

Applying Lean Six Sigma Principles to Remediation Systems: Optimization of a Bioventing System

Victor Gamez Grijalva (victor.gamezgrijalva@jacobs.com) and Baine Foehr (Jacobs, Phoenix, AZ, USA)

Tao Wu (Honeywell International, Inc., Phoenix, AZ, USA)

Background/Objectives. Lean Six Sigma is a methodology to improve performance and reduce waste and is generally associated with manufacturing processes. Site remediation is not usually thought of as a process that can be optimized by using Lean Six Sigma strategies. However, many of the challenges found in manufacturing processes, are also found in site remediation. Lean Six Sigma concepts like DOWNTIME, KAIZEN, and DMAIC, can be successfully adapted and applied to site remediation processes. A case study illustration of how these principles can be applied to an operating remediation system is presented. The case study site includes a manufacturing facility and portions of an international airport. The objective of the presentation is to illustrate how optimization through Lean Six Sigma is applied to an operating system and show the results that these strategies can bring to site remediation when applied from system startup to site closure.

Approach/Activities. Bioventing was selected as the method for remediation of a 46-acre zone of free-product jet fuel at a 60-year old aerospace engines manufacturing and testing facility in the southwestern United States. Throughout the system remediation lifecycle, it operated in three different stages:

- An initial extraction-dominated phase with a total extraction flow rate of 2,500 standard cubic feet per minute (scfm) and an injection flow rate of 1,500 scfm,
- A second injection-dominated phase with a total injection rate of 2,600 scfm and extraction rate of 1,300 scfm, and
- A third and final air injection-only phase of 2,600 scfm.

Lean Six Sigma optimization strategies were applied at each of these stages resulting in improved mass removal, reduction of operating costs, and minimization of quality defects. System performance was evaluated at each maturity stage and opportunities for optimization were identified by applying Lean Six Sigma strategies.

Results/Lessons Learned. After approximately nine years of operation and continuous system optimization, the bioventing system removed over 17 million pounds of petroleum hydrocarbons and reduced operational costs from over 4 dollars per pound removed to below 0.5 dollars per pound removed, representing a cost reduction of more than 80%. This presentation will provide a summary of how implementation of Lean Six Sigma principles and strategies accelerated site remediation through system optimization, cost reduction, stakeholder engagement, and elimination of quality defects. Finally, it will provide a complete visualization of how Lean Six Sigma optimization strategies can be applied throughout the remediation process from system startup to site closure.