less to changes that have been observed, and those models are run with historical increases in greenhouse gases and changes in other forcing factors. Changes in the amount of aerosol that is present in the atmosphere, for example, another product of fossil fuel combustion.

Statistical analysis of the observations finds evidence that

these signals that are anticipated by climate models are present in the observations. We find this evidence with high confidence in the case of temperature extremes and with somewhat lower confidence in the case of precipitation extremes, but in both cases, it would be difficult to explain observed changes with natural climate variability alone. The most plausible explanation for observed changes in temperature extremes and observed changes in precipitation extremes is human influence on the climate system and human-induced increase in greenhouse gases in the atmosphere.

With regard to temperature, we are beginning to be confident enough so that we can cautiously attempt to estimate changes in waiting times for rare events. You could think of the 20-year extreme temperature event. In the case of cold temperature events that were expected to recur about once every 20 years in the 1960s, we see that by the end of the 20th century these events were recurring roughly two times as frequently, they became roughly 10-year events, and we are able to attribute that change and probability of likelihood in extreme cold temperature events to increasing greenhouse gas concentrations.

Similar results are available for warm temperature extremes. In the case of precipitation, the odds of extreme events has appeared to increase, but it is generally too soon to quantify scientifically the extent to which those odds have changed. So we have evidence that indicates that human influence on the climate system is tilting the odds towards more intense precipitation

events, but at this stage, we are not able to say by how much.

A few events have been studied in detail. One that has been studied in detail was the European 2003 heat wave, which was an event that took 40,000 lives. It is very likely that human influence on climate increased the odds of that event by a factor of at least two. In the case of the U.K. flooding in the fall of 2000, it is also very likely that human influence has increased the odds of flooding. The best estimate is the risk was doubled.

So these kinds of events have significant impacts. Heat waves cause death. Flooding cause death, damage, and enormous economic impacts. Even seemingly benign changes can have negative impacts. If you think of the reduced intensity of cold extremes in wintertime, this has been linked to forest bark beetle outbreaks throughout western North America which have devastated forest industries in western North America as an impact of climate change over the last several decades.

The available studies are subject to uncertainties, and therefore do not provide the final word on the question of whether and by how much increasing greenhouse gas concentrations has affected the frequency and intensity of extreme weather events, but they provide sufficient evidence, I believe, to indicate that human influence is having an effect on high impact events to put people and their livelihood at risk and provide an additional piece of information for taking action on greenhouse gas emissions. Thank you.

Mr. Whitfield. Thank you, Dr. Zwiers.

[The prepared statement of Mr. Zwiers follows:]

******** INSERT 1-5 ********

Mr. Whitfield. Dr. Nadelhoffer, you are recognized for 5 minutes.

Mr. Nadelhoffer. Thank you, Chairman Whitfield, Ranking Member Rush, and other members of the committee. It is a true pleasure and honor to be testifying before you, and I very much appreciate the opportunity. My name is Knute Nadelhoffer. I am a researcher and professor of ecology. I am not a climatologist or a climate scientist, but I study the effects of all kinds of factors as they affect arctic and arctic ecosystems and tempered forests.

RPTS WALKER

DCMN NORMAN

[11 a.m.]

Mr. Nadelhoffer. I worked for 20 years as a researcher in Woods Hall, Massachusetts, at the marine biological laboratory, and for the past 8 years I have been a professor at the University of Michigan in Ann Arbor.

I am also the director of a major field station near the center of the Great Lakes Basin. Our field station, the University of Michigan biological station, is over 100 years old. It attracts researchers from around the world who have been recording distributions of plants and animals, ecosystem properties, and interactions between humans and their environments for over a century.

That field station is in the middle of the largest freshwater system in the world. Twenty percent of the world's surface freshwater is in the Great Lakes Basin. Our economy, the economy of the eight States and Canadian provinces that surround the Great Lakes are the third or fourth largest economy in the world, and in our region we interact intimately with our natural resources to sustain our economy and our culture. So we pay very close attention to what happens around us.

Measurements at my field station and others across the Great Lakes region are providing knowledge and insights into changes in ecosystems associated with the changes in climates that we have

heard about.

Climate change is real. You have heard that from others on the panel. The fact that there is a consensus is minor in my view. The evidence is what drives our conclusions, and science is an evidentiary-based process. The evidence is strong and overwhelming. We can measure its effects in the Great Lakes region, and we know that the change is primarily driven by increases in greenhouse gases. In fact, even the skeptics call these gases greenhouse gases. We can thank them for warming the planet as much as it is. Excursions that we are now encountering and experience are likely to drive our planet to a warmer state. They have, in fact.

In the Arctic, where I have worked for 20 years on the north slope of Alaska, we see changes, changes in vegetation. There is now more shrub cover in the Arctic, but more importantly, summer ice cover has decreased by 30 percent in the satellite records since 1978. Less summer sea ice means less reflection of heat back into space and more absorption of heat by the ocean. This has huge implications for global climate, as our climate scientists will tell you.

Not only is the Arctic warming but the Great Lakes region is warming -- in the north by 4 degrees Fahrenheit; in the southern part of the Great Lakes region by 1 degree since 1978.

Stunning is the fact that Lake Superior has warmed by 4-1/2 degrees in the past 30 years. That is a lot of joules. That is a

lot of energy. Lake Superior is a big thermometer. It is the deepest lake and the largest lake in the Western Hemisphere, second largest in the world, and it is warming at a rate that no one thought it would.

Ice cover is decreasing on the Great Lakes. It varies year to year, but over decades we can see that the ice cover is lower. That affects our climate. That affects evaporation from the lakes.

In the Great Lakes itself, in the region, total annual precipitation has been relatively constant over the past 50 years, but major storm events have increased by a factor of two, and those major storms tend to come in the springtime, late winter; and they are balanced by droughts in the summer, and we feel it. Our coastal cities, small cities, like South Haven on the west coast of Michigan, and larger cities like Milwaukee on the east coast of Wisconsin, have storm sewer systems that are now compromised. They were built 50 years ago, and they can't handle the floods. So we are paying a cost in terms of infrastructure.

We are experiencing more late-winter, early-spring storms, more summer droughts and heat events. Not only does this compromise our infrastructure, but it can degrade drinking water quality, lead to the export of nutrient sediments into our lakes, exacerbating dead zones. It delays planting in springtime and stresses crops in the summer.

We have heard about the heat tolerances of corn and soybeans,

which are major crops in the Midwest. It stresses them for us, making them more vulnerable to pests, and jeopardizing a $40 billion forest products industry. It reduces summer swim flow and groundwater recharge and threatens our tourist and recreation industry which is a part of our culture.

Business-as-usual scenarios of various greenhouse gas emissions will exacerbate these trends, compromising our environment and the economy and culture and water of this resource-rich region.

Thank you very much for listening to me. I look forward to questions.

Mr. Whitfield. Thank you very much.

[The prepared statement of Dr. Nadelhoffer follows:]

******** INSERT 2-1 ********

Mr. Whitfield. And, Dr. Roberts, you are recognized for 5 minutes.

STATEMENT OF PROFESSOR DONALD ROBERTS

Mr. Roberts. Thank you, Chairman Whitfield, Ranking Member Rush, and members of the committee for the opportunity to be here this morning.

I am a retired professor emeritus of tropical public health. I follow closely the debate on claims of public health harm from climate change. There are parallels in claims about climate change and regulatory controls of carbon dioxide and claims about insecticides and human health. The arguments for government interventions in both topic areas rests on fearful claims, doomsday predictions of devastating consequences in the absence of regulatory intervention, and in my mind, this is fear messaging.

Thirty-nine years ago, the EPA took a political position to ban a famous insecticide, DDT. Global public health leaders at that time repeatedly and firmly warned that a ban would cause return of devastating diseases and millions and millions of deaths. In 1972, in spite of those warnings, the EPA banned DDT. The public health community was right, and the results of that decision have been devastating.

I raise the issue of this famous insecticide because it is an

excellent example of the harm that arises when politics and ideology trump science. Poor people in malaria countries are paying every day for an EPA decision taken 4 decades ago. As supporting documentation, I am submitting for the record recent statements by Ministers of Health of Namibia and Guyana, as well as a recent peer-reviewed paper I coauthored confirming an ideological agenda which is, regrettably, supported by the EPA.

As I document in written testimony, those who campaigned to reduce CO2 emissions through EPA regulatory controls are striving to show climate change is a source of harm to public health. Claims of such harm are necessary for fear messaging. These claims are reflected in many attempts to attribute all sorts of increases in malaria, dengue, and other diseases to global warming. Again, I offer documentation of this in written testimony.

However, attempts by climate change advocates to link those diseases to climate change have been vigorously rebutted. While climate can affect disease rates, there is most assuredly no simple relationship between climate and public health. The truth is those diseases are under control of many complex and dominant factors, with condition of human poverty and man's own effort to control them being most important.

As evidence to back up this statement, I would point to the different conditions of public health on the border of Mexico and Texas. I could also point to the differences in insect-borne

disease rates on the border areas between Mozambique and South Africa. Both those cases show how, under the same climatic conditions and same geography, divergent public health outcomes are achieved thanks to differing poverty rates and man's efforts in disease control.

Growing publicity about climate change and asthma shows an effort to prove climate change harms public health are unabated. In written testimony, I review a recent well-publicized paper on this topic. My area of expertise is in tropical public health, but I review this paper as a scientist and a taxpayer, and I question the political agenda of highlighting climate change as an asthma problem. If we accept that it will worsen asthma, the question that arises is, what should we do about it? How are we to improve the health and welfare of those suffering from asthma? The whole body of asthma science points to conditions of poverty being dominant risk factors for asthma. Thus, if we want to reduce asthma problems, then, first, our goal is to improve our economy and eliminate conditions of poverty. It is a mistake to believe that greater EPA control over carbon dioxide will make the slightest difference for asthma sufferers. To the contrary, I believe that with greater EPA control, economic growth will suffer and we will be a poorer Nation as a result.

Let us disabuse ourselves of the idea, if it is out there, that EPA controlling CO2 will improve health outcomes in the U.S. or elsewhere. I fear, based on outcomes of past EPA decisions,

that greater EPA control over our lives and economy could indeed worsen our health outcomes and, most assuredly, worsen our economy.

Thank you, and I welcome questions.

Mr. Whitfield. Thanks, Dr. Roberts.

[The prepared statement of Mr. Roberts follows:]

******** INSERT 2-2 ********

Mr. Whitfield. And thank all of you for your testimony. We appreciate your coming here and appreciate your remarks this morning.

First question I would like to ask you is a raise of hands. How many of you have participated in some way and at some level with the International Panel on Climate Change? Okay. So everyone except one has been involved in that. Okay.

Now, you know, we find ourselves today in a situation where EPA is moving quickly on regulating greenhouse gases. So, in some ways, as far as their decision is concerned, the science is behind us. And I would just like to ask you, Dr. Christy, in your view, would EPA's regulations to control greenhouse gas emissions in the U.S. have any real impact on the overall presence of greenhouse gases in the world?

Mr. Christy. I have done several calculations in that regard, and the impact is minuscule to whatever -- really both the greenhouse gas concentration total and really what the climate system might do as a result of that delta.

