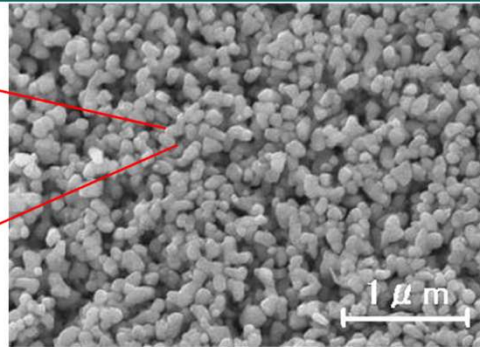
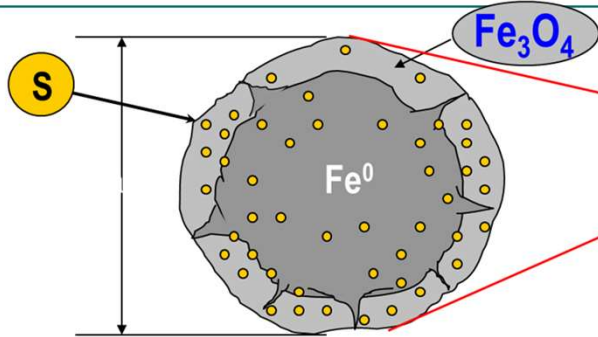


Viet Nam-Japan Environmental Week Dec. 2021

# In-Situ Soil and Groundwater Remediation using Reactive Nanoscale Iron Particles (**RNIP<sup>®</sup>**)

 **NAKAMURAKISO.CO., LTD.**

# What is RNIP ?



**Fig. 1 Schematic RNIP structure**    **Fig. 2 SEM image of RNIP**

- Particle size; 70 nm
- Specific surface area; 30 m<sup>2</sup>/g



**Fig. 4 RNIP production plant**

- We have produced 60 tons of RNIP per month at our Higashi-hiroshima plant since 2017.

➤ **RNIP is processed in aqueous slurry.**

- Slurry Density; 1.25 g/ml
- Solid concentration; 25 wt.%
- Slurry Viscosity; 600~700 mPa·s

➤ **Slurry of RNIP is diluted by several to one hundred times in use.**



**Fig. 3 Our product of RNIP**



**1m<sup>3</sup>  
SUS container**



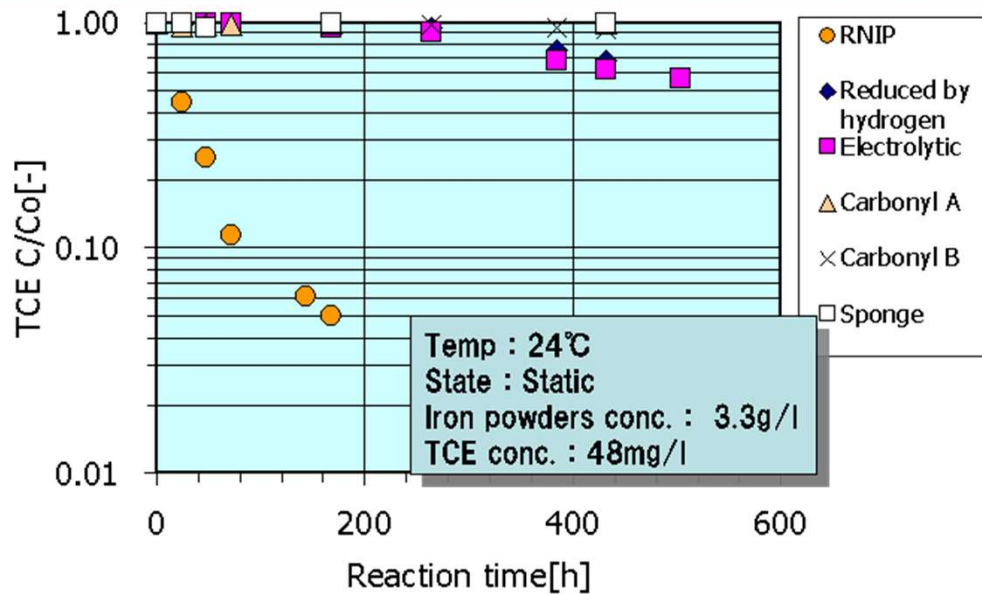
**200L  
Drum can**



**20L  
Plastic container**

**Fig. 5 RNIP packaging**

# Characteristics of RNIP & Cleanup works using RNIP



**Fig. 6 TCE Decomposition rate by RNIP compared with another iron powders**

➤ The reaction rate of RNIP is much greater than that of commercial iron powders by 100 times.



**Fig. 7 Injection of RNIP into contaminated soil with chemical grouting method**




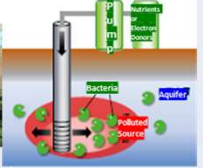
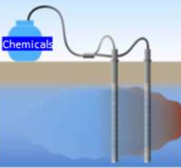


**Fig. 8 Mixing of RNIP into contaminated soil with mechanical mixing or agitating method**

# Summary of RNIP & Our Remediation Solutions

- **RNIP is no toxicity and quite safety. Therefore, it does not cause a secondary environmental pollution using RNIP.**
- **The VOC remediation performance of RNIP is much greater than those of commercial iron powders by 100 times.**
- **RNIP has also a high cleanup performance for containing heavy metals such a Chromium (VI) .**
- **RNIP has a high mobility performance and is suited for rapid in-site cleanup with both chemical grouting method and mixing method.**

**Table 1 Our remediation solutions besides RNIP**

	Excavation & Removal	In-Situ Remediation			
		Injection of RNIP	Mixing of RNIP or Iron	Bio Remediation	Chemical Oxidation
Schematic Figure or Picture					
Target Contaminants	VOC Heavy Metals	VOC Heavy Metals	VOC	VOC · Oil Cyanide	VOC Cyanide
Certainty	◎	○	△	△	○
Environmental Benign	△	◎	○	△	△
Work Period	◎	◎	△	△	◎
Cost	△	◎	◎	◎	◎