

# CLINTON LANDFILL #2 GAS COLLECTION AND COMBUSTION VCS MONITORING REPORT



Document Prepared By Nick Facciola, P.E.

|                          |                                                                                                                                                                                                                   |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Title</b>     | Clinton Landfill #2 Gas Collection and Combustion Project                                                                                                                                                         |
| <b>Version</b>           | 5                                                                                                                                                                                                                 |
| <b>Report ID</b>         | Clinton-2015-v2.1                                                                                                                                                                                                 |
| <b>Date of Issue</b>     | 20-July-2016                                                                                                                                                                                                      |
| <b>Project ID</b>        | 318                                                                                                                                                                                                               |
| <b>Monitoring Period</b> | 01-November-2014 to 30-April-2016                                                                                                                                                                                 |
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## 1 PROJECT DETAILS

### 1.1 Summary Description of the Implementation Status of the Project

The project activity is the capture and destruction of methane from the Clinton Landfill #2, via two combustion engines and two open flares. The generated electricity is sold to the local grid.

Clinton Landfill #2 opened in 1989, and closed in 2010. Clinton Landfill accepts municipal solid waste and non-hazardous special waste, which includes commercial solid waste, sludge, conditionally exempt small quantity generator waste, and industrial solid waste, among other waste types. The landfill was permitted for ten cells and a total capacity is 4.7 million cubic yards of waste. It accepted approximately 270,000 short tons of waste per year during operation. In 1998, an active methane recovery and destruction system was constructed at Clinton landfill #2 to maintain compliance with federal and state standards regarding the control of non-methane organic compounds (NMOCs) and landfill gas (35 IAC, Part 220).

The project seeks credit for the voluntary emissions reductions over and above those achieved by the previously installed, mandated gas collection system. The original system consisted of 40 landfill gas wells, piping, and a 550 scfm open flare. Implementing the project's gas-to-energy activity entailed the addition of 10 wells, more powerful blowers, gas measurement meters, two 1.6-MW Caterpillar 3520C engine generator sets, gas conditioning equipment, a building to house the generators, and associated interconnection and metering devices.

Note that the displacement of fossil fuels resulting from this activity is not included in this project and emissions reductions from the offsite use of electricity are not addressed. More details about the project can be found in Project Design document.

DeWitt Energy received a permit to construct the landfill gas power plant on February 23, 2005 and achieved financial closure on December 30, 2005, when DeWitt Energy accepted financing from a local bank. Engines were delivered to the site in April 2006. The Illinois State Fire Marshall inspected the new facility and signed approval on January 8, 2007. We consider the actual project start date to be the day on which the Project began delivering electricity to the grid, January 24, 2007.

The total emission reductions generated during the current monitoring period of November 1, 2014 through April 30, 2016 is 102,962 metric tons carbon dioxide equivalent (tCO<sub>2</sub>e).

### 1.2 Sectoral Scope and Project Type

The project activity falls into Sectoral Scope 13 – Waste Handling and Disposal. The project meets the criteria of a landfill gas project activity as defined in the CDM Approved Consolidated Baseline Methodology ACM0001 Version 10, "Consolidated baseline and monitoring methodology for landfill gas project activities." The project is not a grouped project.

## 1.3 Project Proponent

|                   |                                                      |
|-------------------|------------------------------------------------------|
| Organization name | Origin Climate Inc.                                  |
| Contact person    | Nick Facciola                                        |
| Title             | Director, Carbon Projects                            |
| Address           | 4 Embarcadero Ctr, Ste 1400, San Francisco, CA 94111 |
| Telephone         | (415) 762-4727                                       |
| Email             | nick@OriginClimate.com                               |

## 1.4 Other Entities Involved in the Project

|                     |                                                 |
|---------------------|-------------------------------------------------|
| Organization name   | Wabash Valley Power Association, Inc.           |
| Role in the project | Project Owner                                   |
| Contact person      | Vicki Meyers                                    |
| Title               | Manager, Power Supply                           |
| Address             | 722 N. High School Road, Indianapolis, IN 46224 |
| Telephone           | (317) 481-2833                                  |
| Email               | vickim@wvpa.com                                 |

|                     |                                                    |
|---------------------|----------------------------------------------------|
| Organization name   | Peoria Disposal Company                            |
| Role in the project | Landfill Owner                                     |
| Contact person      | George Armstrong                                   |
| Title               | Vice President Engineering and Consulting Services |
| Address             | 4700 N Sterling Ave, Peoria, IL 61615              |
| Telephone           | (309) 686-8033                                     |
| Email               | garmstrong@pdcarea.com                             |

## 1.5 Project Start Date

The project start date is January 24, 2007, the day on which the Project began delivering electricity to the grid.

## 1.6 Project Crediting Period

The crediting period began on July 1, 2009. It will cease on June 30, 2019, for a total length of ten years.

## 1.7 Project Location

The project is located at Clinton Landfill #2, a small landfill located at 9560 Heritage Road in Clinton, IL, in DeWitt County. The landfill occupies approximately 64 acres of a 153-acre permitted site. The project is conducted within the property owned by Clinton Landfill, Inc. This property's GPS coordinates are 40° 6' 51.411" N and -88° 57' 28.7994" W. The project engines are housed in a free-standing building along the northern edge of the waste area.

## 1.8 Title and Reference of Methodology

The approved methodology applied for this project is the CDM Approved Consolidated Baseline Methodology ACM0001 Version 10, "Consolidated baseline and monitoring methodology for landfill gas project activities."

The following tools are referenced in the methodology, and are also applied in the calculation of VERs generated during the reporting period:

- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01) (EB39, annex 7);"
- "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (version 05) (EB55, annex 18);"
- "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02) (EB41, annex 11)."

## 1.9 Other Programs

Not applicable.

# 2 IMPLEMENTATION STATUS

## 2.1 Implementation Status of the Project Activity

The project was implemented and has been operational since 1/24/2007. During the reporting period, LFG has been sent to both the power plant and the two project flares. Though the volumes of gas destroyed in each flare varies month to month by quite a bit, the sum of the gas delivered to all three destruction devices is fairly constant over the reporting period. Flare #1 was seldom used during the reporting period and was no longer operating as of January 1, 2016.

On October 31, 2014 the previous project owner DeWitt Energy sold the gas plant to a new entity, Wabash Valley Power Association. Wabash Valley Power now owns and operates the power plant and owns the environmental attributes associated with destruction of methane. Wabash Valley Power entered into an agreement with Origin Climate to manage the verification and monetization of the emission reductions. Wabash Valley Power consigns the VCUs resulting from this effort to Origin Climate for subsequent sale to third parties.

On October 13, 2015, the landfill began importing landfill gas from the neighboring Clinton Landfill No. 3. Gas from this other landfill is outside the project boundary so we do not intend to credit this volume. Gas from Clinton Landfill No. 3 was previously being destroyed in what was called "Flare #3" but to save on costs, the gas was rerouted over to the collection and combustion

system at Clinton Landfill No. 2 and monitored at the point of entry. Because the CL#3 gas is monitored with the same rigor as the meters in this Project, we can easily subtract the volume of gas from our equations without a major deviation from the Project Description. Landfill gas from CL#3 is denoted in the project data files as “Flow Tube”.

## 2.2 Deviations

### 2.2.1 Methodology Deviations

The project deviated from the methodology in one instance.

-As we’ve done every reporting period, we use a flare efficiency of 96% for the project flare, Flare #2. This number is widely used in well established carbon protocols for flares operated under US EPA 40CFR60.18, as is the case here. This deviation is expected to provide a closer estimate to the true quantity of emission reductions. This does not impact the conservativeness of quantification, because the flaring can exceed the 96% destruction efficiency in practice. By limiting the flare flow volumes only to those periods in which the thermocouple reads hotter than 500°F we ensure that only adequate combustion is taking place at all times in the quantified GHG emission reductions. Thus the accuracy is not impacted negatively.

### 2.2.2 Project Description Deviations

The project deviated from the monitoring plan in the following ways. None of the deviations impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario.

#### New project description deviations:

On October 31, 2014, DeWitt Energy transferred ownership of the power plant to Wabash Valley Power who now owns and operates the power plant at the Clinton Landfill. The onsite staff changed to a contractor hired under Wabash, but otherwise no significant changes are noted. The same project equipment continues to operate, including the engine and the flow meter. This deviation does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

On October 13, 2015 a change was made to the gas collection system that was not written into the project description. Clinton Landfill #3 is next to Clinton Landfill #2 – with a barrier between the two – and has been operating its own gas collection and destruction system with Flare #3. But on October 13, 2015 the Flare #3 was shut down and the line bringing gas from Landfill #3 to the header in Landfill #2 was completed, effectively bringing the Clinton Landfill #3 gas collection into the Clinton Landfill #2 gas destruction system. Because Clinton Landfill #3 is outside the project boundary, we do not seek to credit destruction of the imported landfill gas. A new flow meter (often referred to as the “Flow Tube”) was installed in the line importing gas so that the imported gas could be backed out of the calculations. We subtract the quantity out of the term  $MD_{\text{project}, y}$ , which is the only place the project equations will deviate from the project description. The deviation does not affect the applicability of the methodology. Because we subtract the volume of

gas from the project landfill gas destruction, the deviation does not affect the additionality or the appropriateness of the baseline scenario.

As noted above in the Methodology Deviations, we apply a flare efficiency of 96% to the project flare, Flare #2, which deviates from what was written in the project description. The 96% value is widely used in well established carbon protocols for flares operated under US EPA 40CFR60.18, as is the case here. This deviation is expected to provide a closer estimate to the true quantity of emission reductions, particularly as we are monitoring the flame temperature and only claiming credit for landfill gas that is demonstrated to be combusted while the flame temperature is at least 500°F. The deviation does not impact the applicability of the methodology, or additionality. And because we have elected to keep the validated value of 50% for the baseline flare, Flare #1, the deviation does not impact the appropriateness of the baseline scenario. This effectively treats the old baseline flare as less efficient as the new project flare, which is not unreasonable. Additionally, the old baseline Flare #1 was seldom used during this reporting period.

## Deviations applied during previous reporting periods:

1- The PDD described a web-based reporting tool that would aggregate monitored parameters for the engines. Instead, the project manually recorded methane measurements at the engine skid taken with a handheld methane analyzer. These measurements were then entered into spreadsheet documents, which are stored in computers at the Clinton power plant as well as on servers at DeWitt Energy Associates headquarters in New York State. The effect of this lower frequency of measurement is immaterial in respect to the calculations. This does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

2- Total electricity generated by the project is tracked through monthly electricity bills from the power company's metering efforts, rather than from the meters themselves. This adds an additional level of scrutiny by being revenue meters, but has no effect on the calculations. This does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

3- Rather than using hourly records of electricity generated, the engine operating hours were tracked by each engine's operating clock totalizer. Operating clock hours are kept showing monthly totalizer readings, which are used to demonstrate consistent operation by comparing against monthly gas flow and monthly power generation. The theoretical monthly gas volume is calculated for this comparison using the following equation:  $\text{Gas flow (SCF)} = \text{BSFC (btu/hp-hr)} \times 1.341 \text{ hp/kW} / (\text{CH}_4\% \times \text{LHV}_{\text{CH}_4}) \times \text{Power output (kWh)} / \text{Power factor (0.8)}$ . The BSFC is found on the engine Technical Data sheet, the power output is the gross monthly power generation, and the power factor is also found on the Technical Data sheet – and accounts for the power conversion from the engine to the generator's output. To account for the hourly aspect of this deviation, we turn to the pressure in the fuel line at the engine, which is in the raw, 2-minute data. We know from the engine technical information sheet that the fuel pressure ranges from 1.5 – 5.0 psi ("G3500 Gas Engine Technical Information", page 7). We then compare the monthly gas flow against the sum of the 2-minute gas flow for when the pressure is in the correct range and find that the total of each month matches to well within 5%. While this test (and the deviation itself) does not affect the calculations, it does help to support the hourly operation of the energy

plant. This deviation does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

4- The reference temperature and pressure of the flow meters monitoring the engine and the flare differ from the standards assumed in the PDD (60°F instead of 68°F most notably). We calculate the methane density for gas monitored at the engine and Flare 1 as based on 60°F and 14.696psi and we use 60°F and 14.73psi at Flare 2, providing greater accuracy to the calculations. This does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

5- The landfill staff has replaced the portable methane analyzer equipment used onsite. Rather than the Landtec GEM-2000 noted in the PDD for methane concentration to be used as project data at the power plant, they now own and operate a Landtec GEM-5000, which is an improved device over the GEM-2000. Rather than the handheld gas analyzer used at the flares, they now have a Siemens Ultramat 23 continuous gas analyzer installed on each flare skid. The use of continuous data from this instrument is an improvement over the handheld equipment. This does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

6- The PDD notes that the electricity meter, which monitors the net electricity generation, will be subject to regular maintenance and testing to ensure accuracy. We have found that due to the nature of the meter being owned and maintained by the utility purchasing the power, we are unable to obtain evidence of these maintenance activities for purposes of carbon credits. We expect that as a revenue meter, the power utility will keep the meter sufficiently maintained and accurate. This does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario. Furthermore, as the power generation data is not used for project data, this will not have any impact on the accuracy or the results of the GHG Emission Reductions calculations.

