

## Kuehling, Harlan H.

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**From:** Evanson, Theresa A.  
**Sent:** Wednesday, August 10, 2005 10:12 AM  
**To:** Kuehling, Harlan H.  
**Subject:** FW: Permanganate Injection into Groundwater

FYI

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**From:** Evanson, Theresa A  
**Sent:** Tuesday, March 25, 2003 1:14 PM  
**To:** DNR\_RR\_STATE  
**Cc:** Phelps, William L; Roth, Richard T  
**Subject:** Permanganate Injection into Groundwater

There have been recent requests to inject permanganate (MnO<sub>4</sub> - in either the potassium or sodium form) into groundwater to treat contaminants in-situ. Some issues have come up that we'd like all project managers to be aware of.

1. MnO<sub>4</sub> is used to oxidize & destroy chlorinated ethenes, primarily. It does not oxidize petroleum compounds, however MnO<sub>4</sub> does provide oxygen to the subsurface and will support biological activity which can degrade petroleum (however, this is a very costly method for adding oxygen).
2. MnO<sub>4</sub> is created from manganese ores, which contain a variety of trace metals. Trace metals that may be present include: antimony, arsenic, chromium, mercury, beryllium, cadmium, lead, and thallium. The metal of most concern is chromium which will be in the Cr (VI) form (the most oxidized & mobile form). In general, concentrations of the trace metals injected with the MnO<sub>4</sub> should not exceed ES standards. However, there are various grades of MnO<sub>4</sub>, containing different concentrations of trace metals. The manufacturer should be able to provide an analysis of the MnO<sub>4</sub> proposed for injection at a remediation site, including the amounts of trace metals to be expected.
3. MnO<sub>4</sub> (and other strong oxidizers) can oxidize and mobilize chromium that is native to soils/bedrock. Other metals may also be mobilized through oxidation. The background concentration of the trace metals, the availability of the trace metals to the oxidant, the soil type, etc., will determine the final concentrations in groundwater. It is possible to exceed ES levels of chromium (& perhaps other metals) through of mobilization of native trace metals.
4. It's recommended that the following issues be addressed before proceeding with an approval of MnO<sub>4</sub> injection:
  - a. Obtain the chemical analysis of the MnO<sub>4</sub> proposed for injection.
  - b. The consultant should provide a mass balance of the MnO<sub>4</sub> vs. the natural oxidant demand and contaminant demand (i.e., to limit addition of excess MnO<sub>4</sub>).
  - c. Concentrations of MnO<sub>4</sub> in groundwater necessary to oxidize the contaminant.
  - d. Expected persistence of MnO<sub>4</sub> in the groundwater (i.e., how long it will be effective).
  - e. A monitoring system should be in place that can determine the extent of the area affected by the MnO<sub>4</sub> injection.
  - f. Analyze groundwater for:
    - total Cr before treatment & then periodically during treatment & after treatment until Cr has declined to background levels.
    - other trace metals that could exceed PALs. This includes an assessment of metals contained in the MnO<sub>4</sub> as well as native trace metals.
    - MnO<sub>4</sub> concentrations
  - g. Sentinel wells should be part of the monitoring program. Use these wells to determine that MnO<sub>4</sub> doesn't extend beyond the area intended to be treated.
  - h. Monitor MnO<sub>4</sub> and trace metals until those compounds have returned to background levels.
5. **All injection requests require approval under NR 812 before injection. Depending on levels, an exemption from NR 140 may also be necessary. All injection approvals must be copied to Rich Roth - UIC, DW&GW/2 and Bill Phelps - DW&GW/2.**

If you have any questions, please call or e-mail myself or Bill Phelps.

Terry

## **Kuehling, Harlan H.**

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**From:** Kuehling, Harlan H.  
**Sent:** Tuesday, August 09, 2005 1:42 PM  
**To:** Evanson, Theresa A.  
**Subject:** Reedsburg Cleaners DERF Site - Consultant Selection

Hi, Terry,

I'd like to briefly describe a situation in which I am involved and get your opinions, as the DERF team leader, on how to proceed, assuming you have the time and interest.

I recently was asked to become the project manager for the Reedsburg Cleaners site. Proposals had been submitted about a year ago but the project manager at the time didn't have the time to keep the process moving forward. In June, I requested that the proposing consultants update their proposals, and we now have three proposals from Triad Engineering, BT2, and STS Consultants.

Last Wednesday, I met with the RP to explain the process and listen to his opinions. The RP (Wayne Butz) would like to choose Triad Engineering, for no other reason than the Triad project manager has routinely been in communication with the RP, which the RP appreciates. I didn't know it, but the RP had also arranged for the Triad reps to also attend the meeting, which they did after my meeting with the RP. Triad is proposing in-situ chemical oxidation, using sodium permanganate in the portion of the GW plume nearest the source, together with one SVE well. Their initial proposal included only an institutional control (existing concrete parking lot) to address the source area soil. In response to my criticism of this approach for the soil, Triad is in the process of writing an addendum to their proposal that will include mechanically mixing peroxide into the shallow soil. The site also has petroleum contaminants, to a probably small extent from former tanks on the site and to a much larger extent from an up-gradient off-site source.

I have recently read the slides from a former computer/telephone conference offered by EPA, and now posted on "Clu-In", on the sodium permanganate remediation method for groundwater. Looks like this approach works well for CVOCs and PVOCS (except benzene), although much time and money was spent on conceptual models, bench-scale tests, and field tests before actual implementation in the example given in the presentation. This level of planning has certainly not been proposed for this site, and would be cost prohibitive.

The Triad proposal is the lowest cost of the three submitted, and probably will remain the lowest after they submit their addendum (the three proposals are in the \$220,000-300,000 range).

I have included here only the most basic information, but I would like your opinions about the Triad approach, to the extent that it is described here (or I can give you more information, too).

My understanding of my role is to evaluate the Triad proposal and conclude that either: 1) the proposal has a good chance to remediate the site for closure for the estimated cost; or 2) it has a poor chance of remediating the site and I would then have the RP choose one of the remaining two proposing consultants. Is this an accurate statement?

At this point, I don't have any good reason to dismiss Triad's approach, but would like to have your opinion on the potential effectiveness of this remedial approach. I'm more than willing to fill you in on more details if you need them. How about we discuss this further, including your response, on the phone? I'll be in the office today through Thursday, then on vacation until the middle of next week. Can we talk this week?

Thanks very much for spending some time on these requests, Terry.

Hank