Statement of

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Madam Chairman and Members of the Subcommittee, thank you for the opportunity to share my views with you on the role of science in public policy. My name is Roy Spencer, and I am a Principal Research Scientist at The University of Alabama in Huntsville, where I direct a research program involving satellite microwave observations of the Earth. I am the United States Science Team Leader for the Advanced Microwave Scanning Radiometer flying on NASA's Aqua satellite, and I previously held the position of Senior Scientist for Climate Studies at NASA's Marshall Space Flight Center. While my specific knowledge regards climate science and meteorology, I will make some general comments that can probably be applied to all of science.

We would like to think of science as a process by which we get firm answers to specific questions about the physical world. But even scientists forget that scientific conclusions are only as good as the assumptions that were made in the process of doing the science. This is why different researchers can look at the same data and come to different, even opposing, conclusions. Or why a climate modeler can come to believe in his model's predictions of dramatic global warming. Usually, the scientists that are the most convinced of their conclusions are the ones with the shortest memory of their assumptions. In my experience, the less a scientist knows about a problem, the more certain he or she is of their conclusions. This isn't a fault of the scientific process, it's just human nature. Witness the scientific community's warnings about an impending ice age in the 1970's, and then the inflated global warming projections of the late 1980's and early 1990's. Luckily, the public has seen this kind of behavior before in scientists and is distrustful of dramatic predictions.

Certainly when the science is straightforward, involving sufficient and compelling data with only one reasonable interpretation, then the scientist's and the policymaker's jobs are easier. In climate science, though, the processes being studied are amazingly complex – probably in more ways than we are even aware of right now. Few climate problems can be researched without making sweeping assumptions.

Complex scientific problems naturally lead to greater uncertainty in scientific conclusions, and the policymaker will not be able to get around this problem. Unfortunately, we can't put the Earth into the laboratory and test it's response to various forcings. So, we call upon a scientific body such as the U.N. Intergovernmental Panel on Climate Change (IPCC), to provide some sort of consensus about what global warming will look like in the future, based upon our present understanding of the science. Once we enter the realm of consensus, though, scientists are asked to make value judgments. In the case of the IPCC Scientific Assessments, only one to a few participants were involved in formulating this consensus as an "Executive Summary" statement. This process will inevitably be influenced by whether those scientists believe the Earth is fragile, sensitive to manmade influences; or resilient, and relatively insensitive to those

influences. I have found that most scientist's judgment is also influenced by whether they believe that a change in public policy will provide a net benefit to society, irrespective of the science.

Uncertain and immature science does not put a scientific theory on a firm footing for influencing public policy. Even if a physical relationship is so well understood that it is elevated to the status of a physical "law", this does not guarantee that scientific truth has been found. For instance, the "Law of Parity" in nuclear physics was disproved in 1956 through research at Columbia University and at the National Bureau of Standards, thus overturning a scientific belief held for the previous thirty years. In the realm of climate science, we know that increasing precipitation efficiency (as we see in tropical precipitation systems) could greatly offset the warming effects of carbon dioxide. But we don't even understand the processes that control precipitation efficiency, let alone have that understanding in climate models. As we've seen with the Law of Parity example, it only takes a single experiment to disprove a widely-held scientific theory. Science is not truth, it only provides a current, educated guess of how things work. And the more complex the problem, the greater the level of faith that is needed to reach conclusions.

With such massive policy implications and so little firmly-settled science, the global warming issue has at times brought out questionable behavior in scientists, institutions, agencies, and politicians. Some scientists have made comments, both in public and in private, that suggest to me that their scientific judgement is clouded by their adherence to a catastrophic global warming paradigm. In the political realm, Vice President Gore's book "Earth in the Balance: Ecology and the Human Spirit" makes it clear that Mr. Gore has a philosophical and spiritual adherence to the global warming paradigm. The IPCC, of course, had the famous flap over their Summary for Policymakers sounding much more alarmist than the scientific body of their report could justify. In the science publication process, there seems to be an increasing number of instances where the editorial process has clearly favored the publishing of pro-global warming papers over those that do not support a catastrophic view of global warming. Climate catastrophe is always more interesting, and thus more newsworthy, so the public receives a skewed view of the state of the science.

Does all this mean that we can throw out the science and the peer review process? Of course not. While the peer review process does not always lead to a fair and impartial disposition of manuscripts, it's probably still the best system we have. It must be used for science to proceed. But we should always remember that scientific conclusions can not be trusted any more than the assumptions that went into them. Assumptions necessarily entail a level of faith. For example, the National Assessment activity of recent years assumed extreme climate scenarios from only a couple of global climate models, then proceeded to imply that the United States was in for massive climate changes.

So, how should policymakers approach the use of science for policymaking? If a policy change happened to be win-win for everyone, then even the slightest hint from the science would be enough to proceed with the change—indeed, make the policy change regardless of the science. But at the other extreme, if a policy change is anticipated to be very painful, with negative consequences outweighing the positive ones that were intended, then even 100% certainty in the science might not justify the change. All members of this subcommittee already know this, of course. But the scientist who publishes his results isn't asked to stake the life or welfare of his children on his conclusions being correct. And in the case of policymaking based upon climate science, this kind of outcome is entirely within the realm of possibility. Perhaps a better way to say this is, for the scientist to be wrong about his conclusions is to be expected sometimes, and has little lasting consequence – but if bad science ends up leading to bad policy, then the consequences are much more widely felt.

In summary, the peer review process, and scientific results, must be used when they can be applied to policy issues. But since it is humans -- with their own biases, blinders, pet theories, and world views -- that control the scientific process, the scientist and the policymaker must continually strive to separate what we really know, from what we think we know. And the latter is frequently a much longer list than the former.