7- The PDD indicates TerraPass Inc. as the project proponent. As indicated in the Appendix, TerraPass has changed its name and is now Origin Climate Inc. and continues to manage the verification of the credits and represent them for sale. This administrative change does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

8- The project deviated from the PDD in that the continuous gas analyzer installed at the Flare #1 was found to be materially out of calibration twice during previous reporting periods. On May 29, 2014 the Siemens Ultramat 23 was received its quarterly planned field check and was found to be reading 6% low and recalibrated. Because the readings were low, we considered these to be conservative by using the readings as-is. On December 12, 2014 the same device received its quarterly planned field check and was found to be reading 6% high. It was recalibrated, but to keep the emission reductions from being overstated we adjusted the readings by 6% back to the last successful field check on August 18, 2014. While Flare #1 continues to be seldom used, we found its continuous gas analyzer to be materially out of calibration two more times during this reporting period. This very well may be due to the fact that there was no gas flowing to the skid at the time. Nevertheless we apply drift adjustments to the periods in which the device was reading high, from the beginning of the reporting period through December 12, 2014 at 6%, and from

March 31, 2015 through June 24, 2015 at 8%. For the period preceding March 30, 2015 when the device was found to be reporting 5.4% low, we make no adjustments in order to be conservative. As no flow was recorded during the times of drift adjustment, this does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario.

9- The project deviated from the PDD by including propane as an emissions source in the Project activity. The PDD states that because the flare was also used in the baseline scenario, we would not monitor the propane and would not include it in the emission reductions. However, since the propane purchase records were supplied by the Clinton Landfill staff, we've gone ahead and included them as project emissions. The deviation is more conservative, and does not affect the applicability of the methodology, the additionality, or the appropriateness of the baseline scenario. The effect of inclusion was minor.

## 2.3 Grouped Project

Not applicable.

## 3 DATA AND PARAMETERS

### 3.1 Data and Parameters Available at Validation

|                                                                                              |                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | Regulatory requirements relating to landfill gas projects                                                                                                                                                                                                             |
| Data unit:                                                                                   | ---                                                                                                                                                                                                                                                                   |
| Description:                                                                                 | Regulatory requirements relating to landfill gas projects                                                                                                                                                                                                             |
| Source of data:                                                                              | U.S. Code of Federal Regulations and Illinois Administrative Code<br>Any new legislation passed at State or federal levels                                                                                                                                            |
| Value applied:                                                                               | At the current time, there are no regulatory requirements that require landfill gas to be collected.                                                                                                                                                                  |
| Justification of choice of data or description of measurement methods and procedures applied | The landfill is regulated under Title 35 Illinois Administrative Code (35 IAC), Subtitle G: Land Pollution (Regulations) and under the Title V Clean Air Act Permit Program.<br>The DeWitt energy plant is also regulated under Title 40 Code of Federal Regulations. |
| Purpose of the data:                                                                         | This data is used for changes to the adjustment factor (AF) or directly $MD_{BL,y}$ at renewal of the credit period.                                                                                                                                                  |
| Any comment:                                                                                 | Relevant regulations are converted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ( $MD_{BL,y}$ ) and used to determine the baseline destruction efficiency and the adjustment factor (AF). |

|                                                                                              |                                                                                                                                         |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | $GWP_{CH_4}$                                                                                                                            |
| Data unit:                                                                                   | $tCO_2e/tCH_4$                                                                                                                          |
| Description:                                                                                 | Global warming potential of $CH_4$                                                                                                      |
| Source of data:                                                                              | IPCC                                                                                                                                    |
| Value applied:                                                                               | 21                                                                                                                                      |
| Justification of choice of data or description of measurement methods and procedures applied | This term is specified in the ACM0001 Methodology.                                                                                      |
| Purpose of the data:                                                                         | Calculation of baseline and project emissions                                                                                           |
| Any comment:                                                                                 | This parameter is used in the calculation of baseline emissions, as well as project emissions related to operation of the back-up flare |

|                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | $D_{CH_4}$                                                                                                                                                                                                                                                                                                                                                                                               |
| Data unit:                                                                                   | $lbs\ CH_4/ft^3$                                                                                                                                                                                                                                                                                                                                                                                         |
| Description:                                                                                 | Methane density                                                                                                                                                                                                                                                                                                                                                                                          |
| Source of data:                                                                              | US EPA conversion factor, "Basic Concepts in Environmental Science," Conversion Factors, Volume (Gas) @STP<br><a href="http://www.epa.gov/apti/bces/reference/reference.htm">http://www.epa.gov/apti/bces/reference/reference.htm</a>                                                                                                                                                                    |
| Value applied:                                                                               | 0.0416 @ "1 atm and 68°F" (baseline scenario in PDD),<br>0.04226 @ 14.696 psi and 60°F (at the engine and flare #1),<br>0.04235 @ 14.73 psi and 60°F (at flare #2 only)                                                                                                                                                                                                                                  |
| Justification of choice of data or description of measurement methods and procedures applied | $D_{CH_4} = \text{Molecular Weight of Methane (16.043 lb/lbmol)} \times P_{\text{Reference}} / \text{Universal Gas Constant (10.73 psia-ft}^3/\text{lbmol-}^\circ\text{R)} / T_{\text{Reference}}$                                                                                                                                                                                                       |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                                                                        |
| Any comment:                                                                                 | This value differs between Flare #1 and the engine (with flow meters using 14.696 psi as the reference temperature) and Flare #2 (with flow meter using 14.73 psi). The baseline calculations used a slightly different value of 0.0416 $lb\ CH_4/ft^3$ or 0.0000189 metric tons $CH_4/ft^3$ . We use the adjusted values now to account for variations of standard pressure and temperature references. |

|                                                                                              |                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | $BE_{CH_4,SWDS,y}$                                                                                                                                                  |
| Data unit:                                                                                   | tCO <sub>2</sub> e                                                                                                                                                  |
| Description:                                                                                 | Methane generation from the landfill in the absence of any gas collection activity at year y                                                                        |
| Source of data:                                                                              | Calculated using a first-order decay equation as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"        |
| Value applied:                                                                               | 9,762                                                                                                                                                               |
| Justification of choice of data or description of measurement methods and procedures applied | This term is specified in the ACM0001 Methodology. The value was determined at validation.                                                                          |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                   |
| Any comment:                                                                                 | Used for ex ante estimation of the amount of methane that would have been generated in a given year, as well as to establish baseline scenario emissions reductions |

|                                                                                              |                                                                                                                                                                |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | $MD_{BL,2006}$                                                                                                                                                 |
| Data unit:                                                                                   | tCH <sub>4</sub>                                                                                                                                               |
| Description:                                                                                 | Amount of methane which would have been destroyed historically for calendar year 2006 if the baseline scenario had been chosen instead of the project scenario |
| Source of data:                                                                              | Calculated in the PD based on historic project data.<br>$MD_{BL,2006} = \epsilon_{BL} * MG_{2006}$                                                             |
| Value applied:                                                                               | 1,950                                                                                                                                                          |
| Justification of choice of data or description of measurement methods and procedures applied | The value was determined at validation.                                                                                                                        |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                              |
| Any comment:                                                                                 | Used to calculate the adjustment factor (AF)                                                                                                                   |

|                                                                                              |                                                                                                                                                              |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | MG <sub>BL,2006</sub>                                                                                                                                        |
| Data unit:                                                                                   | tCH <sub>4</sub>                                                                                                                                             |
| Description:                                                                                 | Amount of methane generated historically for calendar year 2006, the year before the start of project activity                                               |
| Source of data:                                                                              | Calculated using a first-order decay equation as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" |
| Value applied:                                                                               | 12,130                                                                                                                                                       |
| Justification of choice of data or description of measurement methods and procedures applied | The value was determined at validation.                                                                                                                      |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                            |
| Any comment:                                                                                 | Used to calculate the methane destruction efficiency of the collection system in the baseline scenario                                                       |

|                                                                                              |                                                                                                                                        |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | ε <sub>BL</sub>                                                                                                                        |
| Data unit:                                                                                   | Percent                                                                                                                                |
| Description:                                                                                 | Methane destruction efficiency of the collection system in the baseline scenario                                                       |
| Source of data:                                                                              | Derived from the amount of methane generated and destroyed in the baseline scenario in 2006 (the year prior to project implementation) |
| Value applied:                                                                               | 16.1%, as determined in the validated PDD                                                                                              |
| Justification of choice of data or description of measurement methods and procedures applied | This term is specified in the ACM0001 Methodology. The value was determined at validation.                                             |
| Purpose of the data:                                                                         | Calculation of project emissions                                                                                                       |
| Any comment:                                                                                 | Used to calculate the project's Adjustment Factor (AF)                                                                                 |

The following parameters were not monitored and used in the “Tool to determine project emissions from flaring gases containing methane”:

|                                                                                              |                                                                                                    |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | $\eta_{\text{flare1}}$                                                                             |
| Data unit:                                                                                   | Percent                                                                                            |
| Description:                                                                                 | Destruction efficiency of an open flare                                                            |
| Source of data:                                                                              | Default value from the “Tool to determine project emissions from flaring gases containing methane” |
| Value applied:                                                                               | 50%                                                                                                |
| Justification of choice of data or description of measurement methods and procedures applied | Prescribed in the validated project description for the baseline flare, Flare #1.                  |
| Purpose of the data:                                                                         | Calculation of baseline and some project emissions                                                 |
| Any comment:                                                                                 |                                                                                                    |

|                                                                                              |                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | $\eta_{\text{flare2}}$                                                                                                                                                                                                                    |
| Data unit:                                                                                   | Percent                                                                                                                                                                                                                                   |
| Description:                                                                                 | Destruction efficiency of an open flare                                                                                                                                                                                                   |
| Source of data:                                                                              | Seebold, J.G. et al. “Reaction Efficiency of Industrial Flares: The Perspective of the Past,” (2003).                                                                                                                                     |
| Value applied:                                                                               | 96%                                                                                                                                                                                                                                       |
| Justification of choice of data or description of measurement methods and procedures applied | Seebold calculates the overall destruction efficiency of industrial gas flares to be 96.4%. We use the conservative figure of 96%, which is widely used in well established carbon protocols for flares operated under US EPA 40CFR60.18. |
| Purpose of the data:                                                                         | Calculation of project emissions                                                                                                                                                                                                          |
| Any comment:                                                                                 | This has been used every reporting period and will be used for the duration of the reporting period for the project flare, Flare #2.                                                                                                      |

The following parameters were not monitored and used in the “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion”:

|                        |                                                                                                                                                                                                                                   |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | WC. Propane                                                                                                                                                                                                                       |
| Data unit:             | lbs C/lbs Propane                                                                                                                                                                                                                 |
| Description:           | Weighted average mass fraction of carbon in propane                                                                                                                                                                               |
| Source of data:        | The fraction of carbon in propane comes from the US EPA clean energy resources calculator ( <a href="http://www.epa.gov/cleanenergy/energy-resources/refs.html">http://www.epa.gov/cleanenergy/energy-resources/refs.html</a> ),. |

|                                                                                              |                                                                                                             |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Value applied:                                                                               | 0.817                                                                                                       |
| Justification of choice of data or description of measurement methods and procedures applied | Reflects data from the US EPA 2009 Greenhouse Gas inventory and continues to be a relevant emission factor. |
| Purpose of the data:                                                                         | Calculation of project emissions                                                                            |
| Any comment:                                                                                 | For consumption of propane in the open flares                                                               |

