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March 24, 2017

MEMORANDUM TO: David Wrona, Deputy Director (Acting)
Division of License Renewal
Office of Nuclear Reactor Regulation

FROM: Nancy Martinez, Physical Scientist /***RA***/
Environmental Review and Project
Management Branch
Division of License Renewal
Office of Nuclear Reactor Regulation

SUBJECT: NEW CLIMATE CHANGE INFORMATION FOR SOUTH TEXAS PROJECT, UNITS 1 AND 2 – LICENSE RENEWAL APPLICATION

The U.S. Nuclear Regulatory Commission (NRC) staff evaluated new climate change information pertaining to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding South Texas Project, Units 1 and 2 (NUREG 1437, Supplement 48), Final Report." NUREG-1437, Supplement 48 was published in November 2013. The enclosed climate change analysis documents the NRC staff's review and evaluation of new climate change information from the Third National Climate Assessment (NCA) report released in 2014. Based on the NRC staff's review of new climate change information, a supplement to NUREG-1437, Supplement 48 is not needed because the information does not present a seriously different picture of the environmental impacts of the proposed action (license renewal) as compared to the impacts discussed in NUREG-1437, Supplement 48.

Docket Nos. 50-498 and 50-499

Enclosure:
New Climate Change Information
Pertaining to NUREG-1437, Supplement 48

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Memorandum to D. Wrona from Nancy Martinez dated March 24, 2017

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NEW CLIMATE CHANGE INFORMATION PERTAINING TO NUREG-1437, SUPPLEMENT 48

Introduction

On May 6, 2014, the U.S. Global Change Research Program (USGCRP) released the Third National Climate Assessment (NCA) report. The USGCRP integrates and presents the prevailing consensus of Federal research on U.S. climate change, as sponsored by thirteen Federal agencies. The NRC uses consensus information from the USGCRP to evaluate the effects of climate change in its environmental impact statements (EISs) for license renewal of nuclear power plants. NRC regulations specify conditions when a supplement to a Final Environmental Impact Statement (FEIS) should be prepared. NRC regulation at 10 CFR 51.92(a) specifies that if the proposed action has not been taken, the FEIS will be supplemented if:

(1) There are substantial changes in the proposed action that are relevant to environmental concerns; or

(2) There are new and significant circumstances or information relevant to environmental concerns and bearing on the proposed actions or its impacts.

NUREG-1437, Supplement 48, Final Supplemental Environmental Impact Statement for license renewal of South Texas Project, Units 1 and 2 (STP FSEIS) was published in November 2013 (NRC 2013). Section 4.12 of the STP FSEIS considers the potential cumulative impacts from climate change on environmental resources that could be impacted by the proposed action (license renewal). Because the 2014 USGCRP report (USGCRP 2014) presents new climate change information relevant to the environmental impacts of the proposed action and was released after publication of the STP FSEIS, the staff analyzed whether this 2014 report presents new and significant information such that a supplement to the STP FSEIS is required under 10 CFR 51.92(a)(2). To merit a supplement, information must be both new and significant and it must bear on the proposed action or its impacts. The Commission has stated that "[t]he new information must present 'a seriously different picture of the environmental impact of the proposed project from what was previously envisioned.'"[1]

The analysis below: a) briefly summarizes the new information in the USGCRP 2014 report; b) evaluates the new information for its significance, and c) determines whether a supplement to the STP FSEIS is needed and should be performed in accordance with 10 CFR 51.92(a).