Mr. Whitfield. So you would agree with Administrator Jackson? That is basically what she said as well.

Mr. Christy. Yes.

Mr. Whitfield. Okay. Now, Dr. Roberts, I may have missed -- maybe I didn't hear you correctly, but did you say that there is no relationship between climate and public health?

Mr. Roberts. Not precisely, but the fact is that the relationship between climate and public health is not going to go in a single direction. I think my fear that the feeling that climate change is a negative force for public health is flatly wrong. It is just wrong.

Mr. Whitfield. A lot of the hearings we have had relating to these regulations, the new people at EPA say, oh, this is essential because we have got to cut back on asthma. We are exposing children and elderly people to all sorts of difficulties if we don't cut back on greenhouse gas emissions with these regulations. Do you believe that the proposed EPA regulations would appreciably impact public health in any way?

Mr. Roberts. No, I do not.

Mr. Whitfield. Okay. Now, I am going to make just a comment here. Obviously, this whole issue has been politicized in a way -- I mean, we have got science, we have got politics, we have got all sorts of things going on, and when you look at the events at the University of East Anglia, when you consider Dr. Lai on the 2007 IPCC who made the comment that the Himalayan glaciers would melt by the year 2035, which I think then he backed off of that and said, you know, I don't -- that was a mistake, we are not -- this is not accurate.

I remember Dr. Landsea, who was an expert on hurricanes, served on a panel at the IPCC, in fact read the study on hurricanes, and he testified here that someone at the IPCC

announced emphatically that more hurricanes were a direct cause of global warming. He was so upset about it, because he said the science is simply not there, that he resigned from IPCC. And we have heard other incidences of that.

And I know that you can pick out isolated events in anything, but you hear this so frequently with IPCC, it is disserving in many ways. So just yes or no, on the IPCC in general, do you have confidence in what they are doing? Dr. Somerville.

Mr. Somerville. I certainly do have confidence, very isolated instances.

Mr. Whitfield. Dr. Christy?

Mr. Christy. Yes and no.

Mr. Whitfield. Yes, no, okay. Dr. Field?

Mr. Field. Yes, I have confidence.

Mr. Whitfield. Dr. Pielke?

Mr. Pielke. No.

Mr. Whitfield. Dr. Zwiers?

Mr. Zwiers. Yes.

Mr. Whitfield. Dr. Nadelhoffer?

Mr. Nadelhoffer. As a reviewer of IPCC reports, I have confidence.

Mr. Whitfield. Okay. Do you have a comment, Dr. Roberts?

Mr. Roberts. I do not have a confidence.

Mr. Whitfield. I would also, Dr. Pielke, I don't know if I have all of the details on this, but the NOAA temperature

monitoring stations -- and I think I read some article that you all did an analysis and you found that 85 percent of these stations were unduly close to heat-generating areas -- is that correct or is that not?

Mr. Pielke. Well, we have a study that is almost through the review process that shows that many of the stations are very poorly located next to air conditioners, under satellite dishes, and we are showing that is contaminating the surface temperature record. In fact, it is introducing a warm bias over the United States.

Mr. Whitfield. Thank you. I see my time has expired. So I recognize the gentleman from Illinois, Mr. Rush.

Mr. Rush. Thank you, Mr. Chairman.

And Dr. Nadelhoffer, I actually appreciate you being here. Explain to the subcommittee what the effects of climate change are on the economy and the environment of the Great Lakes region. You spoke something about -- someone about that in the testimony. Would you like to expound upon it, please?

Mr. Nadelhoffer. Well, thank you, Congressman Rush. I am not an economist. I can refer to several reports on the Great Lakes economy, one most recently by the Michigan sea grant program which identified large numbers of jobs depending on the waters themselves. But as I mentioned in my previous testimony, we in the Great Lakes region, in particular, are dependent upon natural resources. Many of those natural resources are provided by

natural systems like forests, wetlands, and agricultural ecosystems. Our agricultural ecosystems are at great risk because of not only warming temperatures and summer droughts, spring rains, and floods, but also exceeding levels of heat tolerance of major crops like corn and soybeans, which, as you know from Illinois, are major to our agricultural economy. So...

Mr. Rush. Well, you also reference drinking water. And the question is, if we should fail to limit greenhouse gas emissions, how will this affect the supply of drinking water to the millions of people who live in the Great Lakes region in Illinois, Michigan, Wisconsin, and Indiana?

Mr. Nadelhoffer. Thank you for that question. It is a very complex and interesting question, but there are simple things and simple answers. One is, again, springtime floods which deliver large loads of waters to the large lakes with a lot of energy, carry sediments, pesticides, fertilizers, and nutrients into the water. These cause increases in production in the lakes, more algae growth, and are well associated with toxic algae blooms; that is, blooms of algae that actually produce toxins that harm people.

They also contribute to dead zones, organic matter that falls to the bottom of the lakes and then is decomposed, consuming oxygen and thereby killing fish. These are happening now again on Lake Superior. They are likely the result of floods that deliver materials and nutrients to the lakes. So this increases our costs

of water treatment.

Also the flooding, when it comes early in the spring, carries more water off of the landscape, and there is less water available for percolating into aquifers and groundwater sources. So our groundwater sources paradoxically are at risk in the Great Lakes region.

Mr. Rush. What will be the effect on the Great Lakes region if we do not curb emissions of greenhouse gases?

Mr. Nadelhoffer. Part of that answer is in deference to our climate scientists who, again, I have reviewed IPCC reports. I am not an author, but I think the evidence is very clear that business as usual with respect to emissions will exacerbate the trends we have seen and therefore, I think, compromise not only our agricultural and forestry resources, but our water supplies.

To the extent that future droughts, draw down of aquifers in the Great Plains creates needs for waters outside the basin, any policies in the futures which actually remove water from the Great Lakes could have dramatic effects on water levels. Right now, 1 percent of the volume of the Great Lakes leaves the Great Lakes annually in the Saint Lawrence Seaway, and the lake levels are relatively stable. They go up and down a meter or two, but they are relatively stable. If we start exporting large quantities to drought areas outside the basin, our water levels will more than likely decrease, decreasing supplies, as well as quality.

Thank you.

Mr. Rush. Dr. Somerville and Dr. Zwiers, with 95 percent of the world's scientists saying that climate change is man-made and can be rolled back, do you think that it is wise policy for Congress and the Federal Government to risk our family, our children, our grandchildren's future because a few holdovers are not really certain climate change does exist and can be avoided? Will you answer that?

Mr. Somerville. I am glad to speak to that, Congressman Rush, and I harken back to Congressman Waxman's metaphors to the medical profession, that you don't go seeking the lone contrary doctor when you have received a serious diagnosis. Get a second opinion, but not 99 opinions, until you find one that you like.

I think here the scientific evidence is overwhelming. I mean, if I could use another medical metaphor, sure, there is risk and costs to taking action, and there is -- we also know for elective surgery, for example, as well as climate change, there are risks and costs to not taking action, too. And I think the balanced view here is that we have a strong case. We need international action. The U.S. can lead. It cannot do the whole job, as you have heard, but I believe that the U.S. and China together contribute more than half of the global carbon dioxide emissions. If they could reach an accommodation in which they both took action, then I think that would be an enormous step forward.

Mr. Whitfield. Gentleman from Texas, 5 minutes.

Dr. Burgess. Thank you, Mr. Chairman.

Dr. Somerville, let me stay with you for just a moment. Is it your opinion that the United States Congress should pass legislation that increases the government's control over how much energy the American family uses or the type of energy that is used by American families?

Mr. Somerville. Congressman, I am not an economist or a politician, and I would leave that decision to you. I think that in many other areas we see a variety of actions to promote things that are taken to be good and to discourage those things taken to be bad.

Dr. Burgess. Let me ask you a question. I don't mean to interrupt, but my time is limited.

In this committee just exactly 2 years ago, we had -- little less than 2 years ago, we had legislation popularly known as the Waxman-Markey legislation. Are you familiar with that?

Mr. Somerville. Yes.

Dr. Burgess. And was it your opinion that that represented a balanced and reasonable approach to addressing the problem of climate change?

Mr. Somerville. I think it is far better than doing nothing.

Dr. Burgess. And are you aware that that bill had as its major premise to control the amount and type of energy used by American families?

Mr. Somerville. I do understand that aspect of it, sir.

Dr. Burgess. And do you understand there was no such control over families in India or China?

Mr. Somerville. Of course, the U.S. Congress can't control India and China.

Dr. Burgess. Exactly right. It is a global problem. And do you understand why the revulsion that the country had after that legislation was passed late at night on the floor of the United States House of Representatives, just prior to the Fourth of July recess in 2009, can you understand how Members of Congress went home to their districts and were actually reviled by their constituents for having done such an activity?

Mr. Somerville. Congressman, I am going to have to stick to the science here.

Dr. Burgess. Well, I will tell you, having been in those town halls and actually voting against the legislation, voting "no" was not enough. People wanted us to stop that thing cold dead in its tracks, and they were not shy about telling us that.

So, again, I reference my opening statement, some of the problems that we encountered here in this very committee room in 2008 when gasoline prices went to $4 a gallon.

Now I remember after Hurricane Katrina we also had hearings in this very committee room, and gasoline went to $3 a gallon. We had hearings about that. Now the American public is kind of inured to $3 a gallon. It gets to $4 a gallon and it gets their attention again.

But I remember a panel similar to this where I asked the question that you guys have to be pretty happy now with gas up at $3 a gallon -- there is going to be less used. And the answer I got actually stunned me, and I don't remember the witness at the time, but he said, Actually, sir, you have to get it to $6 a gallon before you are going to affect utilization.

People hear statements like that, and it understandably scares them to death. And that is one of the reasons why it is so important for us to have a panel like this today. It is important for people to understand just exactly what it is we are talking about. We all talk in pear-shaped tones about controlling the climate and controlling carbon dioxide, but what we are really talking about is placing energy costs beyond the reach of the average middle-class American family.

Dr. Christy, let me ask you a question. The memorandum that the minority has put out for this hearing explains that the state of the science is -- climate change is occurring, it is caused largely by human activities, poses significant risks for, and in many cases is already affecting, a broad range of human and natural systems. Is that an accurate description of the state of the science as we know it now and, of course, man's role in the science?

Mr. Christy. I think if I remember the comment right, they stated that humans were the cause or some major cause of it. Climate always changes. I mean, that is a fact. So the fact that

climate is changing is not news to anyone, others here. But the notion that humans are causing most of it, that is purely a model-driven result that you cannot discount and cannot prove that natural enforced variability is causing this. We don't have thermometers that say this much warming was human cause and then this much warming was natural. We only have one thermometer. So you are trying to figure out how much might have been caused by human, and the fact that models fail so many times in the tests we do with the data sets that we build tell us they don't have the natural enforced variability level at all yet.

Dr. Burgess. Thank you, Mr. Chairman. I yield back the balance of my time.

Mr. Whitfield. The gentleman from California is recognized for 5 minutes.

Mr. Waxman. Dr. Christy, is there warming going on globally?

Mr. Christy. Yes, the average temperature, yes.

Mr. Waxman. So there is a fact of warming?