The following parameters were not monitored and used in the “Tool to calculate baseline, project, and/or leakage emissions from electricity consumption”:

|                                                                                              |                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | EF <sub>EL, grid</sub>                                                                                                                                                                                                                                                                              |
| Data unit:                                                                                   | tCO <sub>2</sub> /MWh                                                                                                                                                                                                                                                                               |
| Description:                                                                                 | Carbon emission factor of electricity                                                                                                                                                                                                                                                               |
| Source of data:                                                                              | Selected as the conservative default value in accordance with Option A2 of “Tool to calculate baseline, project, and/or leakage emissions from electricity consumption”                                                                                                                             |
| Value applied:                                                                               | 1.3                                                                                                                                                                                                                                                                                                 |
| Justification of choice of data or description of measurement methods and procedures applied | The Project meets the criterion described in the tool: “Scenario A applies to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the project and leakage sources is greater than the electricity consumption of the baseline sources.” |
| Purpose of the data:                                                                         | Calculation of project emissions                                                                                                                                                                                                                                                                    |
| Any comment:                                                                                 |                                                                                                                                                                                                                                                                                                     |

The following parameters were not monitored and used in the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site:”

|                                                                                              |                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | φ                                                                                                                                                                                                                                                                                                                          |
| Data unit:                                                                                   | N/A                                                                                                                                                                                                                                                                                                                        |
| Description:                                                                                 | Model correction factor to account for model uncertainties                                                                                                                                                                                                                                                                 |
| Source of data:                                                                              | Default value prescribed in the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”                                                                                                                                                                                        |
| Value applied:                                                                               | 0.9                                                                                                                                                                                                                                                                                                                        |
| Justification of choice of data or description of measurement methods and procedures applied | Oonk et al. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% |

|                      |                                                                                                                                       |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                      | is applied to the model results.                                                                                                      |
| Purpose of the data: | Calculation of baseline emissions                                                                                                     |
| Any comment:         | Oonk H., Weenk A., Coops O., Luning L. (1994) Validation of landfill gas formation models; EWAB 9427; NOVEM, Utrecht, The Netherlands |

|                                                                                              |                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | OX                                                                                                                                                                                           |
| Data unit:                                                                                   | N/A                                                                                                                                                                                          |
| Description:                                                                                 | Oxidation factor, reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste                                                               |
| Source of data:                                                                              | Default factor in "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" for managed solid waste disposal sites covered with oxidizing material |
| Value applied:                                                                               | 0                                                                                                                                                                                            |
| Justification of choice of data or description of measurement methods and procedures applied | We used a value of 0 in the project validation, because the Clinton Landfill is covered with 60-mil high density polyethylene liner.                                                         |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                                            |
| Any comment:                                                                                 | "Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Use 0 for other types of solid waste disposal sites."                      |

|                                                                                              |                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | F                                                                                                                                                                                                   |
| Data unit:                                                                                   | Percent methane                                                                                                                                                                                     |
| Description:                                                                                 | Fraction of methane in the solid waste disposal site gas (volume fraction)                                                                                                                          |
| Source of data:                                                                              | Default factor in "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" for methane fraction in SWDS gas                                              |
| Value applied:                                                                               | 0.5                                                                                                                                                                                                 |
| Justification of choice of data or description of measurement methods and procedures applied | This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC. |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                                                   |
| Any comment:                                                                                 | To adjust for fraction of methane present in landfill gas                                                                                                                                           |

|                                                                                              |                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | DOC <sub>f</sub>                                                                                                                                                                |
| Data unit:                                                                                   | N/A                                                                                                                                                                             |
| Description:                                                                                 | Fraction of degradable organic carbon (DOC) that can decompose                                                                                                                  |
| Source of data:                                                                              | IPCC 2006 Guidelines for National Greenhouse Gas Inventories, prescribed in "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" |
| Value applied:                                                                               | 0.5                                                                                                                                                                             |
| Justification of choice of data or description of measurement methods and procedures applied | Specified in ACM0001 methodology.                                                                                                                                               |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                               |
| Any comment:                                                                                 |                                                                                                                                                                                 |

|                                                                                              |                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                                                       | MCF                                                                                                                                                                                                     |
| Data unit:                                                                                   | N/A                                                                                                                                                                                                     |
| Description:                                                                                 | Methane correction factor                                                                                                                                                                               |
| Source of data:                                                                              | IPCC 2006 Guidelines for National Greenhouse Gas Inventories, prescribed in "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"                         |
| Value applied:                                                                               | 1.0                                                                                                                                                                                                     |
| Justification of choice of data or description of measurement methods and procedures applied | Specified in ACM0001 methodology for anaerobic managed solid waste disposal sites that has controlled placement of waste and cover material.                                                            |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                                                       |
| Any comment:                                                                                 | Clinton Landfill is an anaerobic managed disposal site, therefore we use a factor of 1.0 as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" |

| Data Unit / Parameter:                                                                       | $P_{n,j,x}$                                                                                                                                                                                                                                                                                                                                                                                                                             |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------------------------|------|-------------------------------------|------|---------------------------------|------|----------|-----|-----------------------------|-----|------------------------------------|------|
| Data unit:                                                                                   | Weight fraction of the waste type $j$                                                                                                                                                                                                                                                                                                                                                                                                   |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Description:                                                                                 | Used in ex-ante calculations of the emissions of the landfill in the baseline scenario                                                                                                                                                                                                                                                                                                                                                  |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Source of data:                                                                              | Sampling conducted by Iowa Department of Natural Resources and reported in a 2006 report entitled "Iowa Statewide Waste Characterization Study"                                                                                                                                                                                                                                                                                         |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Value applied:                                                                               | <table> <tr> <th>Waste Type</th><th>% by weight</th></tr> <tr> <td>Wood and wood products</td><td>10.4</td></tr> <tr> <td>Pulp, paper, cardboard (not sludge)</td><td>33.0</td></tr> <tr> <td>Food, food waste, bev &amp; tobacco</td><td>10.6</td></tr> <tr> <td>Textiles</td><td>4.9</td></tr> <tr> <td>Garden, yard and park waste</td><td>3.1</td></tr> <tr> <td>Glass, plastic, metal, other inert</td><td>38.0</td></tr> </table> | Waste Type | % by weight | Wood and wood products | 10.4 | Pulp, paper, cardboard (not sludge) | 33.0 | Food, food waste, bev & tobacco | 10.6 | Textiles | 4.9 | Garden, yard and park waste | 3.1 | Glass, plastic, metal, other inert | 38.0 |
| Waste Type                                                                                   | % by weight                                                                                                                                                                                                                                                                                                                                                                                                                             |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Wood and wood products                                                                       | 10.4                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Pulp, paper, cardboard (not sludge)                                                          | 33.0                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Food, food waste, bev & tobacco                                                              | 10.6                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Textiles                                                                                     | 4.9                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Garden, yard and park waste                                                                  | 3.1                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Glass, plastic, metal, other inert                                                           | 38.0                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Justification of choice of data or description of measurement methods and procedures applied | Iowa borders on Illinois has a similar climatic and demographic profile.                                                                                                                                                                                                                                                                                                                                                                |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                                                                                                       |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |
| Any comment:                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |             |                        |      |                                     |      |                                 |      |          |     |                             |     |                                    |      |

| Data Unit / Parameter:                                                                       | $DOC_j$                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------|------------------------|----|-------------------------------------|----|----------------------------------------------|----|----------|----|-----------------------------|----|------------------------------------|---|
| Data unit:                                                                                   | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Description:                                                                                 | Fraction of degradable organic carbon (by weight) in waste type $j$                                                                                                                                                                                                                                                                                                                                                                             |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Source of data:                                                                              | IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5) prescribed in "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"                                                                                                                                                                                                                      |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Value applied:                                                                               | <table> <tr> <th>Waste Type</th><th>DOC - % dry waste</th></tr> <tr> <td>Wood and wood products</td><td>50</td></tr> <tr> <td>Pulp, paper, cardboard (not sludge)</td><td>44</td></tr> <tr> <td>Food, food waste, bev &amp; tobacco (not sludge)</td><td>38</td></tr> <tr> <td>Textiles</td><td>30</td></tr> <tr> <td>Garden, yard and park waste</td><td>49</td></tr> <tr> <td>Glass, plastic, metal, other inert</td><td>0</td></tr> </table> | Waste Type | DOC - % dry waste | Wood and wood products | 50 | Pulp, paper, cardboard (not sludge) | 44 | Food, food waste, bev & tobacco (not sludge) | 38 | Textiles | 30 | Garden, yard and park waste | 49 | Glass, plastic, metal, other inert | 0 |
| Waste Type                                                                                   | DOC - % dry waste                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Wood and wood products                                                                       | 50                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Pulp, paper, cardboard (not sludge)                                                          | 44                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Food, food waste, bev & tobacco (not sludge)                                                 | 38                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Textiles                                                                                     | 30                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Garden, yard and park waste                                                                  | 49                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Glass, plastic, metal, other inert                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |
| Justification of choice of data or description of measurement methods and procedures applied | We derived our waste composition figures from a study published in 2006 by the Iowa Department of Natural Resources. Iowa shares a border with Illinois and has a similar climactic and demographic composition.                                                                                                                                                                                                                                |            |                   |                        |    |                                     |    |                                              |    |          |    |                             |    |                                    |   |

|                      |                                                                                              |
|----------------------|----------------------------------------------------------------------------------------------|
| Purpose of the data: | Calculation of baseline emissions                                                            |
| Any comment:         | Further discussion of this parameter can be found in Annex 1 of the previously validated PDD |

| Data Unit / Parameter:                                                                       | $k_j$                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----|----------------------------|------|-----------------------------------------------|------|--------------------------------------------------------|-----|-----------------------------------------|-------|
| Data unit:                                                                                   | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Description:                                                                                 | Decay rate for the waste type $j$                                                                                                                                                                                                                                                                                                                                                                                                    |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Source of data:                                                                              | IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) prescribed in “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”                                                                                                                                                                                                                    |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Value applied:                                                                               | <table> <thead> <tr> <th>Waste Type (<math>j</math>)</th><th><math>k</math></th></tr> </thead> <tbody> <tr> <td>Wood, wood products, straw</td><td>0.06</td></tr> <tr> <td>Pulp, paper, cardboard (not sludge), textiles</td><td>0.03</td></tr> <tr> <td>Other (non-food) organic putrescible garden/park waste</td><td>0.1</td></tr> <tr> <td>Food, food waste, sludge, bev &amp; tobacco</td><td>0.185</td></tr> </tbody> </table> | Waste Type ( $j$ ) | $k$ | Wood, wood products, straw | 0.06 | Pulp, paper, cardboard (not sludge), textiles | 0.03 | Other (non-food) organic putrescible garden/park waste | 0.1 | Food, food waste, sludge, bev & tobacco | 0.185 |
| Waste Type ( $j$ )                                                                           | $k$                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Wood, wood products, straw                                                                   | 0.06                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Pulp, paper, cardboard (not sludge), textiles                                                | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Other (non-food) organic putrescible garden/park waste                                       | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Food, food waste, sludge, bev & tobacco                                                      | 0.185                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Justification of choice of data or description of measurement methods and procedures applied | <p>At Clinton, the climatic conditions are as follows:<br/> Mean Avg. Temp = 11.5° C (NOAA 30-year normals)<br/> Mean Avg. Precip = 90.3 cm (NOAA 30-year normals)<br/> Potential Evapotranspiration = 63.6 cm (Thornthwaite method)<br/> MAP/PET = 1.420<br/> → Boreal/Temperate, Wet</p>                                                                                                                                           |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Purpose of the data:                                                                         | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                                                                                                    |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |
| Any comment:                                                                                 | The project site meets the climatic conditions of the “Boreal and Temperate/Wet” designation. More discussion can be found in the PDD.                                                                                                                                                                                                                                                                                               |                    |     |                            |      |                                               |      |                                                        |     |                                         |       |

