

## Thermally Enhanced Free Product Recovery and Residual Treatment with Persulfate

An underground storage tank (UST) released fuel oil to the environment in western South Carolina. The tank was removed from the ground in 1992. As part of a property transaction, it became necessary to expedite removal of free product. For five years, free product recovery was completed on a quarterly basis with a vacuum truck. Over the course of 5 years only 85 gallons of free product were recovered. The highest level of free product measured on monitoring wells was 0.1 foot. The area impacted by free-product was estimated to be 10 feet by 20 feet. In order to expedite free product recovery, Redox Tech injected superheated water into the ground to decrease the viscosity of the fuel oil and to displace the free phase product. The superheated water flashes when introduced to the subsurface environment to create steam that is approximately 30 percent vapor. After two days of steaming for 10 hours, Redox Tech completed a free product recovery event. In the first event, 330 gallons of free product was recovered and there was no product left on the monitoring wells the next day. The free product did not reappear for one month. Redox Tech then completed another superheated water (steam) injection event, and 260 gallons of free product were recovered. After the second steam and recovery event, 2200 pounds of sodium persulfate was injected to treat residual fuel oil. The sodium persulfate was thermally catalyzed because the subsurface temperature was approximately 40 to 50C at the time of injection. No free product appeared for two months. At three months, additional free product appeared in the monitoring wells in the impacted area. The soil temperature was still 30C. As a result, additional assessment work was completed on the site, and a substantial upgradient source of fuel oil was identified that had not been previously reported. In two events, Redox Tech had recovered 6 times more free product than in the previous 5 years of quarterly free product recovery. Steaming can be using to enhance removal of petroleum products. However, like any remedial project, the site must be sufficiently characterized to obtain successful remediation.