In Situ Smoldering Combustion (STAR) for the Treatment of Contaminated Soils: Challenges Encountered & Lessons Learned In Providing a New Remediation Technology to the Industry

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STAR (in situ) is an innovative remediation technology based on the principles of smoldering combustion where the contaminants are the source of fuel. The process is self-sustaining following a short duration, low energy input ‘ignition event’. The energy released from the reacting contaminants is used to propagate the combustion front through the contaminated soils, provided that a sufficient flux of air is supplied. This presentation presents background information on the technology and case studies highlighting lessons learned for successful implementation.

The first case study involved the STAR treatment of two contaminated horizons (DNAPL and LNAPL) in a fine sand unit at a former Gasworks Site in northern Michigan. Self-sustaining smoldering combustion was achieved in both the LNAPL and DNAPL zones resulting in a Radius of Influence (ROI) of approximately 8 feet with an average propagation rate of approximately one foot per day. However, air flow fluctuations during the first test lead to premature quenching of the combustion reaction, demonstrating the importance of a steady air supply on the smoldering combustion process. The second case study involved the first in-situ field application of a surrogate fuel (emulsified vegetable oil [EVO]) to support combustion of high volatility compounds including Gasoline Range Organic (GRO) and Diesel Range Organic (DRO) compounds at a former refinery in Michigan. Successful injection and combustion of EVO resulted in a more robust smoldering reaction, with an increased ROI as compared to the “standard” STAR test. The third case study involved the STAR treatment of Navy Special Fuel Oil (NSFO) within a former tank farm area in Virginia. The field test demonstrated that the smoldering reaction successfully treated contaminated soil located both above and below a discontinuous clay layer. The final case study involved the full-scale STAR treatment of a former manufacturing facility in New Jersey. Approximately 1500 surficial fill ignition points and 500 deep sand ignition points and two treatment systems (air distribution and vapor collection / treatment system) are being used to remediate an approximately 14-acre footprint of contaminated soils.

Data demonstrating the effectiveness of the technology will be presented for each site, including a discussion of technology applicability and limitations.

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Dr. Grant has more than 10 years of experience in the field of environmental remediation and the development and implementation of the Self-sustaining Treatment for Active Remediation (STAR) technology. He completed his Ph.D. studies at the University of Edinburgh, Scotland, under the direction of Dr. Jason Gerhard, co-inventors of the STAR technology. Dr. Grant is the Operations lead for Savron and has been the primary project manager, director, or technical lead on all STAR-related projects to date. He has completed dozens of treatability studies and numerous pilot tests and full-scale implementations of the STAR technology and is currently managing STAR projects for top-tier clients in the chemical manufacturing, oil and gas, and utility industries.

Dr. Grant continues to advance the state of the practice as a frequent presenter at events and lectures focused on soil contamination and organic waste disposal.