

**White Paper on Climate Change Impacts on
Small and Rural Public Water Systems¹**

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¹ This white paper includes a brief review of the science on which climate change/global warming predictions are based, delineating major disputes in these predictions. It is not intended to resolve these disputes, but rather to explain the overall state of the science. The reader is encouraged to obtain copies of and review the Intergovernmental Panel on Climate Change (IPCC) documents and references cited throughout this white paper and offer thoughtful comments for improvement of the white paper to the author at fredp@pontiuswater.com.

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I. Introduction

Assessing the impacts of climate change on public water systems, and in particular small and rural systems, is a serious undertaking because human lives are at stake. Very large amounts of public monies will be required to mitigate or adapt to the potential impacts being predicted or attributed to “global warming” as a result of atmospheric carbon dioxide (CO₂) and other green house gases (GHGs). For many years, some scientists have been warning of disastrous consequences if GHGs are not controlled:

“By mid-century, millions more poor children around the world are likely to face displacement, malnourishment, disease and even starvation unless all countries take action now to slow global warming” Michael Oppenheimer, Princeton University, June 15, 2004 (Eilperin 2004).

Legislation, regulation, and water utility decisions to mitigate and/or adapt to ‘global warming’ based on incomplete, incorrect, or spurious information may have disastrous consequences because there are always competing risks. If the phenomenon being labeled ‘climate change’ is in reality primarily driven by natural variations in weather patterns over time, then money spent to control GHGs will have little or no benefit. Monies spent to address a non-problem or a theoretical or improbable risk are no longer available to address problems that have real life and death consequences. Indeed, a higher level of scrutiny and review must be given to government reports² and public statements by scientists and politicians regarding the academic research on global warming and climate change.

² Government agencies and research centers funded by the government have a direct, vested interest in continued research funding, and expansion of government regulation of GHGs. The existence or expansion of many government programs and research centers depend on global warming. In addition, many companies, including some energy utilities, are rebuilding their business models on the presumption that the U.S. Congress or the US Environmental Protection Agency (USEPA) will in fact enact strict legislation and/or regulations to address global warming, impose a cap or tax on carbon emissions, or implement a cap and trade program. Such companies have a vested interest (e.g., making money, expanding market share, gaining power, etc.) in the business of global warming. Obvious biases must be taken into consideration when evaluating statements and claims from any entity.

Virtually every aspect of water system operation could be affected by global warming, climate change, and by any legislation eventually enacted to address GHGs. This includes not only water resources planning, but water system administration, design, operations, water distribution, utility vehicles, and customer service. Customer ability to pay increased water rates will also be affected as the customer's cost of living increases overall as a result of legislative mandates and regulations.

This white paper presents a critical evaluation of the possible impacts on small and rural water systems and management/operational techniques or actions that may be indicated as a result of these potential impacts. This evaluation addresses:

- A brief review of the science on which climate change/global warming predictions are based, clearly delineating major disputes in these predictions.
- A review of significant legislative/regulatory initiatives underway or contemplated in this area.
- Identification of specific impacts of a regulatory, operational or other nature that may affect small water systems and suggested approaches to deal with these impacts.

II. Definition of “Climate Change”

The U.S. Environmental Protection Agency (USEPA) defines “climate change as any significant changes in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer)” (USEPA 2010). This definition is ambiguous. No agreed-upon uniform scientific criteria exists that can be applied to define exactly when the state of the climate system has permanently changed. “Climate change”³ is defined as statistical

³ Climate change may result from natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun; natural processes within the climate system (e.g. changes in ocean circulation); human

changes in “measures of climate,” which may or may not reflect permanent changes or shifts in the climate state.⁴ Hence, this definition assumes any “change in a measure” is caused by some known or as yet unknown fundamental change in climate.

The statement often made is that “weather” is not “climate.” Jane Lubchenco, head of the National Oceanic and Atmospheric Administration (NOAA), has stated: “weather is not the same thing as climate. The planet is warming but the weather is variable.” (Geman 2010). The statement assumes that weather⁵ is nearly static (localized for a short period of time), and climate is dynamic (global over extended periods), and that observed global warming is caused by some underlying fundamental change in the global climate system. In addition, weather naturally varies, and hence, weather changes are considered unreliable for assessing climate change.

In reality, climate and weather are always changing.⁶ To determine if “climate change” is occurring, changes in indicators of weather are measured locally at different points on the globe over long periods of time, and analyzed statistically. The measures used and the number of years that constitute an extended period (decades or longer) are arbitrarily defined. Changes in measures of weather (local) become changes in measures of climate (global) as data from many weather stations, extended over a long time (decades or longer) and space (globally), are analyzed using statistical methods and computer models. However, the actual measured data

activities that change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.).

⁴ Climate is usually defined as the “average weather.” More precisely, climate is the statistical description in terms of the mean and variability of relevant measures over a period of time ranging from months to thousands of years. The classical period is 3 decades, as defined by the World Meteorological Organization (WMO). These measures are most often surface variables such as temperature, precipitation, and wind. Climate in a broad sense is the state, including a statistical description, of the climate system.

⁵ Weather is typically defined as the atmospheric condition at any given time or place. Weather is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. Weather can change from hour-to-hour, day-to-day, and season-to-season.

⁶ It has been argued that climate is what you expect (e.g. cold winters) and “weather” is what you get (e.g. a blizzard). This distinction is artificial. Climate and climate change are statistical probabilities; Weather is a physical reality. Climate and weather are always changing. At the local water utility level, climate change is abstract statistical theory; weather is experienced; In reality, “average weather” rarely exists, at least not for very long.

may be interpreted in alternative ways. Meteorologists have long recognized this and, knowing the very complicated nature of meteorological science, and the difficulties faced in predicting weather in general, many meteorologists reject the idea that computer models can accurately predict future global climate changes.⁷ Sophisticated application of statistical methods and impressive models (e.g., models used by the IPCC) to analyze global climate change do not necessarily make the results and output from those models and analyses true.⁸

In recent years, the phrase “climate change” has grown in preferred use to “global warming,” primarily because it helps to convey that changes occur in addition to rising temperature. Further, climate change is not equivalent to global warming. Significant, societally important climate change can occur without any global warming or cooling.

Precise definitions of terms is necessary for clarity in public and scientific discourse. Lastrucci (1963) notes that a good definition can be neither true nor false—it is not a factual position. Because measures of weather (and therefore climate) are continually changing, USEPA’s definition of “climate change” presumes its truth,⁹ and does not allow for alternative hypotheses for interpreting changes in measures of weather that involve natural variations in weather and climate over time and space.¹⁰ The definitions used by USEPA and others to define climate change and global warming are ambiguous and result in significant confusion.¹¹ As an

⁷ Piers Corbyn, of WeatherAction: “Global warming is a failed science built on falsified data. It is a sham to say that man has caused it.” (Brown 2010).

⁸ Computer models require validation. Validation using measured data is necessary to establish “correspondence”—that is, does the computer code representations used in the model accurately portray the physical phenomenon (e.g., chemistry, physics, thermodynamics, etc.) being modeled.

⁹ This is a form of the logical fallacy of *Petito Principii*, or what is known as “begging the question.”

¹⁰ This is an example of the logical fallacy known as a “persuasive definition.”

¹¹ In popular and scientific discourse on climate change, the logical fallacy known as “equivocation” or “weasel word” is encountered. Equivocation occurs when a word is used in more than one sense. Weasel word occurs when the meaning of a word is changed in the middle of an argument, so that the conclusion can be maintained, though its meaning may have shifted radically. For example, “John practices engineering.” “Practice makes perfect.” “Therefore, John is perfect.”

example, some researchers substitute the term “climate change” for “global warming” even though global warming is clearly presumed. Language that pretends to communicate but does not, is known as “doublespeak” (Lutz 1989).¹²

III. Climate Change Science

The current state of climate science must be understood in light of the history of the United Nations (U.N.) Intergovernmental Panel on Climate Change (IPCC). The roots of the IPCC extend back to early beginnings of the environmental movement as expressed in World Earth Day in 1970, the Stockholm Conference in 1971-72, and the Villach Conferences in 1980 and 1985. In July 1986, the U.N. Environment Program (UNEP) and the World Meteorological Organization (WMO) established the IPCC as an appendage of the U.N.

