Cool-Ox®

REMEDIATION & CHARACTERIZATION OF BTEX RESIDUAL FROM A PIPELINE RELEASE

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Introduction

The challenging wilderness terrain of a South Louisiana bayou obviated the use of conventional remedial technologies to mitigate a release from a product pipeline transporting gasoline. Persistent concentrations of BTEX in the ground water prohibited closure by natural attenuation. Therefore, an aggressive remedial solution was required.

Because this remote site is underwater much of the year, and has no access to electricity, conventional remedial systems such as pump and treat or soil vapor extraction were not applicable. Bioremediation was also ruled out because of the expense of the oxygen generating material and the difficulty of conventional methods of placing the compounds in the swampy terrain. Therefore, based upon the client's desire to evaluate the new chemical oxidation technology developed by William Lundy and the ease at which the application team can inject materials under difficult circumstances, the *Cool-Ox*® Process was chosen.

Although the site was successfully remediated and closure applied for, the most significant factor observed during the work was the ability of the technology to precisely locate the contaminants so that the reagent could be concentrated in those areas where the highest concentrations of contaminants were found. It is this site characterization tool that makes the *Cool-Ox*® Process unique.

The Site

The remedial zones, delineated during the engineering design phase of the project, included two areas from approximately two hundred feet to four hundred fifty feet south of the main access highway. The zones consisted of two plots, Area A, measuring fifty (50) feet by sixty (60), and Area B, measuring sixty (60) feet by eighty (80) feet (see Figure 1). The larger area included two monitoring wells (MW-5 and MW-6) while the smaller plot contained one well (MW-7). The water level at the time of injections was approximately two (2) feet below grade level. Two product pipelines and a crude oil pipeline traversed the site from east to west. The presence of residual crude oil from historical releases further complicated the remedial process.

Applications

When the first application work was completed, the site conditions were dry owing to an unusually long period of hot, dry weather. The dry conditions allowed staging the equipment close to the injection zones thereby, greatly facilitating the injection work. Photo 1 depicts a view to the northwest across Area A. The injection equipment can be seen in the background behind the probe operator.

Photo 1: Site view to the northwest from MW-7 across treatment Area A. The pipelines are located between the equipment and the operator.

It was determined that a six (6) foot application matrix would provide a sufficient radius of influence to thoroughly "wet" the contaminant with the *Cool-Ox®* reagent. This matrix constituted two hundred sixteen (216) injection points including both Areas A and B. Based upon information developed from the pre-injection *Cool-Ox®* site test protocol, fifteen (15) gallons of *Cool-Ox®* reagent were injected per point. The vertical application extent was from one (1) foot to seven (7) feet below grade level. Injections were conducted employing the *Cool-Ox® Hydro-Dart™*.

Results

Satisfactory results were obtained in Area B containing monitoring wells MW-5 and MW-6. In the north well (MW-5), the benzene concentration dropped from 230 µgm/L (ppb) prior to treatment to 12 ppb five (5) weeks post treatment. A similar decrease in the BTEX concentration was observed where the contaminants dropped from 331 ppb to 24.7 ppb. Benzene concentration in MW-6 decreased an order of magnitude from 200 ppb to 24 ppb with total BTEX dropping from 386 ppb to 30.2 ppb over the same period of time.

The concentrations in monitoring well MW-7 in Area A were less encouraging and indicated that a contaminant source had been missed or not fully treated in the initial application. A second application of *Cool-Ox®* reagent was injected three months later, with significantly improved results. Table 1 below depicts the dramatic results of the second injection.

Table 1 (MW-7)

	Baseline	2 Wks	6 Weeks	20 Weeks
Benzene*	7,500	7,300	5,300	44
Toluene*	8,800	5,400	210	32
E-Benzene*	1,700	1,400	880	ND
Xylenes*	6,800	6,200	1,900	14
BTEX*	24,800	20,300	8,290	90
GRO**	120	75	66	8.2

* µgm/L (ppb) **mlgm/L (ppm)

Conclusions

Review of the monitoring well data would indicate that the treatment of this site using the *Cool-Ox*® chemistry was a success. However, it is important to note that it was not only the *Cool-Ox*® chemistry that worked here but, rather all the tools embodied in the DTI Process that rendered a successful conclusion to this project. The chemistry, the ability to locate the contaminant and the equipment mix necessary to deliver the reagent to the target are all integral components in the technology.

Having shown no rebound in contaminant levels, the site has since received no further environmental remediation action (NFA) status. Clean closure was achieved!