Mr. Christy. Yes.

Mr. Waxman. Okay. Now, Dr. Somerville, as I understand most people looking at this problem, they look at the fact of warming and they see climate change happening as a result. The mainstream consensus appears to be that it is primarily caused by humans.

The widespread impacts are occurring now and expected to get worse. I am not a scientist, but my understanding is that there is a tremendous amount of data to support these conclusions, not

just models but actual observations and measurement. Can you briefly describe the independent lines of evidence that support these scientific conclusions?

Mr. Somerville. Yes, Congressman Waxman, I am glad to do that. I would like to say that a thread has been running through this hearing that disturbs me; that I think that it is wrong to frame this issue in terms of the evidence for human-caused climate change hanging from some very slender chain of evidence that could be cut by one brilliant insightful paper. It is not a slender thread at all. It is a thick rope woven together of many, many chains of evidence, and there is a well-developed branch of science and chapters in the IPCC report devoted to exactly this question of discerning unnatural climate change and attributing it to a cause. There are hundreds of papers cited in the report. It is very unlikely that they are going to be overturned by a single Einstein.

You know, we have hard about the Einsteins and Copernicus and Galileos. They are rare. I think they deserve extreme scrutiny. A claim to upset conventional wisdom on the basis of a few papers which we have heard mention of today, I think deserves extremely strong scrutiny.

Einstein was actually very quickly accepted by the physics community, won a Nobel prize. He wasn't the lone voice in the wilderness for very long. He was, of course, an isolated genius. Those geniuses are rare. Those people who claim that they are

Galileo are just plain mistaken. In fact, I wonder, since the skeptics or contrarians tend not to agree with one another, which of them, if any, is going to turn out to upset the conventional wisdom here.

I think it will require a very strong case to go against the IPCC. You know, the IPCC was established just to get around this cacophony of hearing many voices. There are outliers in any field of science. We have retrovirus experts who don't think that AIDS is caused by HIV.

But the IPCC is not merely a consensus. I resent that characterization of it. The IPCC assesses the state of science. It says where the science is solid and relatively firm, where more research needs to be done, and it does take into account a wide range of views. I think the discussion of this has to begin with that and not with outliers.

Mr. Waxman. What did you think of Dr. Christy's comment? I thought it was interesting. He said that if we are going to fund the IPCC -- and of course, the Republicans have said, no, we shouldn't give them any money anymore -- he suggested that we have a certain amount set aside for people who have contrary points of view. What do you think of that in terms of distribution of money to scientific research?

Mr. Somerville. You have to start with the fact that the IPCC doesn't really have much money. It is a little organization with a skeleton staff in Geneva. It basically organizes

scientists into writing these reports, and we serve without pay. It is our universities, our employers, who pay our salaries. We don't get a penny from the IPCC, and I think the IPCC does a very fine job of taking into account contrary opinions.

You know, the stolen e-mails from the server in East Anglia have been mentioned in this hearing. People have to realize that those events have now been thoroughly investigated. The scientists have been exonerated. They are cleared. They did not commit fraud. They did not suppress publication of their opponents' views. They did not manipulate data, and in fact, the IPCC considered the very publications alleged. I think they do a fine job of considering other opinions.

Mr. Waxman. I appreciate your comments. I just think it is quite amazing that scientific money for research ought to be distributed based on who has minority points of views and give them a certain amount of money. It seems to me it ought to be peer-reviewed and see what is the most promising research. Otherwise, I could see going into a pretty good business, always objecting to whatever the majority view is, and then getting my share of the allocations.

Professor Field, in your testimony, you focused on the impacts of climate change in American agriculture and wildfires in the Western United States. What are the key impacts on future crop yield? What is it that you see happening in this area?

Mr. Field. You know, if we look at the observation, what we

see is in global agriculture a system that is very sensitive to warming. Based on farmer experiences, on models, there are a wide range of different mechanisms that kick in at different parts of the world. Some of the stresses are related to limited water availability. Some of the stresses are intrinsic to the crops. Some of the stresses have to do with outbreaks of disease and pathogens, and some have to do with complicated factors like when the farmers can get into the fields for different kinds of activities. The observations of the crops' sensitivity are based on summaries over all of these different processes, and that is one of the reasons that they are so robust.

Mr. Waxman. Thank you. Thank you, Mr. Chairman.

Mr. Whitfield. Yes, sir. Mr. McKinley, you are recognized for 5 minutes.

Mr. McKinley. Thank you, Mr. Chairman.

Dr. Roberts, let me start with you if I could, please, just to try to frame the argument a little bit here. We have been besieged now for the last 60 days on greenhouse gas questions, and we have apparently 15 million people unemployed in America. Probably an equal amount are underemployed or quit seeking work. We have 10.3 percent unemployed in West Virginia. Lisa Jackson was here just a few weeks ago and said that she feels that she has no obligation to take into consideration the economic impact of any of her decisions to the regulatory bodies.

We have had others come before this group and say that there

is no cost-effective way to handle the greenhouse gas emissions, not cost effective. Others have testified that higher energy costs are a result of the greenhouse gas emissions under the Clean Air Act. And others have talked about the high energy costs will cause economic malaise and deter the manufacturing expansion.

So, since West Virginia is one of the leading producers of fossil fuel and so dependent on all this, with 150 million tons in the work that we do producing coal in West Virginia, what is the future? What is going to be the impact of all this testimony that we are hearing about the EPA overregulation of greenhouse gases on West Virginian jobs?

Mr. Roberts. It will be a disaster.

Mr. McKinley. Thank you. Dr. Pielke, do you agree with that?

Mr. Pielke. That is really outside my area of expertise.

Mr. McKinley. So you don't have an opinion of whether or not an attack on coal or war on coal is going to have an economic impact?

Mr. Pielke. Well, I came to talk about the science, and that really is outside my area of expertise. I don't want to get into the politics of it. I just want to stick to the science.

Mr. McKinley. Thank you. Dr. Christy

Mr. Christy. As a State climatologist, I deal with a lot of economic development activity, and in my State, too, it would be a real problem. It would create more poverty than there is now, and

I can tell you, as someone who has lived in Africa, without energy life is brutal and short.

Mr. McKinley. Thank you. Do the three of you concur that has been -- your predecessors that have come before the panel before have indicated to this group that the greenhouse gases are a precursor to Earth warming, global warming. Is that generally a consensus?

Mr. Pielke. I think we have to realize that greenhouse gas increases are one component of the climate system. It is not the entire picture, and I think that is one of the failures of the IPCC to adequately take into account these factors.

Mr. McKinley. Dr. Pielke, we have had some come before us and say it is a precursor to global warming; you are going to see the emission of greenhouse gases is a precursor to global warming. But yet, from my reading, your paper, Landsea's, Hal Lewis', and others have indicated that what they are finding in Antarctica, the Russian scientists down there, that the reverse is true.

Mr. Pielke. But it is unequivocal. I think that is the wrong argument, because we can see that CO2 is increasing because of human activities. We know that. The problem is how does that fit into these other forcings -- land use change, aerosols, the natural variability? And as we learn more about the climate system, it is more complex than we thought. And the IPCC, unfortunately, takes a very narrowed, limited view of how we are altering the climate system.

So when we are talking about all these impacts about global warming, first of all, climate change is more than global warming; and secondly, even global warming and cooling is affected by more than just carbon dioxide. And we need to recognize that broader perspective and apparently the IPCC decided not to do that.

Mr. McKinley. Dr. Roberts, would you like to amplify on that?

Mr. Roberts. I am not sure that I have the expertise or background to add much to that, actually.

Mr. Somerville. I would be glad to comment.

Mr. McKinley. Sorry. Yield back my time. I am sorry, I missed something?

Mr. Somerville. I just said I would be glad to comment on the issue you raised.

Mr. McKinley. Go right ahead. I am sorry. I am hard of hearing. So if someone wanted to make a joke over that, that is their problem.

Mr. Somerville. Sure. I am happy to clarify the issue of timing of carbon dioxide increases that you mentioned in the Antarctic ice coolers. We do know that the Ice Ages and transitions between Ice Ages and interglacial periods are paced by changes in the Earth's orbit around the Sun, but that after the pacing happens, then as a feedback carbon dioxide is added to the atmosphere, comes out of the ocean in a warming period, goes away out of the atmosphere, and a cooling period. So it is an

amplifier. It adds probably 30 percent to the effect of the orbital forcing, but it is not a primary cause but it is an amplifying effect.

Mr. McKinley. Thank you.

Mr. Whitfield. Thank you. Mr. Inslee, you are recognized for 5 minutes.

Mr. Inslee. Thank you. I want to thank all of you for being here today, but I have to express some degree of embarrassment that a Nation that went to the Moon, mapped the human genome, established the best software companies in the world, does now have one of its great parties adopt a chronic anti-science syndrome; one of its great parties that has decided to have an allergy to consensus science instead of respect for science and scientists. And that is embarrassing.

In listening to this hearing, I am convinced that if we had Copernicus, Galileo, Newton, and Einstein at this table instead of you fine scientists, one of these parties would still not accept the clear science until the entire Antarctic ice sheet has melted or Hell has frozen over, whichever comes first. That is the situation that we are in today, and I think it is a pretty sad state of affairs.

There is one point I want to make particularly, and I hope some who are covering this hearing might pay attention to this. There are seven people at the table. If this hearing is reported as saying four people said one thing and three people said

another, you are missing the big story here, and I want to make sure everybody understands this.

I want to put in the record a letter dated February 9 by 1,800 doctors saying specifically that the health of United States' citizens is jeopardized by greenhouse gases, and I want to put this into the record.

Mr. Whitfield. Without objection.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Inslee. I want to put a statement by the CDC, the Centers for Disease Control and Prevention, which says specifically that climate change gases affect the health of human beings in America.

Mr. Whitfield. Without objection.

Mr. Inslee. Thank you, Mr. Chair. I want to put in the record a letter from 250 of the most esteemed climate scientists in the world urging us to act on this clear science of climate change dated May 7th, 2010.

Mr. Whitfield. Without objection.

Mr. Inslee. I want to put in the record a letter of February 2011 of 2,705 scientists basically urging us to allow the Environmental Protection Agency to do its job.

Mr. Whitfield. Without objection.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Inslee. Those are 4,560 scientists, and what I want to say, standing behind Dr. Field at his table are 4,560 scientists. Now, the Republican Party has found two people to raise some questions, and of course, there are lots of questions about how fast this is going to go, and what it is going to do, but there is enormous scientific consensus on the Planet Earth about this fact that we have got a problem.

Now, I want to ask a question on how fast we are going. Can we put up this slide, please, of the Arctic? I want to show an Arctic picture of the Arctic icecap. It shows 1979 the northern icecap on top. Then you see in September 2007, it shrunk by about 40 or 50 percent. The most recent science predicts it may be absolutely gone in any meaningful sense in the next 5 to 10 years. I understand a few years ago we thought that wouldn't happen for 20 or 30 years.

It appears to me like this is happening a lot faster than many of us thought was going to happen, and this is one of the things that are causing not fear, Dr. Roberts, but I think a rational concern that my 2-year-old grandson is going to grow up in a world that is really, really different than I grew up in, with no coral reefs and no Arctic icecap.

