

## SVRATKA SITE: INNOVATIVE NZVI GEOCHEMICAL BARRIERE SUPPORTED BY DIRECT CURRENT (DC)

Massive contamination by chlorinated ethenes (CHCs) under an engineering plant showed to be problem for a near groundwater receiving river. The innovative approach including formation of nZVI reactive geochemical barrier was chosen by the remediation company MEGA. Moreover, a prolongation of activity of the applied NANO FER was achieved thanks to the usage of DC.

### SITE CHARACTERISTICS

#### General

Name:	MARS
Location:	Svratka, Czech Republic
Function:	mechanical engineering; currently operating plant
Contaminants:	CHCs (chlorinated ethenes)

#### Hydrogeology

Treatment Area:	25 000 m <sup>2</sup>
Groundwater Table:	3 – 5 m bgl
Groundwater Velocity:	0.27 m/day
Geological Profile:	quaternary sediments located above two-mica migmatites

Long-term monitoring and remediation actions have been performed on site since 1992. The used measures included venting, airsparging and stripping but these methods collided with current operations at the plant. Therefore, geochemical reactive barrier was applied as a temporary safety element to remove pollution in the zone of contamination plume discharge. The principle of geochemical reactive barrier is based on in-situ reaction treatment zone formed in the place where contamination is leaking from the protected area – water flowing through the treatment zone is remediated and concentration of contaminants is reduced to required clean-up level.

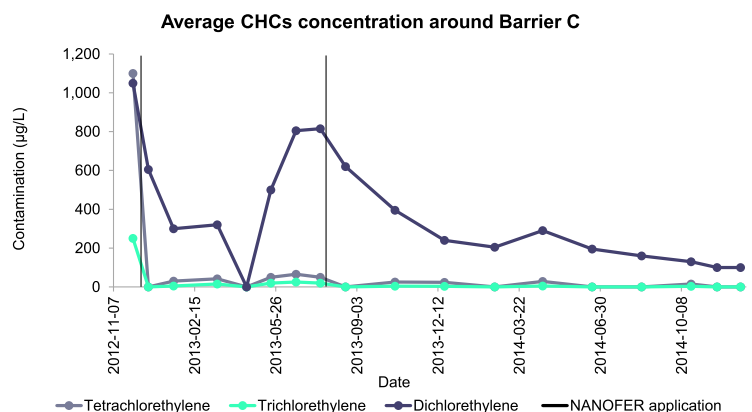
### REMEDIATION APPROACH

#### Remediation Objectives

- Form effective reactive nZVI barrier
- Prevent contamination plume reaching the river
- Revive applied nZVI and boost electron exchange between Fe and CHCs using DC

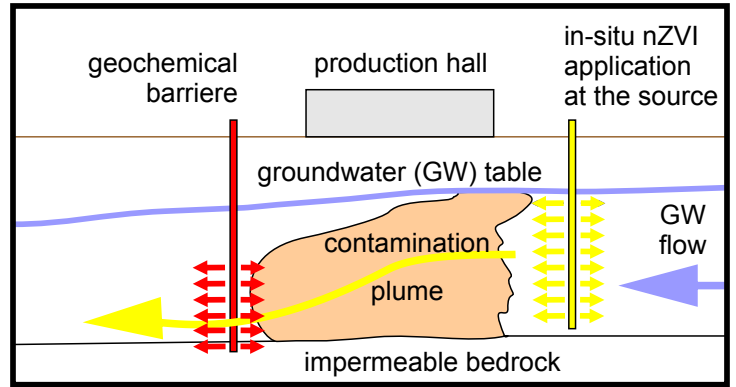
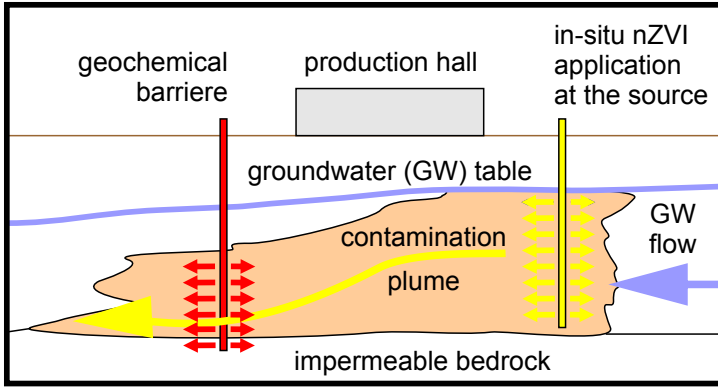
#### Application Strategy

- Application Type: pressure injection through permanent wells
- Product: NANO FER STAR DC aqueous suspension
- Total Quantity Applied: 1 500 kg / 3,300 lb in 5 application rounds

