

## Remediation Techniques



Unlike hydrocarbons metals in general are harder to treat and there are less viable options

It is difficult to actually destruct the metal and hence for many techniques the total levels of metals does not change – it is more to do with altering their state or by concentrating them into a smaller volume for subsequent disposal or high level treatment

Metals are more readily risked out by Consultants because easy to put barriers in place – hence tends to be down to impact on groundwater (but not always)

## Remediation Techniques



### COMPLEXATION/ALTERATION

Site in Dudley, West Midlands

- Former chromium, nickel and zinc plating works
- Used XRF to reduce volume for disposal
- Groundwater plume extending into adjacent brook
- Plume had chrome VI but also, copper, nickel and zinc
- Used MRC<sup>®</sup> to complex the metal compounds out into stable mineral salts

## Remediation Techniques



### COMPLEXATION/ALTERATION

Site in Shrewsbury

- Lead impacted topsoil
- Common problem found on army shooting ranges
- Lead sulphate deemed a risk
- Lead phosphate identified as a stable lead compound
- Apply phosphate powder to complex into lead phosphate – does not leach out
- Must prove chemistry as total lead level has not altered

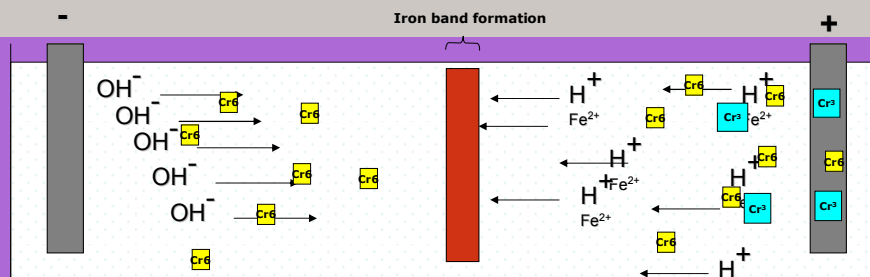
## Remediation Techniques



### Ferrous Iron Remediation Stabilisation (FIRS)

The FIRS technique involves the application of a low magnitude direct electric potential between two or more **sacrificial**, iron-rich, electrodes emplaced either side of a contaminated soil or sediment.

The electric potential is used to generate a strong pH gradient and force the precipitation of an iron-rich band. The iron band together with the pH gradient, provides a chemical trap for a range of contaminants.



## Remediation Techniques



The aim of FIRS is to reduce the carcinogenic and mobile  $\text{Cr}^{6+}$  to the less toxic and less mobile  $\text{Cr}^{3+}$

$\text{Cr}^{6+}$  species are soluble over a wide pH range and will migrate towards the anode during electrokinetic treatment

It has been found that reduction of  $\text{Cr}^{6+}$  in the presence of  $\text{Fe}^{2+}$  occurs instantaneously as shown by the following reaction:



The anode zone will be flooded by  $\text{Fe}^{2+}$ .

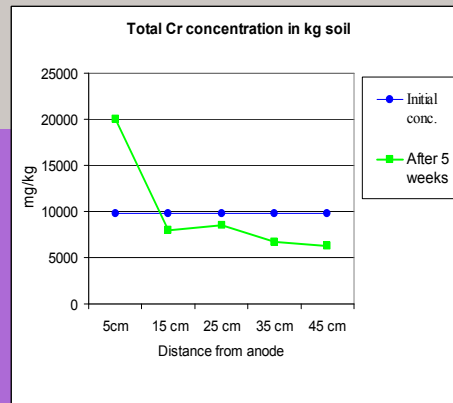
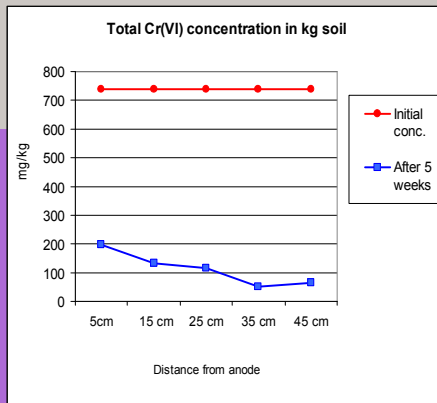
It follows that FIRS has considerable potential to reduce the toxicity of  $\text{Cr}^{6+}$  wastes.

## Remediation Techniques



### Bench Scale Trial

50kg Cr<sup>6+</sup> contaminated soil, trial run for 5 weeks at 75v (1.5v/cm)



Units mg.kg<sup>-1</sup>

## Remediation Techniques



- A 60% reduction of Cr(VI) concentration near the anode
- A 95% reduction of Cr(VI) concentration near the cathode
- A 100 % increase in Total Cr concentration near the anode
- A 32% decrease in Total Cr concentration near the cathode
- A 27% build up of iron near the anode

## Conclusion



There are fewer options relating to heavy metals –  
BUT there are options and the market is continuing to  
develop new techniques