**FINAL – submitted June 8, 2015 via the USGCRP Review and Comment System
*AMWA Comments on the draft USGCRP Report, “*The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment” available at** [***http://www.globalchange.gov/health-assessment***](http://www.globalchange.gov/health-assessment)

Note: Comments were required to be submitted in a comment response system that requires categorization, i.e.: Whole document, whole chapter, *whole page, text region, figure. AMWA’s comments are therefore organized in this way.*

Whole Document Comments:

* Under non-climate stressors-is listed “ecosystem degradation” which the report points out may be positive or negative. Therefore suggest changing “ecosystem degradation” to “ecosystem change” throughout the document.
* The document should represent an unbiased assessment of the relationship between climate and health, in such as way so as not to overstate the risk that is described in the reports and underlying data. For example,

ES -Page 2-line 1-“Climate change is a significant threat to the health of the American people…” This is stated in a way that better represents the uncertainty described throughout the report in section 1.4.2 (Page 23-line 1): “Climate change threatens human health and well-being in the U.S.” This report does not define what is meant by “significant” and whether that is attributable to climate change, or just your everyday climate events.

* Each chapter has a paragraph on “traceable accounts”. This term should be explained further throughout the document.
* Overall, while the report covers a broad range of relationships, the only relationships that can be drawn with more than a medium confidence between climate change and public health appears to be increases in risk due to: thermal stress, elevated ozone, and impacts of flooding, extreme weather and other physical stressors-that occur both naturally and randomly, but which may be exacerbated by climate change. Suggest that the report indicate this upfront, in plain language.
* (Also Chapter 2) The report lacks important information to help the reader assess the strength or weaknesses in the qualitative assessment of the uncertainty and likelihood of each of the key findings. Additionally, some of the assessments seem at odds or seemingly contradict the discussion in the text. For example, Key Finding 1, on Page 51 notes that the potential for additional deaths due to heat in summer is “very likely, high confidence”; while the deaths from cold ranked as “very likely, medium confidence”, yet the deaths projected to be smaller due to cold than heat listed as “likely, medium confidence”. Why is this the case? Some of the rationale is explained in the text, but since the net increase is attributable to one study-the rationale for this quantification is unclear.
* The report notes that likelihood is supposed to range from “unlikely to very likely”. However, on page 123, line 15, the term “extremely likely” is used, calling into question how closely aligned the estimates of likelihood are to the scaling process.
* We suggest that the information that ties infrastructure failure as a result of extreme events and the increase in public health risk be tied primarily to chapter 7, with a reference made to it in Chapter 5. Specifically, in chapter 5 Key finding 3 about aging infrastructure and extreme events should instead be listed in chapter 7. And another finding noted in Chapter 5 should instead be elevated as a key finding, i.e.: “If drinking water is appropriately treated, climate change is not expected to increase the risk of contracting a water-related illness.” This fact is important to point out in the discussion of the Walkerton outbreak because although the rainfall may have been a catalyst (and it’s not clear from the text that the rainfall event would be classified as “extreme”), the other factors included an improperly chlorinated/treated system and criminal neglect as well as the factors listed in the chapter. As noted in the report by CBC news about the judicial inquiry into Walkerton, which has links to the inquiry report (http://www.cbc.ca/news2/background/walkerton/walkerton\_report.html.) , “The most serious case of water contamination in Canadian history could have been prevented by proper chlorination of drinking water,”
* The multiple barrier approach was simply not employed in the case of Walkerton. As a result of this outbreak as well as the one Milwaukee, several improvements have been made in the SDWA in the U.S. that strengthen the multiple barrier protections that are implied by the statement “if drinking water is appropriately treated.”
* With regard to the infrastructure failure that we recommend be addressed solely in chapter 7, not 5 (with a reference that the reader consult chapter 7), the likely issue with infrastructure failure is that water treatment systems are shut down (and this has different implications to the population depending on if the drinking water or wastewater utility is shut down.)
* The danger for the population for a cessation in drinking water treatment is the lack of water – and finding sources or drinking water, and potentially more so than the risk of waterborne disease from drinking contaminated water from a public water system. While a report by the Water Research Foundation following Hurricane Irene (http://www.waterrf.org/resources/Lists/PublicSpecialReports/Attachments/6/Hurricane\_Irene\_Survey\_Report.pdf) does indicate that a few systems did experience contamination of the distribution system, this number is lower than those who experienced source water contamination and an order of magnitude lower than those who experienced a loss of power. Again, the potential for the treatment plant to be shut down and implications for the availability of water for drinking appears to be the greater risk.