The IPCC’s key personnel and lead authors are appointed by governments, and its *Summary for Policymakers* is subject to approval by member governments of the U.N. The scientists involved with the IPCC are almost all supported by government contracts, which pay not only for their research but for their IPCC activities.¹³

The role of the IPCC...

“is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation” (IPCC 2007).

From its beginning, the IPCC has functioned as an activist enterprise with an agenda to justify control of the emission of GHGs, and in particular CO₂. As a result, its reports have focused on evidence that supports the thesis of human-induced climate change, while ignoring contrary

¹² Basic to doublespeak is incongruity between what is said or left unsaid, and what really is (Lutz 1989): “It is the incongruity between the word and the referent, between seem and be, between essential function of language—communication—and what doublespeak does—mislead, distort, deceive, inflate, circumvent, obfuscate.”

¹³ Most travel to and hotel accommodations at exotic locations for the IPCC drafting authors is paid with government funds.

evidence (Sheth 2010).¹⁴ As a result, each IPCC report issued has generally been engulfed in controversy. Subsequent research frequently contradicts IPCC report statements. The IPCC organization as a government entity is subject to political influence. It's activities have focused on finding evidence of a human role in climate change. Large professional and financial rewards have gone to scientists and government employees who interpret scientific facts to further the IPCC and government agendas.

From the very beginning, the IPCC was designed to be a political rather than a scientific entity. IPCC leading scientists either reflect the positions of their governments or seeking to convince their governments to adopt the IPCC position. In particular, a small group of activists wrote the *Summary for Policymakers* for each of the four IPCC reports (McKittrick et al., 2007). Typically, only this *Summary for Policymakers* is read by policymakers, politicians, and most readers. Underlying assessment reports are generally too technical for anyone to understand other than a scientist. Workgroup Assessment reports are typically very long (800 pages or more). The *Summary for Policymakers*, in all cases, are selective summaries of the Assessment reports, communicating the “take home” message the *Summary for Policymakers* authors desired.

Several thousand scientists worked on the Assessment reports. But the vast majority of these scientists have no direct influence on the conclusions expressed by the IPCC in the *Summary for Policymakers*. Policy summaries were produced by an inner core of scientists, and each *Summary for Policymakers* was revised and agreed to, line-by-line, by representatives of

¹⁴ This is an example of the logical fallacy of “suppressed evidence” – presenting only the part of a piece of evidence that supports your claim while ignoring the parts that contradict your claim.

member governments.¹⁵ As a result, each *Summary for Policymakers* does not represent a consensus view among experts.¹⁶

The IPCC's First Assessment Report (IPCC 1990) concluded that the observed temperature changes were "broadly consistent" with greenhouse models.¹⁷ Without much analysis, it gave the "climate sensitivity" of a 1.5 to 4.5° C rise for a doubling of greenhouse gases. The IPCC 1990 report led to the adoption of the Global Climate Treaty at the 1992 Earth Summit in Rio de Janeiro. The IPCC 1990 report drew critical responses, both in terms of scientific content (SEPP 1992) and style of work (Anonymous 1994, Maddox 1991).

The IPCC's Second Assessment Report (IPCC 1995) was completed in 1995 and published in 1996. The *Summary for Policy Makers* contained an important conclusion, "the balance of evidence suggests a discernible human influence on global climate." The IPCC 2005 report was also criticized. Significant changes in the body of the report were made to make it 'conform' to the *Summary for Policymakers*, after the body of the report was finally approved by the scientists involved in writing the report. In addition, a key graph was doctored to suggest a human influence. Critics argued that the evidence presented to support the *Summary for Policymakers* conclusion was completely spurious (Seitz 1996). This led to heated discussions between supporters of the IPCC and those who were aware of the altered text and graph, including an exchange of letters in the *Bulletin of the American Meteorological Society* (Singer 1997).

¹⁵ The IPCC process deviates significantly from commonly accepted practices for reviewing and publishing scientific studies and research.

¹⁶ When scientific facts, arguments, and conclusions made in a *Summary for Policymakers* are not based on sound science those "facts," "arguments," and "conclusions" in the *Summary for Policymakers* become a government-imposed (top down) "consensus."

¹⁷ This review of prior IPCC reports is adapted from the discussion of "A Brief History of the IPCC" presented by Idso and Singer (2009), pages iii – v.

The IPCC 1995 report resulted in the 1996 publication of the Leipzig Declaration¹⁸ (SEPP 2005), signed by some 100 climate scientists. In spite of its shortcomings (SEEP 1997), the IPCC report provided the underpinning for the Kyoto Protocol, adopted in December 1997 (Singer 2000).

The IPCC Third Assessment Report (IPCC 2001) was questioned for use of weak scientific papers to back up its *Summary for Policymakers* claim of “new and stronger evidence” of anthropogenic global warming. One of these was the now-famous “hockey stick.” An analysis of proxy data was presented, claiming the twentieth century was the warmest in the past 1,000 years. The paper was later found to contain basic errors in its statistical analysis (McIntyre and McKittrick 2005; Wegman 2006). The IPCC also cited a paper that claimed pre-1940 warming was of human origin and caused by GHGs. This paper contained fundamental errors in its statistical analysis (Singer 2002).

Scientists often disagree. Even the use of peer-reviewed science will not ensure agreement. It is not unusual for scientists to disagree on the application of sound science to public policy issues. Indeed, differences regarding climate change or global warming science can arise simply because differing presuppositions and basic assumptions are unstated. But disagreement among scientists does not by itself mean that a particular scientific viewpoint is unsound; that depends on the available scientific evidence.

Throughout the development of the first three IPCC reports, voices of educated and well-qualified scientists raised questions regarding the IPCC process and the quality and scientific basis its findings and conclusions (Lott 2008). However, supporters of the IPCC findings, self-assured of their own beliefs about global warming and climate change, began to characterize

¹⁸ The full-text of the Leipzig Declaration is presented in Appendix A.

scientists who disagreed with the IPCC report narrative as “skeptics” and “deniers.”¹⁹ These terms are pejorative, and have been used by the press, government agencies, politicians, and IPCC supporters to put those who question the IPCC report on the defensive and to suppress dissent (Max and Ritter 2009). Any scientist who question the IPCC analysis on any level (e.g., scientific, statistical, etc.) are vehemently rebuffed²⁰ (Enserink 2010) and, in some cases, have had their scientific papers blocked for publication by journal editors (Clarke 2010) and/or biased “peer” reviews (Douglass and Christy 2009, Frank 2010), had funding cuts (Associated Press 2009, Cotter 2010), physical threats (Nelson 2010), and/or forced resignations (Solomon 2010).²¹

Throughout the history of science, advancement in science begins with one, two, or just a few researchers pursuing an idea or line of study out of the mainstream. This is almost always viewed negatively or opposed by other scientists. But “mainstream” beliefs are not necessarily true. In many cases scientists who raise inconvenient but valid questions regarding “mainstream”²² beliefs are sometimes met with *ad hominum* insults or retribution. In the case of global warming, scientists supporting the IPCC have attempted to marginalize others who may disagree with the IPCC analyses and findings, and have relied on name calling²³ (e.g., “skeptic”

¹⁹ The term “denier” is intentionally used for those who do not agree with the IPCC narrative because it directly implies an association with Holocaust deniers. (Murphy 2010)

²⁰ In light of subsequent events, the vitriolic rebuffs by some supporters of the IPCC findings against those scientists who disagree were apparently not the product of scientific rigor, but self-protection at any cost.

²¹ Greenpeace has stated: “The politicians have failed. Now it's up to us. We must break the law to make the laws we need: laws that are supposed to protect society, and protect our future. Until our laws do that, screw being climate lobbyists. Screw being climate activists. It's not working. We need an army of climate outlaws. The proper channels have failed. It's time for mass civil disobedience to cut off the financial oxygen from denial and skepticism.” (Nelson 2010)

²² “Mainstream” beliefs are simply those held by the majority. At the extreme, a mainstream belief in science can take form of dogma or a tautology that may never be questioned. Appealing to the majority as support for the truth of a particular belief is a logical fallacy known as *ad populum* – appealing to the emotions of a crowd, or appealing to a person to “go along” with the crowd, without presenting any reasons to show that the crowd is an informed or impartial source.