New Information: Climate Change

The USGCRP reports that from 1895 to 2012, average surface temperature in the United States has increased by 1.3 to 1.9 °F (0.72 to 1.06 °C) and since 1900, average annual precipitation has increased by 5 percent (USGCRP 2014). On a seasonal basis, warming has been the greatest in winter and spring. Since the 1980s, a longer freeze-free season, the period between the last occurrence of 32 °F (0 °C) in the spring and first occurrence of 32 °F (0 °C) in the fall, has been observed for the contiguous United States. Between 1991 and 2011 the average freeze-free season was 10 days longer than the average freeze-free season between 1901 and 1960 (USGCRP 2014). Since the 1970s, the United States has warmed at a faster rate as the average surface temperature rose at an average rate of 0.31 to 0.45 °F (0.17 to 0.25 °C) per

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[1] *Union Electric Co*. (Callaway Plant, Unit 2), CLI-11-5, 74 NRC 141, 167-68 (2011) (*quoting Hydro Resources, Inc.* (2929 Coors Road, Suite 101, Albuquerque, NM 87120), CLI-99-22, 50 NRC 3, 14 (1999) (*citing Marsh v. Oregon Natural Resources* Council, 490 U.S. 360, 373 (1989); *Sierra Club v. Froehlke*, 816 F.2d 205, 210 (5th Cir. 1987))).

decade (USGCRP 2014). Observed climate related changes in the United States include increases in the frequency and intensity of heavy precipitation, earlier onset of spring snowmelt and runoff, rise of sea level in coastal areas, increase in occurrence of heat waves, and a decrease in occurrence of cold waves (USGCRP 2014).

Temperature data for the southern Great Plains region[2], where STP is located, exhibits an increasing trend since 1895. Since the 1940s, average surface temperatures have been above average, particularly in the spring and winter seasons. Since 1991, average surface temperature has increased by 1.0 to 1.5 °F (0.56 to 0.83 °C) (USGCRP 2014). Long-term (1895 to 2012) average annual precipitation data for the southern Great Plains also exhibits an increasing trend. Since 1991, precipitation has increased by 8 percent in the southern Great Plains and heavy precipitation events have increased by 16 percent between 1958 and 2012 (USGCRP 2014). Furthermore, between 1991 and 2012, the frost free season has increased by 10 to 14 days (USGCRP 2014).

For the license renewal period of STP (2027-2047 for Unit 1 and 2028-2048 for Unit 2), climate model simulations (for the 2021-2050 time period relative to 1971-1999) indicate an increase in annual mean temperature in the Great Plains region from 1.5 to 3.5 °F (0.83 to 1.9 °C), or both a low- and high-emission-modeled scenario[3] (NOAA 2013[4]). The predicted increase in temperature during this time period occurs for all seasons with the largest increase occurring in the summertime (June, July, and August). Climate model simulations (for the time period 2021-2050) suggest spatial differences in annual mean precipitation changes for the Great Plains with some areas experiencing an increase and others a decrease in precipitation (for Texas, a 0 to 6 percent increase in annual mean precipitation is predicted), for both a low- and high-emission-modeled scenario; however, these changes in precipitation were not significant and the models indicate changes that are less than normal year to year variations (NOAA 2013). By mid-century (2041 to 2070), heavy precipitation events are not projected to increase significantly in Texas; however, the number of consecutive dry days (less than 0.01 inches of precipitation) is projected to increase by 1 to 4 days (for both a low- and high-emission-modelled scenario) along the Texas coast and the number of days with the hottest temperatures (days with temperature over 100 °F) will increase by 13 to 19 days under a low-emission modeled scenario and 25-28 days under a high-emission modeled scenario along the Texas Gulf Coast (USGCRP 2014). These projections indicate that towards the end of the license renewal period, dryer days, increased evaporation, increased drought frequency, and increased heat waves will be the trend. Furthermore, sea level rise is projected to increase. Changes in sea level, at any one coastal location, depend not only on the increase in the global average sea level but on various regional geomorphic, meteorological, and hydrological factors. While there is great uncertainty, mean global sea levels are expected to rise an additional 0.5 to 1 ft (0.15 to 0.3 m) by 2050 and between 1 to 4 ft (0.3 to 1.2 m) by 2100 (USGCRP 2014). Along the Texas Gulf Coast, sea levels are projected to rise 0.7 to 2.0 ft (0.21 to 0.61 m) by 2050, but will depend on the extent of ice sheet melting (USGCRP 2014).