Dr. Field, could you comment on what is the most recent science in that regard?.

Mr. Field. The changes are occurring very rapidly. There is

no question that changes in things like Arctic ice, in the positions of glaciers, in the ranges of species and in the water availability for the western U.S. have changed dramatically.

Now, the science tends to keep up with the new observations, and so I don't think it is accurate to say that the current scientific consensus is inconsistent with these observations, but I do think it is fair to say that as of a few years ago, most scientists were projecting that the kinds of events we are seeing now might occur in the second half of the century.

Mr. Inslee. I read yesterday that the algae bloom in the Arctic is now 50 days earlier than it was. I read that the melting of the Greenland ice sheet seems to be much more significant than perhaps we even predicted 5 or 10 years ago. Many of these indices, to a layperson such as myself, would suggest that we are in the upper, sort of the redder zone of the parameters of what we have looked at. Is that a fair assessment or not? Dr. Somerville wants to say something.

Mr. Somerville. Yes, that is very much a fair assessment, and the Greenland icecap is a good example. The IPCC has been cautious. It is not political at all, but it is intellectually conservative. It doesn't go beyond the data. It doesn't do hunches and conjectures. And it said in the last report that you could put a number on how much sea-level rise would happen from melting ice on land and thermal expansion of the ocean, but it said we don't yet know enough about what might happened to the

Greenland and/or Arctic ice sheet. Now the newer science says, yes, there are positive contributions.

Mr. Inslee. As one layperson, I had the oyster grocers of Washington State into my office last week. They are having trouble growing oysters in Puget Sound because of ocean acidification, which we haven't talked about. Carbon goes in the air, goes into the ocean, and makes it more acidic. My oyster growers are having problems today. My berry growers are having problems. This is not hypothetical. This is a problem today.

Mr. Whitfield. Did you want to say something, Mr. Pielke?

Mr. Pielke. Yes, I would. I think the observations are certainly correct that the Arctic ice has been diminishing and the result are effects we talked about. I think the question is, are there other explanations that haven't been fully explored in addition to carbon dioxide? And one of them is black carbon, which I think most of the members of the IPCC would have recognized. It has been better recognized recently. There is also natural circulation effects that have caused this.

And I think that the proposal that Dr. Christy made that there needs to be an alternative view is analogous in the medical community to basically getting a second opinion. And if you had a medical drug developed by a company and that company is reporting on how well that drug does, you certainly would like to have an independent assessment of that, and I think that is what we need, and I think John's suggestion is a good one.

Mr. Inslee. Mr. Chair, would you permit me one comment or follow-up question in light of Dr. Pielke's comment there?

Mr. Whitfield. Yes, I will give you one follow-up question, and then we have to move on.

Mr. Inslee. I appreciate your courtesy, Mr. Chair.

The concern that I have, and I think many people, are that this is a profound geophysical change in the entire system of the Planet Earth to have this icecap disappear, and I am very concerned about black carbon. I actually have offered a bill to deal with black carbon. It is a problem.

But I think it is a fair statement, as far as I can tell, is that no one in any peer-reviewed research that I can find have suggested such a rapid change in a fundamentally pivotal part of the climactic system, geophysical driver which the Arctic is, other than carbon. Has anybody come up with any other peer-reviewed hypothesis to say why this is happening? I am not aware of any.

Mr. Whitfield. Maybe we will have a second round, but we have got a number who haven't had questions yet.

Mr. Griffith, you are recognized for 5 minutes.

Mr. Griffith. Thank you, Mr. Chairman.

I want you all to know I am here today because I have lots of questions about the various things that are going on and what is happening, and so I am not sure I am going to get to answers. So, if we don't get to answers, if you all could submit those to the

committee so I can review the information, that would be great.

Let me also say that I am concerned that we are shifting jobs to other parts of the world where they are not going to pay attention to this. So, even if we believe that there is a problem and we shift all the jobs to someplace that is going to create actually more greenhouse gases, are we creating a solution or are we making the problem worse by having some of the EPA regulations?

That being said, here are some of my questions. Has anybody studied what the temperatures were, or do we know what the temperatures were during the period in history known as the Great Optimum, which led to the rise of the Mesopotamian Egyptian cultures? That was a time in history of global warming. We know that. But how warm did it get? Obviously those were things that led to the rise of our earliest civilizations.

At some point, I would like to have somebody look at the Lesser Optimum, which is a little closer in time, and how much did the temperature rise then? We know that that led to the Vikings -- Professor Nadelhoffer -- led to the Vikings dominating Europe for several hundreds years, and also led to where the icecap in the North is melting; we are now finding evidence of Viking habitation in those areas.

Can somebody answer the question, and has the IPCC studied why are the icecaps on Mars melting? Both NASA and National Geographic have had reports on this. Is it, in fact, and has there been a study, a shift in the orbit of Mars, or is it that

the Sun is putting out more radiant heat?

If we have known, as you suggest, Dr. Somerville, for 150 years the effects of greenhouse gases, then why 40 years ago, when I was in elementary and middle school, were we taught that an increase in greenhouse gas effect was going to lead to a new Ice Age?

In regard to radiant heat, the Sun spot effects, what do we know about that? I was reading one report here that indicates that by 2020 we will reach a new peak on Sun spot activity, and this report actually suggests that the Earth's temperature may be raised by .5 degrees Centigrade as a result of the Sun spot activity. And could that also be the cause -- when we were talking about patients earlier, somebody said why do you distrust the doctor? Then somebody made the comment, May we get a second opinion? I would like to know if we have looked at maybe the other patients? And Mars, having a similar global warming effect or event going on, have we studied what that is and has the IPCC done that?

And then what is the /OPty /PHUFPL temperature for man? Have we looked at that? Dr. Somerville, you indicated that pre-1900 industrialized world temperatures was where you wanted to go, but in light of the fact that we had a little Ice Age in the 18th century, are you indicating that we want to return to the little Ice Age period? Or are you indicating something between 1820 and 1900?

I don't know the answer to that, and it was just kind of an interesting -- these are questions that I, believe it or not, lay awake at night trying to figure out.

I would like to actually hear from Dr. Christy and Dr. Pielke first, and then if we have time we can move on to the others. But I did anticipate there wouldn't be a lot of time for answers, which is why I started my comments by saying if you have got info, you know, feel free to get it to me and please give it to the committee as well.

Mr. Christy. I think what you are describing is the fact that natural, unforced viability creates a large excursion of temperature that humans have no responsibility for. I didn't see up on the chart here after the Arctic sea ice, I didn't see the Antarctic sea ice which reached its maximum recorded 2 weeks later after that particular picture was taken.

I will be happy to answer those questions. That was a boatload of them, if we can have them in writing.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Griffith. I would be happy to give you my notes. These are things I have been worrying about for some time and questions that -- particularly the one about why we were taught there was a new Ice Age coming, if we have known about this 40 years ago because all of my constituents were taught that. Now, maybe our books in southwest Virginia just weren't up to par and maybe they were 150 years out of date, but I doubt it.

Mr. Pielke. Can I follow up?

Mr. Griffith. Yes.

Mr. Pielke. What you asked about Mesopotamia and the other regions, these are affected by regional temperatures, and I think this really highlights the global average surface temperature trend is a very poor metric to use to diagnose climate change. Even global warming is not properly diagnosed by that metric. So the question is, What was it like in Mesopotamia, what was it like in the Arctic, for example? Those are the questions we really need to focus on.

Mr. Griffith. Thank you. I only have 11 seconds but you are welcome to them, Dr. Somerville.

Mr. Somerville. I would like to respond. I wish I had time to respond to all of them.

The 1970s global cooling is a myth, perpetrated by the popular media. It is in Newsweek magazine. It is not in the scientific literature, papered by Peterson, et al., Bulletin of

American Meteorological Society establishes that --

Mr. Griffith. Mr. Chairman, if I might, look, I was there. I studied it. Now maybe it is a myth. Maybe I am remembering a myth, but I was there. It was in my textbook. That is all I can say.

Mr. Whitfield. I think we will just stipulate that there may be difference of opinions about that.

Mr. Gardner, you are recognized for 5 minutes.

Mr. Gardner. Thank you, Mr. Chairman, and thank you to the witnesses who have joined us this morning.

And to my friend from Washington, I think I am going to get you a Kindle. I am a little concerned about that tower of books over there.

Mr. Inslee. Would you like to read some? It might be helpful.

Mr. Gardner. Only if you will read some of mine.

Mr. Inslee. I would be happy because it is a lot shorter list.

Mr. Gardner. Anyway, I wanted to just briefly touch base with Dr. Christy. We talked a little bit about agriculture in this committee hearing. In my view, farmers are really America's true environmentalists, people who work every day in the land, and if global warming really threatened to cause extreme weather, they would be the first in line to want to stop it because it threatened their livelihoods, or livelihoods are at stake.

If the speculation is out there that warming reduces crop yields had any real-world validation, farmers would be on the front lines fighting for global warming regulations, encouraging the EPA to pass the regulations, encouraging Congress to pass the bill.

But what the agriculture community has been saying is that global warming policies are far worse than global warming itself. The Farm Bureau opposes EPA's regulations for what they would do to energy and fertilizer costs for farmers. From an agricultural standpoint, is the cure worse than the disease?

Mr. Christy. Oh, I think so. I was just on the farm 2 weeks ago, working with a farmer on something, and I am just surprised at my colleagues' comments here about how agriculture changes. We grow corn from North Dakota to Alabama. When it is warm in Alabama, we still get 240 bushels an acre for irrigated corn, a tremendous amount of corn.

The temperature is not as critical when you know how to farm and deal with the variations that occur in their particular area. But I can assure you, because I talk to a lot of farmers and deal with them, that their fuel costs, their fertilizer costs, they are complaining a lot right now and just cannot bear to see those costs go up any more, which would happen if a price were put on carbon like that.

Mr. Gardner. Thank you.

Dr. Pielke, in your testimony, there is a 2009 paper you

wrote and an excerpt in your testimony that says: Therefore, the cost-benefit analysis regarding the mitigation of CO2 and other greenhouse gases need to be considered along with the other human climate forcings in a broader environmental context, as well as with respect to their role in a climate system.

Do you feel that there hasn't been adequate cost-benefit analysis regarding the CO2 regulations?

Mr. Pielke. No. Actually, what we proposed is a bottom-up resource-faced focus where you basically take something like corn and asked what are the threats to that resource, of which climate is one of many but it is one of them, and what are the worse of the policies and the funding go to try to minimize those risks?

Mr. Gardner. So you believe there hasn't been enough cost-benefit analysis?

Mr. Pielke. No, there has not been.

Mr. Gardner. There has not been enough cost-benefit analysis.

And to follow up on that, Dr. Pielke, EPA is moving quickly on a number of greenhouse gas and other regulations right now, and we have seen a chart that shows what is called the "train wreck." Do you think it is a good idea to do all of what we are talking about, greenhouse gas regulations in the middle of a recession and what those effects could be?

Mr. Pielke. Well, now you are asking me a political policy question. I will defer that because I want to focus on the

science.

Mr. Gardner. Dr. Christy?

