

### **Workshop on Probabilistic Flood Hazard Assessment**

The U.S. Nuclear Regulatory Commission's (NRC's) Offices of Nuclear Regulatory Research (RES), Nuclear Reactor Regulation (NRR) and New Reactors (NRO) organized a Workshop on Probabilistic Flood Hazard Assessment (PFHA). The workshop was held January 29–31, 2013 at the NRC headquarters auditorium, 11545 Rockville Pike, Rockville, MD. The workshop was coordinated with Federal agency partners: the U.S. Department of Energy (DOE), U.S. Department of the Interior's Bureau of Reclamation (BoR) and U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), and Federal Energy Regulatory Commission (FERC). The research workshop was devoted to the sharing of information on probabilistic flood-hazard assessments for extreme events (i.e., annual exceedance probabilities much less than  $2.0E-3$  per year) from the Federal community. The topics included: federal agencies' interests and needs in PFHA; state of the practice in identifying extreme flood hazards; extreme precipitation events; flood-induced dam and levee failures; tsunami flooding; riverine flooding; extreme storm surges for coastal areas; and combined events flooding. The workshop objectives included to: (1) assess, discuss, and inform workshop participants on the state of the practice for extreme flood assessments within a risk context, (2) facilitate the sharing of information between both federal agencies and other interested parties to bridge the current state of knowledge between extreme flood assessments and risk assessments of critical infrastructures, (3) seek ideas and insights on possible ways to develop a PFHA for use in probabilistic risk assessments, (4) identify potential components of flood-causing mechanisms that lend themselves to probabilistic analysis and warrant collaborative study, and (5) establish realistic plans for coordination of PFHA research studies. Observations and insights provided during session presentations and subsequent panel discussions that followed were documented by the panel reporters and are included in NUREG/CP-0302. Significant recommendations included:

- Develop a systematic process of expert elicitation for flood hazard assessment (EEFHA). The EEFHA would address information gaps in flood event scenarios. It would assist in estimating probabilistic flood hazard magnitudes, durations, and frequencies. The EEFHA process should include uncertainty assessments of the flood scenarios, past histories of floods including paleofloods and regional storm events, and related storm-event parameters.
- Support ongoing development of the USACE's Storm Catalogue for analyzing floods in the U.S. The catalogue relates extreme storms to flood events, and includes both point measurements and radar data for spatial and temporal distribution of the precipitation. This information will support both the expert elicitation process, and site-specific stochastic modeling of extreme floods (e.g., Stochastic Event Flood Model).
- Develop a structured evaluation process for dam and levee failures to examine comprehensive uncertainties in data and modeling of potential failure mode scenarios.
- Further develop and apply the USACE's joint probability method for storm and hurricane surge analyses along the Gulf and Atlantic coasts with possible application to the Great Lakes.

- Integrate risk analysis into the state-of-the-practice of watershed and coastal-storm surge modeling as presented by the Bureau of Reclamation and USACE.
- Support ongoing interagency committee activities such as the Subcommittee on Hydrology's working groups on Hydrologic Frequency Analysis and Extreme Storm Events.

Following the workshop, NRC staff briefed the ACRS on the insights and recommendations from the PFHA Workshop; discussed with them on how this information is being used in development of a RES research plan on flooding; and conducted a bilateral technical exchange with the French regulatory authority on probabilistic flood hazard assessments and flood protection.