²³ Name calling, rather than responding to valid scientific issues raised, is an example of the logical fallacy of “*abusive ad hominum*.” Its purpose is to discredit the integrity of the person raising the question, rather than responding to valid issues being raised by the person.

or “denier”), rather than responding to science-based alternative hypotheses presented by other scientists. Statements such as “all reputable scientists believe that CO₂ causes global warming”²⁴ or “the science is settled”²⁵ are misleading at best.

Government scientists and others supporting the IPCC process and agenda began to portray climate science as “settled,” that a clear “scientific consensus” exists, and that no more scientific debate on “anthropogenic global warming” was warranted. This claim has turned out to be premature.

In 2007 more than 400 scientists, many of whom are current or former members of the IPCC, cast doubt on the “scientific consensus” that manmade global warming imperils the planet (Miller 2007, Morano 2007). Supported primarily by Robinson et al. (2007), over 31,000 American scientists, including over 9,000 with Ph.Ds., signed a petition stating (GWPP 2008):

“There is no scientific evidence that human release of carbon dioxide, methane, or other greenhouse gases is causing or will, in the foreseeable future, cause catastrophic heating of the Earth’s atmosphere and disruption of Earth’s climate.”

An open letter²⁶ to the Secretary-General of the United Nations signed in Dec. 2007 by over 100 leading climate scientists worldwide is significant (National Post 2007). Among other points, these scientists point out:

- it is not established that it is possible to significantly alter global climate through cuts in human greenhouse gas emissions. The current UN approach of CO₂ reduction is likely to increase human suffering from future climate change rather than to decrease it.
- Recent observations of phenomena such as glacial retreats, sea-level rise and the migration of temperature-sensitive species are not evidence for abnormal climate

²⁴ This is an example of the logically fallacy known as ‘No True Scotsman.’ “No true Scotsman puts sugar in his tea.” “Bilal is a Scotsman and he puts sugar in his tea.” “Ah, but no TRUE Scotsman puts sugar in his tea.” In the same way, ‘All REPUTABLE scientists believe that CO₂ causes global warming.’ The implication is that if you don’t believe CO₂ causes global warming, you are not reputable.

²⁵ Such a statement is a form of the logical fallacy known as ‘composition’—assuming that the whole (the entire scientific community) has the same beliefs about the science as one of its parts (a small group of scientists.)

²⁶ The Open Letter to Secretary-General of the United Nations signed in Dec. 2007 is provided in Appendix B.

change, for none of these changes has been shown to lie outside the bounds of known natural variability.

- The average rate of warming of 0.1 to 0.2 degrees Celsius per decade recorded by satellites during the late 20th century falls within known natural rates of warming and cooling over the last 10,000 years.
- Leading scientists, including some senior IPCC representatives, acknowledge that existing computer models cannot predict climate. Consistent with this, and despite computer projections of temperature rises, there has been no net global warming since 1998. The current temperature plateau follows a late 20th-century period of warming which is consistent with the continuation today of natural multi-decadal or millennial climate cycling.
- In contrast to the claim that climate change science is “settled,” significant new peer-reviewed research has cast even more doubt on the hypothesis of dangerous human-caused global warming. The IPCC working groups were generally instructed²⁷ to consider work published only through May 2005. The IPCC 2007 assessment reports are already materially outdated.

The IPCC has not considered available evidence against a human contribution to observed warming, nor has it seriously considered the substantial research of the past few years on solar activity, climate sensitivity, the role of water vapor, and the importance of naturally-induced variability.

A. IPCC 2007 Report²⁸

The IPCC Fourth Assessment Report (IPCC 2007) was published in 2007. The *Summary for Policymakers* of Working Group I was released in February. The full report from this Working Group was released in May, after it had been changed to “conform” to the *Summary for*

²⁷ see http://ipcc-wg1.ucar.edu/wg1/docs/wg1_timetable_2006-08-14.pdf

²⁸ The reader is encouraged to obtain a copy of all of the assessment reports and *Summary for Policymakers* and draw their own conclusions with regard to the critique presented here. The IPCC 2007 report can be downloaded at: <http://www.ipcc.ch/>

Policymakers. The IPCC 2007 report does not include the hockey-stick paper or the paper claiming pre-1940 human-caused warming.

Controversy ensued when the IPCC refused to publicly share comments submitted by peer-reviewers. All reviewers' comments had been sent in hard copy to a library that was closed for renovation. Only under pressure, were the comments posted online. The authors had rejected, without a response, more than half of all the reviewers' comments on attributing recent warming to human activities.

The IPCC (2007) report states:

“Much of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG (greenhouse gas) concentrations.” UN IPCC, Nov. 17, 2007, Valencia, Spain (IPCC 2007).

For many, the IPCC process and 2007 reports are unreliable, if not completely erroneous.²⁹ A variety of errors and problems with the IPCC 2007 report have been reported,³⁰ as well as problems and limitations of GCMs in general.³¹ Reasons given for the IPCC's unreliability include the withholding of data from external review,³² rejecting reviewer comments without a response (Gray 2007), low standards for accepting “peer-reviewed” literature as necessarily authoritative (Idso and Singer 2009) and reliance upon unpublished

²⁹ German public television station ZDF has put together a video segment (in German) on the substantive problems in the IPCC, including the issue of catastrophe losses. In it Mojib Latif, a prominent German climate scientist, comments on the misrepresentation of the science of disasters and climate change in very strong terms: "This is clearly a fraud to the public and to the colleague. Everybody has to reject such a behaviour. We have to take care, those things won't happen again." View the video here:

<http://www.zdf.de/ZDFmediathek/hauptnavigation/startseite/#/beitrag/video/974276/Pannen-im-IPCC-Bericht>

³⁰ A critique of the IPCC 2007 report has been prepared as a separate document to this white paper, referenced here as Appendix C.

³¹ The problems and limitations of GCMs in general have been summarized in a separate document to this white paper, referenced here as Appendix D.

³² “Climate change needs a do-over on many fronts. First, the science has to be scrubbed....Put the data out there for the world to see.” (Dignan 2010)

research, news articles, and environmental advocacy group reports (Gray and Lefort 2010, Gunter 2010).³³

When published, many governments and policymakers adopted the 2007 IPCC reports as the benchmark standard on climate change science. Many U.S. government agencies and organizations³⁴ simply assumed the IPCC 2007 report was sound and reliable, and proceeded to prepare reports to assess climate change impacts and implement regulatory policies based on the work and models used by the IPCC.³⁵

A recent example is the U.S. State Department April 18, 2010, release of the *Fifth Climate Action Report to the UN Framework Convention on Climate Change* draft (USDOS 2010). This document was issued to lend support for Senate action on climate legislation (Reuters 2010), and suffers from the same limitations as the IPCC 2007 reports (Hayden 2010, Armstrong et al. 2010).³⁶ The document makes the following unsupported claim:³⁷

“Global warming is unequivocal and primarily human-induced....Global temperature has increased over the past 50 years. This observed increase is due primarily to human-induced emissions of heat-trapping gases.”

Ridicule in place of a rational response to valid scientific questions have caused many scientists to conclude that the aggressive efforts to promote the IPCC 2007 *Summary for*

³³ The unpublished research, news articles, and environmental advocacy group reports relied upon by IPCC are listed in a separate document to this white paper, referenced here as Appendix E.

³⁴ *Climate Change and Water Resources: A Primer for Municipal Water Suppliers*, prepared by the National Center for Atmospheric Research (NCAR) and published in 2006 by the AWWA Research Foundation and the University Corporation for Atmospheric Research, presents IPCC climate change science as if it is simply to be accepted, not critically questioned.

³⁵ For example, USEPA based its GHG endangerment finding on the work on the IPCC, without consideration of any new science (Pontius 2009).

³⁶ Additional forecasting method deficiencies of the US State Department’s US Climate Action Report are provided in Appendix F.

