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Case Study: Catalyst use in Soil Remediation

Industry: Environmental Remediation

Application: Soil Remediation

Application and Problem

A manufacturer of soil remediation oxidation systems contacted Applied Catalysts to improve the efficiency and reduce operating costs of their oxidation units. The particular manufacturer specializes in the design, construction, and operation of soil remediation systems that use catalytic oxidizers. These systems are widely used to clean soil that has been contaminated with gasoline; typically from underground storage tanks or spills from fuel transport trucks. Air is used to extract gasoline vapors from the contaminated soil bed. This air is then collected and sent to the oxidizing unit, where the gasoline components are oxidized (burned). From this combustion process, carbon dioxide, water vapor and heat are produced. High efficiency oxidation units complete this final combustion process over an active catalyst, which reduces or eliminates the need to add fuel, (i.e. natural gas), to maintain temperature in the catalytic system. In the case where no additional natural gas fuel is used, the contaminant VOCs sustains the combustion process and maintains the temperature of the catalyst, which is needed for optimal performance. The company worked with Applied Catalysts to design a highly efficient and cost effective catalyst for use in these oxidation units.

In general, these units are mobile, so they can be moved to and from various job sites. Also, each unit has to be robust enough so there is little or no loss in catalytic activity or thermal performance over time. Each catalytic oxidizer unit has an air flow rate of approximately 300 SCFM, and contains a burner, upstream of the catalyst module. Each time the oxidizer unit is started, the burner helps increase the catalyst temperature to 600 – 800°F. The primary Volatile Organic Compound (VOC) contaminants found in such soils are benzene, toluene, ethyl benzene and xylene. These compounds are commonly referred to as BTEX, and make up the majority of the VOC gasoline contaminated soil.

Action

A precious metal catalyst was selected based on several factors, including (1) Air flow rate, (2) Temperature (3) Required BTEX destruction efficiency and (4) Pressure drop. In

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In addition, the catalyst also had to meet high destruction efficiencies, (i.e. >99%), over a range of VOC concentrations. Depending on the remediation site, these VOC concentrations can fluctuate over a wide range. A precious metal catalyst coating was designed to yield high oxidation performance, and to meet the long-term service requirements of the oxidizer unit. The catalyst was also designed to fit into special modules to simplify and expedite the units' assembly process, and to meet space limitations for each unit. Catalyst monoliths were individually secured in stainless steel metal modules using thermally stable gasket material to insure optimum flow dynamics through the catalyst. The catalyst module was installed in several mobile soil remediation units and underwent a battery of pressure tests to identify any leaks. After high temperature testing, each oxidizer was delivered to remediation sites to begin operation. To meet state EPA regulation standards, each catalyst was required to reduce BTEX emissions by 99% or more.

Results

The customer found each catalyst module met every critical requirement for each oxidizer unit. All catalyst units have yielded a consistent and high level of performance over a three (3) year period. At present, the customer has over 60 units in continuous field operation using these catalysts with many units yielding efficiencies greater than 99.9%. In addition, due to the superior performance of each catalyst, the customer has improved average operational profitability by approximately 24% at each soil remediation site. These catalysts continue to be installed in new and existing soil remediation systems.

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