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[2] The USGCRP report summarizes current and future climate change impacts on major U.S. regions and key sectors of the U.S. economy. The state of Texas, where STP is located, is part of the Great Plains region as identified by the USGCRP. Additionally, due to the location of STP, the analysis presented here also includes impacts to coastal regions as discussed in the USGCRP report.

[3] Climate model simulations often use greenhouse gas emission scenarios to represent possible future social, economic, technological, and demographic development that, in turn, drive future emissions.

[4] This report provides projections that overlap with the license renewal period of STP and are not presented in the USGCRP 2014 report. NOAA (2013) provides regional climate descriptions and was developed to provide input to the Third National Climate Assessment (NCA), 2014 USGCRP report.

Evaluation: Climate Change Impacts to Resource Areas

Land-use: The USGCRP (2014) indicates that land use changes, such as the continued expansion of urban areas, paired with climate change effects, such as heaver precipitation events, can exacerbate climate change effects, including reduced water filtration into the soil and increased surface runoff. While anthropogenic land uses will contribute to climate change in these and other ways, land uses will also be affected by climate change in several ways. Projections in land-use changes, between 2010 and 2050, indicate that the Great Plains region will experience an increase in exurban and suburban development and a decrease in cropland land cover (USGCRP 2014). Suburban development can increase impervious surfaces which can increase runoff and flooding. However, the projected increase and rate of increase in development and the decrease and rate of decrease in cropland cover for the Great Plains region is minimal (USGCRP 2014). Therefore, the NRC staff concludes that the information would not change the SMALL cumulative impact conclusion reached in Section 4.12.1 of the STP FSEIS for land-use and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Air Quality: Ozone has been found to be particularly sensitive to climate change (USGCRP 2014). Ozone is formed as a result of the chemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of heat and sunlight. Sunshine, high temperatures, and air stagnation are favorable meteorological conditions to higher levels of ozone. Regional air quality modeling indicates that the Southern regions of the U.S., including Texas, may experience an increase in ozone concentration by the year 2050 (USGCRP 2014). However, the USGCRP (2014) cautions that air quality is a complex function of not only physical meteorology, but also depends on precursor concentrations. Hence, air quality projections are uncertain.

Section 4.12.2 of the STP FSEIS (NRC 2013) identifies climate change as a potential cumulative impact on air quality. Since the STP FSEIS identified and accounted for impacts to air quality from climate change and air quality projections remain uncertain, the NRC staff concludes that the information would not change the SMALL cumulative impact conclusion reached in Section 4.12.2 of the STP FSEIS for air quality and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Water Resources: A declining trend of annual runoff has been observed in the Colorado River Basin (USGCRP 2014). The number of consecutive dry days, the number of days with the hottest temperatures, and the number of nights with the warmest temperatures are projected to all increase during the 2041-2070 time period. Summer precipitation is projected to decrease by 10 percent during the 2041-2070 time period. Additionally, continued sea level rise of 1 to 4 ft (0.3 to 1.2 m) by 2050 could reduce freshwater resources due to saltwater intrusion. Water withdrawals are projected to increase 25 to 50 percent in the Texas region (USGCRP 2014). The trend toward more dry days and higher temperatures projected for the southern Great Plains will increase evaporation, and drought will become more frequent and intense. Furthermore, the USGCRP (2014) reports that the runoff for the Colorado River Basin will decrease substantially by 2050. These conditions could reduce water availability in the region.

Climate change impacts on groundwater availability depends on basin geology, frequency and intensity of high-rainfall periods, recharge, soil moisture, and groundwater-surface water interactions (USGCRP 2014). For instance, coastal aquifers are susceptible to climate change, particularly from saltwater intrusion due to sea level rise and decreased recharge from inland drought. Precipitation and evapotranspiration are key drivers in aquifer recharge. Although exact responses in groundwater storage and flow to climate change are not well understood,

recent studies have started to consider the effects that climate change has on groundwater resources (USGCRP 2014).