³⁷ The report does not establish a link between CO₂ and putative global warming, does not show that the increase in CO₂ concentration is due to human activity instead of natural causes (such as natural warming of the oceans), does not show that either an increase in CO₂ concentration or an increase in temperature is, on balance, bad (or worse than laws restricting CO₂ emissions) and does not present any science whatsoever. “All in all, there is a best policy to direct toward climate change, and that is to have the courage to do nothing. We humans have precious little to do with climate.” (Hayden 2010)

Policymakers findings by the IPCC, government agencies, and those research centers aligned with them are rooted in politics. In 2009 more than 60 prominent German scientists, including several IPCC scientists, publicly declared their dissent from man-made global warming in an open letter³⁸ to German Chancellor Angela Merkel (Morano 2009):

“In the meantime, the belief of climate change, and that it is manmade, has become a pseudo-religion. Its proponents, without thought, pillory independent and fact-based analysts and experts, many of whom are the best and brightest of the international scientific community. Fortunately in the internet it is possible to find numerous scientific works that show in detail there is no anthropogenic CO₂ caused climate change. If it was not for the internet, climate realists would hardly be able to make their voices heard. Rarely do their critical views get published.”

Other scientists have concluded that the IPCC has become tainted by political advocacy, that its chairman should resign, its approach to science should be overhauled, and its leadership has allowed it to advocate for action on global warming, rather than serve simply as a neutral science advisory body (Foot 2009). The overwhelming push to promote the statements contained in the IPCC 2007 *Summary for Policymakers* statements are viewed by many as simple propaganda. Czech President Vaclav Klaus stated:

“It could be even true that we are now at a stage where mere facts, reason and truths are powerless in the face of the global warming propaganda.” Czech President Vaclav Klaus, May 25, 2008, National Press Club, Washington, DC (DPA 2008).

B. ClimateGate

On November 19, 2009, thousands of emails and documents were leaked from the Climatic Research Unit (CRU) of the University of East Anglia in the United Kingdom. The CRU played a central role in the climate change debate. Temperature measurements from around the world were analyzed and provide the primary basis for the argument that human release of GHGs (e.g. carbon dioxide) is leading to unprecedented catastrophic global warming.

³⁸ The Open Letter to German Chancellor Angela Merkel is provided in Appendix G.

The emails allegedly provide evidence that some of the climatologists colluded in manipulating data³⁹ to support a preconceived conclusion (Hickman and Randerson 2009), obstructing release of damaging data and information (Webster and Leake 2010),⁴⁰ colluding to pressure journal editors who publish work questioning the climate science “consensus,” and assuming politically active roles (US Senate 2010). The subsequent fallout from the leaked CRU emails and documents has international implications and has become known as “ClimateGate” (US Senate 2010).

On Dec. 28, 2009, Kenneth P. Green of *The Calgary Herald* wrote in an article titled “Who’s in denial now?”:

“Climategate reveals skulduggery the general public can understand: that a tightly-linked clique of scientists were behaving as crusaders. Their letters reveal they were working in what they repeatedly labelled a "cause" to promote a political agenda. That's not science, that's a crusade. When you cherry-pick, discard, nip, tuck, and tape disparate bits of data into the most alarming portrayal you can in the name of a "cause," you're not engaged in science, but in the production of propaganda.”

The immediate response to ClimateGate by supporters of the IPCC and its report was that ClimateGate would have no effect on the conclusions of the IPCC and would not affect USEPA policy regarding climate change and global warming (Geman 2009). As time proceeded, it became clear that ClimateGate was indeed very significant (Ball 2009). The leaked CRU emails and documents show systematic suppression and discrediting of climate skeptics' views, and

³⁹ Emeritus Professor Arthur Rorsch, Prominent Dutch Scientist: “Climategate e-mails prove the intent to deceive” “This is no longer genuine science” “These are politically motivated people...it is a religion, or something tidier – a belief” <http://climategate.nl/2009/12/13/arthur-rorsch-pakt-eindelijk-uit-in-telegraaf/>

⁴⁰ Institute of Physics: “The CRU e-mails as published on the internet provide *prima facie* evidence of determined and coordinated refusals to comply with honourable scientific traditions and freedom of information law. The principle that scientists should be willing to expose their ideas and results to independent testing and replication by others, which requires the open exchange of data, procedures and materials, is vital.” (Bolt 2010)

discarding of temperature data. The significance of ClimateGate was described by one reporter on March 15, 2010, as follows:

“It is increasingly clear that the leak of the internal emails and documents of the Climate Research Unit at the University of East Anglia in November has done for the climate change debate what the Pentagon Papers did for the Vietnam war debate 40 years ago—changed the narrative decisively. Additional revelations of unethical behavior, errors, and serial exaggeration in climate science are rolling out on an almost daily basis, and there is good reason to expect more.” (Hayward 2010)

Professor Phil Jones, a key figure in the ClimateGate incident, admitted that data used to generate the hockey stick graph is missing and was discarded. In addition, there has been no global warming since 1995, and that the world was possibly warmer during the medieval times than now (Petre 2010). As a result of ClimateGate, an increasing number of scientists as well as the public now realize what many scientists have been contending for many years—the “climate change science is settled” claim is simply not true (Bradley 2010, Lindzen 2009). Accusations and counter accusations have been published (Michaels 2009, Mann 2009) and ethical investigations continue (Barnes 2010). Roberts (2010)⁴¹ presents a severe criticism of the IPCC 2007 reports and ClimateGate fallout. Even an IPCC coordinating author⁴² has labeled the IPCC results “unscientific” and a “fraud” (Lloyd 2009).

Under pressure from the criticisms of the IPCC 2007 report and ClimateGate, some activists and scientists are on the defensive and are speaking out. Emanuel (2010) claims that “Climate Changes are Proven Fact.”⁴³ Some activists and scientists are taking more drastic action and “have plotted to fight back by taking an aggressive approach to gut the credibility” of

⁴¹ In preparation for debates within the Australian Parliament, Roberts (2010) prepared a briefing paper on the UN IPCC claims for members of Parliament. An excerpt from that report is provided in Appendix H.

http://www.ilovemycarbondioxide.com/pdf/dead_elephants.pdf

⁴² Dr Philip Lloyd Pr. Eng.: “The result is not scientific” “The [UN IPCC] process is so flawed that the result is tantamount to fraud. As an authority, the IPCC should be consigned to the scrapheap without delay.” (Lloyd 2009)

⁴³ Colorado State University Professor Emeritus Bill Gray believes that the Emanuel (2010) OpEd presents a one-sided view and has many inaccuracies. Dr. Gray’s response can be found at:

http://icecap.us/images/uploads/Gray_Rebuttal_to_Emanuel.pdf

those who disagree with them (Dinan 2010, Broder 2010). A hearing held on May 6, 2010, by the House Select Committee on Energy Independence and Global Warming, chaired by Rep. Edward J. Markey (D-Mass.).⁴⁴ Rep. Markey believes that the ClimateGate scandal was “manufactured.” The purpose of the hearing was to “address the claims of the deniers head-on” (Markey 2010), and in particular discredit the views of Lord Christopher Monckton. During the hearing three scientists testified, but did not directly responded to the scientific arguments presented by Lord Monckton. When directly asked, each of the three scientists answered that they disagreed with Lord Monckton, but none presented specific reasons (scientific or otherwise) for their disagreement. The hearing provided an opportunity for critics of the so called “deniers” to continue attacking the credibility of those who disagree with the IPCC assessments and the global warming narrative.⁴⁵

On May 7, 2010, a letter signed by 255 scientists was published in the journal *Science* (Gleick et al. 2010).⁴⁶ The letter expresses concern about “recent escalation of political assaults on scientists in general, and on climate scientists in particular.” The letter begins by stating “science never absolutely proves anything.” But it then dogmatically proceeds to make the case that the signatories’ understanding of climate science is the only correct view (so called “facts”

⁴⁴ Hearing witnesses included: Dr. Lisa Graumlich, Director, School of Natural Resources and the Environment, University of Arizona, and member of the “Oxburgh Inquiry” panel; Dr. Chris Field, Director, Department of Global Ecology, Carnegie Institution of Washington, and co-chair of “Impacts, Adaptation and Vulnerability” portion of new IPCC report due in 2014; Dr. James McCarthy, Professor of Biological Oceanography, Harvard University, past President and Chair of the American Association for the Advancement of Science, co-chair of “Impacts, Adaptation and Vulnerability” portion of IPCC report published in 2001; Dr. James Hurrell, Senior Scientist, National Center for Atmospheric Research, contributor to IPCC reports; and Lord Christopher Monckton, Chief Policy Adviser, Science and Public Policy Institute. Testimony statements and a full video of the hearing can be found at: http://globalwarming.house.gov/pubs?id=0018#main_content

⁴⁵ Indeed, during the hearing, Congressman Jay Inslee (D-Wash.) spent much of his question and answer time attacking the personal integrity of Lord Monckton, claiming that Monckton was not at all a real member of the House of Lords, that he was misrepresenting himself by using the title “Lord”, and that he had no scientific qualifications to even be testifying. Lord Monckton simply responded politely to these accusations, and went on with his testimony.

