ENVIRONMENTAL REMEDIATION

GLOBAL CONCERN

November 10, 2011 was a historical marker, when a conference held in Saxony addressed remediation of contaminated sites in Europe. Minister Kupfer noted that soil is the universal resource of our planet and that it is also a finite natural resource, affected by various human activities. The conference highlighted the close connection between a proactive soil protection policy and the existence of a thriving soil remediation industry.

Guarding the welfare of our world's soil serves to protect human health as well as the environment. Soil is fragile and easily damaged by poor management and industrial accidents. Contamination by chemicals can easily come from the very sources that provide the lifestyles to which the developed world has become accustomed.

DEMANDING EVIDENCE

In 2001, the global environmental market, including hazardous waste management and disposal, approaches to brownfield redevelopment and site remediation was reported to be of the order of $1 trillion (Pincent Masons Water Yearbook 2000–2001).
Based on current literature, the international market for remediation is estimated to be in the range of US$30–35 billion. The current estimated hazardous remediation market in the United States is pegged at around $12 billion, which represents about 30% of global demand.

Clearly, many contaminated sites have yet to be formally identified, declared or characterized. There has also been a paradigm shift in the general factors motivating remedial action. Up to the mid-1990s, implementation of cleanup of contaminated properties was driven by regulatory compliances, and guided by cleanup end points or residual limits which bore little relationship to the proposed use of the remediated land. More recently, great attention has been placed on relating remedial action to the intended use of the property, as well as remediation economics and risk assessment. Analysis of international environmental markets in the following subsections clearly

shows that substantial growth will occur over the next decade in markets throughout the world[1].

Based on current applicable regulatory standards in the United States, an estimated quarter of a million sites require some form of remediation, but the number of contaminated sites is larger than that if all brownfield sites are taken into account. The United States Environmental Protection Agency (USEPA) enforcement of the Superfund program is still encouraging remediation by potentially responsible parties at the majority of highly contaminated sites. This is evidenced by USEPA's precedent-setting order, requiring General Electric to pay nearly half a billion dollars for the cleanup of polychlorinated biphenyls (PCBs) in the Hudson River.

EPA estimates that up to $100 billion will be spent during the next 30 years to meet new underground storage tank regulations. The USEPA brownfield development program promotes the remediation and redevelopment of industrial sites by enhancing the acceptance of cleanups based on the concept of risk-based standards and restricted future land use.

FURTHER CONCERNS

Many potential remediation sites have a combination of common contaminants – solvents, petroleum products, VOCs and heavy metals, the nature and concentrations of which will influence technology choice. These contaminated sites can be divided into seven groups, depending on which government agency/regulations have enforcement and/or decontamination responsibility: Superfund, Resource Conservation and Recovery Act (RCRA) Corrective Action, Underground Storage Tanks (UST), Department of Defense (DOD), Department of Energy (DOE), Civilian Federal Agencies, and States (USEPA 2004). Once contaminants are in soils, where they go and how quickly they travel, depends on many factors. Some organic (carbon-based) contaminants can undergo chemical changes or degrade into products that may be more or less toxic than the original compound. Chemical elements (such as metals) cannot break down without outside intervention. Many times, a rapid response to contamination is the only solution to preventing wide-area proliferation.

THE PRINCIPLE ANSWER

Federal Agencies such as the US Environmental Protection Agency and many state and regional agencies are pushing for sustainable options for the remediation of

[1] [Data cited by CTCS (2002), The Delphi group (2003), AEGIS (2003), USEPA (2004), Statistics Canada (2004), EcoLog Group (2005), JETRO (2007) and Industry Canada (2008).]

contaminated sites. Traditional soil “cleanup” has entailed simple disposal or isolation of contaminated soil. Clearly, this is not sustainable. Modern remedial techniques apply mineralogical and geochemical knowledge to clean up contaminated soil and make it good for reuse, rather than simply discarding this precious and finite resource. Using leading-edge reagents presents an effective and sustainable method for soil remediation.

In-Situ

In-situ remediation involves treating the contaminated material at the site. This can reduce the overall time of treating the soil, when removing the soil from the premises is not desired. In cases where the contamination is beneath an existing structure, it may not be cost effective to remove the building so the soil can be excavated. An injection style, in-situ cleanup, can greatly reduce the overall cost of decontamination.

OUR ULTIMATE SOLUTION

PKMM Incorporated has teamed with EN Rx to offer you the best remediation technology, combined with the most advanced decontamination methods in the industry.

The PKMM – EN Rx Team

We provide proprietary chemical oxidants for remediation of various contamination site projects. We pride ourselves on performance, which drives us to be more involved with the design process than other chemical suppliers.

Why EN Rx?

