

August 5, 2008

Mr. Tyler Jones
Business Development
St. Pete Environmental Research Center Inc.
510 3rd Street South
St. Petersburg, FL 33701

RE: Landfill Gas Collection System Evaluation for Leon County Solid Waste Management Facility

Dear Mr. Jones:

HDR Engineering Inc. (HDR) is pleased to submit our evaluation report of the existing gas collection system for the Leon County Solid Waste Management Facility (Facility) to St. Petersburg Environmental Research Center Inc. (SPERC). SPERC requested that HDR visit the Facility and evaluate the existing gas collection system design and operation. SPERC's primary concern is gas flow rate and methane content collected via the gas collection system for the potential gas to energy project at the Facility. We have separated our findings into field inspection, facility data and design review.

Findings

Field Inspection

The gas collection system was installed in April 2006. During our investigation, HDR utilized a calibrated GEM-2000 to measure gas quality for the Facility at each wellhead and the flare station. The flare station flow meter displayed 276 standard cubic feet per minute (scfm) during our site visit. No documentation on flow meter calibration was available. Because no flow meter calibration documentation can be found, there is the potential that the flow meter is not reporting the correct flow. Thus the documented flow rates could actually be higher or lower. Also, the flare station does not have a gas analyzer equipped for methane concentration measurement. Methane concentration and flow rate are required for potential carbon credit determination. A gas measurement was collected at the flare station prior to the blower inlet noting methane levels to be 48% by volume. HDR could not measure flow since the flare station only has one access port for gas sampling and does not have another port perpendicular to this sampling port to allow insertion of a cross gradient pitot tube to measure flow accurately. These ports are typically necessary for flare station performance testing as required for operation of flares at landfills.

The flare station blower is set at -1.5 inches of water column. This provides a very slight vacuum to the wellfield. Since the gas collection system was not required to be installed, according to the control requirements of the New Source Performance Standards Subpart WWW, this low vacuum is preferable to reduce the potential of air intrusion into the landfill and reduce the risk of subsurface combustion of waste.

The existing system has 5 condensate drip legs which allow condensate collected in the header to drain into the leachate collection system. It appears these connections allow for gas collection from the respective leachate line. Current vacuum readings on these leachate connections show varying flow and methane content at the wellhead. Shaw performs monthly monitoring of the gas collection system and makes adjustments as necessary to keep oxygen and nitrogen concentrations low. Currently Shaw is maintaining positive pressure or very slight vacuum (< -1.0 "H₂O) which is appropriate for leachate cleanout connections.

Facility Data

Facility personnel provided HDR monthly monitoring reports for the past 6 months (provided in Appendix A). We received calibration information for Shaw's GEM-2000 but not the flow meter at the flare station. January and February data is missing static pressure information which made it difficult to utilize this data in our investigation for operation of the gas collection system. One trend we noted was that the leachate cleanout connections DL-1, 2, 3, 4 and 5 showed 20-50 scfm and then for the next month flow was much lower. This could be due to wellfield adjustments and trying to equilibrate the system. Vertical wells also displayed variation in flow and gas quality but not to the extent as the leachate cleanout/drip leg connections.

In regards to the flow data at each individual wellhead measured by Shaw with a GEM-2000, flow appears to have generally decreased from December 2007 (a total of 602 cfm of landfill gas) to June 2008 (a total of 497 cfm of landfill gas). Note that these measurements are highly sensitive to operator patience, meaning technicians must allow the static and impact pressure to equilibrate for at least one minute for the GEM-2000 to correctly estimate landfill gas flow through the Landtec wellhead. In addition, the GEM-2000 has varying accuracies for flow and methane content at different flow rates and concentrations, respectively. In addition, wellhead flow readings cannot appropriately be used to determine the total gas collection system flow since flow is measured at different times (one well is measured at 1 PM and the last well is measured at 3 PM, the first well flow could be at a different flow rate at 3PM).

Design Review

HDR reviewed the gas collection system design (the layout sheet is attached as Figure 1). The gas collection system is designed with a 12" diameter HDPE header and 6" diameter HDPE laterals. The sizing of the piping is sufficient for gas collection at a landfill of this size.