⁴⁶ A copy of the letter published in *Science*, the subsequent editor correction, and a rebuttal, are provided in Appendix I.

of science are presented). The letter argues that “climate change” (with no definition presented) should be universally accepted by all as a “fact” just like “evolution” (again, no definition presented),⁴⁷ that any hard questioning of IPCC methods, findings, and scientists represent “assaults on climate science,” and that enforcement of existing laws to address potential criminal wrong doing represent “McCarthy-like threats.”⁴⁸ The letter is accompanied by a photo of a lone Polar bear on an ice berg (ABC 2010), added by the editor, which turned out to be faked using Photoshop. A rebuttal to the letter in *Science* has been provided by Dr. Gerhard Kramm, University of Alaska, Fairbanks (Morano 2010).

A second hearing held on May 20, 2010, by the House Select Committee on Energy Independence and Global Warming, chaired by Rep. Edward J. Markey (D-Mass.), was to focus on climate science in the political arena.⁴⁹ This hearing itself was political by nature, with Rep. Markey focusing discussion on alleged “attacks” against climate scientists as claimed in letter published in *Science*, and giving exposure to results of a \$6 Million dollar NOAA-funded study by the National Research Council (2010a,b,c) which advocates global warming.⁵⁰ Dr. William Happer, Cyrus Fogg Bracket Professor of Physics, Princeton University, testified that climate

⁴⁷ A precise definition of “climate change” is needed that distinguishes it from simultaneous natural weather variability over time and space. Otherwise, the term “climate change” versus such weather changes makes a distinction without a difference.

⁴⁸ This is an example of a logical fallacy know as a “Red Herring” – introducing an irrelevant or secondary subject and thereby diverting attention from the main subject; usually the red herring is an issue about which people have strong opinions, so that no one notices how their attention is being diverted. Everyone has strong negative feelings about being wrongly accused, but the idea that McCarthy-like threats are occurring is to divert attention from the real issue. In reality, what is being questioned is the scientific basis of the presuppositions that undergird the IPCC assessments and the claims of some climate scientists.

⁴⁹ Hearing witnesses included: Dr. Ralph Cicerone, President of the National Academy of Sciences and Chair of the National Research Council; Dr. Mario Molina, Nobel Laureate in Chemistry and Professor, University of California at San Diego; Dr. Stephen Schneider, Professor, Stanford University; Dr. Ben Santer, Research Scientist, Lawrence Livermore National Laboratory; and Dr. William Happer, Professor, Princeton University. Testimony statements of the hearing can be found at: http://globalwarming.house.gov/pubs?id=0019#main_content

⁵⁰ The study and preparation of the three NRC reports was funded by NOAA and written by climate activists. When the reports were released, the NRC openly adopted a political advocacy position in supporting legislation to address climate change (Washington Times 2010). Hence, these reports do not represent an unbiased, impartial, and objective view of climate science.

change scientists have tried to eliminate any who dare question the science establishment climate scientists. The hearing failed to address or even begin to explore the political roles and motivations driving such prejudicial behavior to discredit scientists who disagree with the IPCC narrative (Happer 2010).⁵¹

In a continuing attack on those scientists with views that differ from the IPCC, Anderegg et al (2010) analyzed a dataset of 1,372 climate researchers and their publication and citation data to conclude that (i) 97–98% of the climate researchers most actively publishing in the field support the tenets of anthropogenic climate change outlined by the IPCC, and (ii) the relative climate expertise and scientific prominence of the researchers unconvinced of ACC are substantially below that of the convinced researchers. Publication of this paper was apparently motivated by the desire to create a black list of scientists to be criticized and discredited for their views (Pielke, Jr., 2010). Such reports have no bearing whatsoever on whether or not anthropogenic climate change is actually occurring—that depends on the scientific evidence. As noted earlier, the scientists who support the IPCC narrative that global warming is caused by humans are much more likely to receive research funding and have their papers published. In addition, errors in the Anderegg et al (2010) paper and limitations of their methodology have been noted, discrediting their work (Fuller 2010, Green 2010, Solomon 2010).

C. Alternatives to the IPCC Narrative

An important feature of sound science is the formation and testing of a hypothesis. To be validated a theory or hypothesis must be falsifiable. Grand sweeping generalizations based on presuppositions and interpretation of data and opinion or speculation that are not amenable to

⁵¹ “The climate-change establishment has tried to eliminate any who dare question the science establishment climate scientists and by like-thinking policy-makers – you are either with us or you are a traitor.” (Happer 2010)

falsification (typical of climate models) may be useful thought exercises for generating testable hypothesis, but such generalizations may or may not be valid. A theory that is too vague or general, or makes predictions beyond the ability to test, is often of little value (Davies 1992).

The IPCC places too much confidence in the ability of general circulation models (GCMs) to simulate future climate and attribute observed climate change to anthropogenic emissions of greenhouse gases. As discussed earlier, though impressive, existing climate models are limited in their ability to describe and predict future climate (Pielke, Jr. 2008). For example, news stories continue to appear suggesting a link between hurricane impacts and global warming (Poor 2008). But Pielke, Jr., et al. (2005, 2008) concluded that linkages between global warming and hurricane impacts are premature. An individual storm simply cannot be definitively linked to global warming. Global and regional climate models are not able to predict regional and local climate change and variability (Pielke, Sr. 2008). Climate models cannot be tested by comparing models with other models. Attribution cannot be based on the ability or lack thereof of faulty models to simulate a small portion of the climate record (Lindzen 2010). Models simply do not portray well the underlying basic physics.

It is well-known that CO₂ absorbs space-bound infrared radiation, thereby increasing the energy available at the Earth's surface for warming or increased evaporation. The scientific arguments focus on how powerful the effect is, especially when considered in combination with other factors, various feedback mechanisms both negative and positive, and other influences that might or might not overwhelm the effect of CO₂. Recent research has found that natural cloud variations in the climate system can result in an overestimate of climate sensitivity (meaning that future warming will be weaker than IPCC estimates), and that the role of clouds in causing

climate change has been underestimated (meaning that most warming in the past is likely natural, rather than anthropogenic) (Spencer and Braswell 2010).

Alternative explanations that fit observable data have been put forth to explain the general warming that has been observed over the prior 100 years that do not involve a significant role of CO₂. Such evidence for alternative explanations of climate change has been ignored by the IPCC. Akasofu (2008) has noted that natural components are important and significant, and cannot be ignored. Two natural changes after 1800 have been identified: a linear increase of about +0.5°C/100 years and multi-decadal oscillations superimposed on the linear change. He presents data arguing that

- the Earth is likely to still be recovering from the Little Ice Age (1400-1800).
- there is nothing unusual or abnormal about the present global warming trend and temperature.
- it is insufficient to study climate change on the basis of data from only the last 100 years or so.
- An almost linear global temperature increase of about 0.5°C /100 years (~1°F/100 years) seems to have occurred from about 1800 to the present, or for about 200 years. (IPCC scientists consider the manmade green house effect to be 0.6°C/100 years. This 200-year long linear warming trend is likely to be natural change.

