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Smiths Creek Landfill
Septage Bioreactor RDDP Expansion
Green Project Reserve Business Case

Project Overview

St. Clair County (SCC) proposes to extend the Septage Bioreactor Research, Development, and Demonstration Project (RDDP) at the Smiths Creek Landfill (SCL). The first of its kind in the U.S., residential septage is injected into municipal solid waste (MSW) to treat septage material and increase the degradation of MSW.

In 2004, the Macomb/St. Clair Inter-county Watershed Management Advisory Group completed a study to determine the best locations for new septage receiving facilities and identified SCL as an ideal candidate for a septage receiving facility based on its central location in relation to septic tank users and ability to operate year-round. In 2006, SCL began construction of the septage receiving facility and associated infrastructure. In operation since 2008, approximately 3.5 million gallons of septage have been injected into MSW with numerous documented benefits including: providing a safe, centrally located septage receiving facility for residents, eliminating the need for land application in St. Clair County and helping to ensure no further water quality degradation, accelerating the degradation of MSW allowing for the reuse of landfill space (extending the life of the facility), increasing the rate of methane generation and allowing for beneficial reuse by generating green renewable energy, and an overall reduction in environmental liability through safe, effective management of septage and allowing for an increased rate of stabilization of MSW deposited in the SCL.

This SRF project proposes to expand septage injection into other portions of the SCL as well as construct a new waste and septage treatment unit. This septage bioreactor expansion will allow for additional septage treatment capacity and provide a safe septage disposal location for County residents for the next 20 years. While the existing project utilized only MSW, this project will also incorporate industrial and construction and demolition debris to determine the effectiveness of septage treatment and increased waste degradation on these additional waste sources.

Water Pollution Reduction

Prior to construction of the septage receiving facility at SCL, a large portion of septage generated in SCC was land-applied. While there are some documented benefits to this practice it is historically unreliable due to the inability for septage to percolate into the ground surface during periods of saturation or when the soil is frozen. Such conditions lead to the runoff of septage material into storm water and ultimately into waterways. There are currently more than a dozen water bodies in SCC currently considered impacted with *e coli* by the EPA.

With the septage bioreactor, septage is received at an on-site receiving facility and processed and stored in a holding facility on the landfill. Septage is then injected into the landfill using subsurface injection lines. The subsurface injection practice eliminates the potential for septage material to come in contact with storm water, as septage material is never exposed to the landfill surface. Septage material is absorbed by MSW where the moisture and microbial activity work to increase the rate of degradation. To date, there has been very little evidence of septage material passing entirely through the waste material without being absorbed. However, if any material were to pass through without being absorbed, it would be collected by the landfill leachate collection and removal system and treated in the on-site leachate pretreatment facility before being discharged to the City of Port Huron WWTP. The entire system works to contain septage material and ensure proper treatment.

Since inception of the septage receiving facility at SCL, the need for land application within the County has been significantly minimized. All septage received by the facility is used to promote waste degradation in the landfill, and in turn the landfill ensures proper containment of all received material. This facility has provided for safe, effective treatment and undoubtedly helped improve water quality in the region.

Green Energy Production and Reduction in Greenhouse Gas Emissions

Landfill gas (LFG) is a byproduct of organic degradation of solid waste. LFG contains approximately 50% methane, 45% carbon dioxide, 5% balance gases including nitrogen, oxygen, hydrogen sulfide, volatile organic compounds (VOCs), and other trace gases. Without proper collection and control, LFG is released to ambient air where it contributes greenhouse gasses (GHG) and other air pollutants to the atmosphere. All landfills produce LFG, but the rate at which it is generated varies depending on the rate of organic degradation in the landfill. There are a variety of factors that contribute to the rate of degradation but primary driving factors include waste moisture content, nutrient requirements, and microbial inoculation. Landfills which are typically operated as dry-tomb do not introduce any outside liquids (excluding natural precipitation) and LFG is generated at a very slow rate. By operating in this manner it is much more difficult to utilize LFG for beneficial reuse as most technologies have a minimum operating flowrate which cannot be achieved. Additionally, these facilities will tend to produce LFG for very long periods of time (sometimes centuries), increasing environmental liability for generations. It is commonly agreed that increasing the rate of organic degradation is ideal since LFG can be generated and collected at a flow rate which allows for beneficial reuse, and environmental liability can be reduced through the proper management of these byproducts.

The septage bioreactor project provides a new environmentally innovative method for both safely and effectively treating septage (and thereby improving water quality) and increasing the rate of MSW degradation/stabilization. It represents the perfect win-win combination – safely and effectively treating the septage resources in the area while increasing the rate of MSW degradation and renewable green energy production. Prior to the start of the existing project, the facility was producing only enough LFG for the installation of one landfill gas-to-energy (LFGTE) engine (1.6 megawatt capacity). Since inception of the septage bioreactor project, the LFG collection rate has increased approximately

40%, allowing for the installation of two LFGTE engines (3.2 megawatt capacity) and doubling the amount of renewable energy which can be generated.

