ATTACHMENT 7:
Additional ISCO Considerations

There are several other important considerations that need to be made during the screening process that are not included within the screening tool, and thus need to be made independently after running the tool and gathering the output. One important consideration is the availability and experience behind the methods contained within the tool. Depending on the site location and availability of technology vendors, certain oxidants or distribution methods may or may not be practical or available. In addition, some of the injection methods included in the screening tool output may be considered novel technologies and the experience base may be considerably smaller with some of these methods. Thus, the science and engineering behind them may be considerably less certain than the more commonly used methods (such as vertical well or direct push probe injection). This novelty and/or lack of experience is a major consideration when interpreting tool output, as a commonly applied technology that may score lower in the screening tool may still be preferable at many sites than a novel approach that may have only been tried once or twice. Furthermore, presumed costs may vary. For instance, horizontal wells often have higher costs associated with them, and their cost versus benefit is often limited to situations where the site has access limitations or treatment of a large area is desired. Table A7-1 highlights the experience base with the different oxidants and different injection approaches at the time of the publication of this protocol. Technically impractical indicates that the approach is not valid for the oxidant considered, and these approaches are also blacked out on the screening tool output sheet. Frequently implemented indicates the most common forms of injection for each oxidant, with other terms and colors indicating more novel, less commonly used approaches. It should be noted, however, that injection technologies and oxidant approaches are continually evolving with new innovations, and thus technologies that are presently considered novel may become widely applied in the future as their experience base grows. Thus, it is important to realize the values in this table are not constant and may change as time progresses. Consultation with technology vendors and engineering consultants is recommended prior to selecting an approach to carry forward into conceptual design.

Table A7-1. Frequency and Practicality of Oxidant Delivery Approaches vs. Oxidant Type

Distribution Technique		Permanganate	Hydrogen Peroxide	Ozone	Persulfate
Direct-push Probe Injection		Frequently implemented	Frequently implemented	Technically impractical	Frequently implemented
Well injection -	Vertical Wells	Frequently implemented	Frequently implemented	Frequently implemented	Frequently implemented
	Horizontal Wells	Implemented but rarely	Possible, but not implemented	Implemented but rarely	Implemented but rarely
Recirculation	Vertical Wells	Less frequenly implemented	Technically impractical	Technically impractical	Possible, but not implemented
	Horizontal Wells	Possible, but not often implemented	Technically impractical	Technically impractical	Possible, but not implemented
Trench or curtain Injection		Possible, but not implemented	Possible, but not implemented	Less frequenly implemented	Possible, but not implemented
Soil Mixing		Implemented but rarely	Implemented but rarely	Technically impractical	Implemented but rarely
Fracture emplaced ISCO amendment*	Pneumatic	Implemented but rarely	Technically impractical	Technically impractical	Possible, but not implemented
	Hydraulic	Implemented but rarely	Technically impractical	Technically impractical	Possible, but not implemented
Surface application or infiltration gallery		Frequently implemented	Technically impractical	Technically impractical	Frequently implemented

* refers to oxidant injection during fracturing, not fracturing just to improve delivery

SPECIAL CONSIDERATIONS FOR PERMANGANATE

An additional important consideration with respect to the oxidant permanganate is the natural demand that site media will exert for the oxidant, referred to as the natural oxidant demand (NOD). As part of the site characterization data collection, running a 48-hour permanganate NOD test using the newly developed ASTM method D7262-07 is highly recommended. If the 48-hour NOD from this method is a value higher than 20 g/kg, the natural oxidant demand of the site is likely to be very high and ISCO approaches using permanganate may be uneconomical unless the target treatment zone is very small. Caution should be exercised by the user who proceeds with implementation of permanganate at a site with an NOD over this amount, and further treatability studies or demonstration is recommended. If the permanganate NOD with this method is above 1 g/kg, a kinetic NOD test as described under the Conceptual Design Component of the ISCO Protocol may yield valuable information about the ability to distribute permanganate effectively in the subsurface, especially during Conceptual Design which occurs later in the protocol. The further above the 1 g/kg NOD mark the site is, the more this kinetic consideration will matter, and sites above 20 g/kg may find permanganate very difficult to distribute effectively. If the NOD is under 1 g/kg, permanganate NOD is likely to be low in the subsurface, and further characterization of the NOD is not required unless planning to transport permanganate over long distances. NOTE: a similar evaluation at this screening stage is not necessarily recommended for other oxidants because there will not be a limit to the extent of oxidant consumption. With oxidants that autodecompose when activated (via contact with natural minerals in soil or via engineered activation system), 100% of the oxidant will be depleted, albeit at varied rates of decomposition. These rates of decomposition are addressed during the ISCO Conceptual Design process.