ES Comments

* Whole chapter: The ES would be improved if there was a clear up front summary statement that delineates between:
	1. Where the report makes clear statements and can quantify the potential direction, likelihood and certainty of a relationship between climate change and public health, and
	2. Where there is uncertainty about direction, likelihood, and certainty of a relationship.
* Whole chapter: It appears that the only relationships that can be discussed with any certainty are the relationships between temperature and morbidity/mortality, and temperature and ozone, and physical threats (flooding, drought), yet some of the ways this is quantified gets muddied between chapters.
* Whole chapter: Under non-climate stressors-is listed “ecosystem degradation” which the report points out may be positive or negative. Therefore suggest changing “ecosystem degradation” to “ecosystem change”.
* Page 5-lines 15-21. Key Finding 1 states that future climate change could lead to thousands to tens of thousands of deaths each year. This is properly nuanced in the ES in stating that the number is due to deaths due to extreme heat and recognizes that there are also projected to be a decrease in deaths from the cold in the winter-though with less confidence than the projections for heat related death. This statement is in contrast to the results presented on page 61 lines 14-18, which are from one study that projects a net increase of 2000-10000 deaths.
* Figure ES1 page 4- should the items listed as "drivers" be called “impacts” instead? Also, this figure makes no mention of ocean and lake water acidification-an outcome/impact of increasing CO2 levels. This impact should be addressed in the document if there are references that tie ocean acidification to public health impacts.
* It is unclear why some items are quantified with both a “confidence” level and a “likelihood” and others are not. This should be explained.
* Page 9: According to Chapter 1, which describes the approach for quantifying uncertainty, likelihood is supposed to range from “very unlikely to very likely”. However, on page 9 the phrase “extremely likely” is used.
* While the approach used to quantify uncertainty in the report is discussed briefly on pages 37-38, the methodology should be briefly discussed in the Exec. Summary to clarify that the descriptors represent the consensus “expert judgment”.

**Chapter 1**- **Climate Change and Human health**

* **Page 31 and Table**  p. 31. Lines 8-10. The text suggests that Table 1 shows health conditions that are associated with increased risk from climate change related exposures. For this table, the statement could be interpreted to mean that such health conditions as Alzheimer’s disease increase from climate change exposures. This table and the associated table caption should be edited to indicate that it is a table of health conditions and those populations with these conditions are at increased vulnerability to adverse effects associated with climate change.
* **Pages 37-38**. The uncertainty and likelihood estimates for each key finding are based on expert judgment of the lead authors for the chapters. That should also be clearly stated in the ES along with (in appendix) some information on the judges and their expertise. While the approach used to quantify uncertainty in the report is discussed briefly on pages 37-38, the methodology should be briefly discussed in the Exec. Summary to clarify this for the reader.

**Chapter 4 – Vector borne Diseases**

* Page 123: According to Chapter 1, which describes the approach for quantifying uncertainty, likelihood is supposed to range from “very unlikely to very likely”.

However, on page 123, line 15, the term “extremely likely” is used.