## 3.2 Data and Parameters Monitored

|                                                                 |                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter                                           | $LFG_{\text{electricity}, y}$                                                                                                                                                                                                                                                                                     |
| Data unit                                                       | Standard cubic feet (scf)                                                                                                                                                                                                                                                                                         |
| Description                                                     | Amount of landfill gas combusted in power plant at normal temperature and pressure in year $y$                                                                                                                                                                                                                    |
| Source of data                                                  | Peoria Disposal Company                                                                                                                                                                                                                                                                                           |
| Description of measurement methods and procedures to be applied | Rosemount 3095 MultiVariable Mass Flow Transmitter measures differential pressure, static pressure, and process temperature continuously and automatically converts these parameters into a compensated mass flow value at reference conditions 60°F and 14.696 psia (See Rosemount Transmitters T&P Config.pdf). |
| Frequency of monitoring/recording                               | Flow is measured continuously and recorded continuously to Yokogawa data recorders.                                                                                                                                                                                                                               |

|                                |                                                                                                                                                                                                                              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Value monitored                | LFG flow (by means of differential pressure, static pressure, and temperature) totaled 514,104,000 scf for the reporting period:<br>→ 2,431,000 scf in 2014;<br>→ 379,860,000 scf in 2015; and<br>→ 131,813,000 scf in 2016. |
| Monitoring equipment           | Rosemount 3095 MultiVariable Mass Flow Transmitter, s/n 20768                                                                                                                                                                |
| QA/QC procedures to be applied | This meter is maintained according to manufacturer specification, which is every 5 years. It was calibrated on July 2, 2014.                                                                                                 |
| Purpose of the data            | Calculation of baseline emissions                                                                                                                                                                                            |
| Calculation method             | ---                                                                                                                                                                                                                          |
| Comments                       |                                                                                                                                                                                                                              |

|                                                                  |                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | LFG <sub>Flare 1, y</sub>                                                                                                                                                                                                                                                                            |
| Data unit:                                                       | Standard cubic feet (scf)                                                                                                                                                                                                                                                                            |
| Description:                                                     | Amount of landfill gas flared in Flare 1 in year y                                                                                                                                                                                                                                                   |
| Source of data:                                                  | Peoria Disposal Company                                                                                                                                                                                                                                                                              |
| Description of measurement methods and procedures to be applied: | Rosemount 3095 MultiVariable Mass Flow Transmitter measures differential pressure, static pressure, and process temperature continuously and automatically across a Rosemount Annubar and converts these parameters into a compensated mass flow value at reference conditions 60°F and 14.696 psia. |
| Frequency of monitoring/recording:                               | Flow is measured continuously and recorded continuously to Yokogawa data recorders.                                                                                                                                                                                                                  |
| Value monitored:                                                 | Landfill gas flow totaled 1,396,300 scf for the reporting period:<br>→ 287,800 scf in 2014;<br>→ 1,108,500 scf in 2015; and<br>→ 0 in 2016.                                                                                                                                                          |
| Monitoring equipment:                                            | Rosemount 3095 MultiVariable Mass Flow Transmitters, s/n 41863; Rosemount 3095 Annubar s/n 2652216.1.1                                                                                                                                                                                               |
| QA/QC procedures to be applied:                                  | The transmitter is maintained according to manufacturer specification to calibrate at least every 5 years; and was calibrated on 7/2/2014.                                                                                                                                                           |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                                                                                                                                                    |
| Calculation method:                                              | ---                                                                                                                                                                                                                                                                                                  |
| Any comment:                                                     | Installed 1/5/2012. See Rosemount Transmitters T&P Config.pdf.                                                                                                                                                                                                                                       |

|                                                                  |                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | LFG <sub>Flare 2, y</sub>                                                                                                                                                                                                                              |
| Data unit:                                                       | Standard cubic feet (scf)                                                                                                                                                                                                                              |
| Description:                                                     | Amount of landfill gas flared in Flare 2 in year y                                                                                                                                                                                                     |
| Source of data:                                                  | Peoria Disposal Company                                                                                                                                                                                                                                |
| Description of measurement methods and procedures to be applied: | Rosemount 3095 MultiVariable Mass Flow Transmitter measures differential pressure, static pressure, and process temperature continuously and converts these parameters into a compensated mass flow value at reference conditions 60°F and 14.73 psia. |
| Frequency of monitoring/recording:                               | Flow is measured continuously and recorded continuously to Yokogawa data recorders.                                                                                                                                                                    |
| Value monitored:                                                 | Landfill gas flow totaled 275,091,000 scf for the reporting period:<br>→ 74,617,800 scf in 2014;<br>→ 127,393,000 scf in 2015; and<br>→ 73,080,200 scf in 2016.                                                                                        |
| Monitoring equipment:                                            | Rosemount 3095 MultiVariable Mass Flow Transmitter, s/n 39105                                                                                                                                                                                          |
| QA/QC procedures to be applied:                                  | This meter is maintained according to manufacturer specification, to calibrate at least every 5 years; and was calibrated on 7/2/2014.                                                                                                                 |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                                                                                                      |
| Calculation method:                                              | ---                                                                                                                                                                                                                                                    |
| Any comment:                                                     |                                                                                                                                                                                                                                                        |

|                                                                  |                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | LFG <sub>Imported, y</sub>                                                                                                                                                                                                                                                                              |
| Data unit:                                                       | Standard cubic feet (scf)                                                                                                                                                                                                                                                                               |
| Description:                                                     | Amount of landfill gas imported from outside the project boundary in year y, to be backed out of the project methane destroyed.                                                                                                                                                                         |
| Source of data:                                                  | Peoria Disposal Company                                                                                                                                                                                                                                                                                 |
| Description of measurement methods and procedures to be applied: | Rosemount pressure transmitters measure differential pressure and static pressure around a Veris Verabar, which along with process temperature converts these parameters into a compensated mass flow value at reference conditions 59°F and 14.7 psia (According to Veris Flow Calculation Worksheet). |
| Frequency of monitoring/recording:                               | Flow is measured continuously and recorded continuously to an AutomationDirect C-more EA7 series data recorder.                                                                                                                                                                                         |
| Value monitored:                                                 | Landfill gas flow totaled 147,352,411 scf for the reporting period:<br>→ 0 scf in 2014;<br>→ 57,513,964 scf in 2015; and<br>→ 89,838,447 scf in 2016.                                                                                                                                                   |

|                                 |                                                                                                                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Monitoring equipment:           | Veris Verabar V100, s/n V22930-01.1;<br>Two (2) Rosemount 2051CD Pressure Transmitters, s/n 13879716 and 13876931; and one thermocouple.                                                                |
| QA/QC procedures to be applied: | The pressure transmitters are maintained according to manufacturer specification along with the project meters, which is to calibrate at least every 5 years; and was initially calibrated on 8/6/2015. |
| Purpose of the data             | Calculation of baseline emissions                                                                                                                                                                       |
| Calculation method:             | ---                                                                                                                                                                                                     |
| Any comment:                    | This is a new variable being tracked this reporting period.                                                                                                                                             |

|                                                                  |                                                                                                                       |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | LFG <sub>Total, y</sub>                                                                                               |
| Data unit:                                                       | Standard cubic feet (scf)                                                                                             |
| Description:                                                     | Total amount of landfill gas flared at standard temperature and pressure in year y                                    |
| Source of data:                                                  | Calculated in Clinton Emissions Reductions 2014-2016.xlsx                                                             |
| Description of measurement methods and procedures to be applied: | Aggregate yearly the continuously monitored data.                                                                     |
| Frequency of monitoring/recording:                               | Flow of each stream is measured continuously and recorded continuously to Yokogawa data recorders.                    |
| Value monitored:                                                 | Calculated at 790,591,300 scf<br>→ 77,336,600 scf in 2014;<br>→ 508,361,500 scf in 2015;<br>→ 204,893,200 scf in 2016 |
| Monitoring equipment:                                            | See individual flow streams                                                                                           |
| QA/QC procedures to be applied:                                  | See individual flow streams                                                                                           |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                     |
| Calculation method:                                              | Calculated as $[LFG_{\text{electricity}, y} + LFG_{\text{Flare1}, y} + LFG_{\text{Flare2}, y}]$                       |
| Any comment:                                                     | This is all the landfill gas destroyed at the project destruction devices, including the imported landfill gas.       |

|                            |                                                                                                                                |
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| Data Unit / Parameter:     | PE <sub>flare, y</sub>                                                                                                         |
| Data unit:                 | tCO <sub>2</sub>                                                                                                               |
| Description:               | Project emissions from flaring of the residual gas stream in year y                                                            |
| Source of data:            | Calculated as per the "Tool to determine project emissions from flaring gases containing Methane" and modified equation in PDD |
| Description of measurement | Calculated                                                                                                                     |

|                                    |                                                                                                                |
|------------------------------------|----------------------------------------------------------------------------------------------------------------|
| methods/procedures applied:        |                                                                                                                |
| Frequency of monitoring/recording: | ---                                                                                                            |
| Value monitored:                   | Indirectly accounted for within destruction efficiency                                                         |
| Monitoring equipment:              | ---                                                                                                            |
| QA/QC procedures applied:          | ---                                                                                                            |
| Purpose of the data                | Calculation of project emissions                                                                               |
| Calculation method:                | $LFG_{\text{flare}, y} * W_{CH_4, \text{flare}, y} * D_{CH_4} * \eta_{\text{flare}}$                           |
| Any comment:                       | $PE_{\text{flare}, y}$ is accounted for in the calculation of the methane destroyed in the landfill gas flares |

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| Data Unit / Parameter:                                           | $W_{CH_4}$ , power plant                                                                                                                                    |
| Data unit:                                                       | percent                                                                                                                                                     |
| Description:                                                     | Methane fraction in landfill gas at the power plant                                                                                                         |
| Source of data:                                                  | Peoria Disposal Company                                                                                                                                     |
| Description of measurement methods and procedures to be applied: | Methane fraction is measured approximately weekly with a GEM-5000.                                                                                          |
| Frequency of monitoring/recording:                               | Approximately weekly                                                                                                                                        |
| Value monitored:                                                 | 59.6% is the lower confidence limit of all 67 samples                                                                                                       |
| Monitoring equipment:                                            | 2 Landtec GEM5000 units: s/n G500309 and G500930.                                                                                                           |
| QA/QC procedures to be applied:                                  | Meters are calibrated to reference gases before daily use, as documented in the LFG Monitoring Field Reports. These meters are factory calibrated annually. |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                           |
| Calculation method:                                              | In accordance with ACM0001 v10, we take the 95% lower confidence interval of all methane measurements taken during the reporting period                     |
| Any comment:                                                     | We only use measurements taken with a successful and documented field calibration.                                                                          |

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| Data Unit / Parameter:                                           | $W_{CH_4}$ , Flare 1                                                                                                                                                          |
| Data unit:                                                       | Percent                                                                                                                                                                       |
| Description:                                                     | Methane fraction in landfill gas at Flare 1                                                                                                                                   |
| Source of data:                                                  | Peoria Disposal Company                                                                                                                                                       |
| Description of measurement methods and procedures to be applied: | Methane fraction is measured continuously with a Siemens Ultramat 23 Gas Analyzer. Backup measurements are taken with a portable handheld gas analyzer and used as necessary. |

|                                    |                                                                                                                |
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| Frequency of monitoring/recording: | Continuously (backup measurements taken at least once per week)                                                |
| Value monitored:                   | 41.2% when averaged over the reporting period                                                                  |
| Monitoring equipment:              | Siemens Ultramat 23 Gas Analyzer, s/n N1A2-146                                                                 |
| QA/QC procedures to be applied:    | The gas analyzer is calibrated quarterly in the field.                                                         |
| Purpose of the data                | Calculation of baseline emissions                                                                              |
| Calculation method:                | Annual average                                                                                                 |
| Any comment:                       | The backup measurements using portable instruments were not used for project data during the reporting period. |

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| Data Unit / Parameter:                                           | W <sub>CH4</sub> , Flare 2                                                                                                                                                    |
| Data unit:                                                       | Percent                                                                                                                                                                       |
| Description:                                                     | Methane fraction in landfill gas at Flare 2                                                                                                                                   |
| Source of data:                                                  | Peoria Disposal Company                                                                                                                                                       |
| Description of measurement methods and procedures to be applied: | Methane fraction is measured continuously with a Siemens Ultramat 23 Gas Analyzer. Backup measurements are taken with a portable handheld gas analyzer and used as necessary. |
| Frequency of monitoring/recording:                               | Continuously (backup measurements taken at least once per week)                                                                                                               |
| Value monitored:                                                 | 57.3% when averaged over the reporting period                                                                                                                                 |
| Monitoring equipment:                                            | Siemens Ultramat 23 Gas Analyzer, s/n N1A1-699                                                                                                                                |
| QA/QC procedures to be applied:                                  | The gas analyzer is calibrated quarterly in the field.                                                                                                                        |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                             |
| Calculation method:                                              | Annual average                                                                                                                                                                |
| Any comment:                                                     | The backup measurements using the portable instruments were not used for project data during the reporting period.                                                            |

