

# **A Comparison of Greenhouse Gas Emission Reduction Projects at Three Different Landfills – Lessons Learned**

Extended Abstract #476

## **Sean P. Metivier**

Shaw Environmental, Inc. 88C Elm Street, Hopkinton, MA 01748

## **Bruce K. Maillet**

Shaw Environmental Inc. 88C Elm Street, Hopkinton, MA 01748

## **INTRODUCTION**

Recent, heightened interest around global warming issues has created a rapidly evolving landscape of mandatory and voluntary greenhouse gas (GHG) emission inventory and reduction initiatives. According to the Social Investment Forum<sup>1</sup>, investor interest in the impacts pertaining to climate change and greenhouse gas emissions grew by 40-percent and ranked second among socially responsible issues in 2005. The United States Climate Action Partnership, a business alliance promoting federal GHG emissions legislation, submitted a letter in January 2007 urging the United States Congress to enact legislation requiring significant reductions of greenhouse gas emissions.

Regulatory GHG programs are presently limited in number; however, the development of state, regional, and federal initiatives is accelerating. Nine northeast states (CT, DE, MA, ME, NH, NJ, NY, RI, & VT), through the Regional Greenhouse Gas Initiative (RGGI), established a carbon dioxide (CO<sub>2</sub>) budget trading program designed to stabilize and reduce anthropogenic emissions of CO<sub>2</sub><sup>2</sup>. California's Global Warming Solutions Act of 2006 requires the State Air Resources Board to establish an enforceable state-wide program capping all GHG emissions from major industries. The Californian program, like RGGI, adopts market-based compliance mechanisms including a cap-and-trade program<sup>3</sup>. Although voluntary GHG registry and emission reduction programs are more prevalent than regulatory programs, opportunities to generate saleable emission reduction credits remain limited. The Chicago Climate Exchange (CCX) is a voluntary GHG registry and reduction trading system where members must perform entity-wide GHG emission inventories and commit to annual reductions<sup>4</sup>.

These three programs all provide opportunities for regulated organizations to achieve compliance, in part, through the purchase of GHG offset credits derived from specific project activities. Landfill gas (LFG) projects are eligible sources of GHG credits, or offsets, under current programs and will likely be viewed as eligible emission reduction projects under future voluntary and regulatory programs. Although the debate over the causes and consequences of global warming persists, most industry professionals and political leaders agree that a national GHG regulatory program is inevitable. Most stakeholders anticipate current state and regional programs will become the model for future regulations.

Methane is a potent GHG with an atmospheric residence time of approximately 9-15 years and an atmospheric heat trapping effectiveness, or global warming potential, over 20 times greater than CO<sub>2</sub> over a 100-year period<sup>5</sup>. Furthermore, municipal solid waste landfills are the largest source of anthropogenic methane in the United States<sup>6</sup>. Many GHG protocols consider CO<sub>2</sub> and methane emissions from landfills to be climate, or carbon, neutral because the emissions are the result of decomposition of organic material. Consequently, a landfill that voluntarily captures and destroys landfill gas, which typically has a methane concentration of 50%, is a valuable source of GHG emission reduction credits. Therefore, voluntary and mandatory carbon constraining programs offer business opportunities for landfill owners and operators.

Landfill methane capture and destruction projects require comprehensive monitoring to validate that project related emission reductions are real and verifiable. Voluntary and regulatory GHG protocols have procedures pertaining to monitoring of the two significant measurable parameters: 1) landfill gas flow rates to the combustion device and 2) landfill gas methane concentrations.

In the study that follows, Shaw Environmental, Inc. assessed three LFG GHG offset projects against elements selected from a variety of existing GHG emission reduction project protocols. These projects were evaluated against a robust, but typical suite of GHG emission reduction project requirements. This assessment was performed to determine whether project related emission reductions represent verifiable credits.

## **STUDY DESCRIPTION AND FINDINGS**

Shaw Environmental, Inc. (Shaw) was contracted to perform preliminary assessments of GHG emission reduction projects at three different landfill gas projects located in Georgia, Maine, and Missouri. All three sites have approximately 3 million tons of waste-in-place and utilized varied project types including LFG flaring and direct methane use (Georgia), LFG flaring only (Maine), and landfill gas-to-energy (Missouri).

Project directives involved the performance of initial audits to determine whether each project was designed and managed in a manner that would allow the owners and operators to market methane destruction as GHG emission reduction credits. The audits included a review of data records and other project documents, site inspections, interviews with project personnel, and desktop reviews of reporting and calculation methods. Project assessments were consultative in nature and performed in advance of third party verification to ensure compliance with typical GHG offset project criteria and protocols.

Prior to initiating project assessments, Shaw developed a general set of criteria that would be applicable to a diverse and extensive suite of potential GHG credit markets. The assessment checklist was based upon GHG offset project criteria detailed within several protocols including, MA 310 CMR 7.29<sup>7</sup>, the RGGI Model Rule, World Resources Institute's GHG Protocol for Project Accounting<sup>8</sup>, U.S. EPA Climate Leaders' Draft Offset Protocol<sup>9</sup>, and the CCX Rulebook.

Several project requirements are consistent between GHG programs. Generally, GHG protocols require project activities be “additional”, or initiated on a voluntary basis above and beyond business-as-usual and not pursuant to any local, state or federal law, regulation, or administrative or judicial order. However, since the definition of *additionality* varies from program to program, protocol specific requirements for *additionality*, and other requirements, are detailed in the table below.