Solar activity significantly affects the global energy balance. Archibald (2007), a solar scientist, has put forward an analysis predicting imminent cooling to 2030. Even if it is

recognized that anthropogenic warming is real,⁵² climate change is dictated by solar cycles, not CO₂ levels. The effect of carbon dioxide on temperature is logarithmic in nature—climate sensitivity decreases with increasing concentration. Solar scientists in general consider the link between the Sun and Earth’s climate incontrovertible, which the IPCC dismisses out of hand. Recently, more solar scientists have been speaking out (Solomon 2010b).⁵³ Other scientists have presented credible evidence that the global cooling currently being observed should be expected, and will have more adverse effects, than the global warming predicted by the IPCC (Easterbrook 2010).

Over 20 climate models are tracked by the IPCC, predicting anywhere from moderate to dramatic levels of warming in response to increasing atmospheric CO₂ levels. Each model represents a different hypothesis of how the climate system works to produce global warming. All of the models assume a positive feedback effect, and a sensitive climate system (Spencer 2010). None adequately represent changes in cloud cover (Lindzen 2010). In addition, models cannot be tested against other models to be validated. Computer models are the only basis for claiming atmospheric CO₂ is causing global warming. To some people climate modeling alone constitutes “proof” that global warming (or climate change) is caused by anthropogenic CO₂. However, models must be tested against actual data, and when such comparisons are made the limitations and failures of existing computer models become very clear (Christy 2009, Pielke, Jr. 2008, Easterbrook 2010).⁵⁴ A simple 1% or 2% change in cloud cover could have caused all of the climate change (or global warming) observed in the 20th Century, and such a small change in

⁵² Roberts (2010) notes that the IPCC has found no specific scientifically measured real-world evidence of any causal relationship between human emissions of carbon dioxide (CO₂) and Earth’s latest modest cyclic warming.

⁵³ In 2008, Victor Manuel Velasco Herrera, Institute of Geophysics, National Autonomous University of Mexico, predicted that in about ten years the Earth will enter a “little ice age” which will last from 60 to 80 years and may be caused by the decrease in solar activity. (Milenio 2008)

⁵⁴ IPCC models predict a 1°F warming from 2000 to 2010. No warming has been observed beyond 1998 therefore, the IPCC models have been proven to be incorrect. (Easterbrook 2010)

cloud cover would not have been possible to measure (Spencer 2010). In addition, the quality of the available surface temperature data is highly suspect (D'Aleo and Watts 2010),⁵⁵ precluding their use in verifying global climate models. Indeed, the role of CO₂ (and GHGs in general) in changing the climate, if at all, is still very much open to scientific debate.⁵⁶

For political expediency the IPCC has narrowly focused all of its energy and resources on advocating one possible hypothesis (CO₂ and GHGs) for explaining observed warming trends (and predicting future climate change) while ignoring or attempting to discredit alternative hypotheses and those scientists who raise them. U.S. government agencies have followed suit, and largely dictate the focus of scientific activity for or against a particular hypothesis. As a result, many professional societies, research centers, universities, and nonprofit organizations, focus their efforts primarily on lobbying government agencies to gain special advantage and funding, often with little regard for the quality or basis of the work to be funded (Carlin 2010).⁵⁷

IV. Legislative Initiatives

In 2009, advocates in U.S. Congress introduced legislation to address global warming, climate change, as well as energy development.⁵⁸ Hearings were held in the House of Representatives, resulting in the passage of H.R. 2454, the American Clean Energy and Security Act of 2009 (also known as the Waxman-Markey bill, Cap-and-Trade bill, or Cap-and-Tax bill). The bill is intended to create clean energy jobs, achieve energy independence, reduce global

⁵⁵ Excerpts of the findings of D'Aleo and Watts (2010) are presented in Appendix J.

http://scienceandpublicpolicy.org/reprint/climategate_analysis.html

⁵⁶ This statement is not intended to imply that all alternative explanations are equally plausible—the most plausible explanation will be determined by additional research. Credible experts may be found advocating alternative views, include the IPCC narrative. Which alternative explanation is true or closest to what is actually happening in the atmosphere globally will have a profound effect on the national policy choices regarding mitigation and adaptation.

⁵⁷ Dr. Lindzen in 2008: “In brief, we have the new paradigm where simulation and programs have replaced theory and observation, where government largely determines the nature of scientific activity, and where the primary role of professional societies is the lobbying of the government for special advantage.” (Carlin 2010)

⁵⁸ Additional information on pending legislation and regulations are provided in Appendix K.

warming pollution, and transition to a clean energy economy. The 1,427-page bill would restrict greenhouse gas emissions from industry, and mainly carbon dioxide from the combustion of coal, oil, and natural gas. The bill is projected to have a very high household cost (Beach et al. 2009), while not significantly lowering global temperatures (Knappenberger 2009). The bill has been referred to the Senate.

The House cap-and-trade bill (H.R. 2454) does not have support in the Senate, and therefore a new Senate bill is in the works. Senators John Kerry (D-Mass.) and Joe Lieberman (I-Conn.) have been conducting climate bill negotiations across the Senate, and have released a draft of their climate bill, known as Kerry-Lieberman Climate Bill.⁵⁹ In their bill, an economy-wide cap-and-trade system has been dropped in favor of a more specific sector-by-sector approach to the bill. The bill would cap greenhouse gas emissions and may offer increased incentives for oil and gas drilling as well as nuclear power. The provisions of this bill are still being negotiated. It is expected to be taken up in the Senate in June 2010.

V. Regulatory Initiatives

Climate change-related regulatory activities are underway by USEPA. Many of these activities will directly and indirectly affect small water systems. The more significant regulatory actions are discussed briefly below:

USEPA's Endangerment Finding Declared That CO₂ and Five Other Greenhouses Gases Are Pollutants— USEPA's endangerment finding exercises the Agency's authority under the Clean Air Act (CAA) to regulate greenhouse gases. USEPA's attempt to regulate CO₂—in addition to being the most expensive and expansive environmental regulation in history—would bypass the legislative process completely. The finding took effect in January 2010. USEPA's

⁵⁹ <http://kerry.senate.gov/imo/media/doc/APAbill3.pdf>

Advance Notice of Proposed Rulemaking in July 2008 details the types of entities that could be regulated under the CAA: schools, farms, restaurants, hospitals, apartment complexes, churches, and anything with a motor—from motor vehicles to lawnmowers, jet skis, and leaf blowers.

The attorneys general from Virginia and Alabama asked a federal appeals court on April 15, 2010 to order USEPA to reopen its finding that greenhouse gas emissions from cars and light trucks endanger public health and welfare. The motion seeks to compel USEPA to hold public hearings on the science it used to back up the endangerment finding.

USEPA Final Standard to Limit Greenhouse Gas Emissions From Vehicles—Under the first nationwide greenhouse gas emissions limits to be adopted by the U.S. government, greenhouse gas emissions from cars and light trucks will be limited to an average of 250 grams per mile of carbon dioxide in 2016. USEPA and the National Highway Traffic Safety Administration released the final rule, which also requires an increase in fuel economy for cars and light trucks. The requirements will add about \$950 to the cost of a vehicle. The standards would be phased in starting in 2012.

USEPA Rule on Economy-Wide Greenhouse Gas Emissions Reporting—The economy-wide greenhouse gas emissions reporting rule was issued in October 2009, and applies to sources that emit more than 25,000 metric tons of carbon dioxide-equivalent greenhouse gases. USEPA estimates the rule will require reporting from about 10,000 facilities, including suppliers of coal-based liquid fuel, petroleum products, natural gas, industrial greenhouse gases, and carbon dioxide, plus facilities that use those resources, such as stationary fuel combustion sites, electricity generators, manure management sites, waste landfills, and multiple manufacturing plants—including lime, iron, steel, lead, cement, and aluminum. These sources

had to begin measuring emissions January 1, 2010, and must file their first reports by March 31, 2011.

USEPA Seeks To Require Emissions Reporting For Three Additional Facilities—

USEPA proposed three rules on March 23, 2010 to require greenhouse gas emissions reporting for the following additional sectors that were not included under the economy-wide rule: Oil and natural gas wells, Carbon sequestration facilities, and Facilities that produce and use fluorinated gases.

