

Evaluation of the emergency planning zone for nuclear power Plants in Taiwan after Fukushima daiichi nuclear accident

Shu-Jun Chang^{1,3}, Jay Wu², Zhi-Wei Wang¹, Yung-Muh Yang¹, Bor-Jing Chang¹

¹Division of Health Physics, Institute of Nuclear Energy Research, Taoyuan, Taiwan

²Department of Biomedical Imaging and Radiological Science, China Medical University, Taiwan

³Department of Engineering and System Science, National Tsing Hua University, Hsinchu, Taiwan

Purpose

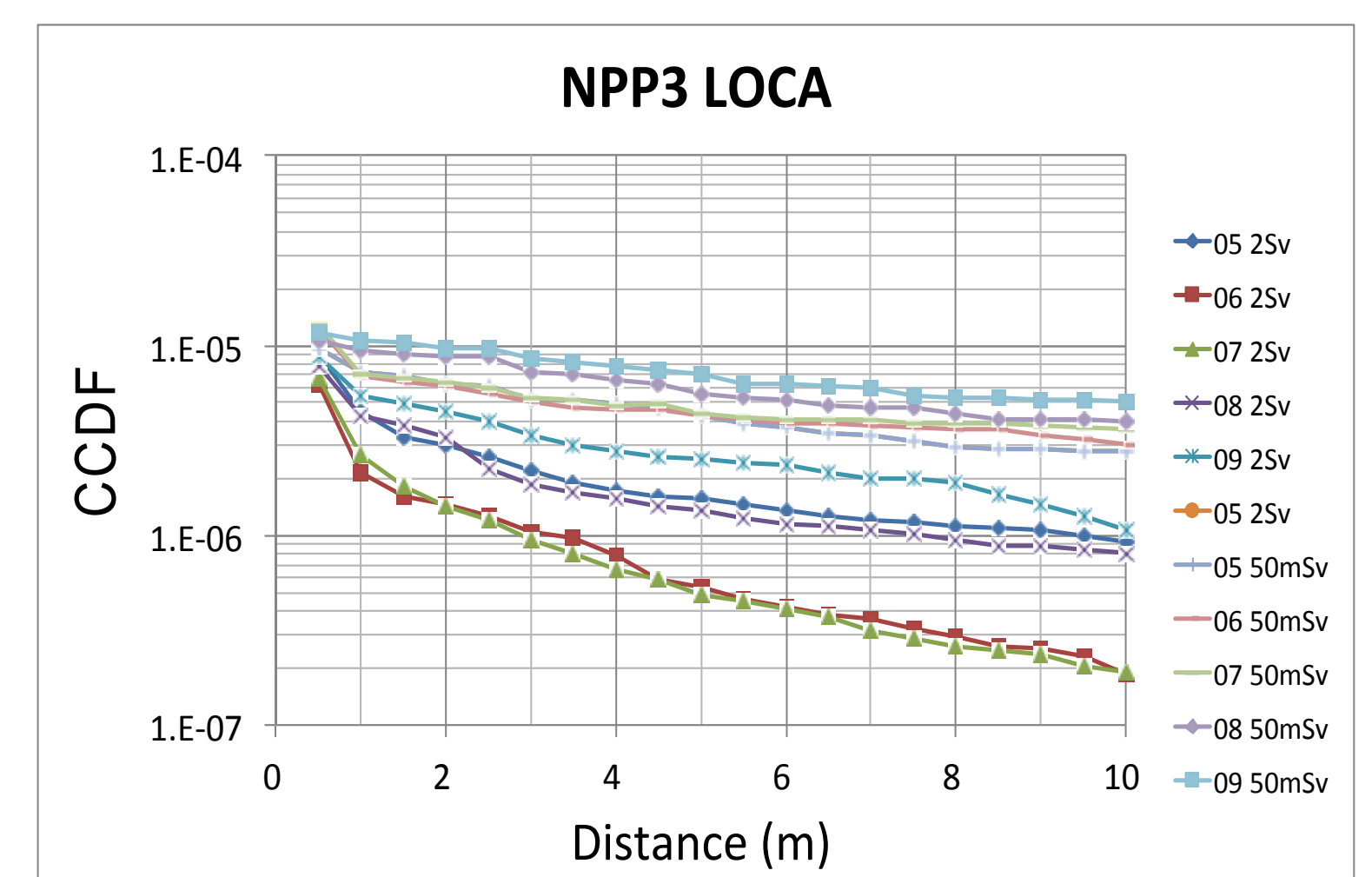
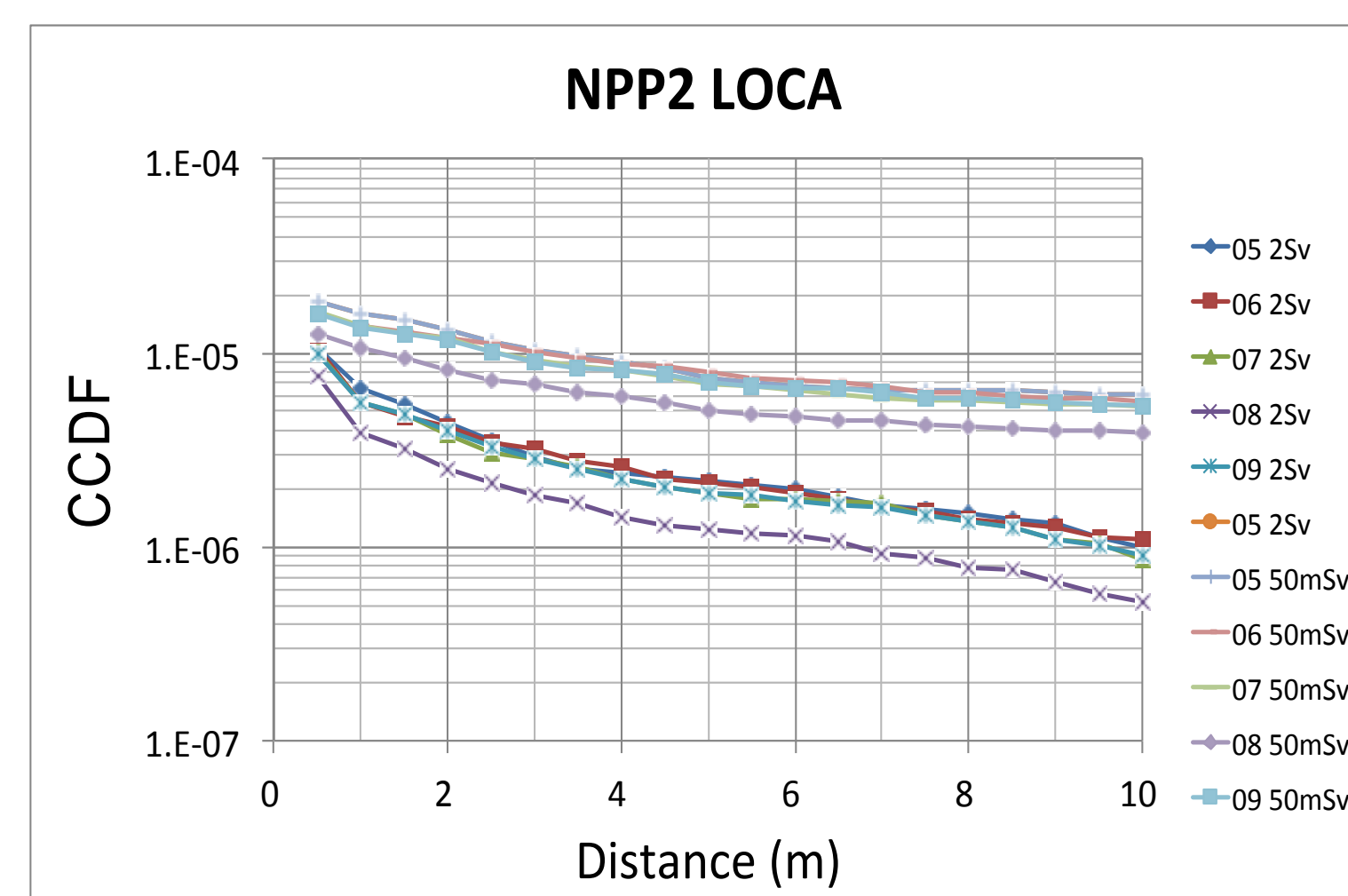
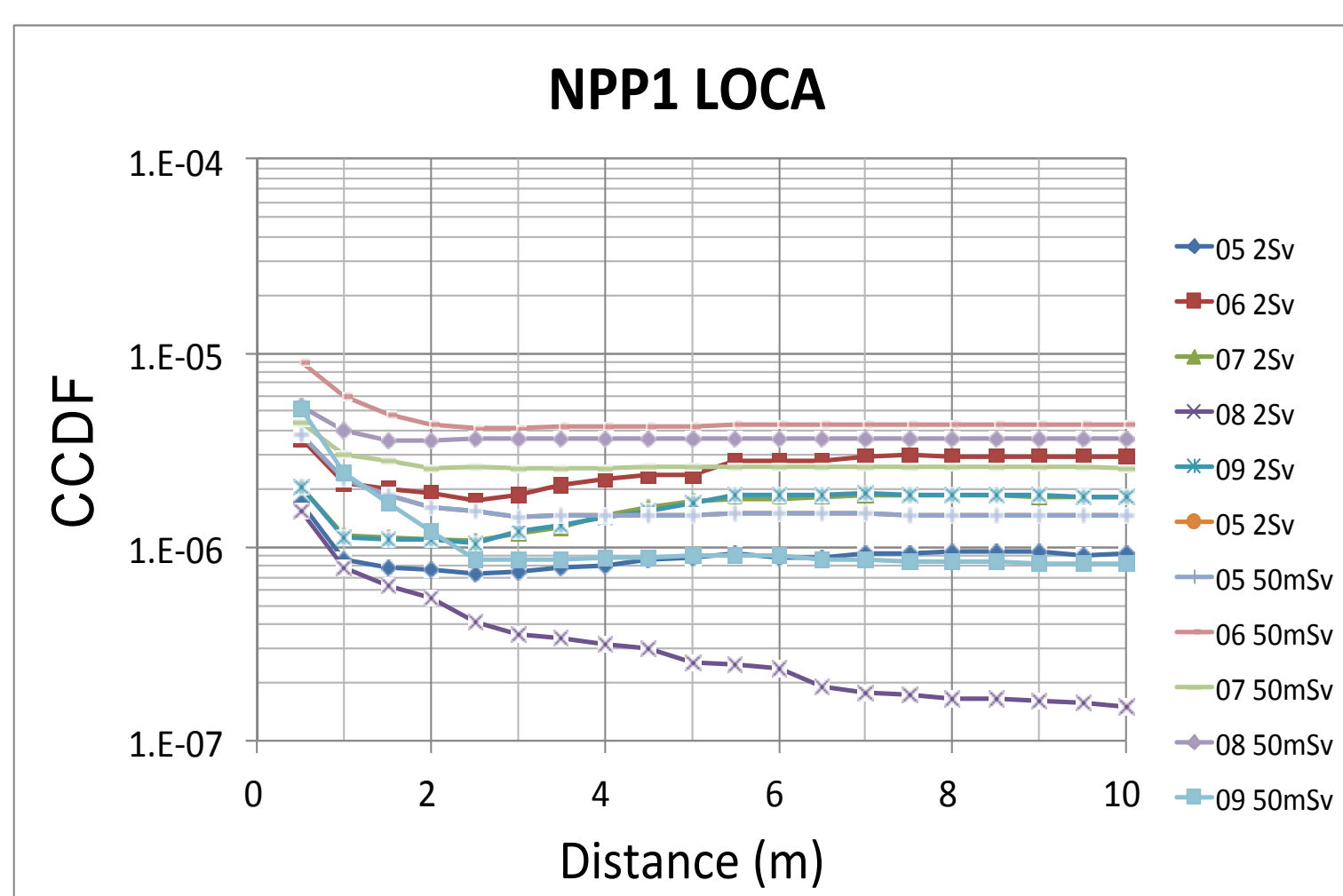