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| Data Unit / Parameter:                                           | T                                                                                                                                                                                       |
| Data unit:                                                       | °F                                                                                                                                                                                      |
| Description:                                                     | Temperature of landfill gas                                                                                                                                                             |
| Source of data:                                                  | Peoria Disposal Company                                                                                                                                                                 |
| Description of measurement methods and procedures to be applied: | Landfill gas temperature is monitored continuously, and automatically converted by the respective flow meter/transmitter into compensated total flow value at reference condition 60°F. |
| Frequency of monitoring/recording:                               | Temperature is monitored continuously                                                                                                                                                   |

|                                 |                                                                                                                                                 |
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| Value monitored:                | Gas temperature varies and is internal to the corrected flow volumes                                                                            |
| Monitoring equipment:           | Temperature sensor part of flow meter equipment listed in LFG <sub>electricity, y</sub> , LFG <sub>Flare 1, y</sub> , LFG <sub>Flare 2, y</sub> |
| QA/QC procedures to be applied: | See LFG <sub>electricity, y</sub> , LFG <sub>Flare 1, y</sub> , LFG <sub>Flare 2, y</sub>                                                       |
| Purpose of the data             | Calculation of baseline emissions                                                                                                               |
| Calculation method:             | ---                                                                                                                                             |
| Any comment:                    |                                                                                                                                                 |

|                                                                  |                                                                                                                                                                                       |
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| Data Unit / Parameter:                                           | P                                                                                                                                                                                     |
| Data unit:                                                       | atm                                                                                                                                                                                   |
| Description:                                                     | Peoria Disposal Company                                                                                                                                                               |
| Source of data:                                                  | Project participants                                                                                                                                                                  |
| Description of measurement methods and procedures to be applied: | Landfill gas pressure is monitored continuously, and automatically converted by the flow meter/transmitter into compensated total flow at reference condition 14.696 [or 14.73] psia. |
| Frequency of monitoring/recording:                               | Pressure is monitored continuously                                                                                                                                                    |
| Value monitored:                                                 | Gas pressure varies and is internal to the corrected flow volumes                                                                                                                     |
| Monitoring equipment:                                            | Static pressure sensor part of flow meter equipment listed in LFG <sub>electricity, y</sub> , LFG <sub>Flare 1, y</sub> , LFG <sub>Flare 2, y</sub>                                   |
| QA/QC procedures to be applied:                                  | See LFG <sub>electricity, y</sub> , LFG <sub>Flare 1, y</sub> , LFG <sub>Flare 2, y</sub>                                                                                             |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                                     |
| Calculation method:                                              | ---                                                                                                                                                                                   |
| Any comment:                                                     |                                                                                                                                                                                       |

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| Data Unit / Parameter:                                           | EL <sub>LFG</sub>                                                                          |
| Data unit:                                                       | MWh                                                                                        |
| Description:                                                     | Net amount of electricity generated using project landfill gas (and delivered to the grid) |
| Source of data:                                                  | Wabash Valley Power                                                                        |
| Description of measurement methods and procedures to be applied: | This data is reported in gas plant monthly summaries.                                      |
| Frequency of monitoring/recording:                               | Monthly                                                                                    |
| Value monitored:                                                 | 12,954 MWh                                                                                 |

|                                 |                                                  |
|---------------------------------|--------------------------------------------------|
| Monitoring equipment:           | MWh meters provided by Ameren                    |
| QA/QC procedures to be applied: | Ameren is responsible for QA/QC for these meters |
| Purpose of the data             | Calculation of project emissions                 |
| Calculation method:             | Annual aggregation                               |
| Any comment:                    | Tracked to verify operating hours of project     |

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| Data Unit / Parameter:                                           | Operation of the energy plant                                                                                                                                                                                                                                                                                                          |
| Data unit:                                                       | Hours                                                                                                                                                                                                                                                                                                                                  |
| Description:                                                     | Operation of the energy plant                                                                                                                                                                                                                                                                                                          |
| Source of data:                                                  | Wabash Valley Power                                                                                                                                                                                                                                                                                                                    |
| Description of measurement methods and procedures to be applied: | Each engine has a totalizer that counts the cumulative amount of hours the engine is in operation. This figure is recorded every weekday.                                                                                                                                                                                              |
| Frequency of monitoring/recording:                               | Engine hours are continuously monitored/recorded by the totalizer. This figure is manually recorded by project personnel every weekday.                                                                                                                                                                                                |
| Value monitored:                                                 | 4,619 hours for Engine #1 and 4,980 hours for Engine #2                                                                                                                                                                                                                                                                                |
| Monitoring equipment:                                            | Flow totalizer                                                                                                                                                                                                                                                                                                                         |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                                                                                                                                                                                                    |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                      |
| Calculation method:                                              | Annual aggregation                                                                                                                                                                                                                                                                                                                     |
| Any comment:                                                     | This is monitored to ensure methane destruction is only claimed for periods when the electricity plant is operational. Though the hours were originally intended to be tracking operational activity on an hourly basis, the collection frequency was only monthly. See the Project Description Deviations above for more information. |

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| Data Unit / Parameter:                                           | Operation of the flares                                                                      |
| Data unit:                                                       | Hours                                                                                        |
| Description:                                                     | Operation of the flare                                                                       |
| Source of data:                                                  | Peoria Disposal Company                                                                      |
| Description of measurement methods and procedures to be applied: | As a proxy for operation of the flares, flare operating temperature is measured continuously |
| Frequency of monitoring/recording:                               | Continuously                                                                                 |

|                                 |                                                                                                                                                                                                       |
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| Value monitored:                | Flare temperature varies                                                                                                                                                                              |
| Monitoring equipment:           | Flare thermocouple                                                                                                                                                                                    |
| QA/QC procedures to be applied: | ---                                                                                                                                                                                                   |
| Purpose of the data             | Calculation of baseline emissions                                                                                                                                                                     |
| Calculation method:             | Any flow measured during periods when the flares' operating temperatures are less than 500°F is considered uncombusted, and ignored in the calculation of $LFG_{Flare\ 1, y}$ and $LFG_{Flare\ 2, y}$ |
| Any comment:                    | This is monitored to ensure methane destruction is only claimed for periods when the flares are operational.                                                                                          |

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| Data Unit / Parameter:                                           | $PE_{EC, y}$                                                                                                                                       |
| Data unit:                                                       | tCO <sub>2</sub>                                                                                                                                   |
| Description:                                                     | Project emissions from electricity consumption by the project activity during year $y$ .                                                           |
| Source of data:                                                  | Calculated as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"                                  |
| Description of measurement methods and procedures to be applied: | As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"                                             |
| Frequency of monitoring/recording:                               | As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"                                             |
| Value monitored:                                                 | Calculated as 461 tCO <sub>2</sub> e:<br>→ 91 tCO <sub>2</sub> e in 2014;<br>→ 226 tCO <sub>2</sub> e in 2015;<br>→ 144 tCO <sub>2</sub> e in 2016 |
| Monitoring equipment:                                            | ---                                                                                                                                                |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                |
| Purpose of the data                                              | Calculation of project emissions                                                                                                                   |
| Calculation method:                                              | $EC_{PJ, y} * EF_{EL, grid} * (1 + TDLY)$                                                                                                          |
| Any comment:                                                     |                                                                                                                                                    |

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| Data Unit / Parameter: | $PE_{FC, Propane, y}$                                                                                                    |
| Data unit:             | tCO <sub>2</sub> e                                                                                                       |
| Description:           | Project emissions from fossil fuel combustion in year $y$ , stemming from propane used to power the flares' pilot lights |
| Source of data:        | Calculated as per "Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion"           |

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| Description of measurement methods and procedures to be applied: | As per “Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion” |
| Frequency of monitoring/recording:                               | As per “Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion” |
| Value monitored:                                                 | Calculated as 0.15 tCO <sub>2</sub> e, with 0 in 2014, 0.08 t in 2015, and 0.07 t in 2016           |
| Monitoring equipment:                                            | ---                                                                                                 |
| QA/QC procedures to be applied:                                  | ---                                                                                                 |
| Purpose of the data                                              | Calculation of project emissions                                                                    |
| Calculation method:                                              | $FC_{\text{Propane}, y} * COEF_{\text{Propane}} / 2204.6$                                           |
| Any comment:                                                     | 2204.6 is the conversion factor for pounds to metric tons                                           |

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| Data Unit / Parameter:                                           | MG <sub>Project, y</sub>                                                                                                                                                                                                                                             |
| Data unit:                                                       | tCH <sub>4</sub>                                                                                                                                                                                                                                                     |
| Description:                                                     | Amount of methane generated during year y                                                                                                                                                                                                                            |
| Source of data:                                                  | Estimated using the actual amount of waste disposed in the landfill as per version 05 of “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”                                                                         |
| Description of measurement methods and procedures to be applied: | As per version 05 of “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”                                                                                                                                             |
| Frequency of monitoring/recording:                               | As per version 05 of “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”                                                                                                                                             |
| Value monitored:                                                 | 13,501.5 tCH <sub>4</sub> for the reporting period, based upon:<br>→ 9,762.0 tCH <sub>4</sub> for 2014<br>→ 9,063.7 tCH <sub>4</sub> for 2015<br>→ 8,432.2 tCH <sub>4</sub> for 2016                                                                                 |
| Monitoring equipment:                                            | ---                                                                                                                                                                                                                                                                  |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                                                                                                                                  |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                                                                                                                    |
| Calculation method:                                              | As per version 05 of “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”                                                                                                                                             |
| Any comment:                                                     | The 2014 annual generation estimate reflects the entire year but since we are only reporting the last two months, we multiply the number by 2/12 for use in the calculations. Similarly, in 2016 we multiply the value by 4/12 to reflect reporting January – April. |

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| Data Unit / Parameter:                                           | MD <sub>electricity, y</sub>                                                                                                                                                   |
| Data unit:                                                       | tCH <sub>4</sub>                                                                                                                                                               |
| Description:                                                     | Quantity of methane destroyed at the power plant                                                                                                                               |
| Source of data:                                                  | Derived from amount of LFG sent to power plant, methane measurements at power plant, and density of methane                                                                    |
| Description of measurement methods and procedures to be applied: | Calculated in "Output Tables" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                                                                                            |
| Frequency of monitoring/recording:                               | Annual aggregation                                                                                                                                                             |
| Value monitored:                                                 | Calculated as 5,870 tCH <sub>4</sub> for the reporting period:<br>→ 28 tCH <sub>4</sub> in 2014;<br>→ 4,337 tCH <sub>4</sub> in 2015; and<br>→ 1,505 tCH <sub>4</sub> in 2016. |
| Monitoring equipment:                                            | ---                                                                                                                                                                            |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                                            |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                              |
| Calculation method:                                              | (LFG <sub>electricity, y</sub> * W <sub>CH<sub>4</sub>, power plant</sub> * D <sub>CH<sub>4</sub></sub> )/2204.6                                                               |
| Any comment:                                                     | 2204.6 is the conversion factor for pounds to metric tons                                                                                                                      |

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| Data Unit / Parameter:                                           | MD <sub>Flare 1, y</sub>                                                                                                                                          |
| Data unit:                                                       | tCH <sub>4</sub>                                                                                                                                                  |
| Description:                                                     | Quantity of methane destroyed in Flare 1 in year y                                                                                                                |
| Source of data:                                                  | Derived from amount of LFG sent to Flare 1, methane measurements at Flare 1, Flare 1's destruction efficiency and density of methane                              |
| Description of measurement methods and procedures to be applied: | Calculated in "Output Tables" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                                                                               |
| Frequency of monitoring/recording:                               | Annual aggregation                                                                                                                                                |
| Value monitored:                                                 | Calculated as 6 tCH <sub>4</sub> for the reporting period:<br>→ 0 tCH <sub>4</sub> in 2014;<br>→ 6 tCH <sub>4</sub> in 2015; and<br>→ 0 tCH <sub>4</sub> in 2016. |
| Monitoring equipment:                                            | N/A                                                                                                                                                               |
| QA/QC procedures to be applied:                                  | N/A                                                                                                                                                               |

|                     |                                                                                                              |
|---------------------|--------------------------------------------------------------------------------------------------------------|
| Purpose of the data | Calculation of baseline emissions                                                                            |
| Calculation method: | $(LFG_{\text{Flare 1, y}} * W_{\text{CH}_4, \text{Flare 1}} * \eta_{\text{flare}} * D_{\text{CH}_4})/2204.6$ |
| Any comment:        | 2204.6 is the conversion factor for pounds to metric tons                                                    |