EPA Seeks To Require Emissions Reporting For Four Additional Facilities—Under a USEPA draft final rule on April 30, 2010, facilities in four additional industrial sectors would be required to report greenhouse gas emissions that were not included under the economy-wide rule: Wastewater treatment facilities, Industrial landfills, Underground coal mines, and Magnesium production.

USEPA Greenhouse Gas Tailoring Rule—USEPA is working on the greenhouse gas tailoring rule, which would limit greenhouse gas emissions control requirements for new and modified sources to only the largest stationary sources, and would limit permitting requirements under Title V of the Clean Air Act to the largest sources of greenhouse gas emissions. The tailoring rule is intended to prevent thousands of new sources from having to comply with prevention of significant deterioration provisions of the CAA.

Climate Ready Water Utilities (CRWU) Work Group of the National Drinking Water Advisory Council (NDWAC)—USEPA's charge for the Climate Ready Water Utilities (CRWU)⁶⁰ workgroup is to evaluate the concept of "Climate Ready Water Utilities" and provide

⁶⁰ More information on the USEPA National Drinking Water Advisory Committee Climate Ready Water Utilities Working Group can be found at: <http://client-ross.com/crwuwg/>

recommendations on the development of an effective program for drinking water and wastewater utilities, including (1) How to use available information for climate change adaptation and mitigation strategies, (2) Identify climate change-related tools, training, and products that address short-term and long-term needs; and (3) Incorporate ways to provide recognition or incentives that encourage broad adoption of climate change adaptation and mitigation strategies by the water sector using existing USEPA Office of Water recognition and awards programs or new recognition programs. As with other government agencies, the activities of USEPA and the CRWU assume the results of the IPCC 2007 report are credible. No allowance is made for new science or alternative, but equally credible, views of climate change other than the IPCC narrative. The CRWU's primary mission is to advise USEPA on how to develop and increase their regulatory programs.

The third meeting of the CRWU working group was held May 5 - 6, 2010, and will include a presentation on the Northeastern Illinois Water Supply/Demand Plan by the Chicago Metropolitan Agency for Planning and a presentation on the International Water Association's Cities of the Future Initiative.

The second meeting of the working group held February 3 - 4, 2010, focused on defining the concept of a climate ready utility and how to create an environment to help utilities become climate ready. At the February meeting, the managing director of a large public Australian water utility presented information on the Australian government's approach to responding to climate change, which has involved their federal government now exerting substantially more control over water resources. Related to the type and extent of the climate adaptation Australia has undertaken, Australia has recently seen the biggest increase in water bills in its history, with bills nearly double what they were a decade or so ago. In an effort to curb the impact to low income

communities, the government has provided support to the water sector for programs in this area. The speaker cited an example (indirect potable water use in communities) where strong community opposition existed, but the government used executive powers (rather than a public vote or consensus building) to implement the program, believing there was no viable alternative available. (Experience with the program and the absence of the feared health consequences has, over time, turned community opposition to support, as the benefits of the program have become apparent.)

Additional water-sector restructuring measures dictated by the Australian federal government included the following:

- Restructuring the relationship between small and larger systems – the government required small systems (struggling under the pressure created by severe and prolonged drought conditions) to merge with larger systems, while the government paid for the value of the small system assets.
- Requiring an alteration of agricultural water use – approximately 80 percent of water in Australia is used for agricultural purposes generating a focus on the part of government to shift agricultural and irrigation practices including altering the types of crops produced (e.g., moving from monsoon crops such as cotton and rice to those more conducive to growing in arid climates).
- Establishing a national water trading and marketing program – this effort created “high” and “low” security water. (High security water comes with a strong guarantee of availability, while low security water is subject to cyclical availability). High security water is sold at ten times the cost of low security water.

USEPA’s Office of Research and Development and the Center for Disease Control (CDC) gave a co-presentation on public health impacts of climate change impacts within the water sector.⁶¹ By the end of this spring, USEPA will have a new five-year plan for their research program. Working group members noted that the presentation emphasized all the

⁶¹ Assessments by the USEPA Office of Research and Development and CDC present the U.S. government “party line” with regard to climate change and global warming. The validity of the IPCC 2007 reports is assumed, with little or no room allowed for alternative hypotheses or the advancement of science. Public health impacts presented are for the most part speculative, and primarily serve to promote the need for additional government funding.

important factors the water utility sector needs to focus on and to set a catalyst for why the sector needs to deal with climate change.

Discussion topics of CRWU group members also included:

- The biggest underlying capacity issue for implementing climate change options is financial. One option considered: in the same way sustainable communities currently receive higher bond ratings, USEPA could establish a rating system for climate responsive utilities that would result in cheaper money for those utilities falling higher on the rating scale. Another approach is for the federal government to stop rewarding “bad” behavior, and instead use those funds to support utilities undertaking actions to prepare for climate change.
- A key is education at all levels, from school children to training future utility leaders at the university level.
- The overarching importance of strengthening partnerships between water utilities and interdependent entities, and of creating an overall culture of acceptance in the community.
- At the highest level, the regulatory ideal would be to align all the existing water regulations into a new bill that also incorporates climate change.

VI. Impacts and Adaptation

Several governmental agencies and non-governmental organizations have conducted studies, developed web sites, and held workshops to assess the impact of climate change on water systems:

USDA Forest Service Climate Resource Center

<http://www.fs.fed.us/ccrc/topics/water.shtml>

The Climate Change Clearinghouse

www.theclimatechangeclearinghouse.org/

Climate Change and Water Research, National Center for Atmospheric Research

http://www.isse.ucar.edu/water_climate/index.html

Water Utility Climate Alliance

http://www.wucaonline.org/html/about_us.html

USEPA's First National Expert and Stakeholder Workshop on Water Infrastructure Sustainability and Adaptation to Climate Change, held on January 6-7, 2009, in Arlington, Virginia.

<http://www.epa.gov/nrmrl/wswrd/wqm/wrap/workshop.html>

Association of Metropolitan Water Agencies Climate Change

<http://www.amwa.net/cs/climatechange>

The information and recommendations presented in the web sites and documents referenced above are focus on a national perspective. The practical needs of small and rural water systems are not specifically addressed.

Practically, planning for climate change is no different than typical water resources, emergency, and strategic planning. At a local level, identify reasonable future scenarios of expected climate change, and systematically consider the potential effects on resources, treatment, operation, distribution, management, customer service, and regulatory compliance.

A. Recommendations for Small Systems

- 1. Small water systems should assess their infrastructure and strategically plan to provide potable to their customers under reasonably expected long-term weather changes and extremes. In most respects, planning for climate change is no different than conventional water resources, emergency, and strategic planning.** Climate and climate change are statistical probabilities; Weather is a physical reality. At the local water utility level, climate change is abstract statistical theory; we experience weather and weather changes, we do not experience statistics nor statistical changes. Weather changes form and magnitude day-to-day, month-to-month, season-to-season, over both space and time.
- 2. Small water systems must consider that because of natural variability, the weather (and climate) experienced in a particular area (especially rural areas) may or may not follow general global, country-wide, or regional trends.** Therefore, small water systems should be prepared to adapt to extended periods of both warming and cooling. For example, catastrophic flooding (e.g., occurred in Nashville, TN) may occur anytime as a result of natural weather variability without regard to any warming or cooling or atmospheric CO₂.
- 3. Existing IPCC computer models are limited and do not produce sufficiently reliable results for strategic planning or assessing climate change impacts at any geographical scale (e.g., local utility, regional, national, global).** Indeed, the results of such models to predict future temperatures, rainfall, or other measures of weather may

have no relationship whatsoever to the weather actually experienced by a small and rural water system over space (geographical location) and time (daily, weekly, monthly, yearly). Small and rural water systems should develop reasonable local planning scenarios based on their own historical experiences, with assistance from trustworthy experts to develop future scenarios. Future scenarios should consider reasonable changes in temperature (warming/cooling); changes in precipitation (flooding/drought); changes in prevailing winds; changes in vegetation (less/more); changes in sea, lake, or reservoir levels (rising/falling); changes in intensity (stronger/weaker); changing ground water tables (lowering/increasing) and others as appropriate for the area.