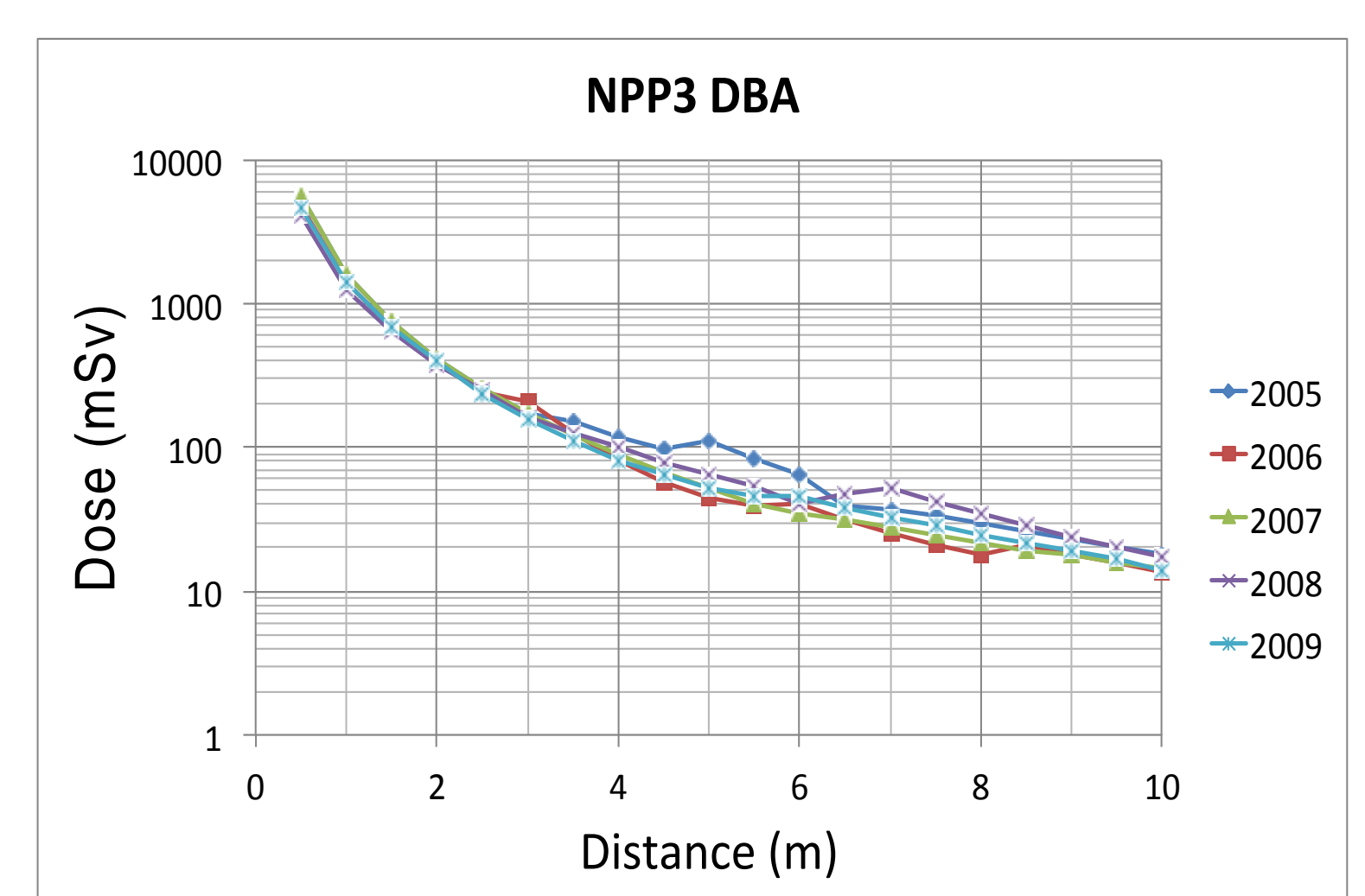
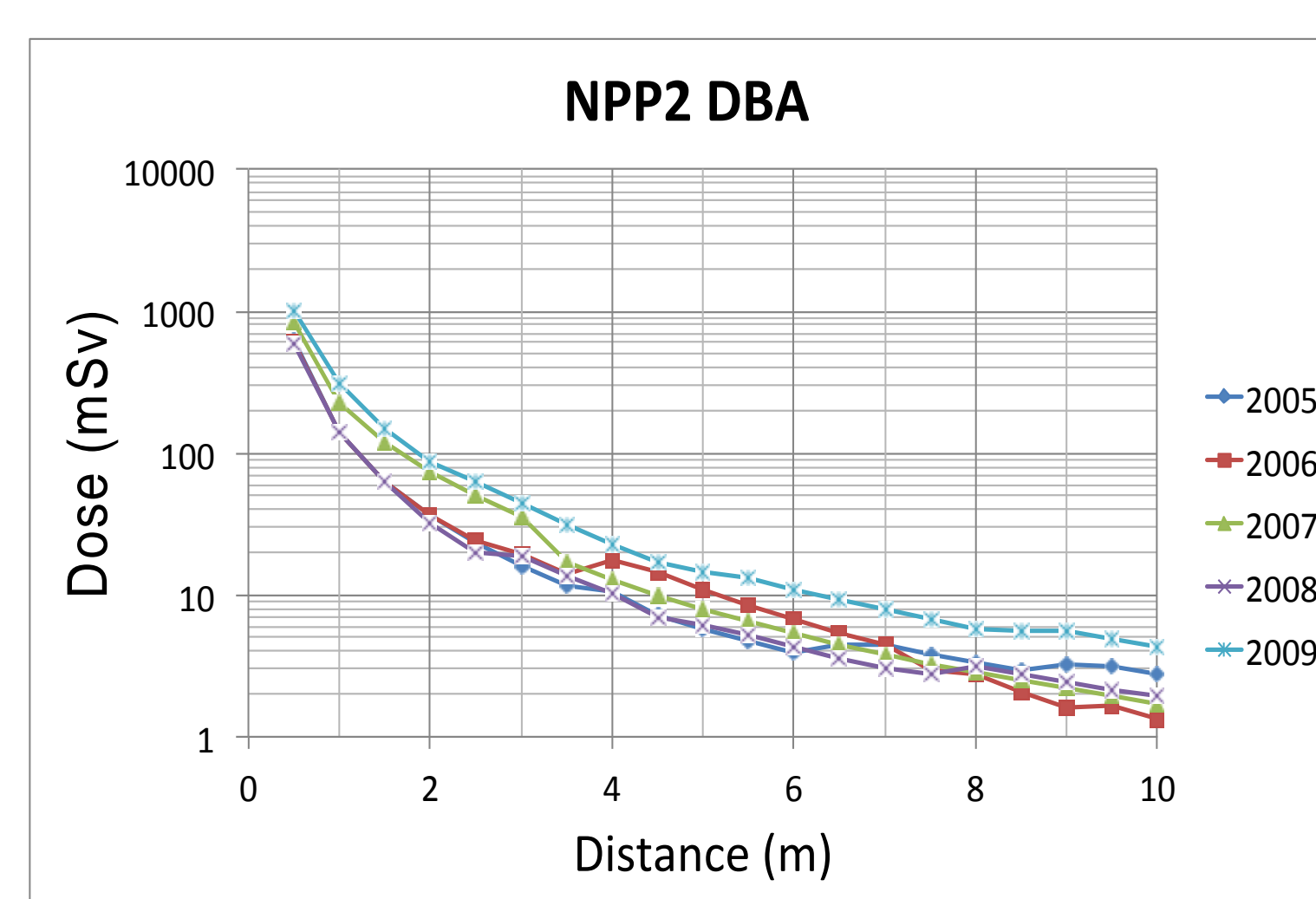
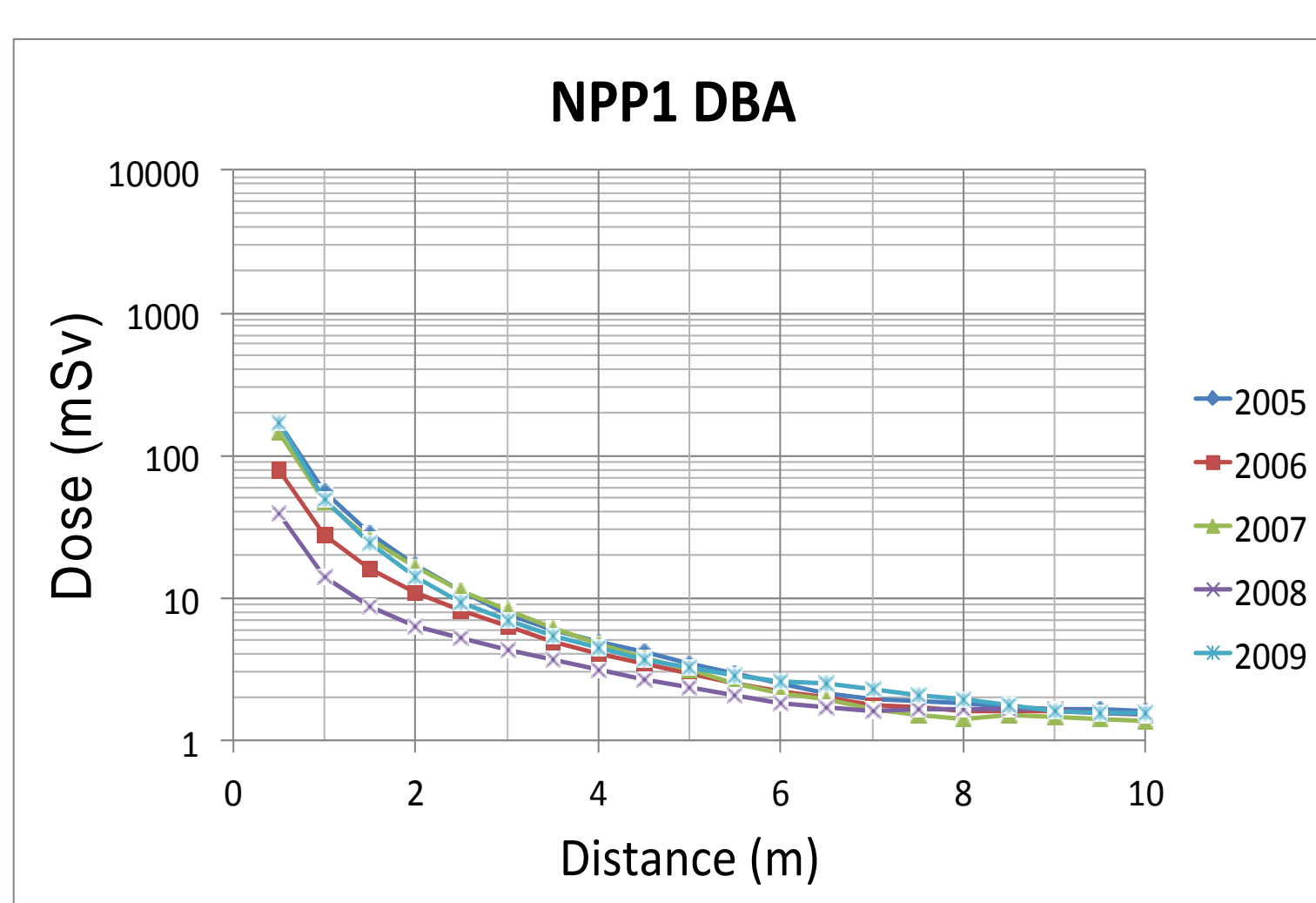
Due to the Fukushima Daiichi nuclear accident happened in Japan, the EPZ of the operating NPPs in Taiwan requires to be reevaluated, based on consideration of the natural disasters and pay attention to the potential threatening of the simultaneous multiple unit malfunctions.

