



Landfill Gas Extraction Well Dewatering Guidelines for the Sunshine Canyon Landfill

This document presents the process and procedures that are used to determine (1) whether a vertical gas extraction well has been adversely impacted by an accumulation of liquids in the well casing of a vertical landfill gas (LFG) extraction well thereby requiring a pump to be installed, and (2) procedures that are taken once a pump is installed to monitor these wells.

The overall purpose of installing a pump in a gas extraction well is to remove the liquids to ensure the well is functioning as intended. If water is left un-managed, liquids will accumulate within the casing of a vertical LFG extraction well and reduce the flow of LFG being collected. This will affect system collection efficiency, create regulatory compliance issues and promote surface emissions and odors. To overcome these issues and maintain gas collection system performance and efficiency, it is necessary to remove the accumulated liquid from the vertical landfill gas extraction wells.

1.0 Liquid Level Measurements in Vertical Gas Extraction Wells

There are currently three (3) methods used at Sunshine Canyon Landfill (SCL) to measure the liquid level inside a vertical gas extraction well. These methods include the following:

- Liquid Level Sounder
 - Standard water level meter which uses the conductivity of water, alarming with a signal when encountered.

- Bubbler Tube System
 - Compressor and PDA system developed by Plexus Controls where liquid level is calculated using the internal air compressor, the system pressurizes a hose installed permanently inside the well and calculates the liquid level from the pressure (differential pressure) value. When a well is under vacuum (or sealed), both hoses (low and high pressure) must be connected so that the liquid level calculated by the instrument is

based on the pressure of the liquid only and not a combination of the liquid pressure and well gas pressure (suction/vacuum).

- Downhole Camera
 - A 2-inch camera head and reel are lowered into the well casing and live footage is recorded and reviewed to determine the well integrity / potential functionality and visible water level in the well. The water level in each well is determined by the length of the camera and cable from ground surface to the water surface in the well casing. The following information is recorded during the camera inspection: Date, time, casing height above grade (ft), top of casing to perforations (when visible) (ft), top of casing to liquid (ft), and top of casing to bottom (ft).

Tetra Tech BAS (TT-BAS) is currently performing liquid level monitoring of the vertical gas extraction wells on behalf of Republic Services Inc. (RSI) at the following frequency:

- Each vertical gas extraction well is inspected with a well sounder semi-annually (twice per year).
- The water level in each vertical gas extraction well with a pump is measured with the bubbler tube system once per week, unless a more frequent interval is determined.
- Vertical gas extraction wells experiencing unexplained reduced flow rates of 50% or greater, while maintaining the same vacuum on the well, are identified during the twice monthly well monitoring and tuning and are then inspected with a downhole camera (assuming the wells have not been inspected with a camera during the past quarter). A minimum of twenty (20) wells per quarter are inspected to identify potential issues in the well casing (i.e. liquids, damage, etc...).

2.0 Criteria for Pump Installation

After the liquid level in a vertical gas extraction well is established, the data is analyzed to determine whether the installation of a pneumatic liquid extraction pump is warranted. It is important to prioritize the installation of pumps based on whether there are ongoing issues at or near the well. There are several factors to consider before a well is selected for pump installation (1 = Highest Priority):

1. Surface emission exceedances (and gas leaks above background levels) occurring near / around well (within 200 feet);
2. Lateral subsurface migration / increased methane level in a nearby perimeter probe;
3. Unexplained reduced flow rate (50% or greater while maintaining same vacuum) or static vacuum build up (with no flow) in well indicating limited collection;
4. A significant amount (30% or greater) of the gas extraction well perforations are blocked (assuming recharge);

Pneumatic pumps are constructed of corrosion resistant materials. The operation of the pump is controlled by air pressure, which pushes the liquid out of the pump and into the force main. Pumps are installed at low-points in the well casing (i.e. bottom of the well casing). These pumps require sufficient air pressure and flow to pump out the liquids from the well casing in order to function properly. Therefore, an air supply line has to be installed to each pump location. The pneumatic pumps being installed in the vertical LFG wells at SCL are PumpOne Environmental EP4-BL pumps and QED Environmental AP4+ Ultra pumps.

3.0 Inspection and Maintenance of Vertical LFG Wells with Pumps

TT-BAS currently performs weekly inspections of each vertical gas extraction well in which a pump is installed. TT-BAS uses the bubbler tube system for determination of the liquid level.

Each vertical gas extraction well with a pump is inspected weekly for the following:

- Well ID
- Date
- Depth to liquid (Ft)
- Pump in Well (Yes / No)
- Condensate and Air Line Connected (Yes / No)
- Pump Running / Operating (Yes / No)
- Pump Counter Reading (Cycles)
- Comments / Maintenance Notes



The bubbler tube data is reviewed and if any issues are identified, maintenance on the pump and or well is completed. Some of the issues identified which require maintenance include:

1. Pump is clogged or plugged and needs to be pulled out of the well and serviced / re-built;
2. Blockage identified in condensate conveyance line and needs to be resolved by either flushing the line with high pressure or cutting out the blockage;
 - a. It is recommended that when an HDPE leachate line is initially installed the line be flushed with water so that the dirt and pipe shavings be removed and prevent potential future clogging
3. Pump is stuck or jammed requiring the airline to be disconnected then reconnected in an effort to restore operation;
4. Condensate and airline removed due to active operations. Once work is completed in area, condensate and airline are installed / reconnected.
 - a. This information will be tracked on a weekly basis and reported so that everyone knows how long an area within the waste has not been monitored and/or pumped.

In order to eliminate delays in replacement of a pump not working, a supply of new or rebuilt and tested pumps will be on hand so the malfunctioning pump can be replaced immediately. Other inventory of parts such as fitting, counter, air regulator, flow meter, pipes, hoses, etc. will be available for immediate use.

Furthermore, the volume of leachate pumped from the gas well dewatering program will be calculated/measured using data collected from flow meters/totalizers installed on the main header lines being discharged into the sewer.

