UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 12, 2021

MEMORANDUM TO: Andrea D. Veil, Director
Office of Nuclear Reactor Regulation

FROM: Raymond V. Furstenau, Director
Office of Nuclear Regulatory Research

Signed by Coffin, Stephanie on 07/12/21

SUBJECT: IMPENDING PUBLICATION OF A FINAL REPORT ON EXTREME PRECIPITATION: NUREG/CR-7132, "APPLICATION OF RADAR-RAINFALL ESTIMATES TO PROBABLE MAXIMUM PRECIPITATION IN THE CAROLINAS"

I am forwarding for your information the enclosed final version a NUREG/CR report, which the Office of Nuclear Regulatory Research (RES) will submit for publication in two weeks. This report documents work sponsored by the U.S. Nuclear Regulatory Commission (NRC) at the U.S. Bureau of Reclamation (USBR) as part of the RES project, "Research to Develop Guidance on Probable Maximum Precipitation Estimates for the Eastern United States," Job Control Number (JCN) N6570, as requested in RES User Need NRO-2008-004. Our original intent in formulating this project was to have the USBR revise the National Oceanic and Atmospheric Administration's (NOAA's) Hydrometeorological Report 51 (HMR51) (last revised in 1978), which provides estimates of probable maximum precipitation (PMP) for the United States east of the Rocky Mountains. This scope turned out to be overly ambitious and expensive, so, in agreement with staff from your office, we reduced the scope to a pilot study of HMR 51 in the Carolinas.

This work supports the revision of Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants," last revised in 1978 (RG-1.59, Rev 2). The staff of NRR's External Hazards Branch is currently revising this guide (RG-1.59, Rev 3).

NUREG/CR-7132, "Application of Radar-Rainfall Estimates to Probable Maximum Precipitation in the Carolinas" focuses on warm-season tropical cyclones in the Carolinas region of the Southeast United States, as these systems are the critical maximum rainfall mechanisms that result in extreme floods there. The report investigates ten tropical cyclones that impacted the Carolinas during the 1996-2007 time-period. The major focus is to identify if these recent storms challenge the PMP values from HMR 51, in order to assess the adequacy of existing PMP estimates and the need for potentially updating the PMP estimates in a North Carolina-South Carolina pilot region.

Enclosures:
As stated

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The availability of modern gridded datasets and increasing computing power provides the impetus to improve on existing PMP methods. The report uses the Multi-sensor Precipitation Reanalysis (MPR) dataset from NOAA's National Climatic Data Center, which covers a test region of the Carolinas for the period 1996-2007 and is available at high spatial and temporal resolution. During the period 1996-2007, many tropical cyclones impacted the two states, including Hurricane Floyd in 1999 and seven different storms in 2004, among others. Depth-Area-Duration (DAD) calculations and in-place storm maximization[1] were performed for ten recent storms. Maximization of these storms also employed modern gridded datasets of moisture-related variables. Maximized DAD values from the new storms were compared with HMR 51 PMP values and three of the largest events that are the basis for HMR 51.

The results suggest that Hurricanes Floyd (1999) and Fran (1996) approached or exceeded HMR 51 PMP at larger area sizes. Hurricane Floyd exceeded the PMP at durations of 24 and 72 hours, while Fran exceeded PMP at a 6-hour duration. The results of the current study should be considered preliminary (since only in-place storm maximization was considered), but suggest an increase in HMR51 PMP estimates for large area sizes may be warranted along the Carolina coasts (based on in-place maximization of Floyd and Fran over the Carolinas). The research also provides insight into the sensitivity of the method to several factors, including representative storm moisture, radar biases and grids, and precipitable water. Long-term trends in moisture availability were investigated using sea surface temperatures (SST) and dew points as proxies. In general, limited significant trends in SSTs were identified along the East Coast or in the Gulf of Mexico. Based on the initial analysis conducted as part of this pilot study, if these historical SST trends continue into the future, there would likely be little impact on in place moisture maximization factors and PMP. However, given climatologists' expectation of climate change and variability, the potential exists for storm moisture availability and long-term moisture climatologies used in storm maximization factors to increase or change over time.

This report was provided for review to staff within the External Hazards Branch and no comments were received. Nonetheless, please feel free to notify the responsible RES contact if you have any questions concerning the impending publication of these reports.

RES established an online quality survey to collect feedback from user offices on the usefulness of RES products and services. This survey can be found online at the RES Quality Survey. I would appreciate the responsible manager or supervisor completing this short—about 5 minutes—survey within the next 10 working days to present your office's views of the delivered RES product.

[1] A technique to ascertain by how much the rainfall from a particular storm would have increased by physically possible increases in the efficiency of the mechanism that caused the moisture present in the atmosphere to precipitate and in the moisture content of the air mass responsible for the storm.

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