Method and Materials

We calculated the source term data including inventory, sensible heat content, and time duration based on the server accident and the design-based accident of multiple units in one NPP, and collect meteorological data around the NPPs in the recent five-year interval, 2005~2009. The effective dose and thyroid dose together with the individual risk and societal risk were calculated using the MELCOR Accident Consequence Code System 2 (MACCS2) developed by Sandia National Laboratory.

Results

According to the regulations in Taiwan, for the design-based accident, prospective effective dose should not exceed 50 mSv; and for server accident, the probability of the whole body dose exceeding 50 mSv should less than 3.0×10^{-5} per year and the probability of the whole body dose exceeding 2.0 Sv (prompt fatality dose) should less than 3.0×10^{-6} per year. Using the MACCS2 code, we estimated the radiological doses and the associated risks that could result from each postulated accidental release category. The effective dose as a function of distance for the DBA of the three NPPs was analyzed. The complementary cumulative distribution function (CCDF) of whole body dose of 50 mSv, and whole body dose of 2.0 Sv versus distance for the three NPPs was used to analyze the probability that could exceed the safety criteria.



Conclusions

The results showed that the EPZs of the three NPPs, based on consideration of the natural disasters and pay attention to the potential threatening of the simultaneous multiple unit malfunctions, should be enlarged from 5 km legislated in the Nuclear Emergency Response Act in Taiwan to a suitable 8-km radius. Subsequently, the emergency response plan (ERP) has to be re-schemed correspondingly.

