



Environmental Solutions

Procedure for Activating Klozur[®] Persulfate with an 8% Hydrogen Peroxide Solution

Background

Klozur Persulfate can be activated with hydrogen peroxide to generate sulfate radicals, which are capable of destroying a wide range of organic contaminants. In general, hydrogen peroxide is dosed in conjunction with Klozur persulfate in a ratio of 1 mole hydrogen peroxide to 1 mole persulfate up to 10 moles hydrogen peroxide to 1 mole persulfate. Typically, a mole ratio of 5 : 1 hydrogen peroxide to persulfate is sufficient to treat most contaminants under a wide range of site conditions.

Safety and Handling

Hydrogen peroxide is a strong oxidant, capable of generating significant heat and gasses when applied in the subsurface.

Review the MSDS with all workers prior to handling this chemical.

Hydrogen peroxide is sold commercially in a variety of concentrations. Common concentrations include 70%, 50%, 17.5%, and 8%. Highly concentrated forms of hydrogen peroxide may generate extreme exothermic reactions upon injection into the subsurface or when contacting high levels of contamination, potentially liberating significant quantities of gas. Care must be taken to avoid excessive heat and gas evolution as this may cause damage to utilities, buildings and represents a safety hazard if not properly controlled.

FMC recommends hydrogen peroxide solutions of no more than 8% by weight be used to activate Klozur persulfate.

This will help to minimize the generation of heat and gas upon injection of hydrogen peroxide into the subsurface.

Use of hydrogen peroxide solutions in excess of 8 wt% may increase the risk of injury, loss of product containment and equipment damage.

Activation Procedures

1. Determine the quantity of Klozur Persulfate in lbs to be injected into the treatment area at the contaminated site.
2. Determine the number of moles of Klozur persulfate:



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moles Klozur persulfate = lbs of Klozur persulfate / 238

3. Determine the number of moles of hydrogen peroxide needed;

moles of hydrogen peroxide = moles of Klozur persulfate x 5

4. Determine the lbs of hydrogen peroxide needed:

lbs of hydrogen peroxide = moles hydrogen peroxide x 34

5. Determine the gallons of 8% hydrogen peroxide needed:

Gallons of hydrogen peroxide = lbs of hydrogen peroxide / 0.684

Applying Klozur solution and hydrogen peroxide activator to a contaminated site

1. Hydrogen peroxide can be injected after injecting Klozur Persulfate
2. It is recommended that if the Klozur persulfate and 8 wt% hydrogen peroxide solution are added simultaneously
 - No more than **5 gallons** of 8% hydrogen peroxide should be added per gallon of 30% Klozur solution
 - No more than **3 gallons** of 8% hydrogen peroxide should be added per gallon of 20% Klozur solution
 - No more than **2 gallons** of 8% hydrogen peroxide should be added per gallon of 10% Klozur solution

It is always safer to inject the materials sequentially. If mixing hydrogen peroxide and Klozur persulfate above ground, insure safe conditions. Use clean water and clean mixing and handling equipment. Transition metals in the supply water, such as iron, can result in rapid decomposition of the hydrogen peroxide. It is recommended that oxidant solutions be injected promptly into the subsurface and avoid delays resulting in the solutions remaining in mix tanks for extended periods of time. Also use vented tanks and piping when using oxidizing solutions. Always drain lines to empty and avoid trapping solution between valves for extended periods of time. Do not “dead head” pumps. When injecting hydrogen peroxide solutions, it is recommended that temperature and back-pressure be monitored and controlled to prevent highly exothermic, subsurface reactions.