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

June 5, 2020

MEMORANDUM TO: Ho Nieh, Director
Office of Nuclear Reactor Regulation

FROM: Raymond Furstenau, Director **/RA/**
Office of Nuclear Regulatory Research

SUBJECT: IMPENDING PUBLICATION OF NUREG/CR-7271, "APPLICATION OF POINT PRECIPITATION FREQUENCY ESTIMATES TO WATERSHEDS"

I am forwarding for your information the enclosed final version of NUREG/CR-7271, "Application of Point Precipitation Frequency Estimates to Watersheds", 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 Oak Ridge National Laboratory (ORNL) as part of the RES project, "Application of Point Precipitation Frequency Estimates to Watersheds." This project was implemented as part of the Probabilistic Flood Hazard Assessment (PFHA) Research Program (User Need Request NRO-2015-002). The objective of the PFHA Research Program is to develop tools and guidance on the use of PFHA methods to risk-inform NRC's licensing of new facilities as well as licensing and oversight of currently operating facilities as they relate to flooding hazards.

Many nuclear power plants (NPPs) are located on or near rivers so riverine flooding hazards need to be considered in their design and operation. Probabilistic riverine flood models are important tools for realistic assessment of flooding risks. However, these models require areal estimates of the depth, duration, and frequency of rainfall distributed over the watershed, which are not often available. Point precipitation frequency estimates are more widely available. For example, the National Oceanic and Atmospheric Administration (NOAA) has published NOAA Atlas 14. Which provides point precipitation frequency estimates for 5-minute through 60-day durations at average recurrence intervals of 1-year through 1,000-year. The research documented in NUREG/CR-7271 addresses areal reduction factors (ARFs), which can be used to convert the widely available point precipitation frequency estimates, to estimates of areal precipitation frequency over a watershed.

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The most widely used ARF source is Technical Paper 29 (TP-29) published by the then U.S. Weather Bureau in 1958. However, both the methods and the underlying precipitation data used to produce TP-29 are seriously out of date. For example, due to the small gauge network available at the time of TP-29's compilation, ARF estimates developed are only for watersheds smaller than about 400 square miles. Due to the relatively short record lengths of precipitation data available, frequency considerations could not be accurately determined. Other factors such as regional climate and seasonality were not addressed.

Several newer methods have been published since TP-29 was developed and both the type and quantity of precipitation data have increased significantly, along with computational resources and analytical tools such as geographic information systems. The research reported in NUREG/CR-7271 reviewed and assessed the available precipitation products and methods for conducting ARF analysis. The work applied up-to-date precipitation data products and analysis methods with a novel watershed-based approach to investigate how ARF estimates vary across different methods, data sources, geographical locations, return periods, and seasons.

The overall findings reported in NUREG/CR-7271 regarding basic ARF trends are in line with other recent studies showing that ARFs decrease with increasing area, increase with increasing duration, and decrease with increasing return period. This study found significant differences among the available ARF methods. This work also found a strong geographical variability across different US hydrologic regions, suggesting that the ARF are specific to regional climate patterns and geographical characteristics and should not be applied arbitrarily to other locations. The results also reveal the importance of data record length, especially for high return level ARFs.

The work reported in NUREG/CR-7271 will assist NRC staff in assessing different classes of ARF methods in conjunction with available rainfall data sets. It will also support the development of guidance for application of point precipitation data in PFHAs. It should be noted that the ARF values presented in this report for any location or region were developed for the purposes of comparing methods and investigating the factors that influence ARFs. They should not be considered official and should not be used in leu of a site-specific analysis.

NUREG/CR-7271 was reviewed by staff in the External Hazards Branch of NRR's Division of Engineering and External Hazards and their comments have been addressed. 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.

Enclosure:
As stated

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