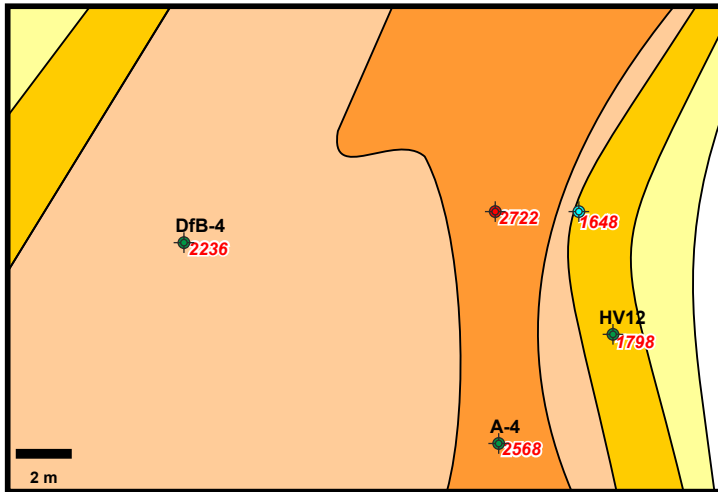


# RESULTS OF A REACTIVE BARRIER FORMATION AND DC EMPLOYMENT

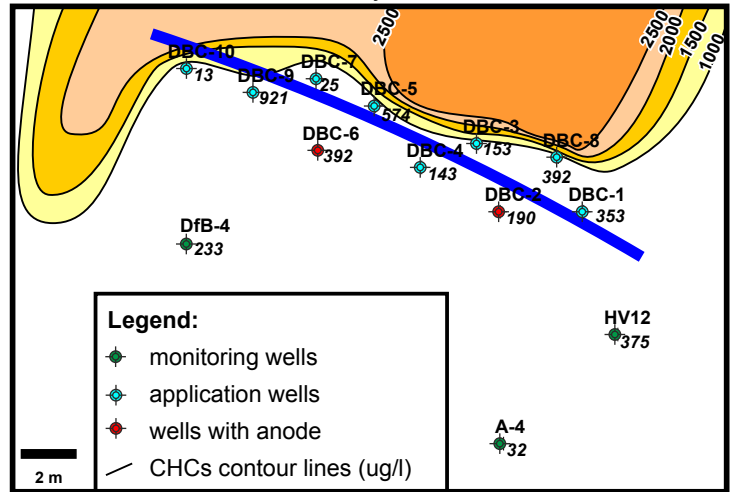
Principle of reactive geochemical barrier - contamination plume evolution over time (before/after nZVI application)



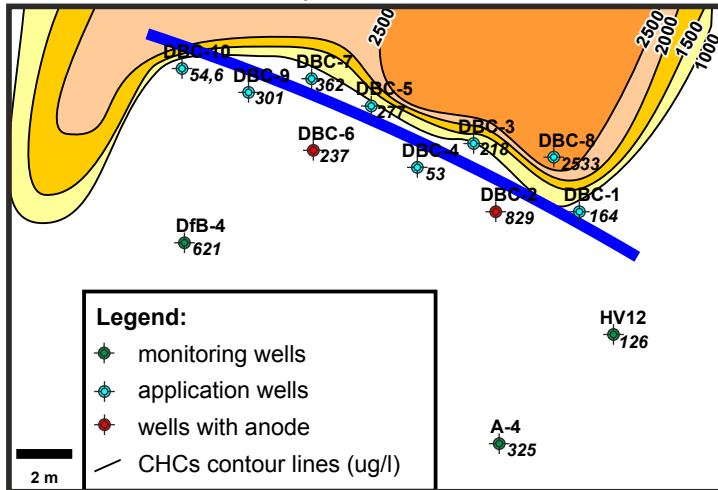
CHCs level in November 2012 - before barrier formation



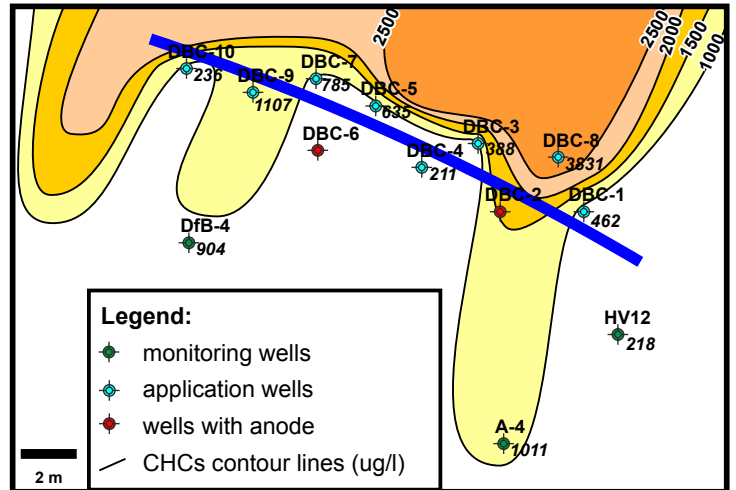
CHCs concentration in January 2013 - Barrier C



CHCs concentration in April 2013 - Barrier C



CHCs concentration in August 2013 - Barrier C



## CONCLUSION

The above described case proved applicability of reactive barrier formed by NANOFER STAR particles in combination with DC. Under proper hydrogeological conditions, the barriers can completely replace conventional processes used to prevent discharge of contaminated water from the remediation zone.

Remediation employing geochemical barrier together with DC is more demanding regarding (hydro) geological survey and information coming from it. Nevertheless, it brings advantages over commonly used remediation methods due to its resistance to external influences (maintenance-free).

We acknowledge MEGA a.s. remediation company and thanks to Jaroslav Hrabal, who provided us data collected on site.