



Presentation

Tritium Concentration in Precipitation around Wolsong NPP

Presentation for KNS

Pusan National University Mechanical Engineering
Nuclear Systems Major
In Suk Song

Contents



1. Introduction
2. Method
3. Result
4. Conclusion



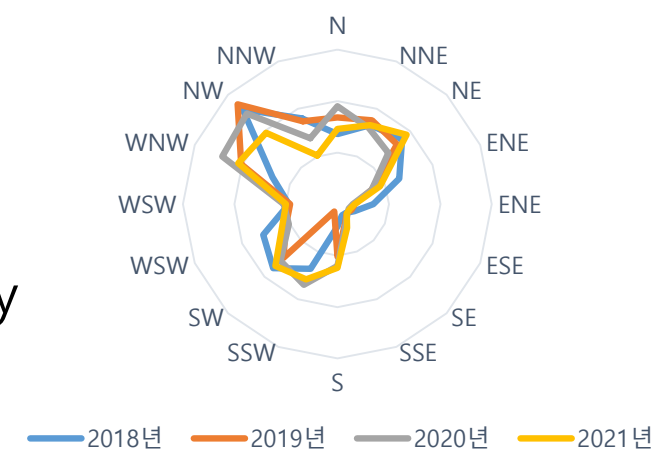
1. Introduction

- Introduction Wolsong NPP
 - Wolsong NPP located in Gyeongju, consists of four PHWRs and two PWRs
 - A lot of tritium is generated, especially in PHWRs (using D_2O)
 - PHWRs release tritium continuously, while PWRs release tritium intermittently into the atmosphere
 - Radioactive material (Tritium) in gaseous form is the main transport routes that can effect the environment
- Purpose
 - To know the range of tritium dispersion in the atmosphere
 - To know correlation between the tritium concentration in precipitation and wind direction

2.1 Sampling Sites



- Considering Wind direction
 - Considering wind direction centered on the Wolseong unit 4
 - Main wind direction : northwest to south east (NW direction)
 - NE(or NNE) and SW(or SSW) direction also have high frequency
 - Sample Location
 - ① mainly in the southern (SW and SSW) region
 - ② Mainly in the northern (NE and NNE) region