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| Data Unit / Parameter:                                           | $MD_{\text{Flare 2, y}}$                                                                                                                                                      |
| Data unit:                                                       | tCH <sub>4</sub>                                                                                                                                                              |
| Description:                                                     | Quantity of methane destroyed in Flare 2 in year y                                                                                                                            |
| Source of data:                                                  | Derived from amount of LFG sent to Flare 2, methane measurements at Flare 2, Flare 2's destruction efficiency and density of methane                                          |
| Description of measurement methods and procedures to be applied: | Calculated in "Output Tables" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                                                                                           |
| Frequency of monitoring/recording:                               | Annual aggregation                                                                                                                                                            |
| Value monitored:                                                 | Calculated as 2,906 tCH <sub>4</sub> for the reporting period:<br>→ 810 tCH <sub>4</sub> in 2014;<br>→ 1,344 tCH <sub>4</sub> in 2015; and<br>→ 752 tCH <sub>4</sub> in 2016. |
| Monitoring equipment:                                            | ---                                                                                                                                                                           |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                                           |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                             |
| Calculation method:                                              | $(LFG_{\text{Flare 2, y}} * W_{\text{CH}_4, \text{Flare 2}} * \eta_{\text{flare}} * D_{\text{CH}_4})/2204.6$                                                                  |
| Any comment:                                                     | 2204.6 is the conversion factor for pounds to metric tons                                                                                                                     |

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| Data Unit / Parameter:                                           | $MD_{\text{Project, y}}$                                                                                                      |
| Data unit:                                                       | tCH <sub>4</sub>                                                                                                              |
| Description:                                                     | Quantity of methane destroyed by the project in year y                                                                        |
| Source of data:                                                  | Equal to the amount of methane destroyed in the engine and two flares, less the methane destroyed from imported landfill gas. |
| Description of measurement methods and procedures to be applied: | Calculated in "Output Tables" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                                           |
| Frequency of monitoring/recording:                               | Annual aggregation                                                                                                            |

|                                 |                                                                                                                                                                                                                                                                                                 |
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| Value monitored:                | Calculated as 7,099 tCH <sub>4</sub> for the reporting period:<br>→ 838 tCH <sub>4</sub> in 2014;<br>→ 5,029 tCH <sub>4</sub> in 2015; and<br>→ 1,232 tCH <sub>4</sub> in 2016.                                                                                                                 |
| Monitoring equipment:           | ---                                                                                                                                                                                                                                                                                             |
| QA/QC procedures to be applied: | ---                                                                                                                                                                                                                                                                                             |
| Purpose of the data             | Calculation of baseline emissions                                                                                                                                                                                                                                                               |
| Calculation method:             | $MD_{\text{electricity}, y} + MD_{\text{Flare 1}, y} + MD_{\text{Flare 2}, y} - (LFG_{\text{Imported}, y} * W_{\text{CH}_4, \text{maximum}} * D_{\text{CH}_4}) / 2204.6$ , where maximum methane concentration is from any annual average of the three destruction devices, to be conservative. |
| Any comment:                    | This is the only project description equation that has been modified, per the exclusion of imported landfill gas, and is discussed in the deviations section.                                                                                                                                   |

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| Data Unit / Parameter:                                           | PE <sub>y</sub>                                                                                                                                                                  |
| Data unit:                                                       | tCO <sub>2</sub> e                                                                                                                                                               |
| Description:                                                     | Emissions in year y in the project scenario                                                                                                                                      |
| Source of data:                                                  | Equal to the project emissions from electricity consumption and combustion of fossil fuel in the flares' pilot lights                                                            |
| Description of measurement methods and procedures to be applied: | Calculated in "PEElectricity consumption" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                                                                                  |
| Frequency of monitoring/recording:                               | Annual aggregation                                                                                                                                                               |
| Value monitored:                                                 | Calculated as 461 tCO <sub>2</sub> e for the reporting period:<br>→ 91 tCO <sub>2</sub> e in 2014;<br>→ 226 tCO <sub>2</sub> e in 2015; and<br>→ 144 tCO <sub>2</sub> e in 2016. |
| Monitoring equipment:                                            | ---                                                                                                                                                                              |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                                              |
| Purpose of the data                                              | Calculation of project emissions                                                                                                                                                 |
| Calculation method:                                              | $PE_{\text{EC}, y} + PE_{\text{FC, Propane}, y}$                                                                                                                                 |
| Any comment:                                                     |                                                                                                                                                                                  |

|                        |                 |
|------------------------|-----------------|
| Data Unit / Parameter: | ε <sub>PR</sub> |
| Data unit:             | percent         |

|                                                                  |                                                                                                                  |
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| Description:                                                     | Methane destruction efficiency of the collection system used in the project activity during the reporting period |
| Source of data:                                                  | Derived from the amount of methane generated and destroyed in the project scenario during the reporting period   |
| Description of measurement methods and procedures to be applied: | Calculated in "Output Tables" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                              |
| Frequency of monitoring/recording:                               | ---                                                                                                              |
| Value monitored:                                                 | Calculated as 52.6% for the reporting period                                                                     |
| Monitoring equipment:                                            | ---                                                                                                              |
| QA/QC procedures to be applied:                                  | ---                                                                                                              |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                |
| Calculation method:                                              | $(MD_{Project} / MG_{Project})$                                                                                  |
| Any comment:                                                     |                                                                                                                  |

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| Data Unit / Parameter:                                           | AF                                                                                                                         |
| Data unit:                                                       | percent                                                                                                                    |
| Description:                                                     | Adjustment Factor                                                                                                          |
| Source of data:                                                  | Derived from the relative methane destruction efficiencies of the collection systems in the project and baseline scenarios |
| Description of measurement methods and procedures to be applied: | Calculated in "Output Tables" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                                        |
| Frequency of monitoring/recording:                               | ---                                                                                                                        |
| Value monitored:                                                 | Calculated as 30.6%                                                                                                        |
| Monitoring equipment:                                            | ---                                                                                                                        |
| QA/QC procedures to be applied:                                  | ---                                                                                                                        |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                          |
| Calculation method:                                              | $\epsilon_{BL} / \epsilon_{PR}$                                                                                            |
| Any comment:                                                     |                                                                                                                            |

|                        |                    |
|------------------------|--------------------|
| Data Unit / Parameter: | BE <sub>y</sub>    |
| Data unit:             | tCO <sub>2</sub> e |
| Description:           | Adjustment Factor  |

|                                                                  |                                                                                                                                                                                                |
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| Source of data:                                                  | Baseline emissions of the landfill in year $y$ , in the baseline scenario                                                                                                                      |
| Description of measurement methods and procedures to be applied: | Calculated, see PDD for derivation of simplified formula                                                                                                                                       |
| Frequency of monitoring/recording:                               | ---                                                                                                                                                                                            |
| Value monitored:                                                 | Calculated as 103,423 tCO <sub>2</sub> e for the reporting period:<br>→ 12,204 tCO <sub>2</sub> e in 2014;<br>→ 73,275 tCO <sub>2</sub> e in 2015; and<br>→ 17,944 tCO <sub>2</sub> e in 2016. |
| Monitoring equipment:                                            | ---                                                                                                                                                                                            |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                                                            |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                                              |
| Calculation method:                                              | $MD_{\text{Project}, y} * (1 - AF) * GWP_{\text{CH}_4}$                                                                                                                                        |
| Any comment:                                                     |                                                                                                                                                                                                |

|                                                                  |                                                                                                                                                                                                |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | ER <sub><math>y</math></sub>                                                                                                                                                                   |
| Data unit:                                                       | tCO <sub>2</sub> e                                                                                                                                                                             |
| Description:                                                     | Creditable emissions reductions in year $y$                                                                                                                                                    |
| Source of data:                                                  | Calculated as the difference between baseline emissions and project emissions                                                                                                                  |
| Description of measurement methods and procedures to be applied: | Calculated in "Output Tables" of <i>Clinton Emissions Reductions 2014-2016.xlsx</i>                                                                                                            |
| Frequency of monitoring/recording:                               | ---                                                                                                                                                                                            |
| Value monitored:                                                 | Calculated as 102,962 tCO <sub>2</sub> e for the reporting period:<br>→ 12,113 tCO <sub>2</sub> e in 2014;<br>→ 73,049 tCO <sub>2</sub> e in 2015; and<br>→ 17,800 tCO <sub>2</sub> e in 2016. |
| Monitoring equipment:                                            | ---                                                                                                                                                                                            |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                                                                            |
| Purpose of the data                                              | Calculation of total emission reductions                                                                                                                                                       |
| Calculation method:                                              | $BE_y - PE_y = MD_{\text{Project}, y} * (1 - AF) * GWP_{\text{CH}_4} - PE_y$                                                                                                                   |
| Any comment:                                                     |                                                                                                                                                                                                |

The following parameters were monitored or calculated and used in the “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion:”

|                                                                  |                                                                                                                                       |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | FC <sub>Propane, y</sub>                                                                                                              |
| Data unit:                                                       | Lbs of propane/year                                                                                                                   |
| Description:                                                     | Quantity of propane combusted in project flares in year y                                                                             |
| Source of data:                                                  | Propane receipts provided by Peoria Disposal Company                                                                                  |
| Description of measurement methods and procedures to be applied: | Collect all propane receipts from the reporting period or maintenance and repair logs.                                                |
| Frequency of monitoring/recording:                               | Periodic                                                                                                                              |
| Value monitored:                                                 | Totals 110 pounds for the reporting period:<br>→ 0 lb in 2014;<br>→ 60 lb in 2015; and<br>→ 50 lb in 2016..                           |
| Monitoring equipment:                                            | ---                                                                                                                                   |
| QA/QC procedures to be applied:                                  | ---                                                                                                                                   |
| Purpose of the data                                              | Calculation of project emissions                                                                                                      |
| Calculation method:                                              | N/A                                                                                                                                   |
| Any comment:                                                     | We assume all propane purchased or refilled in the reporting period was consumed within the calendar year, as a conservative measure. |

|                                                                  |                                                                                                                |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | COEF <sub>Propane</sub>                                                                                        |
| Data unit:                                                       | lb CO <sub>2</sub> /lb propane                                                                                 |
| Description:                                                     | CO <sub>2</sub> emission coefficient for propane                                                               |
| Source of data:                                                  | Calculated as per “Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion” |
| Description of measurement methods and procedures to be applied: | As per “Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion”            |
| Frequency of monitoring/recording:                               | As per “Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion”            |
| Value monitored:                                                 | 2.996                                                                                                          |
| Monitoring equipment:                                            | ---                                                                                                            |
| QA/QC procedures applied:                                        | ---                                                                                                            |
| Purpose of the data                                              | Calculation of project emissions                                                                               |

|                     |                                         |
|---------------------|-----------------------------------------|
| Calculation method: | $W_{C, \text{Propane}} * 44/12 = 2.996$ |
| Any comment:        |                                         |

The following parameters were monitored and used in the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site:”

|                                                                  |                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | $W_x$                                                                                                                                                                                                                                                                                                             |
| Data unit:                                                       | Tons                                                                                                                                                                                                                                                                                                              |
| Description:                                                     | Total amount of organic waste disposed in year x (tons)                                                                                                                                                                                                                                                           |
| Source of data:                                                  | Illinois Environmental Protection Agency Annual Landfill Capacity Reports. Clinton Landfill disposal information can be found in “Region Four: East Central Illinois.”<br><a href="http://www.epa.state.il.us/land/landfill-capacity/index.html">http://www.epa.state.il.us/land/landfill-capacity/index.html</a> |
| Description of measurement methods and procedures to be applied: | Clinton Landfill reports annual disposal totals to the state on an annual basis. Origin Climate monitors the IEPA’s Annual Landfill Capacity Reports and incorporates new data as it becomes available.                                                                                                           |
| Frequency of monitoring/recording:                               | Continuously, aggregated annually                                                                                                                                                                                                                                                                                 |
| Value monitored:                                                 | 0                                                                                                                                                                                                                                                                                                                 |
| Monitoring equipment:                                            | ---                                                                                                                                                                                                                                                                                                               |
| QA/QC procedures applied:                                        | ---                                                                                                                                                                                                                                                                                                               |
| Purpose of the data                                              | Calculation of baseline emissions                                                                                                                                                                                                                                                                                 |
| Calculation method:                                              | N/A                                                                                                                                                                                                                                                                                                               |
| Any comment:                                                     | The landfill closed in 2010.                                                                                                                                                                                                                                                                                      |