Section 4.12.3.1 of the STP FSEIS (NRC 2013) identifies climate change as a contributor to cumulative impacts on surface water. The analysis used information provided in the 2009 USGCRP report (USGCRP 2009) pertaining to changes in temperature and precipitation data for the Colorado River. The discussion identifies that water supplies in the Colorado River Basin could be affected due to reduced surface runoff and increasing evapotranspiration, and that climate change would substantially add to regional surface water cumulative impacts during the license renewal term. The STP FSEIS identified and accounted for impacts to surface water resources from climate change and the USGCRP 2014 report confirmed the 2009 report findings. The NRC staff concludes that the information would not change the MODERATE cumulative impact conclusion reached in Section 4.12.3.1 of the STP FSEIS for surface water and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

The STP FSEIS does not identify climate change as a potential cumulative impact on groundwater. However, as discussed above, the exact impacts of climate change on groundwater resources are not well understood. Various factors play a role in groundwater availability and groundwater-surface water interactions, and the response of groundwater availability to climate change is the subject of ongoing scientific study. Therefore, the NRC staff concludes that the information would not change the SMALL cumulative impact conclusion reached in Section 4.12.3.2 of the STP FSEIS for groundwater resources and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Aquatic Resources: The USGCRP (2014) predicts habitat loss and local extinctions of fish and other aquatic species throughout the United States from the combined effects of water withdrawal and climate change. Climate change is expected to increase harmful algal blooms, disease-causing agents, and low-oxygen conditions in inland and coastal waters. Higher water temperatures and increases in precipitation favor production of blue-green and toxic algae that can harm fish, water quality, habitats, and could heighten the impact of invasive species already present (USGCRP 2014). Additionally, warmer waters will provide a habitat for warm water fish species as the habitat for coldwater fish shrinks.

Section 4.12.4 of the STP FSEIS (NRC 2013) identifies climate change as a potential cumulative impact to aquatic communities. The analysis in the STP FSEIS references the 2009 USGCRP report and identifies that changes in precipitation, increases in sea level, and increased temperatures can alter habitats and identifies the stressors from climate change that can impact aquatic communities. Since the STP FSEIS identified and accounted for impacts to aquatic resources from climate change and the USGCRP 2014 report confirmed the 2009 report findings, the NRC staff concludes that the information would not change the MODERATE cumulative impact conclusion reached in Section 4.12.4 of the STP FSEIS for aquatic resources and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Terrestrial Resources: As the climate changes, terrestrial resources will need to be able to tolerate the new physical conditions or shift their population range to new areas with a more suitable climate. While some species may readily adapt to a changing climate, others may be more prone to experience adverse effects. Species that are most vulnerable to climate change are those that have specific habitat requirements, occur in isolated habitats, and have low reproductive rates (USGCRP 2014). Observed climate-induced changes have been linked to changing timing of flowering, increases in pest outbreaks, shifts in species distributions, declines in the abundance of native species, and the spread of invasive species. For instance,