The septage bioreactor is also unique in the way that LFG is managed. Typical landfills use vertical wells to collect LFG. On average, the EPA estimates that this allows for only a 75% collection efficiency, meaning approximately 25% of LFG is lost to ambient air. Vertical well installation requires a minimum depth of waste in-place which can mean significant delays (up to five years) from waste placement to installation of vertical LFG wells. As a result, some LFG escapes to the atmosphere during the early stages of waste degradation and is not captured by the LFG system. The septage bioreactor construction allows for the installation of lateral septage injection and gas extraction lines concurrently with waste filling activities. This unique construction means that LFG can be collected earlier, reducing fugitive LFG release to environment. The lateral gas extraction system is designed to provide a high collection efficiency (up to 90%). This means that only approximately 10% of LFG is emitted to ambient air. For perspective, SCL generates approximately 1,400 standard cubic feet per minute (scfm) of LFG. Assuming a 75% collection efficiency, approximately 350 scfm escapes to ambient air. With a 90% collection efficiency, only 140 scfm or less is released to ambient air. The reduction in methane released over one year (assuming 50% methane content) is approximately 1,200 tons, or the equivalent of GHG emissions from 4,000 passenger vehicles.

Figure 1 demonstrates two scenarios related to continuing septage bioreactor operation at SCL. The differences in these approaches are a combination of slowing the rate of degradation without further septage injection as well as reduced LFG collection efficiency (75% vs. 90%). As shown, without a continuation of septage injection, the facility will not be able to fully utilize the two LFGTE engines currently installed at the facility. With expansion of this project, not only can both installed LFGTE engines be utilized at full capacity, there is the potential for installation of a third which can also be highly utilized.

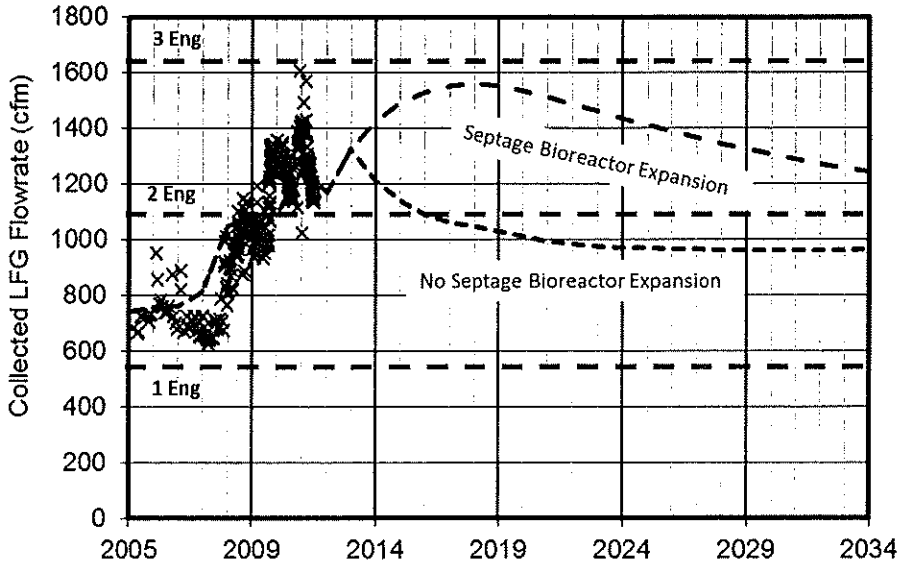

Figure 1. Collected LFG Flowrate for Bioreactor Expansion vs. No Expansion

In summary, operating a septage bioreactor at SCL not only increases the rate of waste degradation allowing for beneficial reuse, it also helps to reduce GHG emissions through the implementation of a more effective gas collection system. This combination minimizes impact of LFG on climate change.

Green Project Justification

According to the EPA, projects "that demonstrate new and/or innovative approaches to managing water resources to remove water pollution in an economically and environmentally sustainable way such as: decentralized wastewater treatment solutions, projects that facilitate adaptation of clean water facilities to climate change, and projects that identify and quantify the benefits of using integrated water resources management approaches, to name a few" are considered environmentally innovative activities under the Green Project Reserve.

The septage bioreactor expansion project clearly meets the definition of an environmentally innovative project as it is demonstrating an innovative approach to managing water resources in a sustainable way by providing a safe place for septage treatment and disposal (as opposed to land application, historically associated with water pollution) in an existing resource (landfill). The project, the first septage bioreactor in the nation, not only provides an environmentally safe facility for septage treatment thereby helping to achieve pollution prevention through eliminating the need for land application of septage in St. Clair County, it also helps with the production of landfill gas which can be used to generate green renewable energy.

For FY 2010, SCL was granted an SRF loan to continue construction of the existing septage bioreactor project under the green project reserve based on the environmental innovativeness of the project. At that time, the entire septage bioreactor portion of the project was considered green and provided with subsidy in the form of 40% principal forgiveness. This proposed expansion will continue to allow for the management of water resources in a sustainable way while helping to offset GHG which contributes to climate change. The project will also examine the effectiveness of septage treatment and waste degradation using new waste types not previously explored as part of the current project. SCL believes that this expansion also meets the requirements of an environmentally innovative project under the green project reserve and requests any subsidy allocated to green projects for FY 2014.