Poster Title: “The CNWRA Three-Dimensional Groundwater Flow Model for Yucca Mountain as a Regulatory Tool to Risk Inform NRC Reviews”

To evaluate the suitability of Yucca Mountain, Nevada, as a potential nuclear waste repository, the U.S. Department of Energy (DOE) conducts total-system performance assessment analyses. The saturated zone flow and transport system is one component of the natural barriers to radionuclide transport. To include saturated zone flow and transport in total-system performance assessment analyses, DOE abstracted flow paths from their site-scale saturated zone flow model. The U.S. Nuclear Regulatory Commission (NRC) staff, with assistance from the Center for Nuclear Waste Regulatory Analyses (CNWRA) staff, are responsible for reviewing the DOE saturated zone process model and total-system performance assessment analyses abstraction to assure that the DOE approach is justified by available data, that data and modeling uncertainties are appropriately considered, and that reasonable alternative conceptual models are considered. Review of the DOE approach and the development of an independent total-system performance assessment analyses abstraction necessitates an in-depth understanding of saturated zone hydrogeology at Yucca Mountain and a means to independently evaluate model and data uncertainties and potentially important alternative conceptual models for saturated zone flow. To this end, the CNWRA staff are developing a three-dimensional groundwater flow model of the Yucca Mountain, Nevada, region. The foundation of this flow model is the CNWRA hydrogeologic framework model, which was also developed independently from the DOE model. The insights gained through such independent model development are useful for a risk-informed review of DOE models. The CNWRA flow model can be used as a tool to evaluate the potential effects of various data and model uncertainties on saturated zone flow paths. Those evaluations can then be used for comparison with the level of uncertainty considered in the DOE performance assessments resulting from factors such as groundwater specific discharge (flux) and flow path lengths through various material types. In addition, the 3D groundwater flow model provides a means for evaluating the sensitivity of simulated flow paths, groundwater travel time, and capture zones and drawdowns of pumping wells, to the underlying interpretation of geologic structures and hydrogeological features. The CNWRA flow model provides the NRC and CNWRA staffs with a tool to help resolve key technical issues pertaining to radionuclide transport via groundwater pathways in the saturated zone.