Estimation of Radioxenon Release Trajectory Plots Based on The Recent Development of the Molten Salt Reactor

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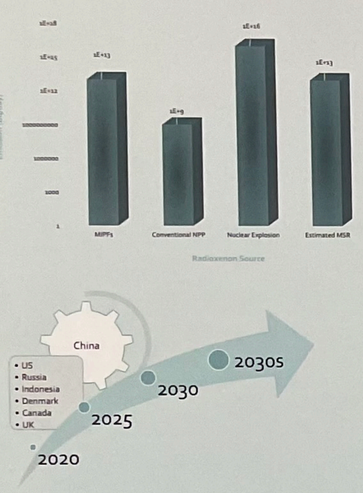
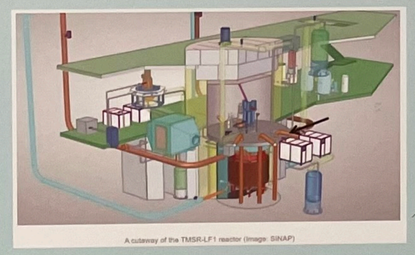
Introduction



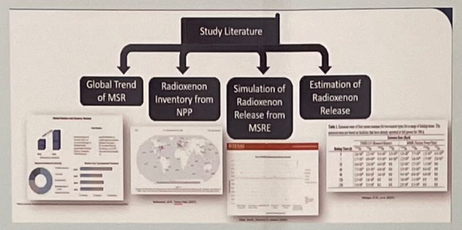
Radioxenon is a gaseous fission result of nuclear weapon testing. Aside from nuclear testing, the medical isotope production facilities produce the most radioxenon, emitting 10^9 -10^{13} Bq/day, while the power plant emits 10^9 Bq/reactor/day. The recent development of Molten Salt Reactor (MSR) revealed that the potential Radioxenon release from a single MSR might be larger than that from a conventional NPP, reaching around ^{133}Xe 10^{10} Bq/day. A previous study of the possible impact on global radioxenon emission in the recent development of the MSR (Retnoasih, Boitsova.,2023) concluded that the first increase in global Radioxenon emissions due to the MSR's operation could be expected in the early 2030s from the Thorium Molten Salt Reactor Liquid Fuel 1 (TMSR-LF1).

Objectives

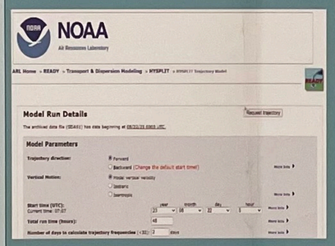
This research focus on the preliminary study of the estimation of radioxenon trajectory plots based on the recent development of the molten salt reactor. This estimation can give a preview for the atmospheric dispersion modelling to simulate the movement of the radioxenon release from the most recent development of the molten salt reactor which is TMSR-LF1 located in Gansu province, China and how it can approximately reach the nearby radionuclide monitoring system (RN20, RN21, RN22).


A cutaway of the TMSR-LF1 reactor (Image: SINAP)

Methods



HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) Simulation

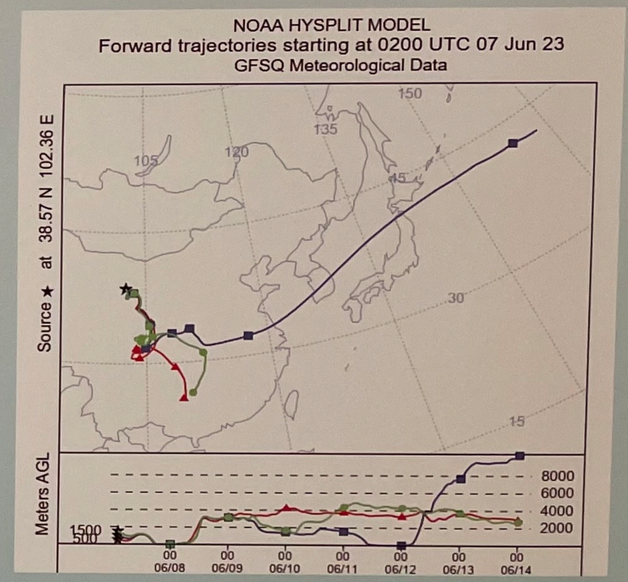


- Online (Internet Based) HYSPLIT , National Oceanic and Atmospheric Administration (NOAA)
- Archived data GSFQ
- Simulation for 7days (168hours)
- Simulation on started on 07 June 2023
- Coordinate of TMSR-LF1: 38°57'31" N, 102°36'55" E
- Level height: 500, 1000, 1500 metersAGL

Trajectory analysis and radionuclide monitoring system possibly affected

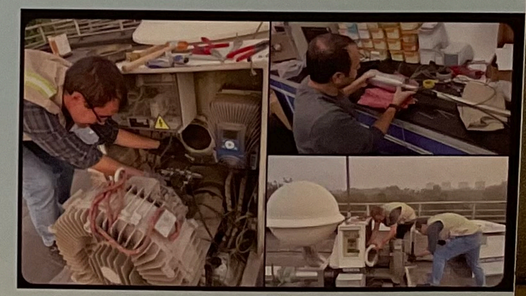
Results

Based on the estimation of the radioxenon release trajectory plots of TMSR-LF1, it shows that generally the particle movement follows the wind current on different level of altitudes. During this period, majority of the wind direction blows toward to the south then to the northeast for the 7 days (168hours) of the simulation. The red, green and blue lines indicate the different ground level for the simulation.



Conclusion

The estimation of radioxenon release trajectory plots using HYSPLIT shows that the recent development of the molten salt reactor, TMSR-LF1, built in China, with the license issued on 07 June 2023, shows that generally the particle movement follows the wind current on different level of altitudes with majority of the wind direction blows toward to the south then to the northeast. It means that the radionuclide monitoring station that could be affected is RN21. The RN21 Radionuclide station is located in Lanzhou with the coordinates: 36°00'00.0"N 104°12'00.0"E and is the nearest to the TMSR-LF1 with the coordinates: 38°57'31" N, 102°36'55" E.



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