Geophysical Research Abstracts
Vol. 18, EGU2016-3589, 2016
EGU General Assembly 2016

Atmospheric Dispersion Modeling of 137Cs generated from Nuclear Spent Fuel under Hypothetic Accidental Condition in the BNPP Area

Jongkuk Lee, Kwan-Hee Lee, Daesik Yook, Sung Il Kim, and Byung Soo Lee
Korea Institute of Nuclear Safety, Daejeon, Korea, Republic Of (Jongkuk@kins.re.kr)

This study presents the results of atmosphere dispersion modeling using CALPUFF code that are based on computational simulation to evaluate the environmental characteristics of the Barakah nuclear power plant (BNPP) in west area of UAE.
According to meteorological data analysis (2012∼2013), the winds from the north(7.68%) and west(9.05%) including NNW(41.63%), NW(28.55%), and WNW(6.31%) winds accounted for more than 90% of the wind directions. East(0.2%) and south(0.6%) direction wind, including ESE(0.31%), SE(0.38%), and SSE(0.38%) were rarely distributed during the simulation period. Seasonal effects were not showed. However, a discrepancy in the tendency between daytime and night-time was observed.
Approximately 87% of the wind speed was distributed below 5.4m/s (17%, 47% and 23% between the speeds of 0.5-1.8m/s 1.8-3.3m/s and 3.3-5.4m/s, respectively) during the annual period. Seasonal wind speed distribution results presented very similar pattern of annual distribution. Wind speed distribution of day and night, on the other hand, had a discrepancy with annual modeling results than seasonal distribution in some sections. The results for high wind speed (more than 10.8m/s) showed that this wind blew from the west. This high wind speed is known locally as the 'Shamal', which occurs rarely, lasting one or two days with the strongest winds experienced in association with gust fronts and thunderstorms.
Six variations of cesium-137 (137Cs) dispersion test were simulated under hypothetic severe accidental condition. The 137Cs dispersion was strongly influenced by the direction and speed of the main wind. From the test cases, east-south area of the BNPP site was mainly influenced by 137Cs dispersion. A virtual receptor was set and calculated for observation of the 137Cs movement and accumulation.
Surface roughness tests were performed for the analysis of topographic conditions. According to the surface condition, there are various surface roughness length. Four types of surface conditions were selected, including city area, hedge area, cut grass, and desert area. Four cases of simulations were performed under the same conditions except for surface the roughness factor. The results indicated that relatively high concentrations were found at the high surface roughness near the origin of the source point. The city area contained approximately four times 137Cs concentration than that of desert area. The atmospheric dispersion of 137Cs was affected by the surface condition in the proximal area. Moreover, movement of the radioactive material had a tendency to be dispersed in a relatively wide range in the desert areas compared to in the higher surface roughness areas.
The results of these study offer useful information for developing environmental radiation monitoring systems (ERMSs) and evacuation plan under unexpected emergency condition for the BNPP and can be used to assess the environmental effects of new nuclear power plant.
This work was supported by the Nuclear Safety Research Program through the Korea Nuclear Safety Foundation(KORSAFe), granted financial resource from the Nuclear Safety and Security Commission(NSSC), Republic of Korea (No. 1503003).