The following table summarizes the basic requirements for each referenced protocol used to evaluate landfill GHG emission reductions in each of the three projects:

Project Requirements	GHG Project Protocols				
	MA	RGGI	WRI	U.S. EPA	CCX
Start Date (on or after)	1/1/06	12/20/05	NA <sup>a</sup>	TBD <sup>b</sup>	1/1/99
Additionality	NA	No RECs <sup>c</sup> ; Financial	NA	NA	NA
GHG Baseline Evaluation	No	Yes	No	No	Yes <sup>d</sup>
LFG Flow Measurements	PDD <sup>e</sup>	Continuous	Continuous	Continuous	Continuous
Flow Meter Calibration	PDD <sup>e</sup>	PDD <sup>e</sup>	NA	Annual	Annual
LFG Flow Verification	PDD <sup>e</sup>	PDD <sup>e</sup>	NA	NA	Quarterly
CH <sub>4</sub> Concentration	PDD <sup>e</sup>	Continuous	Monthly	Monthly	Weekly
CH <sub>4</sub> Meter Calibration	PDD <sup>e</sup>	PDD <sup>e</sup>	Daily	Daily	Daily

- Notes: a) NA – “not applicable”  
b) TBD – “to be determined”  
c) RECs – “Renewable Energy Credits” must be surrendered under RGGI  
d) CCX requires members to perform entity-wide baseline inventories  
e) PDD – “Project Design Document” outlines project specific requirements

Beyond protocol specific requirements detailed in the previous table, the three landfill projects were also evaluated against the following:

- Placement of the designated, in-line flow meter;
- Placement of the methane concentration sample port;
- Records of LFG flow meter specifications and installation;
- Records of LFG methane concentration specifications;
- Documentation of operation and maintenance activities;

During project audits, several common issues were identified that, if uncorrected, could inhibit verification of emission reduction credits generated at these sites. Issues fell into three general categories; project design, operation and maintenance, and record-keeping. No direct connections will be made to specific landfills in the discussion that follow and study findings are discussed as general “lessons learned”.

#### Project Design Issues

The following common LFG project design deficiencies are inconsistent with typical GHG emission reduction project protocols:

- LFG flow meter installation – in-line flow meters must be installed in a position up gradient to control devices (flare, etc.) and down gradient to the blower skid along a straight length of piping that is sufficiently long enough to produce laminar, rather than turbulent, flow at the measurement site<sup>10</sup>. Limited space at the project site could impede ease or feasibility of meeting this requirement.
- Contemporaneous LFG flow and methane determinations – LFG flow rates and methane concentrations should be collected within close proximity of one-another in a position that is up gradient to the control device (flare, etc.) and down gradient to the blower skid.

#### Operation and Maintenance Issues

LFG GHG emission reduction project operation and maintenance deficiencies often prohibit project verification because of improper LFG flow rate or methane concentration documentations. The following are examples of operation and maintenance issues identified during this study:

- Verification of LFG flow measurements – designated in-line LFG flow meter measurements must be verified with annual factory calibration events and/or regular field/manual evaluations of LFG flow rates<sup>10</sup>.
- Verification of methane measurements – daily calibration of devices used to determine methane concentrations must be employed in addition to routine, scheduled maintenance, per manufacturer's specifications.
- Frequency of measurements – projects are more defensible with robust data collection frequencies. Weekly or daily methane concentration measurements are highly recommended.

#### Recordkeeping Issues

The following are examples of LFG project record keeping deficiencies which are inconsistent with GHG emission reduction project protocols:

- Calibration and verification events – methane content and LFG flow meter calibration events must be documented with results in order to prove performance of these activities. Similarly, field verification of LFG flow measurements must be documented with results.
- Instrument documentation – LFG flow measurement installation records and manufacturer specifications must be maintained.
- Credit Ownership – Documentation of clear ownership to LFG and project related GHG offset credits must be maintained.
- Inapplicability of NSPS – EPA New Source Performance Standards (NSPS)<sup>11</sup> require affected landfills collect and control LFG. Landfills with a design capacity of 2.5 Mg or more must demonstrate that non-methane organic compound (NMOC) emission rates are less than 50 Mg to prove that NSPS does not apply.

## CONCLUSIONS

GHG emission regulations are emerging on state and regional levels and it is apparent that a national GHG regulatory program will be in place by 2010. Presently, voluntary and mandatory carbon constraining programs offer business opportunities for landfill owners and operators because landfills that voluntarily reduce methane emissions are potential sources of GHG emission reduction credits. During this study, GHG offset projects at three landfills were assessed for their ability to generate verifiable GHG emission reduction credits. Through the performance of these assessments, several key issues significant to landfill GHG offset projects were considered.

Generally, these audits revealed that a typical gas collection and control system (GCCS) design may not be compatible with the requirements established GHG emission reduction project protocols such as the WRI GHG Protocol, US EPA Climate Leaders program, or RGGI. Furthermore, it was also learned that the monitoring, reporting, and recordkeeping procedures employed by landfill staff accustomed to operating a GCCS under other programs, such as the New Source Performance Standards (NSPS), are not necessarily compatible with GHG emission reduction project protocols. However, a landfill GCCS could convert actions already being implemented to verifiable GHG emission reduction credits through simple modifications to the project design, operation and maintenance procedures, and recordkeeping practices.

## REFERENCES

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