**Chapter 5 - Water borne illness risk**

* Whole chapter - The Chapter title in Table of Contents is Water-Related Illness (and in the header for Chapter 5); however the subheading is about “waterborne illness”. And some of the discussion, arguably, is about really about food borne illness from ingesting aquatic organisms (e.g. Ciguaterra). And key finding 3 is about water infrastructure failure. This mixture of topics, issues, and nomenclature, makes it difficult to follow the relationship between climate and public health since these are distinct concerns. Given the disparate topics covered in this Chapter, suggest using the term water-related illness throughout as a more apt description.
* Whole chapter - The water infrastructure and public health section also covers a range of potential sources and exposure pathways including water, wastewater, and stormwater concerns. We strongly recommend that the authors rewrite chapter 5 so as to separate the public health impacts due to contact with recreational water, stormwater runoff or standing water from those impacts that are due to the exposure to contaminated drinking water.
* Whole chapter - Overall-the Chapter would be improved by: Moving the discussion of extreme events and impacts on water infrastructure to Chapter 7. In addition, the secondary affects of climate change on infrastructure failure should also be discussed in chapter 7, extreme events. In addition, this discussion should make a distinction between the secondary effects to drinking water, wastewater or storm water infrastructure because the impacts to the public health risk will differ.
* Whole chapter - The Chapter should also clearly distinguish and provide an assessment of the certainty and likelihood of climate change impacts on public health due to the following: direct exposure to pathogens in drinking water; direct exposures from pathogens due to direct contact with surface water for recreational purposes, and due to ingestion of freshwater/marine aquatic organisms (e.g. Ciguaterra, brevotoxins, etc.).
* Whole chapter: We recommend that this chapter separate the discussion of drinking water served by PWS with private, untreated groundwater wells. In addition, we recommend that the authors describe in more detail the relationship between climate change and ground water quality.
* P. 163, Line 9 Key finding 2, Recommend separating drinking water from recreational water issues, as these are distinct concerns that are sometimes confused by the study authors.
* Key finding 2—According to the text, 90% of the U.S. is served by a public water system (which has to meet all SDWA quality and disinfection requirements), and as noted on p. 169 lines 23-25-“ if drinking water is appropriately treated, climate change is not expected to increase the risk of contracting a water-related illness”. That should be called out as a key finding and brought up front to the ES. Specifically, we recommend that this statement become Key finding 3 and the current Key finding about infrastructure be moved to Chapter 7 on Extreme events.
* Page 164-Table 1. This table includes a number of pathogens where the waterborne exposure route is listed as “Drinking Water (esp. untreated)”. As the authors point out on page 169, if drinking water is appropriately treated, climate change is not expected to substantially increase the risk of contracting a water-related illness. Suggest that these sections of Table 1 be modified so that the exposure route is listed as “untreated drinking and surface waters” rather than Drinking Water (esp. untreated). The text should also recognize the efforts of the water sector under the SDWA and CWA to build additional barriers and treatment systems and to build more resilient water and wastewater systems to reduce these exposure pathway risks.
* Section 5.4.1 P. 168 The text notes, “Drinking water can be both treated and untreated”. We recommend that the next sentence clarify that public drinking water systems provide TREATED potable water to 90% of Americans. In addition, this section should point out up front that PWS will respond to climate change induced threats to water quality (such as increased turbidity due to storms) by treating the water to comply with the SDWA, even at greater cost. This is not clear, as the text often mixes the two kinds of systems (i.e., PWS and untreated, private ground water wells).
* P. 183, line 22 -184: Key Finding 3 suggests that damage to or a breakdown in water infrastructure “could contribute to increased risk of exposure to water related pathogens, chemicals and algal toxins. This finding should be edited to clarify that the concern here is not with treated drinking water, but with direct contact with flood waters that are contaminated, and potentially, the lack of access to treated water (say if the roads, power, and other utilities are cut off. The other concern would be lack of water, because the water utility is not capable of delivering treated water due to infrastructure failure. Some of the examples cited are process system issues and failure to provide an extra disinfection barrier to address protozoan risks (a problem since corrected under the LT2ESWTR and the GWR, respectively. All public water supplies meet all SDWA requirements for quality and disinfection even after infrastructure is damaged (per item above). If the plant is damaged or vulnerable the risk is instead that the water plant will shut down for a period of time, as occurred following several hurricanes and flooding events, and it will be the lack of potable drinking water (and public fire protection) or more costly water that will be the stressor associated with infrastructure damage. This key finding should be clarified and moved to Chapter 7.
* P. 183, line 22 -184– Key Finding 3 - The text also discusses that breakdowns in water treatment systems, compounded by aging infrastructure, could lead to more serious consequences that we experience now. That statement is true, whether or not there is climate change. For a PWS, the most serious consequence of infrastructure failure is not so much a breakdown of the system, but the lack of treated drinking water, when the water treatment plant has to shut down because it cannot deliver potable water of sufficiently high quality. Given significant treatment or source water issues attributable to excessive flooding (turbidity) or an inability to meet SDWA requirements, the risk to people and vulnerable populations is that the water system will have to shut down the treatment plant altogether and people will have to find an alternative supply and at higher cost and as a result of this reduced reliability will also lose public fire protection. – This occurred in several locations during Hurricanes Irene and Lee.
* 183 lines 10-20: “The assessment of confidence and likelihood based on evidence” should be modified to distinguish drinking water from recreational waters. It is probably correct to state that the confidence is high that increasing frequency or intensity of extreme precipitation will compromise recreational waters and drinking water sources with pathogens, etc. However, as noted on page 169, if drinking water is appropriately treated, climate change is not expected to increase the risk of a water related illness. And generally, it should be noted that if not appropriately treated, the utility will have to notify the public, and shut down or issue a boil water advisory to ensure public health protection. Given this information and the limited number of studies noted, we recommend that the authors reassess the level of certainty or confidence in climate change affecting human exposure risk to water related illness from treated, potable water than suggested by the text on this page.
* p. 183 line 21 184- 31. The discussion is about additional risks due to aging infrastructure and including combined sewers, which were not designed to handle extreme precipitation events. And while the point about CSOs is technically correct, the document should reference the billions of dollars that the large Cities are currently investing to make structures more resilient and to plan for and mitigate extreme weather impacts on CSOs.
* Page 168 line 28 – 169 line 31. The multiple barrier approach was simply not employed in the case of Walkerton. As a result of this outbreak as well as the one in Milwaukee, several improvements have been made in the SDWA in the U.S. that strengthen the multiple barrier protections that are implied by the statement “if drinking water is appropriately treated.”