Well depths range between 29 to 41 feet. Due to the close proximity to the waste limits and the shallow depth to which the vertical extraction wells were installed it may be difficult to collect additional gas even if vacuum is increased on the wellfield. Talking with site personnel, some of the vertical wells have a history of high liquid levels. The Facility has from 1-2 feet of soil in place with no liner cap for Phase IIB, IIC and IID. This allows rain to percolate into the landfill. While liquid is needed for decomposition, it also inhibits gas collection from vertical wells. Liquid can travel through the waste mass and collect in vertical wells. Figure 2 shows how high liquid levels can reduce the perforated zone that allows gas to travel into the vertical well. Leon County personnel mentioned that they have utilized a pump to remove liquid from wells with high liquid levels. Reducing liquid levels can be time consuming, but the benefit is increased gas collection. This may be worth further discussion with Leon County.

Recommendations

HDR visited the Leon County Solid Waste Management Facility to investigate the current gas collection system for any damage or operational methods that would impact the gas collection efficiency and performance. SPERC is most interested in gas flow and methane content to determine the economic viability of a gas to energy project at the Facility. This report provides a snapshot of current functionality and operation of the gas collection system at the Facility. SPERC also requested that HDR provide some recommendations on how the Facility could collect additional landfill gas.

HDR has reviewed the Leon County Solid Waste Management Facility Phases IIB, IIC and IID construction design drawings from PBS&J dated April 2006. The shallow nature of the vertical gas collection wells combined with the absence of a low permeability landfill cover system, results in a build of liquid within the system that minimizes the effectiveness of gas collection.. This is the most significant limiting factor to gas collection for the current system. A common solution to reducing the liquid level in vertical wells is a condensate pumping system consisting of a compressor and 2" HDPE airlines to each well. Installing a condensate pumping system for the current gas collection system could cost a minimum of \$50,000 (this does not include the disposal for waste excavated which could be a significant cost). The vertical wells can be pumped manually, but this is labor intensive (personnel may need to pump wells as much as once per week during high

rainfall seasons). Successfully reducing the liquid levels could potentially increase gas collection by 10-20% scfm.

SPERC/Leon County may want to investigate whether the vacuum to the wellfield can be increased to -5 inches of water column ("H₂O). This would create more pull on each well, but still allow Shaw/Leon County to adjust the wells and minimize the potential for air intrusion into the landfill. This requires more effort on Leon County's part or Shaw to make these adjustments. Wellfield optimization would be necessary to keep oxygen/nitrogen levels low and maximize flow from good gas generating wells. EW-16, EW-20 and EW-21 are wells which have high methane content and low oxygen/nitrogen readings over the past 6 months. HDR recommends that the Facility not increase the vacuum to the wellfield any higher than -5 "H₂O until wellfield monitoring shows that the system has reached equilibrium. Based on our experience, we estimate that this could increase the flow rate by 5% or more.

The current flow meter may not have been calibrated since installation in 2006. Flow meter vendors recommend calibration of equipment at least once per year to maintain accuracy. LFG Specialties (now owned by Shaw) could assist SPERC or Leon County in having the current flow meter factory calibrated. The estimated cost for the factory calibration is typically less than \$5,000. The benefit of calibration is confidence in the flow at the flare station. Note that a gas quality measurement would also need to be made to correlate flow with methane concentration. A GEM-2000 can perform this for the purpose of feasibility of the project, but a gas analyzer would need to be installed (whether at the engine inlet or flare blower inlet or outlet) at some point in the gas to energy project construction as necessary for the engines to operate effectively. A gas analyzer and the current flow meter would need to be calibrated before carbon credits could be realized.

Leon County has leftover HDPE piping from the installation of the gas collection system. SPERC and Leon County may want to discuss if additional vertical extraction wells or connections to leachate collection lines can be installed. However, the potential construction cost could be greater than the revenue generated per well installed. Installation of 400 LF of 6" HDPE piping and drilling 60 LF of vertical well could cost in the range of \$15,000-25,000. Installing three wells in the Phase IID cell could yield an additional 30-100 scfm of landfill gas collection. However, there is still the concern that liquids will block the perforated zone of the well reducing the ability of the well to collect gas.

Landfill gas to energy projects are a great opportunity to provide electricity to the facility or community. However, smaller gas to energy projects are more difficult to initiate because they have such a small margin for error in the area of profitability and such a large margin of risk due to the unpredictable nature of landfills and gas

generation and collection. We hope this report helps both SPERC and Leon County in their efforts to decide the feasibility of a landfill gas to energy project.

If you have questions, please feel free to contact me at (904) 598-8931 should you have any questions.

Sincerely,



Cliff Koenig, P.E.
Project Manager

Cc: Dean Robinson -HDR

Att: Figure 1 – Gas System Layout Sheet
Figure 2 – Vertical Well Detail with Liquid
Appendix A – Shaw Monthly Gas Monitoring Data