# Hydrogeochemical Changes in the Groundwater System at the Gyeongju LILW Disposal Site After Construction

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## 1. Introduction

This study is objected to understand the hydrogeochemical change and its long-term perspective in the groundwater system at the Gyeongju LILW disposal site during the site operation period.

## 2. Methods

### *2.1 Monitoring Site*

This study uses the long-term monitoring data obtained from the LILW site monitoring program by KORAD. Groundwater and sea-waer monitoring data were analyzed [1].

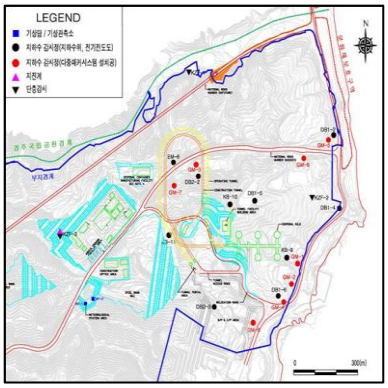



Fig. 1. Location of groundwater monitoring wells.

### *2.2 Data analysis*

The obtained monitoring data were analyzed using various techniques including plotting for hydrochemistry, statistical analysis, and time-series analysis.

## 3. Results & Discussion

### *3.1 Hydrogeochemical characteristics*

Hydrogeochemical type of the groundwater samples are presented in Fig. 2. They show significant variation in location of monitoring wells and depths of monitored interval.

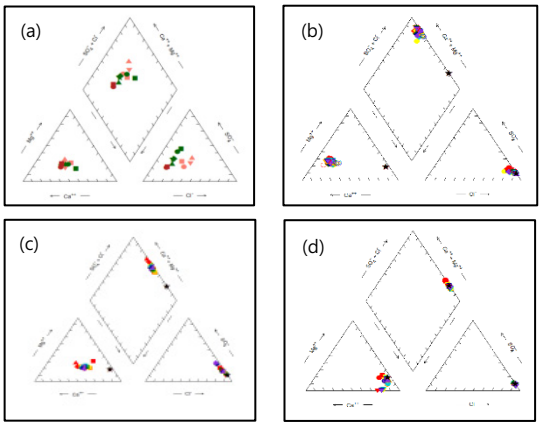



Fig. 2. Hydrogeochemical types of groundwater plotted in the Piper diagram: (a) background waters, (b) Type I, (c) Type II, (d) Type III.

### *3.2 Time-series of EC*

Observed electrical conductivities of groundwater samples, implying the dissolved content of the samples, show three types of time-series changes.

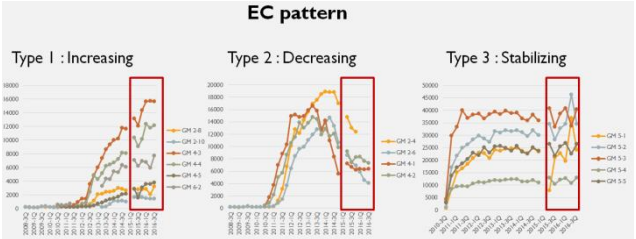
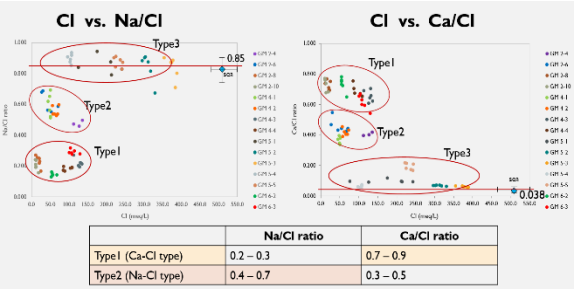



Fig. 3. Time-series data of groundwater EC's.

Type I shows the changes in the groundwater system started relatively later and the change is still on-going process. Type II indicated the change has past the highest point and now is moving backward to the original state. Type III represents the new equilibrium states after some changes, however, the variation is not settled yet.

*3.3 Hydrogeochemical reactions*

Groundwater of different types indicate that they are experiencing different hydrochemical reactions [2].




| | Na/Cl ratio | Ca/Cl ratio |
|---|---|---|
| Type1 (Ca-Cl type) | 0.2 – 0.3 | 0.7 – 0.9 |
| Type2 (Na-Cl type) | 0.4 – 0.7 | 0.3 – 0.5 |

Fig. 4. Hydrochemical reactions related to different types of groundwater.

Hydrogeochemical reactions in the coastal groundwater system is related to the degree of influence by the sea-water intrusion (Fig. 4). Most significant reaction can be explained using the ion-exchange process (Fig. 5).

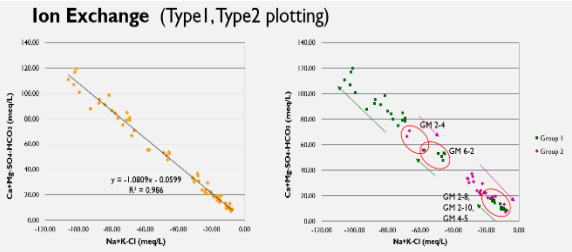



Fig. 5. Ion-exchange process of Type I and II groundwater samples.

## 4. Conclusion

In this study, we tried to understand the time-series change in hydrogeochemistry of the groundwater system at the LILW disposal site since 2015, when the site operation began.

Water-rock interaction of fresh groundwater with the intruded saline-water is clearly observed in the chemistry change of groundwater monitoring data.

Partly, groundwater system is still changing, and some parts show returning to the original state, and even approaching new equilibriums. These changes in time warrant the long-term monitoring of the site, and the interpretation and evaluation of the site safety and integrity based on those changes will provide significant scientific information that can improve the public acceptance of the LILW site operation.

## REFERENCES


[1] KORAD, Monitoring and Surveillance of Radioactive Waste Disposal Facility during pre-operation (2015).

[2] Anders, R., Mendez, G.O., Futa, K. and Danskin, W.R., “A geochemical approach to determine sources and movement of saline groundwater in a coastal aquifer”, Groundwater, 52 (5), 756-768 (2014).