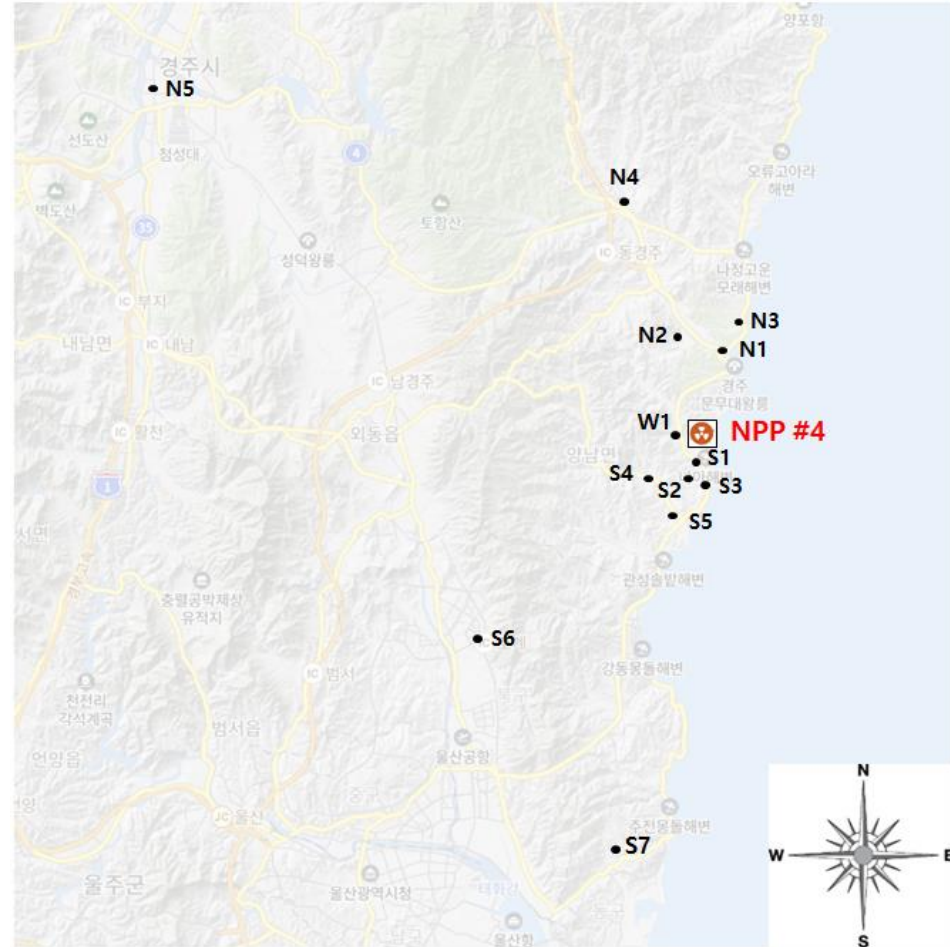


Wind direction frequency Wolseong NPP during the January 2018-2021

2.2 Sampling Sites

- Considering distance
 - Total Sampling location : 13 sites

Station	Distance (km)	Direction
S1	1.05	S
S2	1.86	S
S3	2.10	SSE
S4	3.10	SW
S5	3.75	SSW
S6	13.2	SW
S7	18.9	S
W1	1.24	W
N1	3.75	NNE
N2	4.30	NNW
N3	5.25	NNE
N4	10.9	NNW
N5	28.6	NW

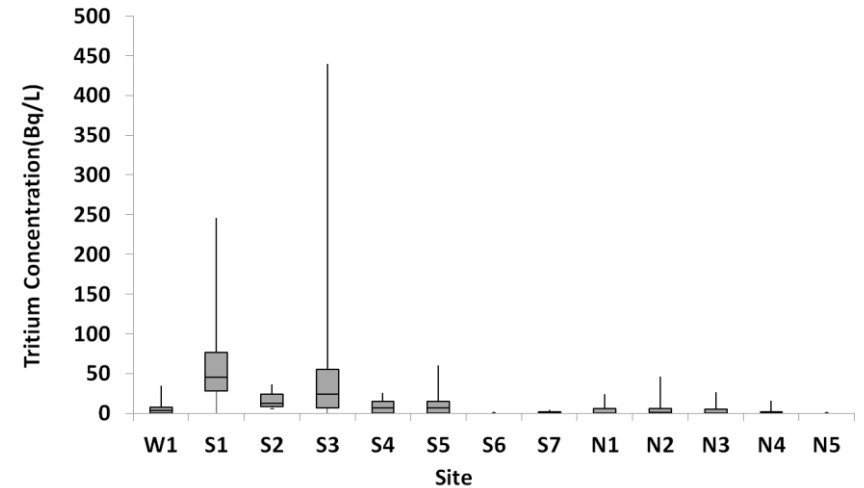


2.3 Tritium in the precipitation

- Information

- During the sampling period, it rained 14 times
- The concentration distribution was higher mainly in southern regions

Location	Sample Number	Maximum Concentration [Bq/L]	Date [2022]
S1	14	246 ± 3	April 13,14
S2	9	56.1 ± 1.7	June 13,14
S3	9	440 ± 3	April 13,14
S4	13	25.2 ± 1.2	March 17,18,19
S5	14	20.7 ± 1.3	June 5,6
S6	11	Not dected	
S7	12	8.04 ± 1.13	June 13,14
W1	14	34.8 ± 1.3	April 26
N1	12	42.4 ± 1.4	June 27
N2	13	45.7 ± 1.5	March 25,26
N3	14	38.2 ± 1.4	June 27
N4	14	15.5 ± 1.2	March 25,26
N5	11	Not dected	