**Chapter 7 – Impacts of Extreme Events on Human Health**

* Page 258 line 9 through 17 - The Milwaukee incident was triggered by an extreme precipitation event, and as such it may make sense to include it as an example of a cascading event. However, the authors should be careful not to attribute this specific event to climate change per se, unless there has been research that has put this event in the context of a changing climate. Rather than tie this event to climate change, this incident points out the need to perform the following activities to protect source waters and the water system as a whole from infrastructure failure:
	+ carefully look at water utility operational practices,
	+ conduct vulnerability assessments,
	+ process system safety assessments, and
	+ engage in watershed management activities.
* Page 258 line 9 through 17 -The Milwaukee incident was triggered by an extreme precipitation event, and as such it may or may not make sense to include it as an example of a cascading event per our previous comment. However, as a result of the Milwaukee Cryptosporidium outbreak, EPA mandated additional barriers and procedures to protect against Cryptosporidium and therefore, many of the citations related to the Milwaukee incident are out of date. These improvements in the SDWA multiple barrier approach should be noted.
* Page 258 line 9 through 17 - The Hoxie et al (1997) reference should be updated with the more recent reference from Davis et al. (2009), which looked at death certificate data and revised the number of deaths attributable to the outbreak down to 69. Specifically, p. 113 of Davis et al notes, *“Based mainly on review of death certificate data, we attributed 69 deaths to this outbreak; most of these were premature deaths among people with AIDS/HIV infection (Hoxie et al., 1997).”* The citation is: Davis, JP, MacKenzie WR, & Addiss DG (2009). “Lessons from the massive waterborne outbreak of Cryptosporidium infections, Milwaukee, 1993”. In: Global Issues in Water, Sanitation, and Health: Washington DC: National Academies Press, pp. 108-126. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK28462/pdf/TOC.pdf>. [14 January 2014].
* Text region: Page 261, line 4 - 264 line 3. Section 7.6. The section on drought (7.6) should be organized to include subsections that call out the health implications related to the different aspects of drought. For example, health impacts associated with less access to water, with vector borne disease and air quality concerns. In addition this section does not address affects of drought on sensitive subpopulations. Are there data to suggest that there are impacts to people who are unable to cool off in drought, for example, or is this tied to the extreme heat discussion?