Mr. Christy. My mind might have been drifting there, but I think you were asking about --

Mr. Gardner. Moving forward with these regulations in the middle of a recession, given what we have said, the lack of cost-benefit analysis.

Mr. Christy. Well, I think moving forward, whether it is a recession or not, is going to make energy prices go up. In a State like mine, which is very poor, that is a big fraction of the people's expenditures and their own economy, so I would --

Mr. Gardner. When those costs go up here, will it in turn then cause jobs to go overseas where there is little or no regulation?

Mr. Christy. We have seen that. I have talked to particular industries that say we have already looked at Mexico and China, because if our energy costs go up, we are going to move, period.

Mr. Gardner. You mentioned if we could build 1,000 nuclear plants, what was that statistic you used?

Mr. Christy. Yeah. If we could build 1,000 nuclear plants, which is not going to happen, 1.4 gigawatts each, that would be approximately 10 percent of the CO2 emissions taken out of the mix, and that is not going to have much effect at all on climate.

Mr. Gardner. Thank you, Mr. Chairman. Yield back my time.

Mr. Whitfield. Thank you. At this time, I recognize the

gentleman from Louisiana, Mr. Scalise.

Mr. Scalise. Thank you, Mr. Chairman. I appreciate all of the panelists being with us today to talk about this issue, especially as it relates to broader efforts by the EPA to regulate greenhouse gases. We have had a number of hearings on not only the science in the past but also on economic impacts, and I would like to talk about both of those with you.

Now, one thing we hear a lot by people on the other side is this concept that the science is settled -- and I think when we go into past hearings that we have had on this, as well as today, I think it is clear that the science is not settled. There is, you know, these armies of thousands of scientists somewhere that hide behind these organizations that themselves have been discredited, but that try to in essence diminish countering views. And it should all come back to science. And I know, Dr. Pielke, you talked about this, too. Would you address this?

Mr. Pielke. Yes. There is certainly not a consensus. In fact, let me give you an example.

In 2005, a National Research Council report on expanding the radio forcing concept, was coauthored by a range of different people, including Michael Mann, for example, was on this committee, and he signed off on this report, or all of us did, in which we showed that there are these multiple other types of climate forcings. The IPCC basically ignored that report which was available to them.

Mr. Scalise. Thank you.

Dr. Somerville, in your opening statement you used terms like "the great preponderance of experts agree." Later on, you say "Nobody should be compressed by these discredited claims." Later on you used the comment, "It is silly and just accepted and it will take a strong case to go against the IPCC."

Why is there this kind of elitest arrogant view to people that have a contrarian view in the scientific community to that that you hold?

Mr. Somerville. I am certainly not trying to be elitist or arrogant, Congressman, and I regret it if you took that impression away.

What I am saying is that obviously no science is firmly settled, so you don't get absolute 100 percent certainty from science. Everybody recognizes that. But some things are much more firmly known than others. I am not going to write a research proposal to the National Science Foundation to find out whether the Earth goes around the Sun. That is pretty firmly established.

Mr. Scalise. And none of us dispute that. However, there is dispute over this claim that man is the cause of global warming.

And let me ask Dr. Christy because, you know, kind of in contrast to some of the statements Dr. Somerville has made, I know you have been involved, I think, in some of the IPCC, some of the scandal that has been going on over there over the last year. Can you comment on this -- this concept that the science is settled?

Mr. Christy. Yeah. I don't agree that it is at all, and I think Dr. Somerville's comments about being exonerated for these folks in the climate gate thing is just absolutely false, because that was not a legal test of anything. There was not admissible evidence. There was not cross-examination of the evidence. There was not due process and all those things, so those were not exoneration panels. Well, that is what they were is exoneration panels. They weren't science or investigative panels.

RPTS JURA

DCMN HOFSTAD

[11:55 a.m.]

Mr. Christy. Your original question was about why are there so many scientists that seem to look one way, or --

Mr. Scalise. Yeah, let me restate it a little bit. Because, you know, we have seen -- and this has been a common trend over the last over a year, well over a year. You have people like Al Gore, "The debate is over." They literally try to make somebody out to be a flat-earther if they just disagree in a scientific way. And, again --

Mr. Christy. Okay.

Mr. Scalise. -- just this attempt to discredit scientists who pose scientific theories that counter their -- in some cases, it is not even scientific theory. Al Gore is surely not a scientist; you are.

But then you go to what happened in Climategate, where the IPCC -- and they have used the hockey-stick graph to try to, again, say this is a settled science. And we saw in Climategate, they used a trick to hide the decline. This is something that really happened.

And yet, it seems like people like you and Dr. Pielke and others who truly do go to the data -- I think you have built models on data -- they are trying to actually change our economy in the United States in a way that would run millions of jobs out

of this country. We have already seen real evidence of that, by the way. The scientific evidence clearly is not settled on this issue, but we do know from testimony we have had about people who have said they have moved jobs to other countries.

If you can maybe give me a summary of what carbon leakage means. For those companies that go and they will build a steel plant or they will build a refinery in another country that doesn't have the standards that we have today, where they will actually emit more carbon, what does that do to the global atmosphere, if they are concerned about carbon and you are actually emitting more carbon in another country because you have sent those jobs out of America instead of keeping them here?

Mr. Christy. Yeah, emissions will rise as a result of that kind of unintended consequence. Poverty will increase in a State like mine.

In fact, I had this very conversation with a plant owner who said it is ironic that, with this legislative action, if it were to go forward -- they were looking at Mexico, in fact -- that they would emit four times more emissions if they were to move their operations, plus create a pocket of poverty that we don't need in our State that would make health concerns even worse for those folks.

Mr. Scalise. I appreciate that. Thank you.

And I yield back, Mr. Chairman.

Mr. Whitfield. Mr. Terry is recognized for 5 minutes.

Mr. Terry. Thank you for that, Mr. Chairman.

Dr. Nadelhoffer -- did I pronounce that correctly? I got here a little late.

Mr. Nadelhoffer. Yes, correctly enough. Thank you.

Mr. Terry. Should nitrogen be banned? Should the EPA ban nitrogen?

Mr. Nadelhoffer. The short answer is, no, the EPA could never ban nitrogen. It is --

Mr. Terry. Why?

Mr. Nadelhoffer. -- the dominant gas in our atmosphere.

Mr. Terry. All right. Man's use of nitrogen?

Mr. Nadelhoffer. Again, the use of nitrogen as synthetic fertilizer has essentially allowed us to feed 8 billion, 9 billion people on Earth. I don't think EPA is proposing to ban nitrogen fertilizer.

Mr. Terry. I didn't -- okay. How about you? Do you think we should?

Mr. Nadelhoffer. No.

Mr. Terry. Okay. Just wanted to establish if we were allowed to eat anymore.

Mr. Nadelhoffer. Oh, yes, we are.

Mr. Terry. Okay.

It was interesting, it piqued my curiosity, Dr. Pielke; you had mentioned earlier in the discussion -- and it is a real nuance here, but it is one that I think grasps at average, nonscientific

citizens when they are trying to digest all of this global warming and man's role in it.

You had said earlier, in an answer to a question, that man's role is a part of global warming, that there are many other attributes or causes, and it is difficult to, kind of, unwind man's cause. That is the ultimate issue here, because we can only control man's role within the borders of the United States of America.

So I am curious, what are some of the other factors? Has there been scientific studies that would enable us to measure more accurately so we can have a more targeted solution here than simply trying to eliminate and go to a zero-carbon baseline from 1820?

Mr. Pielke. Well, we have to recognize there are consequences whenever humans do anything. But what we have done -- and there was that 2005 National Research Council report I referenced that talks about land-use change, talks about aerosols, talks about nitrogen deposition, for example, as well as carbon dioxide, both the biogeochemical and the radiative effect. And the more we learn about this, the more uncertain it becomes.

And to try to factor out what is the CO2 contribution to any of these impacts, whether it is floods or heat waves, is becoming an increasingly more difficult problem. And when we discuss just CO2, we focus just on C02, we are ignoring all these other influences and not even then considering what the natural part is.

Mr. Terry. If the United States did go to an 1820 carbon baseline for man's emissions within the United States, has the scientific community concluded what globally the impact would be on global warming?

Mr. Pielke. Well, in terms of the CO2 emissions, I am sure that work has been done. And Chris can probably talk more about that.

But in terms of man's impact, look at the land-use change that has occurred since 1820. And we have done quite a bit of research showing that that has a major effect on precipitation and on temperature and extreme weather. And this factor was inadequately assessed in the IPCC.

So there are these other climate forcings in addition to CO2 that really should be explored further, and they have not been, by the IPCC.

Mr. Terry. Mr. Somerville, do you believe that farming contributes to global warming? Farming activities?

Mr. Somerville. I think that there is certainly a contribution, a minor contribution.

But I would like to reiterate, if I may, sir, that the overwhelming scientific consensus -- that there is no doubt that land-use changes especially have an influence on the local climate. But when you talk about the global climate, the science community is not persuaded by the arguments you have heard today from --

Mr. Terry. That there is additional contributions. Your belief is it is 100 percent caused by these activities.

Mr. Somerville. No, it is not 100 percent at all, but it is the dominant contribution. IPCC said in their last report --

Mr. Terry. All right.

Mr. Somerville. -- in this language that your government approved --

Mr. Terry. Have you in your studies or your research been able to determine, if we went to an 1820 baseline for man's contribution of CO2 in the United States, what impact that would have on global warming?

Mr. Somerville. Congressman, by itself it would not solve the problem. We are not advocating anybody go back to the 1820s. What is scary now --

Mr. Terry. All right. 1880? 1900?

Mr. Somerville. What is scary now is the rate of change of climate. We are not saying there was an ideal climate in some year in the past. What is frightening, what is something to be very concerned about is the rate at which the climate is changing now.

Mr. Terry. And my time is up. And that is part of the problem here, is we can't get our mind around what we are supposed to be doing if there is really that great of a problem.

Mr. Whitfield. Okay. We appreciate you all coming from many long distances, and this is a very important subject.

Do you all have any interest in doing one more round?

Mr. Rush. Oh, absolutely, Mr. Chairman.

Mr. Whitfield. All right. Five minutes each.

All right. I will start off.

As public-policymakers, I think the thing that concerns me, particularly, just like this -- we have had 24 panels of witnesses on science. And every time basically there is an agreement there is warming, there is a disagreement on why it is.

And we know that we have had warming periods in the past. We have had the Minoan warming period, the Roman warming period, the medieval warming period. And during that time, there was no industrialization, and so CO2 carbon emissions were not as high as they are today. Why? We don't exactly know the answer. The ice in the Arctic is diminishing; the ice in the Antarctic is growing, for lack of a better word.

So when we are asked to adopt policies unilaterally for America that would place us at a competitive disadvantage with other countries like China and India when jobs are at stake, when we have high unemployment, then it is a significant issue here.

And this administration, through EPA, has made the decision that they are going to regulate greenhouse gases. So, as I have said before, on three different occasions Congress has said no. In 1990, they said no. In 1998, they said no. They rejected the cap-and-trade legislation the last time.