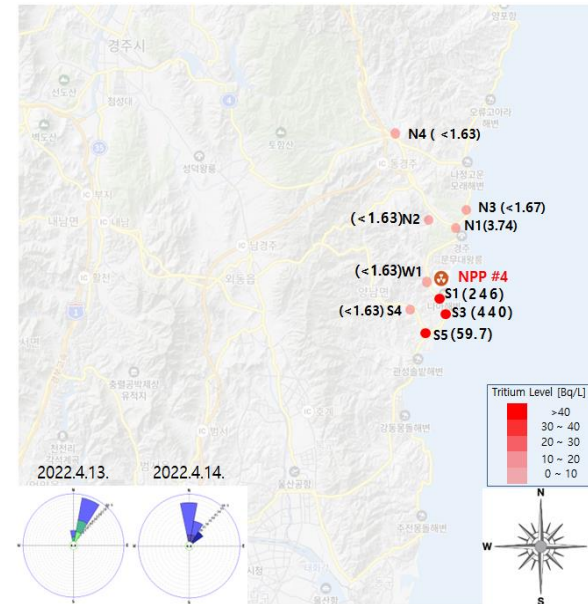


<Concentration Distribution>

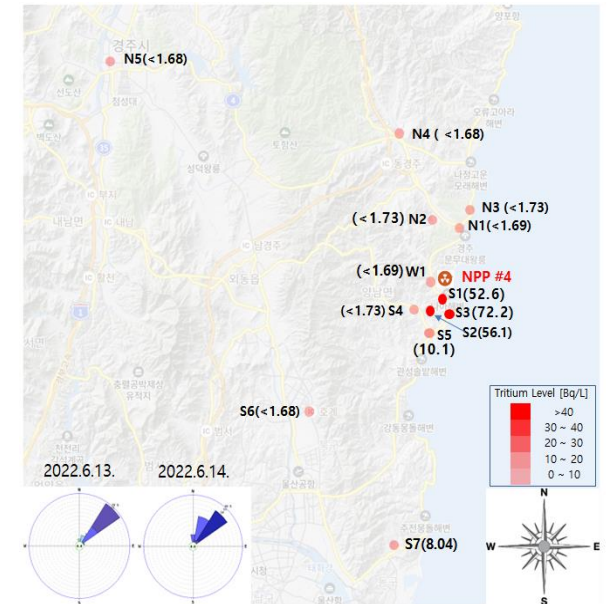
3.1 Tritium in the precipitation

- 2022.4.13. ~ 2022.4.14.
 - The maximum concentration at S1 and S3
 - Wind direction was N and NNE
 - Tritium was also detected at S1 and S7, and was detected at no other sites

- 2022.6.13. ~ 2022.6.14.
 - The maximum concentration at S2 and S7
 - Wind direction was NE and NNE
 - Tritium was also detected at S1, S2, S2, and S5
 - Tritium was detected 3 times at S7 site



<Wind direction 2022.4.13. ~ 2022.4.14.>

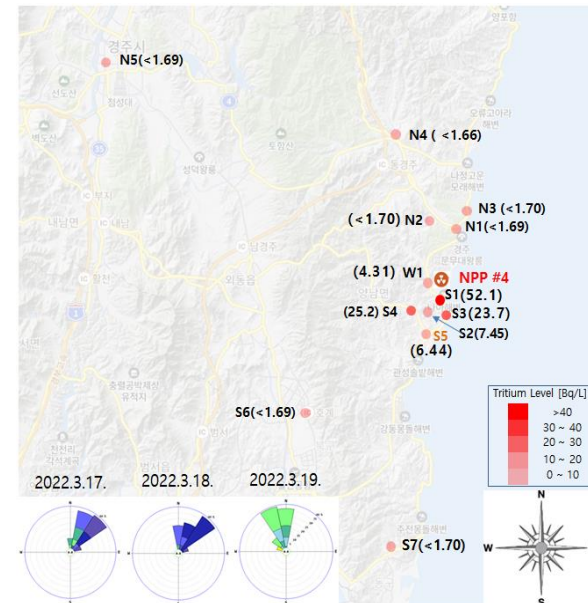


<Wind direction 2022.6.13. ~ 2022.6.14.>

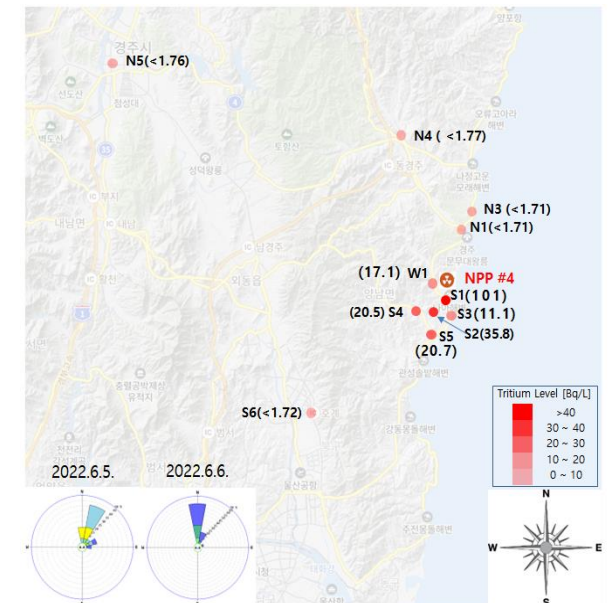
3.1 Tritium in the precipitation

- 2022.3.17. ~ 2022.3.19.
 - The maximum concentration at S4
 - Wind direction was NNW, NW and N
 - Tritium was also detected at S1 and S2, and S4

- 2022.6.5. ~ 2022.6.6.
 - The maximum concentration at S5
 - Wind direction was NNE and NE
 - Tritium was detected in all southern points except for S6 on that day