The following parameters were monitored and used in the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption:”

|                                                                  |                                                                                                                                                                                                |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | $TDL_y$                                                                                                                                                                                        |
| Data unit:                                                       | percent                                                                                                                                                                                        |
| Description:                                                     | Transmission and distribution losses attributable to the use of local grid electricity                                                                                                         |
| Source of data:                                                  | U.S. Energy Information Administration “February 2015 Monthly Energy Review,” p. 38<br><a href="http://www.eia.gov/totalenergy/data/monthly/">http://www.eia.gov/totalenergy/data/monthly/</a> |
| Description of measurement methods and procedures to be applied: | The EIA releases a study of the U.S. Energy sector every few years, including a figure for percent of electricity lost in transmission and distribution.                                       |
| Frequency of monitoring/recording:                               | Origin Climate monitors these updates and uses the most recent figures available.                                                                                                              |

|                                 |                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Value monitored:                | 7%                                                                                                                                        |
| Monitoring equipment:           | ---                                                                                                                                       |
| QA/QC procedures to be applied: | ---                                                                                                                                       |
| Purpose of the data             | Calculation of project emissions                                                                                                          |
| Calculation method:             | Per "EIA Feb 2015 Energy Review."                                                                                                         |
| Any comment:                    | Note that the EIA has not published an annual edition of the Annual Energy Review since 2011, and have moved to monthly editions instead. |

|                                                                  |                                                                                                                  |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | EC <sub>PJ, y</sub>                                                                                              |
| Data unit:                                                       | MWh                                                                                                              |
| Description:                                                     | Quantity of electricity consumed by the project in year y                                                        |
| Source of data:                                                  | Monthly energy bills provided by Wabash Valley Power and Peoria Disposal Company                                 |
| Description of measurement methods and procedures to be applied: | Collect utility bills each month                                                                                 |
| Frequency of monitoring/recording:                               | Monitored continuously, aggregated monthly on utility bills                                                      |
| Value monitored:                                                 | 331.3 MWh for the reporting period:<br>→ 65.6 mWh in 2014;<br>→ 162.12 mWh in 2015; and<br>→ 103.58 mWh in 2016. |
| Monitoring equipment:                                            | Meter no. 47703495 monitors the engines and meter no. 17502073 monitors the flares.                              |
| QA/QC procedures to be applied:                                  | ---                                                                                                              |
| Purpose of the data                                              | Calculation of project emissions                                                                                 |
| Calculation method:                                              | Annual aggregation                                                                                               |
| Any comment:                                                     | Meter no. 49790813 serves the scalehouse and is not related to the landfill GCCS.                                |

### 3.3 Monitoring Plan

A strong monitoring plan is important to ensure that project data is of high quality. Origin Climate strives to ensure that the monitoring plan reflects actual monitoring procedures onsite, conforms to equipment manufacturer specifications, and meets the standards of ACM0001.

The following table provides a summary of monitored parameters.

| Parameter                             | Data source                                                             | Frequency             | Party                                       | Notes                                                                                                                                      |
|---------------------------------------|-------------------------------------------------------------------------|-----------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Normalized flow to generators         | Continuous flow meter (Rosemount Transmitter)                           | Captured continuously | Wabash operations technician                | Continuous flow data is submitted periodically to Origin Climate                                                                           |
| Normalized flow to flares             | Continuous flow meter (Rosemount Transmitter)                           | Captured continuously | Peoria Disposal Company technician          | Continuous flow data is submitted periodically to Origin Climate                                                                           |
| Landfill gas temperature and pressure | Continuous flow meter                                                   | Captured continuously | Wabash operations technician/PDC technician | Flow readings are normalized to standard temperature and pressure by flow meter, thus temperature and pressure are not tracked separately  |
| Total electricity generated           | kWh meters                                                              | Hourly                | Ameren                                      | Total generated electricity is reported in Wabash monthly electricity bills, used to verify methane destruction                            |
| Engine Operating Hours                | Operating hours meters                                                  | Hourly                | Wabash operations technician                | Cumulative engine operating hours are recorded daily                                                                                       |
| Flare Operating Hours                 | Flare Thermocouples                                                     | Continuously          | Peoria Disposal Company                     | At temperatures above 500 degrees F, flare is assumed to be operational                                                                    |
| Methane fraction at flares            | Siemens Ultramat 23 continuous gas analyzers                            | Continuously          | Peoria Disposal Company                     | Continuous methane data is submitted periodically to Origin Climate                                                                        |
| Methane fraction at power plant       | Handheld meter (Elkins Earthworks Envision and Landtec GEM units)       | At least weekly       | Peoria Disposal Company                     | Methane data is aggregated in a spreadsheet manually and sent to Origin Climate periodically. Field calibration records also kept on meter |
| Waste Disposed                        | Scale readings as submitted to Illinois Environmental Protection Agency | Annually              | Peoria Disposal Company personnel           | Origin Climate will collect this data annually from IEPA reports as they become available                                                  |
| Grid electricity used by Project      | Electricity bills for DeWitt Energy/PDC                                 | Monthly               | PDC staff                                   |                                                                                                                                            |
| Propane used by the project           | Propane receipts for PDC                                                | Periodically          | PDC                                         |                                                                                                                                            |

|                   |                                                  |          |                |                                                                     |
|-------------------|--------------------------------------------------|----------|----------------|---------------------------------------------------------------------|
| Operating permits | Wabash Valley Power personnel, PDC, Illinois EPA | Annually | Origin Climate | Origin Climate will ensure operating permits are valid and complete |
|-------------------|--------------------------------------------------|----------|----------------|---------------------------------------------------------------------|

The following chart provides a summary of the equipment calibration plan.

| Equipment                                                                    | Calibration Procedure                                          | Frequency                                      | Party                             |
|------------------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------|-----------------------------------|
| Project flow meters: Rosemount 3095 Multivariable Mass Flow Transmitters (3) | Factory calibration                                            | At least every 5 years                         | Factory-authorized representative |
| Generator kilowatt-hour meter                                                | As recommended by manufacturer                                 | <i>Not responsibility of project operators</i> | Ameren                            |
| Siemens Ultramat 23 continuous methane analyzers (2)                         | Field calibrate against reference gases, record results        | Annually                                       | PDC technician                    |
| Peoria Disposal Company Landtec GEM                                          | Field calibrate against reference gas cylinder, record results | Daily prior to use                             | PDC technician                    |
| Peoria Disposal Company Landtec GEM                                          | Factory calibration                                            | At least annually                              | Factory-authorized representative |

### Project Personnel and Responsibilities

Peoria Disposal Company is responsible for data collection and quality assurance for flare related data. George Armstrong, Vice President – Engineering and Consulting Services, oversees his staff that performs day-to-day operation of the project well field and two open flares. Relevant staff includes Andrew Whelpley, Program Manager, and Kyle Martin, Compliance Specialist. Dedicated Yokogawa data recorders continuously record gas flow, methane, and flare operating temperature for each flare. PDC is responsible for factory calibration of the meters related to the flares.

Wabash Valley Power has overall responsibility for operation and maintenance of the power plant. The primary data that they retain relevant to effort is the engine hour logs. PDC remains responsible for data collection and quality assurance of the engine flow meter and collection of methane readings at the power plant and field calibration of the handheld methane analyzer.

Origin Climate is responsible for collating data, performing additional quality assurance checks, preparing project emissions reductions calculations in accordance with the PDD and ACM0001, and preparing monitoring reports and VCS documentation.

### Data Generation and Storage

Project data is generated on site by project meters, or through utility bills/propane receipts. For the engines, data from project meters is backed up through manual records, i.e. totalized flow, weekly methane readings, and engine operating hours are entered into Excel spreadsheets for

long-term storage. Utility bills are stored on site, and also scanned for storage on PDC servers and transfer to Origin Climate.

Continuous flow, methane, and flare temperature data for the two project flares is recorded to flash memory cards on the two Yokogawa data recorders and the one Digital Services recorder, and also backed up wirelessly to an online SCADA system. Field calibration records for the flare flow meters, continuous methane analyzers, and the Landtec GEMs are stored at PDC offices in Peoria, IL. Field calibration events for the Landtec GEM are recorded manually in a weekly monitoring log. Utility bills and propane receipts are stored on site in the Landfill offices, and scanned for transfer to Origin Climate.

Project data is submitted to Origin Climate in electronic format on an approximately quarterly basis. Origin Climate typically receives flow, methane, and engine operating hours in Excel format with the exception of raw flow data in proprietary Yokogawa format (Origin Climate has a viewer for this type of file and converts to an excel format for data processing). Utility bills, factory calibration certificates are transmitted to Origin Climate in PDF form. These data submittals form the basis of the Origin Climate's calculation of credits generated during each monitoring period. Origin Climate also collects current copies of permits and ensures that all necessary permits are valid.

All project data, documents, permits, and calculations are stored on Origin Climate's server, which is backed up daily to a remote server as well as to physical hard drive on site. Origin Climate ensures that all the documents and records are maintained for at least two years after the end of the project crediting period.

#### *Internal Auditing Procedures*

Quality Assurance is provided by Origin Climate's independent review of all Project data and calibration records on a quarterly basis. Origin Climate's handling of Project data includes the following steps:

- Integration of new data submittals into past performance data;
- Review of data for anomalies, inconsistencies, and outlying data points;
- Completeness checks of data for gas quality, gas quantity, and evidence of destruction;
- Review of electricity generation and engine operating hours in relationship to Project performance.

Origin Climate works with Peoria Disposal Company to resolve any issues identified during the quality assurance review.

## **4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS**

### **4.1 Baseline Emissions**

All project calculations and aggregated raw data can be found in the Excel workbook "Clinton Emissions Reductions 2014-2016."

According to ACM0001 version 10, baseline emissions for the project are equal to:

$$BE_y = (MD_{Project, y} - MD_{BL, y}) * GWP_{CH_4}$$

and,

$$MD_{BL, y} = MD_{Project, y} * AF$$

Substituting the second equation into the first equation leaves us with the following simplified expression for baseline emissions:

$$BE_y = MD_{Project, y} * (1 - AF) * GWP_{CH_4}$$

First, we calculate  $MD_{Project, y}$ .  $MD_{Project, y}$  is equal to the sum of the methane destroyed in each project device less methane destroyed from the landfill gas imported from Clinton Landfill #3, or:

$$MD_{Project, y} = MD_{electricity, y} + MD_{Flare 1, y} + MD_{Flare 2, y} - MD_{Imported}$$

In accordance with ACM0001 v10, we calculate  $MD_{electricity, y}$  according to the equation:

$$MD_{electricity, y} = LFG_{electricity, y} * W_{CH_4, power plant} * D_{CH_4} / 2,204.6$$

Substituting in the total amount of LFG sent to the engines from November 1, 2014 to April 30, 2016 (514,104,000 scf), the 95% lower confidence interval of all methane measurements taken at the power plant (59.6%), the density of methane (0.04226 lbs/ft<sup>3</sup>), and dividing by the number of lbs in a ton (2,204.6) to convert our final number to metric tons, we calculate that the engines destroyed 5,870 tons of methane during the reporting period.

In accordance with the PDD, we derive the following equation for methane destroyed by each flare (which takes into account the emissions of methane due to the flare's destruction efficiency being less than 100%):

$$MD_{Flare x, y} = (LFG_{Flare x, y} * W_{CH_4, Flare x} * D_{CH_4} * \eta_{flare}) / 2,204.6$$

Substituting in the total amount of LFG sent to Flare 1 from November 1, 2014 to April 30, 2016 (1,396,300 scf), the monthly weighted average methane concentration at Flare 1 (averaging 41.2%), the density of methane (0.04226 lbs/ft<sup>3</sup>), the destruction efficiency of the baseline open flare (0.50) and dividing by the number of pounds in a ton (2,204.6) to convert our final number to metric tons, we calculate that Flare 1 destroyed 6 tons of methane during the reporting period.

