AEHS 2017 Conference Paper

HARNESSING THE EXOTHERMIC FENTON'S REACTION DURING INJECTION OF STABILIZED HYDROGEN PEROXIDE

By Gary Cronk (JAG Consulting Group, Inc.)

Paper Presented at the AEHS 2017 Conference

ABSTRACT

A critical safety provision for all hydrogen peroxide injections is the ability to control the exothermic Fenton's reaction. Hydrogen peroxide possesses tremendous exothermic potential, with a heat of decomposition that is equivalent to a temperature increase of 124 degrees Fahrenheit per gallon of 10% peroxide (in a static situation). Of course, the temperature increase during a subsurface injection is normally less than this, as it is affected by a continual injection inflow of peroxide, the effects of dilution, and by the availability of iron as a catalyst. None-the-less, the Fenton's reaction, if left unattended, can cause subsurface temperatures to increase rapidly to unsafe levels over 180 degrees Fahrenheit (F) and can cause chemical daylighting and possible damage to underground utilities and pavement. By the addition of a stabilizer compound (which acts as an iron chelating agent), the exothermic catalyzation of peroxide can be slowed down, and the subsurface temperatures can be controlled to limit the temperature increase to no more than 130 degrees F. The effective use of SHP also minimizes the occurrence of chemical daylighting. The use of SHP to safely control the subsurface build-up of temperature and pressure is a patented process of JAG Consulting Group known as Temperature Controlled Peroxide™.

Keywords: Fenton's reaction, exothermic, catalyzed hydrogen peroxide, stabilized hydrogen peroxide, temperature controlled peroxide, chemical daylighting.

1. INTRODUCTION

Catalyzed hydrogen peroxide (CHP) has been used for over 20 years for the rapid destruction of organic contaminants by injection into the subsurface via in-situ chemical oxidation (ISCO). Catalyzed hydrogen peroxide involves the use of hydrogen peroxide with a ferrous iron catalyst, resulting in Fenton's type reaction. The Fenton's reaction gives off excess heat (heat of decomposition).

$$H_2O_2 + Fe^{+2} \rightarrow OH\bullet + OH^- + Fe^{+3} + \text{Heat}$$