So we can talk about consensus on global warming, fine. But

consensus on why and the questions about the models, I don't think anyone, obviously, can say definitively, "This is the answer."

So you all have been really helpful today. I really appreciate all of you coming. I know you are all scientists, you are well-educated. You are committed to trying to improve America and our world that we live in.

So I just wanted to make that comment. And, at this point, I would recognize Mr. Rush for 5 minutes.

Mr. Rush. I want to thank you, Mr. Chairman. And I join you in thanking these panelists, all of them, who are making some significant contributions to this subcommittee.

I want to get back to Dr. Nadelhoffer.

Dr. Nadelhoffer, you spent 20-plus years in the Arctic. And there has been some testimony, I saw you squirming and biting at the bit because you wanted to jump in.

So would you answer the question, what impact does climate change have for population centers globally? And referring to your experiences from the Arctic, what did you learn from your Arctic experiences?

Mr. Nadelhoffer. Excuse me, Congressman Rush. Could you repeat the last part of the question? It was hard to hear.

Mr. Rush. Yeah, your experiences in the Arctic drew you to certain conclusions about the effect of climate change on population centers globally. Could you expound on your experience?

Mr. Nadelhoffer. Well, the Arctic is a fragile environment. It is a cold environment, and temperature excursions change the Arctic in ways that we really are only learning are playing out. But, certainly, in many parts of the Arctic, permafrost is getting warmer, and in some places permafrost, which holds the ground firmly in place, is melting and diminishing. And so, many of our north Alaskan communities are compromised. Their building structures are sinking, often, into thawing permafrost.

The climate system -- interesting that we talked about Antarctica. The Antarctic ice sheet, of course, is a very complex system. But most of the glaciers that are measured in the Antarctic continent are increasing their flow rates into the Antarctic Ocean. And so, you know, it only makes sense that there may be more ice in the Antarctic Ocean because of the donation from the landscape.

The Antarctic Peninsula, over the past 50 years, has increased more than any place on Earth of a comparable size. So there are indicators from the Antarctic region, as well.

And, of course, these regions, one of the reasons that I and others work in the Arctic and my colleagues are working in the Antarctic is they are bellwethers. Those are the parts of the Earth that in the Arctic summer and the Antarctic summer face into the sun. The field station I work in in northern Alaska has sunlight continuously from May 20th to July 20th. And when there is less reflectivity from ice in the summer, there is more heat

coming into the Earth's system in the summer.

So the Arctic systems, although sparsely populated, feed back and affect the global climate in ways that I think others on the panel could express better than I can. But thank you very much for your question.

Mr. Rush. Well, I have another question. Dr. Christy indicated that crop loss may be more contributed to farmers not really knowing what they are doing than the impacts of climate change. Do you have a response to this, his assertions?

Mr. Nadelhoffer. Well, I have an indirect response. I, again, don't cover agricultural policy and farmer behavior and attitudes in my research.

However, I think one of the things that climate change does for agriculture -- or, one of the ways it impacts agriculture is to increase the uncertainty surrounding extreme events. I think farmers could well benefit from talking at high levels with climate scientists and trying to understand the risks involved with a more variable climate in agricultural regions.

Mr. Rush. Dr. Field, would you respond to that question also?

Mr. Field. Sure.

I would like to congratulate John on knowing some very successful farmers.

The observations are that, in warmer periods, crop yields go down. And with corn, it is very clear that there is a threshold

of about 84 degrees Fahrenheit, and when the temperatures are higher than that, yields go down.

The sensitivity of corn is quite dramatic. A single day with a temperature of 104, as opposed to 84, can decrease corn yields by about 7 percent.

Mr. Rush. Mr. Chairman, I yield back the balance of my time.

Mr. Whitfield. The gentleman from Texas is recognized for 5 minutes.

Dr. Burgess. Dr. Christy, from your study of -- and we have heard some talk today and some comparison to medicine and diagnosis and treatment. So what does the evidence say about how we are going about diagnosing this problem?

Mr. Christy. Well, as someone who actually builds those data sets, what I find is that we have one standard of instrumentation that gives us some answers but there are really more answers to be found. We do need a better set of satellites going up. I can divert there for a second, but I won't.

I will say --

Dr. Burgess. Unfortunately, some of the satellites seem to be coming down, and that is a problem.

Mr. Christy. Right. That is a problem.

Someone mentioned about, there were 4,500 people behind Dr. Field here. And my point in my talk was that I have looked at the very evidence for this thing, a climate model. So those 4,500 people, to make it simple, think the world is warming at 0.26

degrees C per decade right now. That is what climate model theory, that is what greenhouse theory in these models indicates. The data set does not. Does that mean they are still right and I am wrong, or what is it?

So I am not here to be a popular person. I hope I am providing the numbers of science that make this situation more understandable.

Dr. Burgess. And you have put together these observational databases essentially from -- you have built them on your own, you have built them from scratch?

Mr. Christy. Yes, our group has built them and published them. They are in the literature.

Dr. Burgess. Well, does the AIPCC or the National Academy of Sciences use your work?

Mr. Christy. Sparingly.

Dr. Burgess. Well, when they talk to you, what do they say is the justification for not including your work in the consensus?

Mr. Christy. I think they would say, because we have so many people, we have to include everybody's work, and so you are just -- you know, it is a democracy there, so you only get one vote. It doesn't matter how good the data are, it is one vote.

Dr. Burgess. Well, what are your observations suggesting to you about the impact of carbon dioxide on global climate change or global warming?

Mr. Christy. Yeah, carbon dioxide is a greenhouse gas.

There is no question about that. It will increase the surface temperature somewhat. But the effect is about one-third, the best we can figure, than what the current theory indicates, on which all these legislative actions are based.

Dr. Burgess. Dr. Somerville, let me ask you a question. In your summation of your opening statement, which I appreciate you providing for us, item number 5, you state that, "Science has its own high standards. It does not work by unqualified people making claims and expressing opinions on television or the Internet. People who are not experts, who are not trained and experienced in this field, who do not do research and publish it following standard scientific practice, are not doing science."

Does that statement apply to Dr. Christy?

Mr. Somerville. No.

Dr. Burgess. Well, let me ask you this. And I alluded to it earlier, the legislation that was before us in this committee late into the night on May 31st and then on the House floor late into the night on June 26. Why do you think it is -- if the vast preponderance of science and scientists agree with you and your position, why haven't you closed the deal with the public?

Mr. Somerville. That is a very good question. I think that we, as a science community, suffer as communicators. I think that we have not done a good job of outreach. The IPCC reports are hard to read. I think we haven't translated them into plain English.

I think that some people who have done that translating aren't well enough recognized, and I would put the U.S. military in that category, sir. I highly recommend to this subcommittee a report called "Climate Change and National Security" by the CNA Corporation, which is composed of retired flags officers, generals, and admirals and so on, who reviewed this area, were briefed by climate scientists --

Dr. Burgess. Yeah.

Mr. Somerville. -- said, it is a threat multiplier, it is a national security concern --

Dr. Burgess. Let me just --

Mr. Somerville. -- we don't wait for perfect information before --

Dr. Burgess. Let me just reclaim my time. It obviously doesn't take a rocket scientist, or a rocket surgeon for that matter, to know that Members of Congress are not held in very high regard right now, so anything we say is certainly suspect. The military is held in very high regard.

Mr. Somerville. Right.

Dr. Burgess. So why -- again, I would pose my question to you -- why have you not closed the deal with the public? Why, when I go home to my district and have my town-halls, why is the public not clamoring for me to control carbon in the atmosphere and drive up energy prices?

Mr. Somerville. I think there are many reasons for that.

There is an active disinformation campaign out there, as you may know --

Dr. Burgess. Who are you accusing of the active disinformation campaign?

Mr. Somerville. I am accusing parts of the fossil fuel industry and certain think-tanks and political centers. There is a lot of misinformation out there, and we haven't done as good a job as we need to to counteract it, sir.

Dr. Burgess. Mr. Chairman, if I could, just a point of personal privilege. I really appreciate Mr. Inslee bringing his own brand of carbon sequestration to the committee. It is an interesting tower he has constructed there.

Thank you.

Mr. Whitfield. Thank you.

Mr. Waxman, you are recognized for 5 minutes.

Mr. Waxman. Thank you, Mr. Chairman.

This panel was invited to give us information about the scientific record. I don't think that it would be fair to ask any of you to tell us exactly how to solve the problem. There are a lot of different alternatives, and we could explore those alternatives if we think something needs to be done.

I think there is a moral imperative to address climate change because of the damaging consequences that appear to be occurring. We don't have an abstract concern about how many parts per million of carbon dioxide are in the atmosphere. We are worried about

extreme weather events, the reduced crop yields, the wildfires, the floods, the rising sea level, and the rest of a long list of impacts.

And when analyzing the costs of acting to address climate change, it would be irresponsible to ignore the costs of inaction. But this isn't the panel to ask about what costs we ought to spend on acting and what are the consequences of inacting, except on the level of science.

Professor Field, let me just go back to this point. Earlier you said that corn, soybean, and cotton yields are very sensitive to increased temperatures. What effect does a very high-temperature day have on corn yields? How much are corn, soybean, and cotton yields in the U.S. expected to decline as a result of climate change? For example, if you have a single day of 104 degrees temperature, instead of 84 degrees, what would be the impact on corn? And what would be a modest warming impact?

Mr. Field. Currently, the best science came out in a 2010 report of the National Research Council. And what it concluded is that we should expect, in the absence of other activities, to see U.S. crop yields drop by something on the order of 5 to 10 percent for each degree Fahrenheit of warming.

We may be able to do technological fixes that avoid some of those changes. But I think that the best way to understand the climate change is, it is like an anchor that we are trying to drag as we advance agricultural technology through improved breeding

and improved practices.

Mr. Waxman. Now, if a single day of 104 degrees temperature instead of 84 reduces corn yields by 7 percent -- is that accurate?

Mr. Field. Yes.

Mr. Waxman. Even modest warming over this century is expected to reduce corn, soybean, and cotton yields by 30 to 46 percent. Is that an accurate statement?

Mr. Field. That is as well.

Mr. Waxman. And so, if we had a severe warming, that could reduce 63 to 82 percent.

Mr. Field. Yes.

Mr. Waxman. Now, maybe the farmers don't know about it; they are not clamoring for any legislation on the subject. But I could easily imagine they not knowing about it because they are not doing this research that you are doing.

Mr. Field. The new information is really quite striking. What it demonstrates is that, for major food crops in the U.S. and for cotton, there is very little temperature sensitivity until you reach a threshold. After you reach a threshold temperature -- I indicated that it is 82 for corn, 84 for soybeans, and about 90 for cotton -- you will begin to drop rapidly. And that is why people aren't generally aware of the sensitivities.

Mr. Waxman. Now, some of our Members represent districts in the western United States. Have the frequency and duration of

western wildfires been affected by these increasing temperatures?

Mr. Field. Since the middle of the 1980s, we have seen a dramatic increase in the area burned, in the average length of fires, and in the length of fire season across the western U.S.

Mr. Waxman. And these are already happening?

Mr. Field. Yes.

Mr. Waxman. What can we expect as temperatures continue to rise?