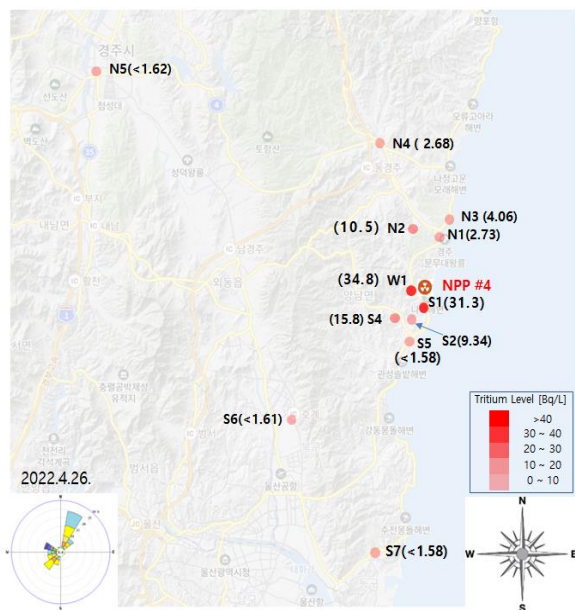


<Wind direction 2022.3.17. ~ 2022.3.19.>



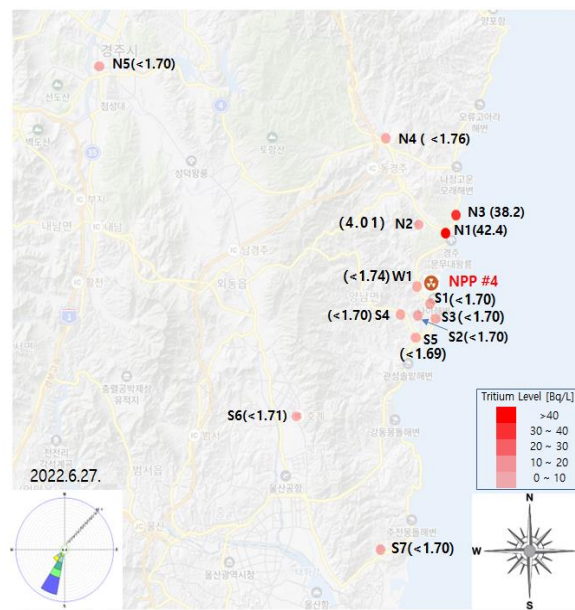
<Wind direction 2022.6.5. ~ 2022.6.6.>

3.1 Tritium in the precipitation



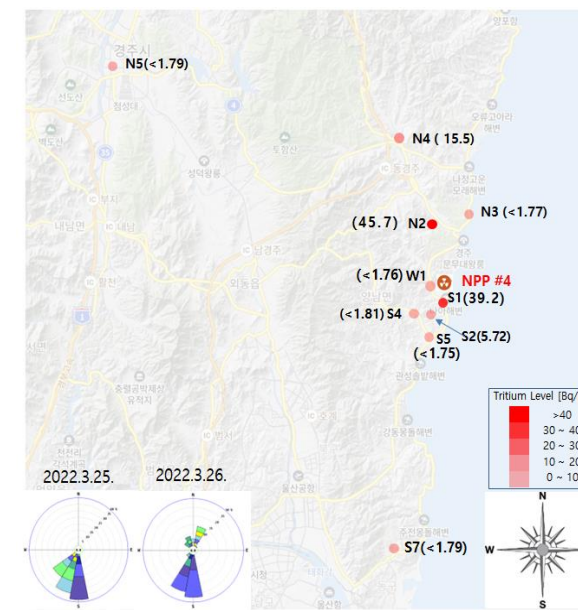
<Wind direction 2022.4.26.>

- In case of W1, low or not detected at all (NNE, WNW, SW, W, NW)
- Tritium was detected at S1, S2, S4, N1, N2, N3, and N4 on that day



<Wind direction 2022.6.27.>

- In case of northern region, low or not detected at all (SSW)
- The maximum concentrations were detected at N1 and N3