- 4. Temperature changes are greater in urban areas due to the Urban Heat Island Effect (UHIE). The UHIE does not appear to effect atmospheric temperatures in rural areas.** Therefore, Earth-based weather station measurements in urban areas are not applicable to rural areas. Small and rural water systems should identify the closest National Weather Service monitoring station to their location. If that weather station does not adequately represent the area where the small system is located, then the small system (or group of systems in a local area) should consider establishing their own weather station, giving careful consideration to the weather parameters measured and the station location so as not to bias the measurements. Such data may not be useful for several decades, but is necessary if forecasting models (once improved) are to be useful in the future.
- 5. A general global cooling trend has been observed since about 1998, and is projected by some solar scientists to extend for the next several decades.** Since the affects of global cooling have a greater public health impact than warming, small water systems should pay particular attention to and plan for the affects of extended colder weather periods.
- 6. Climate change science is by no means settled, including the role of CO₂. Indeed, carbon footprints will likely have no relevance to future weather variability experienced by small and rural water systems.** Given the conflicts of interest and political nature of the IPCC, the NRC, the NAS, the USEPA, and the CRWU work group, these and other agencies will likely continue to assume the IPCC narrative to be true, and resist fair consideration of alternative hypotheses and contrary data. However, as has been demonstrated time and again over many centuries, the best science will in the end ultimately emerge and prevail. Regardless of the position of the IPCC, NRC, NAS, USEPA, CRWU work group and other organizations, small and rural water systems must keep abreast of the latest developments in the underlying climate change science, and make decisions based on the best available science, eliminating information that is solely political, promotional, or propaganda in nature. Recommendations for assessing climate science are presented below.
- 7. Small and rural water system organizations (NRWA) should consider developing a web site focused on digesting the technical information available on climate change into an unbiased form that is useful to small and rural water systems.** Practical scientific and technical information on climate change useful to small and rural water

systems is very limited at this time. Most web sites are focused on national policy, promoting IPCC-style modeling, promoting control of carbon footprints, promoting the biases and agenda of the particular government agency, disseminating information with a particular point of view, or attempting to seek favor or funding from government agencies.

8. **Any federal legislation and/or regulations to control GHG emissions using a cap-and-trade system, carbon tax, or other means that raise the cost of energy will adversely affect small and rural water systems by forcing increases in water rates with little or no measurable benefit.** Assessments of legislation pending and being considered in Congress indicate that little benefit will be achieved if implemented, but individual households and small and rural water systems will face real cost increases.

B. Recommendations for Assessing Climate Science

The following recommendations to small and rural water systems are made regarding assessing climate science for strategic planning and adaptation:

1. *Find Trustworthy Experts.*

Over 30 years ago the late physicist Richard Feynman (1989), a recognized leader of modern science, identified the qualities of a trustworthy expert that apply to areas of scientific inquiry, including climate science. He exhorted a 1974 California Institute of Technology graduating class to cultivate

“a kind of scientific inquiry, a principle of scientific thought that corresponds to the kind of utter honesty—a kind of leaning over backwards. For example, if you’re doing an experiment, you should report everything that you think might make it invalid—not only what you think is right about it; other causes that could possibly explain your results; and things you thought of that you’ve eliminated by some other experiment, and how they worked—to make sure the other fellow can tell they have been eliminated...In summary, the idea is to try to give all the information to help others to judge the value of your contribution; not just the information that leads to judgment in one particular direction or another.

The first principle is that you must not fool yourself—and you are the easiest person to fool. So you have to be very careful about that. After you’ve not fooled yourself, it’s easy not to fool other scientists. You just have to be honest in a conventional way after that.”

Feynman went on to add something not essential to science, but nevertheless important to scientists making statements in the public square, which is

“you should not fool the layman when you’re talking as a scientist. I’m talking about a specific extra type of integrity that is [more than] not lying, but bending over backward to show how you may be wrong, that you ought to have when acting as a scientist. And this is our responsibility as scientists, certainly to other scientists, and I think to laymen.”

Given the potentially high human impact and cost, scientists (as well as politicians, legislators, and regulators) must not fool themselves, but exhibit a “type of integrity that is more than not lying.” Decision-makers must rely only on those scientists who bend over backward to act with integrity on climate change and global warming assessments.

2. Take into account direct and indirect conflicts of interest, including those of government agencies, government funded research centers, scientific academies, and professional organizations.

Government agencies and research centers funded by the government have a direct, vested interest in continued research funding, and expansion of government regulation of GHGs. The existence or expansion of many government programs and research centers depend on it. In addition, many companies, including some energy utilities, are rebuilding their business models on the presumption that the U.S. Congress or USEPA will in fact enact strict legislation and/or regulations to address global warming, impose a cap or tax on carbon emissions, or implement a cap and trade program. Such companies have a vested interest (e.g., making money, gaining power, etc.) in the business of global warming. Obvious biases must be taken into consideration when evaluating statements and claims.

3. When the term “climate change” or “global warming” is used in a report, in a regulation, or in testimony, insist on clear definitions. Give careful attention to fairly evaluating scientific methods and findings.

Terms must be precisely defined. Global warming is not equivalent to climate change. Significant, societally important climate change can occur without any global warming or cooling. Climate change is usually defined as “average weather.” But average weather (and therefore climate change) is only a statistical relationship, not an actual physical phenomenon—in reality, climate (our statistics) and weather (our experience) are always changing.

Mathematical computations must be done with integrity. Rigorous statistical analyses are typically required to make proper sense of research data and trends. If not performed correctly, erroneous conclusions can result. For example, the famous “hockey stick graph” was widely cited as proof of dramatic atmospheric temperature increases associated with the increased use of fossil fuels. Subsequent analysis and an independent review concluded that the hockey stick shape resulted from an incorrect statistical analysis (McIntyre and McKittrick 2005, Wegman 2006). When errors in the analysis were eliminated, the hockey stick disappeared.

Recognize “doublespeak”—language that pretends to communicate but does not. As an example, the phrase “climate change” has grown in preferred use to “global warming,” primarily because it helps to convey that changes occur in addition to rising temperature. But in contemporary usage to deflect criticism, some researchers substitute “climate change” for “global warming” even though global warming is clearly presumed.

4. Allow room for “new” scientific findings, even if contrary to prior “facts,” especially when computer models are involved. Modify hypotheses and models based on new studies, properly peer-reviewed.

Early predictions by scientists at the Massachusetts Institute of Technology were previously touted as showing the certainty of a link between global warming and stronger hurricanes. The same researchers using a new forecasting technique recently report different

model results. Emanuel et al. (2008) now predict a reduction in the number of hurricanes around the world over the next two centuries, with increases in intensity in some regions.

5. *Avoid drawing conclusions based on extending science beyond what is known or can be reliably tested.*

Regardless of the Decision Support Planning Method applied,⁶² decisions regarding mitigation and/or adaptation to climate change (e.g., global warming) based on incomplete, incorrect, or speculative information may result in disastrous consequences.

Decision makers are often in the position of having to act in the face of incomplete information. In the case of climate change and presumed long-term global warming, the consequences of a poor decision now will be high (either in terms of unnecessarily high costs, or avoidable loss of life and property, or both). Clearly, a better understanding of climate science is needed to ensure that laws and regulations enacted to mitigate and/or adapt to climate change impacts do not proceed down a path resulting in more harm than good. At present, at a national level, the best strategy would be to do nothing until a better understanding of climate science is achieved.⁶³ However, small and rural water systems should proceed now at the local level with appropriate water resources and emergency planning based on reasonable climate change scenarios.

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⁶² Decision Support Planning Methods include Classical Decision Analysis, Scenario Planning, Robust Decision Making, Real Options, and Portfolio Planning. Small and rural water systems typically apply simplified versions of these techniques.

⁶³ Some have argued that because we do not know what will happen in the future, and some climate models predict catastrophic warming based on atmospheric CO₂ increases, we should proceed now with national legislation and strict regulations to control CO₂ and global warming. This is a form of the logical fallacy known as *ad ignorantum*—arguing that something is true or desirable because of ignorance. In other words, “we don’t know” so “we better act.” This is faulty reasoning, because acting out of ignorance may also result in catastrophic consequences due to unanticipated risks and unforeseen circumstances.

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