Substituting in the total amount of LFG sent to Flare 2 from November 1, 2014 to April 30, 2016 (275,091,000 scf), the monthly weighted average methane concentration at Flare 2 (averaging 57.3%), the density of methane (0.04235 lbs/ft<sup>3</sup> at this flow meter's reference condition), the destruction efficiency of the project open flare (0.96), and dividing by the number of pounds in a ton (2,204.6) to convert our final number to metric tons, we calculate that Flare 2 destroyed 2,906 tons of methane during the reporting period.

In order to back out the imported landfill gas that is not part of this project, we must remove the volume of methane destroyed in any of the destruction devices attributable to the imported gas. Because the imported gas joins the system in a way that allows for combustion in any of the three destruction devices, we will use the most conservative path, which would assume the gas was destroyed in the engines (flares would only assume 96% of the gas is destroyed so the 100% destruction in the engines is a more conservative way to remove the impact of the imported gas). As such, we again follow the equation from ACM0001 v10 to calculate  $MD_{Imported, y}$  according to the equation:

$$MD_{Imported, y} = LFG_{Imported, y} * W_{CH_4} * D_{CH_4} / 2,204.6$$

Note that in a conservative fashion, we apply the maximum methane concentration measured at any of the three destruction devices. Substituting in the total amount of LFG sent to the engines from November 1, 2014 to April 30, 2016 (147,352,411 scf), the maximum of all methane measurements taken at the any destruction device (applied on a vintage-year basis), the density of methane (0.04226 lbs/ft<sup>3</sup>), and dividing by the number of lbs in a ton (2,204.6) to convert our final number to metric tons, we calculate that the imported landfill gas destroyed was 1,682 tons of methane during the reporting period.

Thus MD<sub>Project, y</sub> is equal to 7,099 tons of methane for this reporting period. The total methane destroyed by project activity is less than the total quantity of gas *generated* over the same period (13,501.5 tCH<sub>4</sub> over a period of 18 months) and therefore is used as MD<sub>Project, y</sub>.

Next, we must calculate the adjustment factor (AF). The adjustment factor is equal to:

$$AF = \epsilon_{BL} / \epsilon_{PR}$$

with

$$\epsilon_{PR} = MD_{Project, Oct. 2014 - Apr. 2016} / MG_{Project, Oct. 2014 - Apr. 2016}$$

In the PDD,  $\epsilon_{BL}$  was found to be 16.1%.

In order to calculate  $\epsilon_{PR}$  for the reporting period we substitute in the total amount of methane destroyed by the project from November 1, 2014 to April 30, 2016 (7,099 tons) and divide by the total amount of methane generated by the project from the same period. MG<sub>Project, y</sub> was calculated in the "Clinton Methane Generation Calculator" according to the first order decay equation prescribed by the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site." Note that the landfill stopped accepting waste in 2010, so we leave zeroes for 2011 and beyond in the inputs of the tool. After running the model, MG<sub>Project</sub> was calculated to be 13,501.5 tons, which yields a project destruction efficiency of 52.6% ( $\epsilon_{PR}$ ).

Dividing the baseline destruction efficiency by the project destruction efficiency, we calculate the adjustment factor to be 16.1/52.6 = 30.6%.

Returning to our simplified equation for the project's baseline emissions,

$$BE_y = MD_{Project, y} * (1 - AF) * GWP_{CH_4}$$

we now enter in all previously calculated values as well as a value of 21 for GWP<sub>CH<sub>4</sub></sub> (in accordance with ACM0001 v10), to produce a baseline emissions estimate of 103,423 tons of carbon dioxide equivalent.

### Operational Hours of Project

It is important that credits are only claimed for methane sent to the destruction devices while the project was operating, in order to ensure that the landfill gas was actually destroyed.

The project engines' operational hours are tracked in two ways, first by kWh produced and sold to the grid per month, and engine run hours. The raw data for which can be found in the "Engine Operations" folder of the project data files.

When total amount of landfill gas sent to the generators is graphed against the total amount of kWh produced in each month and against the engine operating clock hours in each month, total LFG tracks closely with both parameters (see “Engine Operating Hours” spreadsheet). We can also be confident that all gas sent to the engines was destroyed, because each engine is equipped with a solenoid valve that will not open to deliver gas to the engines unless the engines are operating and ready to destroy gas.

The project flares’ operating hours are tracked by the proxy of flare operating temperature. Any flow measured by the flare flow meters when the flare operating temperature was less than 500°F is considered uncombusted and ignored in the calculation of  $LFG_{Flare\ 1,\ y}$  and  $LFG_{Flare\ 2,\ y}$ .

## 4.2 Project Emissions

There are two relevant sources of project emissions in this case: indirect emissions related to the project’s electricity consumption, and emissions related to combustion of propane in the flares’ pilot lights. Thus

$$PE_y = PE_{EC,\ y} + PE_{FC,\ Propane,\ y}$$

The vast majority of the time, the project engines are self-powered by the electricity generated from the landfill gas, and emissions associated with electricity consumption are biogenic. However, the project engines and the project flares did consume grid electricity in the reporting period (tracked by monthly utility bills from Ameren). We calculate the emissions associated with this grid electricity consumption according to the following equation, as dictated by the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption:”

$$PE_{EC,\ y} = EC_{PJ,\ y} * EF_{EL,\ grid} * (1 + TDL_y)$$

The amount of electricity consumed by the project ( $EC_{PJ,\ y}$ ) is totaled on the “PEElectricity consumption” worksheet of the “Clinton Emissions Reductions 2014-2016” workbook. According to monthly utility bills, the project consumed 331.3 MWh of electricity over the reporting period. Next, we apply the default factor of 1.3 for the grid emissions factor ( $EF_{EL,\ grid}$ ) as provided for in the PDD and the tool described above. Lastly, we apply a value of 7% to account for transmission and distribution losses ( $TDL_y$ ), in accordance with p.38 of the U.S. Energy Information Administration “February 2015 Monthly Energy Review.”

Substituting these values for the variables in the equation above, we calculate the project emissions from electricity consumption to be 461 tons of carbon dioxide equivalent over the reporting period.

We calculate the emissions associated with the combustion of propane according to the “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion:”

$$PE_{FC,\ Propane,\ y} = FC_{Propane,\ y} * COEF_{Propane,\ y}$$

As specified in the tool,

$$COEF_{Propane,\ y} = W_{C,\ Propane,\ y} * 44/12$$

The amount of propane consumed by the project ( $FC_{\text{Propane}, y}$ ) is totaled on the “PEFC Propane” worksheet of the “Clinton Emissions Reductions 2014-2016” workbook. According to maintenance and repair logs, 110 pounds of propane was refilled in 2015 and assumed to be fully consumed at the flare pilot. Using the weighted average mass fraction of carbon in propane (0.817 according to the US EPA) for  $w_{C, \text{Propane}, y}$ , and dividing by 2,204.60 to convert our final total from pounds to tons, we calculate the emissions from propane combustion to be 0.15 tons of carbon dioxide equivalent.

Adding both sources of project emissions produces a total of 461 tons of carbon dioxide equivalent in the reporting period.

### 4.3 Leakage

No leakage effects need to be accounted for under the ACM0001 methodology (p.12).

### 4.4 Net GHG Emission Reductions and Removals

Emissions reductions produced from November 1, 2014 through April 30, 2016 are equal to the difference between the baseline emissions and the project emissions, or

$$ER_y = BE_y - PE_y$$

Subtracting project emissions (461) from baseline emissions (103,423) results in 102,962 net emissions reductions for the reporting period.

| Year                    | Baseline emissions or removals (tCO <sub>2</sub> e) | Project emissions or removals (tCO <sub>2</sub> e) | Leakage emissions (tCO <sub>2</sub> e) | Net GHG emission reductions or removals (tCO <sub>2</sub> e) |
|-------------------------|-----------------------------------------------------|----------------------------------------------------|----------------------------------------|--------------------------------------------------------------|
| 2014 (Nov. – Dec.)      | 12,204                                              | 91                                                 | 0                                      | 12,113                                                       |
| 2015                    | 73,275                                              | 226                                                | 0                                      | 73,049                                                       |
| 2016 (Jan. – Apr.)      | 17,944                                              | 144                                                | 0                                      | 17,800                                                       |
| Reporting Period Totals | 103,423                                             | 461                                                | 0                                      | 102,962                                                      |

## APPENDIX 1: ADDITIONAL INFORMATION

### Ownership of Emissions Reductions

Wabash Valley Power Association has exclusive right to extract landfill gas and shares the revenue from any sale of carbon credits with Clinton Landfill arising from the capture and destruction of landfill gas both within the power plant and from the flares. Origin Climate has exclusive right to market any VERs arising from the project (see “Origin-WVPA CCMSA Dec 2015 Redacted.pdf”).

### Regulatory Compliance

#### *Wabash Valley Power Facility*

The Wabash Valley power plant has been operated in accordance with the law at all times during the reporting period. The project’s permit to operate is included with the report references folder.

A search for Enforcement Orders on the Illinois Environmental Protection Agency’s website<sup>1</sup> revealed no Enforcement Orders were ever issued to the facility.

#### *Clinton Landfill*

A search of the Illinois EPA Facility Compliance Tracking System<sup>2</sup> does not show any inspection violation notices issued to Clinton Landfill #2.

A search for Enforcement Orders on the Illinois Environmental Protection Agency’s website (see footnote 1) revealed that two Orders were issued to Clinton Landfill #2 in the history of its operation. The first was issued on 7/22/2004, related to improper waste disposal procedures (see “Clinton Landfill 2004 Settlement.pdf”); this settlement was unrelated to the collection of landfill gas at the site. The second Enforcement Order was issued on 1/6/2011 for continued odor violations at the site starting in April 2009 (see “Clinton Landfill 2011 Settlement.pdf”). Related to these violations and the settlement, the Landfill installed a second flare, which became operational on June 24, 2010.

Since the validated project baseline deduction increases over time to account for gas that would have been required to be destroyed under NSPS rules at an operating (and therefore growing) landfill, the installation of the second flare does not affect the additionality of the project.

During the reporting period the landfill operated the gas system on its application for a Title V Clean Air Act permit (see “Flare 1 Modification CAAPP Construction Permit 10-28-2010.pdf” and “Flare 2 CAAPP Construction Permit 10-28-2010.pdf”).

### Raw Data Files

Raw data files are cited throughout the “Clinton Emissions Reductions 2014-2016” workbook.

<sup>1</sup> <http://www.epa.state.il.us/cgi-bin/en/orders/orders.pl>

<sup>2</sup> <http://epadata.epa.state.il.us/land/WebFACTS/index.asp>

## Manufacturer Maintenance Recommendations

The project has several meters that require regular maintenance as follows:

- Three Rosemount 3095 Multivariable Mass Flow Transmitters, which requires a calibration every five years (see “Rosemount Cal Frequency Recommendation.pdf”, and “Rosemount Specifications.pdf”).
- A portable gas analyzer Landtec GEM owned by Clinton Landfill, Inc. According to the manufacturer, this device should be field calibrated before every use in the field and factory calibrated annually (see “Landtec Service Recommendation.pdf” and “Landtec GEM5000\_Manual.pdf”).
- Two Siemens Ultramat 23 continuous gas analyzers. These devices should be calibrated to span gas at least once a year (see page 2-12 on “Ultramat 23 Specifications.pdf”).

## Other Forms of GHG-Related Environmental Credit

The reductions presented in this monitoring report do not create another form of environmental credit. However, at the Project facility, renewable energy generation produces renewable energy certificates (RECs). The RECs are purchased by Ameren, the alternative retail energy supplier that also purchases the generated electricity.

Guidance from the VCS secretariat makes it clear that the project boundary can be drawn such that the methane destruction credits are separated from the indirect reductions from grid power sales, as indicated in the PDD:<sup>3</sup>

*The VCS treats these projects the same way as the CDM. Both the reductions from the methane destruction and renewable energy generation can create VCUs as long as the project passes the VCS additionality test. Or the electricity generation can create RECs and the methane combustion can create VCUs.*

Based on the above, the project boundary has been drawn to exclude the exported electricity. The Project itself has not sought or received another form of GHG-related environmental credit.

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<sup>3</sup> Personal correspondence with Erin Craig and acting VCS Program Manager. Feb 5, 2008.