- EN Rx reagents™ are the safest oxidants on the market. EN Rx reagents™ are stable and slow acting. This helps both above ground (keeping people and peripherals safe) and below ground (keeping ongoing reactions sustained, minimizing rebound).
- EN Rx reagents™ deliver hydroxyl radicals the most powerful oxidizers on the market. Other technologies may deliver hydroxyl radicals, but not with all the above and below characteristics.
- EN Rx reagents™ destroy more contaminants than any other product on the market. These are the only safe reagents that can destroy DDT, PCB, PCE, DCA, DCE, and MTBE are capable of the commingled plumes challenges .
- EN Rx reagents™ are the least viscous products on the market. The viscosity of EN Rx reagents™ is near that of water. Thus, EN Rx has injected them into, monitoring wells, open pipes, air sparge wells, SVE wells, or anything that will accept water. They will travel much farther in the ground than any two part slurry

reagent or any double injection activator chased oxidant treatment. They will also penetrate farther into the formation than other products.

- EN Rx reagents™ work in all alkalinities; whether the pH is 5 or 10, EN Rx reagents™ will work.
- EN Rx, Inc. is a solutions company, not a chemical sales company. They do not just sell their product but are intimately involved in the design and ultimate success of the project. We stand behind our products and often extend performance guarantees. We may occasionally turn down projects that do not fit our goals and core values. We care about our customer's projects, yet we reserve the right to turn projects down that offer little-to-no success.

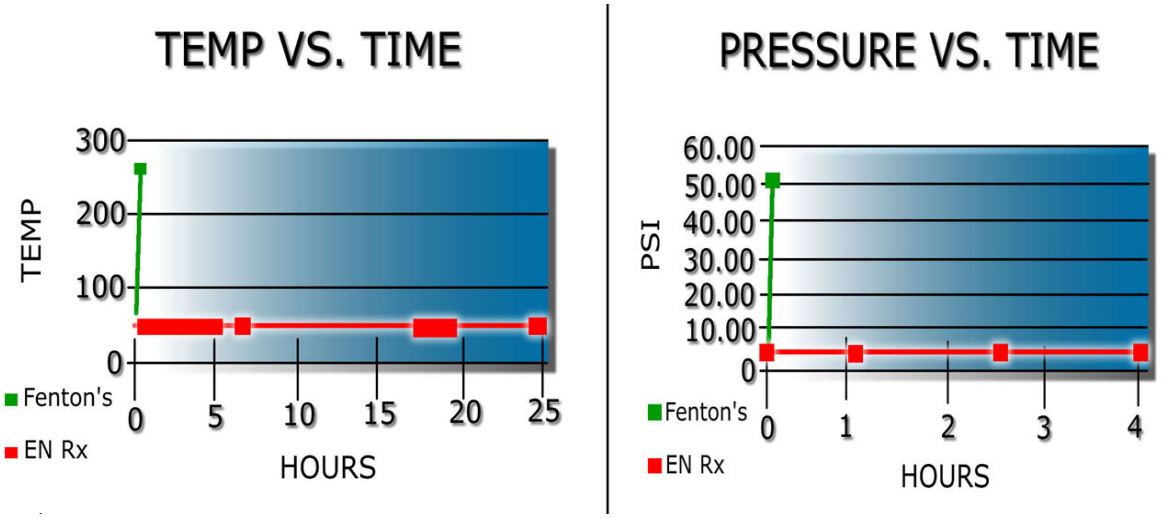
In-Situ Chemical Oxidation

Historically, there have been three oxidants available for in-situ chemical oxidation: catalyzed hydrogen peroxide, potassium / sodium permanganate, and ozone. Each oxidant has been effective for a different group of contaminants.

Among these three oxidants, hydrogen peroxide and ozone are the most common selections used to treat petroleum hydrocarbons, benzene, toluene, ethyl-benzene and total xylenes (BTEX) impacted soil and groundwater. Permanganate is believed to have limited effectiveness for BTEX, especially for benzene.

An innovative chemical to create a catalyzed hydrogen peroxide has been developed by EN Rx, Inc. The EN Rx Reagent™ is comprised of H2O2, SSO™ and Synergist™. H2O2 and SSO™ are the singlet oxygen sources. SSO™ adds a slow release mechanism to the oxygen source. The third reagent component is a proprietary catalyst (Synergist™).

When combined with water, the released peroxide and SSO™ will react with the Synergist™ to generate hydroxyl free radicals, a highly powerful oxidation agent. One of the unique features of the EN Rx Reagent™ is that the calorie release is at a much slower rate in comparison to other formulations, such as Fenton's reagent (H2O2 and FeSO4). This feature allows for an effective use of peroxide and eliminates excessive heat and pressure problems associated with conventional peroxide applications. The graphs below compare EN Rx Reagent™ to Fenton's Reagent at 30% strength. Blue is Fenton's Pink is EN Rx.



The success of in-situ chemical oxidation technology is dependent on effectively delivering chemical oxidants to the contaminant impacted groundwater. The delayed calorie release allows EN Rx Reagent™ to be applied at very low pressure. The goal is to elevate groundwater to cover the vadose zone and use head pressure to naturally migrate reagent through groundwater void space.

Upon contact with organic contamination the chemical oxidants will convert them to carbon dioxide and water in the case of hydrocarbons. As with any groundwater remedial technology, the effectiveness of the in-situ chemical oxidation technology is site specific. It is important to realize that the successful delivery of the chemical oxidants to the impacted groundwater is the primary factor that influences overall performance.

More Information

We have more information available about Oxidizable Constituents and case studies in our digital library. Contact us for complete data on any of our products and/or services.

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