Mr. Field. The best estimates, based on observations, not based on any kind of a simulation, is that a warming of about 1.8, more or less the same amount of warming that the U.S. has seen over the last century, would increase the annual area consumed in wildfires in the western U.S. from about 1.3 million acres a year to about 4.5 million acres per year, a more than threefold increase as a consequence of a very modest warming, more or less the amount of warming we have already seen.

Mr. Waxman. And, Professor Nadelhoffer, what climate change impacts can we expect to crop yields in the Midwest?

Mr. Nadelhoffer. Well, I don't have a percentage number, but we are seeing higher frequencies of high-heat events. And to the extent that those high-heat events exceed the critical thresholds beyond which crop yields decline qualitatively, I can say that it would damage agriculture in the U.S.

Mr. Waxman. Is it possible that soybean yields could decline in Illinois by as much as 55 percent by the end of the century?

Mr. Nadelhoffer. I would not rule that out.

Mr. Waxman. And weed-induced losses for corn could increase 22 percent in the Great Lakes States and 35 percent for soybeans?

Mr. Nadelhoffer. That is within the realm of possibility.

Mr. Waxman. Well, I want to end, Mr. Chairman, by saying that we have heard a lot of reasons from Members of Congress why people are afraid to do anything. But for us to do nothing, for the rest of the world to do nothing, there is a cost of inaction. And we ought to recognize that fact and try to figure out what can we do to make things better.

If we don't want something major, let's do something modest. But let's don't just put our heads in the sand and say, "We heard there is no problem from some scientists and some people that seem to be reputable, and therefore we are not going to do anything. Let's let the problem get worse." I don't think that is a responsible position.

I yield back my time.

Mr. Whitfield. Thank you.

Mr. Griffith, you are recognized for 5 minutes.

Mr. Griffith. Thank you, Mr. Chairman.

Let me reiterate something that I mentioned previously. As you know, I was on a rapid-fire because I thought I was only going to get 5 minutes and I wanted to get all my questions out there. And I do ask you all to please get me answers, and we will get the questions in writing to you and so forth.

But one of my great concerns in this whole debate is that we shift our jobs and our wealth to other countries -- Asia, Mexico -- other countries that are not doing what we are doing. If it turns out that those of you who believe that it is all manmade greenhouse gases and manmade effect, I worry that we have crippled ourselves to respond to it later when other countries want to do something about it because we won't have the money. We will be a second-tier nation at that point, and that is a great concern of mine.

And I think we should have, you know, reasonable rules and regulations, but I want to make sure that we are doing it in a reasonable fashion. And I am not sure that unilaterally stopping the use of carbon fuels does this country or the world any great favors.

That being said, I was interested in the comments by you, Dr. Christy, in regard to land use. And I am wondering if you can amplify that, as to how that is affecting global warming and what we might be able to do. You know, is one of the concerns deforestation? Are we worried about the peat bogs? I heard permafrost mentioned. I am just wondering if you could amplify on that.

Mr. Christy. I will just talk about the fact that, when you look at surface temperature measurements, like I saw a chart up there earlier, we have shown how that is contaminated by the fact that it uses nighttime temperatures, which are a clear signal and

affected by surface development of all kinds. It is a really complicated problem that we published on.

But there is clearly a warming component that is very large in that surface-temperature record over land that is not due to greenhouse gases at all, but it is due to humans. It is due to surface development. And so, I made the comment one time that if you turn California back into a desert, you will see the temperature fall, simply because of this effect. I don't recommend it, but.

Mr. Griffith. Yeah, I am not in favor of that either.

But what other -- you said turn California, you know, back. What other things would we have to turn back to get back to temperatures pre-industrialization in the 19th century -- or, excuse me, in the 1900s?

Mr. Christy. It would be to go back to what it was like in the 18th century.

Mr. Griffith. All right.

And then, Dr. Fields, I have been very interested in -- and you may not have it here today, but I have been very interested in -- and let me see if I have this right -- 90 degrees for cotton, 82 for corn, 84 for soybeans? Did I get that correct? Can you give me the same number on barley, wheat, oats, millet, rice, et cetera?

Mr. Field. I can't give you the specific numbers because the analysis for barley, we have only been able to do it with a global

scale. And with barley, the sensitivity is about 5 percent yield loss per degree Fahrenheit of temperature increase.

Mr. Griffith. But do you know the number for barley?

Mr. Field. I don't know if there is a threshold for barley.

Mr. Griffith. Okay. And how about wheat, oats, millet, rice? Just picking up some of the other grains.

Mr. Field. Right. So, the only grains for which -- the only crops for which we have been able to identify the threshold temperatures are corn, soybean, and cotton. For the others, we can detect the sensitivity to warming and we can detect the fact that historical warming has put this anchor on yields. But as far as we can tell, we are in a part of the temperature range that is already responsive, where we are already seeing the yield decreases.

Mr. Griffith. Okay. Now, let me ask this, because, as Congressman Waxman pointed out, we want to deal with science here today, and that is what I am trying to do. I have all kinds of questions.

Do we not know the other grains because we haven't studied them or we have not yet reached their threshold?

Mr. Field. Well, we have reached the threshold. What we are seeing at the global scale is that there are already yield decreases with historical warming for wheat, maize, corn, and barley. What I said is that there is no evidence from the observations that there is a threshold. We are already in the

responsive part of the system for wheat, barley, and corn.

Mr. Griffith. Okay. Has there been a study on oats?

Mr. Field. No.

Mr. Griffith. So we have lack of science there.

Mr. Field. As far as I am aware, on oats.

Mr. Griffith. Okay. And the same would be true for millet and rice?

Mr. Field. In the study of the world's six major food crops, we do not see that rice is decreasing yields in response to the warming that has already occurred.

Mr. Griffith. All right. Thank you very much.

Mr. Whitfield. Thank you.

Mr. Inslee, you are recognized for 5 minutes.

Mr. Inslee. Thank you.

Dr. Somerville, I would like to suggest that you have been way too self-critical on the scientific community about why there is some remaining uncertainty in the public's mind about this. And I want to suggest that the reason there is some uncertainty is there has been a concerted war on science on this subject, just like there was in the tobacco debate.

This is a movie we have seen before. When the devastating evidence with a scientific consensus came out that tobacco killed Americans, there was a very concerted effort to distort and attack that science. It lasted for decades until it was finally overwhelmed.

And it was in part because there were people with enormous financial stakes that attacked that science, and it was in part and is part today -- and here is another reason for it, and I will suggest it. Maybe it is controversial, but I will suggest it. Folks in the press report this like a divorce trial: He said, she said, then she said, then he said. That is not the way science ought to be reported in this country.

And if people start reporting that this mountain of evidence -- by the way, this is just a partial list of the scientific documents on this. These things could reach to the ceiling. And there isn't one, single peer-reviewed paper in the world that supports a hypothesis about why the Arctic is melting other than this phenomena. And we need people in the press to start reporting that, frankly, so that Americans can make rational decisions.

Now, I want to bring in the parameters of what our real scientific discussion here is, because there is uncertainty about this, obviously, about how fast this is going to go and what the temperature ranges will be.

But I want to ask Dr. Christy, there was a lawsuit up in Vermont, and a judge quoted an expert who testified on behalf of the plaintiff. And he quoted this -- I will call him Dr. X for the moment. I will quote from the judge's opinion.

Quote, "Plaintiff's own expert, Dr. X, agrees with the IPCC's assessment that, in light of new evidence and taking into account

remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in GHG concentrations. Christy" -- excuse me, I gave it away -- "Dr. X agrees that the increase in carbon dioxide is real and primarily due to the burning of fossil fuels, which changes the radiated balance of the atmosphere and has an impact on the planet's surface temperature toward a warming rate."

Now, I gave away who Dr. X was. I just want to make clear, Dr. Christy, you agree, do you not, that human emissions of some of these pollutant gases is playing at least some role in changes in our climate? Now, if you could just say "yes" or "no" to that, I would really appreciate it.

Mr. Christy. The question was a little confused there. Was it the pollution --

Mr. Inslee. Let me just ask you if you agree with the statement you gave up in a court in Vermont. You said you --

Mr. Christy. No, the judge got the statement wrong.

Mr. Inslee. Oh, I see. The judge did it.

Mr. Christy. I did not say that. Go back to the transcript, and that is the problem.

Mr. Inslee. Well, let me just ask you this. Do you agree with the IPC's conclusion, assessment, that, in light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 6 years is likely to have been due to the increase in GHG concentrations, testimony by you

on May 4th, 2007? Do you agree with that or disagree with that?

Mr. Christy. What I said on the transcript was I mostly agreed with that. I did not say I agreed with it. And if they just changed one word, I would agree with that, instead of "most" to "some."

Mr. Inslee. Let's show the picture of the Arctic up here again, if we can. If we can put the picture of the Arctic up here.

Now, what we have observed, due to satellite data and observations on the surface, is incontrovertible. A massive part of the Earth has changed. I don't know how many thousands of square miles are on there, but this is a bunch. And we have seen a 40 to 50 percent reduction in volume of the Arctic Sea ice in September in the last couple of decades. If current trends continue, there will be virtually no Arctic ice in September probably within this decade, perhaps within 5 or 6 years.

Now, what I am told is, this is a very significant change in the planet because of the albedo effect. And perhaps, Dr. Field, could you describe to us what that is and why this is important to us?

Mr. Field. Thank you.

Sea ice reflects about 90 percent of the sunlight that hits it. Seawater absorbs about 90 percent of the sunlight that hits it. That is a big difference in the amount of heat that is reflected back to space versus absorbed in the Earth's system.

Sea ice tends to cool the planet. Open water tends to warm the planet.

Mr. Inslee. Now, this appears to me to be a very dramatic change in the world that we have known since humans walked the planet. This has never existed before while humans were on the planet Earth.

Has anyone produced a peer-reviewed article to suggest a hypothesis as to why this has happened in the Arctic other than the accumulation of greenhouse gases and associated effects? Has anyone published a peer-reviewed article suggesting another hypothesis?

And I am not seeing any takers, because there are none.

Mr. Pielke. Excuse me. If you are asking a question, that 2005 NRC report talks about the black carbon. And there is also the issue of natural circulation --

Mr. Inslee. Black carbon is something associated with burning our fossil fuels. And that --

Mr. Pielke. I understand, but --

Mr. Inslee. -- is another problem we have to get --

Mr. Pielke. -- it is not a greenhouse gas.

Mr. Inslee. Well, it is good enough to melt the Arctic. And it is one of the reasons why the EPA should not be stopped from enforcing the Clean Air Act, like the Republicans want to do. And we are going to stop it.

Mr. Whitfield. The gentleman's time has expired.

You know, there was some nodding going on here when we talked about there is not one peer-reviewed article relating to the Arctic diminishing of ice. Are any of you aware of any peer-reviewed articles that --

Mr. Christy. There are articles that talk about the circulation being a dominant component of why that is missing up there. If you go back several -- a few thousand years, not several, just a few thousand years, there were times when it was probably completely free of ice. This is not a new situation.

And I agree with you that there is no question the Arctic ice has diminished in the past 20 years. Antarctic sea ice has increased. And it has a greater albedo effect, by the way, than the Arctic does. And I think Roger knows something about that.