in Texas, altered flowering patterns due to more frost-free days have increased the length of pollen season for ragweed by as many as 16 days over the period from 1995 to 2009 (USGCRP 2014). Continued drier and warmer days, as discussed above (see New Information: Climate Change), can lead to drought conditions that could reduce the area of wetland habitat. The drier conditions are projected to occur during mid-century (2041 to 2070) and are not likely to significantly impact terrestrial resources during the 20-year license renewal period (2027-2047 for Unit 1 and 2028-2048 for Unit 2). Therefore, the NRC staff concludes that the information would not change the MODERATE impact conclusion reached in Section 4.12.5 of the STP FSEIS for terrestrial resources and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Human Health: The USGCRP (2014) reports that climate change could have an impact on human health. For instance, changes in climate influences vector distribution and the disease they can carry. Warmer air temperatures can shift and elevate pollen concentrations and therefore increase allergies and asthma. However, changes in climate conditions that may occur during the license renewal term will not result in any change to the radiological impacts discussed in Section 4.12.6 of the STP FSEIS (NRC 2013). Increased water temperatures may increase the potential for adverse effects of thermophilic organisms that can be a threat to human health. However, as discussed in Section 4.12.6 of the STP FSEIS, increases in ambient river water temperature were considered and the NRC staff concluded that the impacts to human health due to exposure to microorganisms in the Colorado River would be SMALL (NRC 2013). Therefore, the NRC staff concludes that the information would not change the SMALL cumulative impact conclusion reached in Section 4.12.6 of the STP FSEIS for human health and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Socioeconomics: Changes in climate conditions could affect the availability of jobs in certain industries. In 2010, U.S. shoreline counties accounted for 66 million jobs and $3.4 trillion in wages (USGCRP 2014). This economic activity is dependent on the physical and ecological characteristics of the coastal environment. Climate change, including changes in sea temperature and water levels, could affect the unique economic characteristics of coastal areas. The economic impact of the shift of fish species, to deeper water for instance, will depend on the ability of the commercial fisheries industry to adapt. Coastal area economies are also sustained by the income from tourism, recreation, and seaport commerce. Sea level rise, which increases coastal erosion, along the Texas Gulf Coast is projected to increase 0.7 to 2.0 ft (0.21 to 0.61 m) by 2050, and hurricane rainfall and intensity is also projected to increase (USGCRP 2014). However, as discussed above (see New Information: Climate Change), there is great uncertainty in the extent of projected sea level changes. A changing climate resulting in stronger storms, coastal erosion, inundation, and flooding could damage seaports and reduce beach attractiveness. Additionally, stronger storms could damage oil and natural gas platforms and disrupt energy infrastructure along the Texas Gulf Coast. However, because changes in the environment would occur gradually over time, any impacts during the 20-year license renewal term would not likely result in significant socioeconomic impacts in the vicinity of STP. Therefore, the NRC staff concludes that the information would not change the SMALL to LARGE cumulative impact conclusion reached in Section 4.12.7 of the STP FSEIS for socioeconomics and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Environmental Justice: Changes in climate conditions could disproportionately affect minority and low-income populations. Sea level rise has the potential to place communities in coastal areas at risk from storms, coastal erosion, inundation, and flooding. Specifically, minority and

low-income communities in coastal areas may be more vulnerable to the impacts of climate change. The USGCRP (2014) study finds that minority and low-income communities are vulnerable to the impacts of climate change especially in areas with limited local public services, sparse development, and language barriers. Furthermore, climate change could affect the availability and access to local plant and animal species thus impacting the people that have historically depended on them for food or medicine. However, because changes in the environment would occur gradually over time, minority and low-income populations living near STP are not likely to experience any disproportionately high and adverse human health and environmental effects during the 20-year license renewal term. Therefore, the NRC staff concludes that the information would not change the SMALL cumulative impact conclusion reached in Section 4.12.7 of the STP FSEIS for environmental justice and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Historic and Archeological Resources: Sea level rise could result in the loss of historic and cultural resources along the Texas coast from flooding, erosion, or inundation. Due to water-level changes, some resources could be lost before they could be documented or otherwise studied. Sea level rise, which increases coastal erosion, along the Texas Gulf Coast is projected to increase 0.7 to 2.0 ft (0.21 to 0.61 m) by 2050 and hurricane related rainfall is also projected to increase (USGCRP 2014). However, as discussed above, there is great uncertainty in the extent of sea level changes and projected hurricane activity from computer models are uncertain; some models project increases in hurricane intensity, while others indicate a decrease in hurricane intensity (USGCRP 2014). The changes in the environment that may occur during the 20-year license renewal term would not likely result in any significant loss of historic and cultural resources at STP. Therefore, the NRC staff concludes that the information would not change the SMALL cumulative impact conclusion reached in Section 4.12.8 of the STP FSEIS for historic and archeological resources and thus does not present a seriously different picture from what was previously presented in the STP FSEIS.

Conclusion

The NRC staff has identified, reviewed, and evaluated new information on climate change and related impacts presented in the USGCRP (2014) report. The evaluation did not identify new and significant information bearing on the proposed action (license renewal) or its impacts that presents a seriously different picture of the environmental impacts that would change the conclusions in the STP FSEIS (NUREG-1437, Supplement 48). Therefore, the preparation of a supplement to the STP FSEIS is not necessary.

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