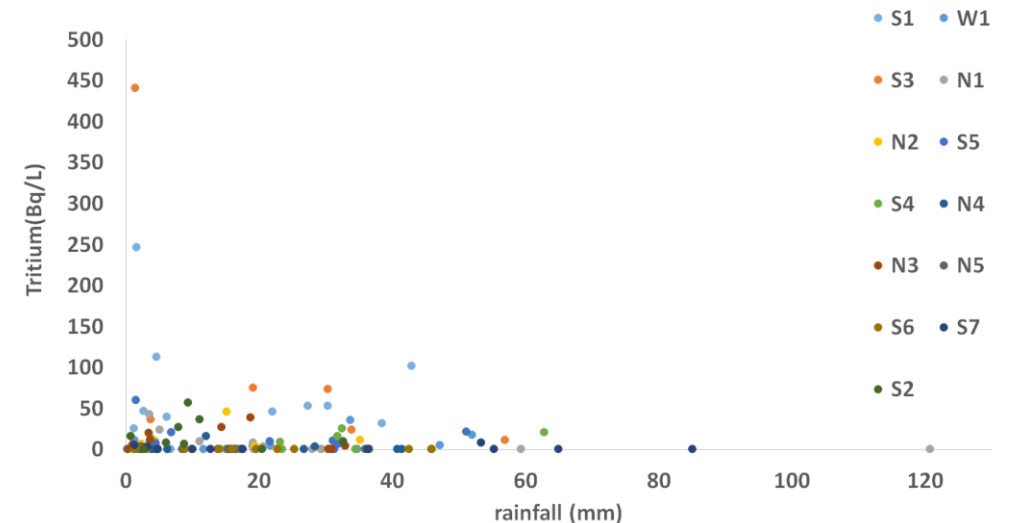
<Wind direction 2022.3.25. ~ 3.26.>

- The maximum concentration at N2 and N4 (SW, SSW, S, NNE, NNW)
- During entire period, tritium was detected at N5

3.2 Precipitation



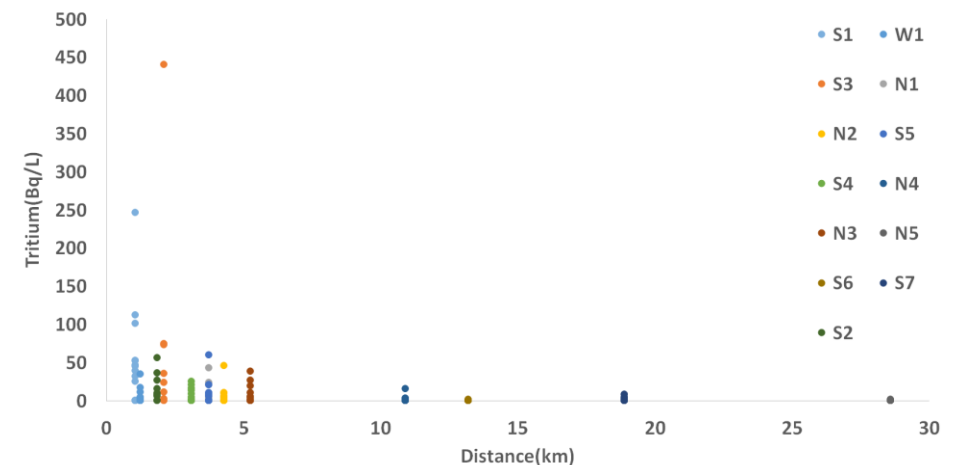
- Relation between tritium concentration and precipitation
 - The amount of precipitation was measured whenever it rained or snowed
 - Precipitation amount and tritium concentration was observed
 - The maximum concentration was higher :
 - When the precipitation was small
 - Tritium released into the atmosphere is less washed away by the precipitation



<Correlation between tritium concentration and rainfall>

3.3 Distance

- Relation between tritium concentration and distance
 - Tritium concentration is relation distance
 - In both the southern and the northern regions,
 - ① Tritium was mainly detected at points close to the NPP
 - ② Tritium was higher the closer to the NPP
 - On the other hand, it was low or not detected at points far from the NPP



3.4 Transfer to precipitation sample

- Tritium transfer to precipitation sample
 - Rainwater was collected and analyzed for each precipitation
 - In February 2022, it rained just only one day (Feb. 13)
 - Samples for this study were collected on Feb. 14 (immediately after precipitation)
 - Another rainwater from same site was collected on Feb. 28

Precipitation date		February 13	
Collection date		February 14	February 28
Concentration [Bq/L] at	W1	<1.33	5.01 ± 1.05
	N3	<1.33	7.51 ± 1.08

4. Conclusion



■ Conclusion

- Related to the distance from the NPP
- Related to the wind direction(W1 and S1) and the amount of precipitation
- The effect of tritium on precipitation is greater in the southern region than in the northern region
- A suspicious phenomenon was observed for the transfer of tritium the air to the precipitation sample
- Special care must be taken in collecting samples to accurately measure the tritium concentration in precipitation