Mr. Whitfield. The gentleman from Louisiana is recognized for 5 minutes.

Mr. Scalise. Thank you again, Mr. Chairman, for the second round.

And, obviously, I think we are seeing some more very interesting, kind of, divergent views. But, in some ways, it is not really divergent. We are really starting to see more of the details that seem to be excluded too often in other reports, when some people want to issue a report just to prove what they are trying to accomplish, as opposed to following the data.

And I want to ask you about this, Dr. Pielke, because you refer to the Climate Change Science Program's report. And I think

you had done an analysis of it, maybe with some other doctors, I would like to ask you to comment on.

But in a few parts of your statement, you talk about, "The process for completing the CCSP report excluded valid scientific perspectives." You talk about, "The editor of the report systemically excluded a range of views on the issue of understanding and reconciling lower atmospheric temperature trends." Later on, you mentioned that, "The executive summary of the CCSP report ignores critical scientific issues and makes unbalanced conclusions concerning our current understanding of temperature trends."

All of you are scientists, and, respectably, you can disagree with each other if you are trying to come to a conclusion. But if you are going to issue a report and deliberately exclude certain things because maybe they don't reach the same conclusion that you are trying to reach, that is not science.

And I think, Dr. Pielke, what you are talking about here -- and you reviewed this -- is getting to the heart of that very concern many of us have, that there are people running around out there talking about "thousands of scientists" out there and trying to discredit anybody who comes out against it, when, in fact, some of these reports exclude key data, and then the thousands of scientists are basing their assumptions on the report that, in itself, is factually inaccurate because it excluded key data.

So if you can talk to me about maybe specifically the CCSP

report and what was excluded. And in the broader picture, are there other scientists like you that have reviewed these kinds of reports and said, "Wait a minute, they are leaving out key data"?

Mr. Pielke. Exactly, they certainly are. And in the CCPS report, I documented it for others in a series of e-mail exchanges that I had that is actually on my Web log. What you quoted was out of a public comment that I responded to. And an outgrowth of that was that we published several papers with many authors in the peer-reviewed literature that showed unresolved issues with the surface-temperature record. I am not going to go through them here, obviously, but one of them is how good is the siting of these sites; what height do they measure the temperatures at.

They deliberately excluded this, and they wanted to assume that this surface-temperature record is robust and they don't need to look at it any further. And on the CCSP report, we raise issues. They were excluded. And then I finally resigned it to the public comment. And since then we have published papers on it and have documented that there are serious issues with the use of that metric to diagnose global warming.

Mr. Scalise. And, again, this should be based on the data. If the data backs it up, that is one thing. But then there are people running around using these reports that, in and of themselves, are corrupt because they specifically excluded key -- this data.

Mr. Pielke. As you know, the CCSP was used in preparation of

the 2007 IPCC report. And I also documented peer-reviewed papers that were excluded from that report that showed an alternative perspective than what was presented in the report on that issue.

Mr. Scalise. Thank you.

And let me ask you, Dr. Christy, because you talk about this in a similar way. You talk about, "Widely publicized consensus reports by thousands of scientists are misrepresentative and contain overstated confidence in their assertions, rarely representing the range of scientific opinion that attends a relatively murky field of climate science."

Can you expand upon that, following a similar line of questioning that I had with Dr. Pielke?

Mr. Christy. Well, fundamentally, only a few people can write the report. Thousands of people don't write the report. Thousands of people don't approve of everything in the report. And so it really comes down to those few who are, as I call them, they are gatekeepers of the information rather than brokers of the information.

This is the information I presented to the InterAcademy Council last summer that they pretty much took to heart. And how do you get out of that? That was one of the things I was trying to --

Mr. Scalise. Let me ask you this, because we have heard this in previous testimony before this committee. Some scientists -- who, as you, Dr. Pielke, and others have maybe pointed out some

inaccuracies or data that is left out, other things -- they talk about blacklisting that goes on inside the scientific community. I don't know if you want to comment on it. But, I mean, what kind of reaction do you get from scientists when you do point out these things that are not necessarily reflective of the full picture?

Mr. Christy. They are hard pressed to deal with the numbers, because all science is numbers, and that is really what we have. But --

Mr. Scalise. And you have built your own data models, so I take it -- and I looked at what you reviewed on the Sierra Nevada mountains, some other things you found in the United States and Africa in terms of temperature, and the complexities, when you get into what really causes it. It is one thing to show that you have a temperature change over thousands of years. You have seen that up and down throughout history. What causes it, I guess, is at the heart of the issue here, and the complexities of that.

So if you can make one final comment there.

Mr. Christy. Well, I would just say, kind of, the thrust of your question, if someone would read the Climategate e-mails, and as someone who was denigrated in those e-mails, I have a completely different view about them than Dr. Somerville might.

Mr. Scalise. Thank you.

And, Mr. Chairman, if I may, just one last thing. Today is Mardi Gras day. I just flew in from New Orleans this morning to be at this panel, so I couldn't be at the parade. But, as we are

talking about icing and agriculture, I have got a king cake back in the back. So if members of the committee on either side would like to come back, we have some good king cake from New Orleans with icing on top --

Mr. Whitfield. How big is it?

Mr. Scalise. -- and I would invite you all to have some of that.

Mr. Whitfield. Is it big?

Mr. Scalise. It is -- and, by the way, your good friend Herschel Abbott is the king of Mardis Gras today.

Mr. Whitfield. All right.

Mr. Scalise. So, a beautiful day back in New Orleans. Wish I could be there, but glad to be here. And I yield back.

Mr. Whitfield. That concludes today's hearing. I want to thank --

Mr. Rush. Mr. Chairman?

Mr. Whitfield. Yes?

Mr. Rush. Mr. Chairman, I have a unanimous consent request for some reports to be entered into the record, if I might. A very extensive --

Mr. Whitfield. How big is this report?

Mr. Rush. There are a number of reports. But I would like to have them entered into the record.

Mr. Whitfield. Well, yeah. And we will enter some in the record, too, then. All right, go ahead.

Mr. Rush. Mr. Chairman, the first report is a 2009 report entitled, "Global Climate Change Impacts in the United States." And this study was conducted on behalf of the National Science and Technology Council and the U.S. Global Change Research Program and was transmitted to the Bush White House and the Congress in June 2009. The report summarizes the science of climate change --

Mr. Whitfield. How many pages is that?

Mr. Rush. I think it is about 170, 180 pages.

Mr. Whitfield. Okay.

Mr. Rush. And I will quote just one part of it. It says, "Observations show that warming of the climate is unequivocal. The global warming observed over the past 50 years is due primarily to human-induced emissions."

Mr. Whitfield. Mr. Rush, I mean, if you would read the title, we would be happy to submit them.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Rush. All right. Well, then this study is a 2007 study entitled, "The U.S. Economic Impacts of Climate Change and the Costs of Inaction," and it is a review and assessment by the Center for Integrative Environmental Research at the University of Maryland.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Rush. The third is a statement from the board of directors of the American Association for the Advancement of Science, the world's largest general scientific society, which serves 262 affiliated societies and academies of science and 10 million individuals.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Rush. The other is a statement by 18 scientific societies, including the American Association for the Advancement of Science, representing an assessment of the science.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Rush. The other one is a letter on behalf of 152 researchers from universities, colleges, and research institutes across the State of Michigan strongly urging members of the Michigan congressional delegation to reject any measure that will block or delay the EPA from protecting the people of Michigan from air pollution and human-caused climate change, which endangers the public agriculture and the environment and the economy.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Rush. The next is a letter on behalf of scientists and colleges and universities across the State of Wisconsin urging the Wisconsin congressional delegation to support strong Federal policies for rapid and deep reductions in emissions of carbon dioxide and other greenhouse gases at least on par with the reductions recommended by the Intergovernmental Panel on Climate Change.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Rush. And the last report, Mr. Chairman, is the report that I heard about today, along with the rest of the Members, is the report that Dr. Somerville stated -- and I don't know the full name of the report. It was a military report, the CNA report. Maybe Dr. Somerville can give us the formal name of the study.

Mr. Somerville. Yes, I am glad to do that. It is "National Security and the Threat of Climate Change," 2007, the CNA Corporation.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Whitfield. We will be happy to do that.

And we will also include this document, "More Than 700 International Scientists Dissent Over Man-Made Global Warming Claims." Without objection, so ordered.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Waxman. Mr. Chairman?

Mr. Whitfield. Yes.

Mr. Waxman. First of all, I want to thank you for holding this hearing. I think it was important for us to hear about the science of this whole issue.

But I was just informed that you are planning to call a meeting of our subcommittee to mark up the bill on Thursday, and I want to make a request that you not do that. I have extended an offer to you to work with you. I would hate to see Congress take a position on declaring science, a science conclusion that what the EPA determined was false, amending the Clean Air Act and denying the EPA ability to do anything.

I would hope we could come up with a more nuanced and more reasonable policy in light of what we are hearing from people today and how this issue is of a great deal of significance to many of us. So I would appeal to you to meet with us, no preconditions, and see if we can come up with something better.

Mr. Whitfield. Well, Mr. Waxman, thank you very much for those comments. And, you know, these are some issues that there are significant disagreements on. And I know that when we have this markup on Thursday there will be a lot of debate, a lot of amendments, and we will air it all out at that time.

And I want to thank the witnesses for being here today very much. We appreciate your testimony. This is a very -- your

testimony is very important.

I would like to also remind Members that they have 10 business days to submit questions for the record.

And I ask that the witnesses all agree to respond as quickly as you can to any questions that come your way. I know Mr. Griffith has a lot.

And so, with that --

Mr. Rush. Mr. Chairman? Mr. Chairman?

Mr. Whitfield. Yes, sir.

Mr. Rush. Mr. Chairman, I would ask, if I could, I would join with the ranking member of the full committee and ask that this subcommittee delay the markup that is occurring on Thursday.

You know, Mr. Chairman, it seems like we are trying to force-feed a hoax on the American people. And I just think that we should be more deliberative and that we should take our time with this.

The ranking member has offered his sincere request that we delay this and offered his participation and his eagerness to work with you and the committee and the subcommittee on trying to come up with some kind of modification of the bill that is currently going to be under markup. And I would join him in that.

I just think it is important, Mr. Chairman, that we take our time on this, because, as you can see, there is not any agreement. As a matter of fact, most of the scientific community basically take odds, enormous odds, with the opinion of the majority on this

particular issue.

Mr. Whitfield. Well, Mr. Rush, thank you very much. I appreciate your and Mr. Waxman's comments. We certainly have a lot of respect for both of you and your views.

As I said in the beginning of this hearing, we have had 24, now 25 hearings on the science on this issue. And on this side of the aisle, we feel like that EPA is really forcing us to act quickly because Congress has addressed this issue three separate times and said "no" each time.

So we will go by regular order. It will be in the subcommittee, it will be in the full committee, and if it is able to get out of there, it will be on the floor. So we will have plenty of opportunity for debate, plenty of opportunity for amendment. And we look forward to working with all of you.

So, with that, the committee is adjourned. Thank you very much.

[Whereupon, at 12:46 p.m., the subcommittee was adjourned.]