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The Effect of Landfill Gas on Electric and Pneumatic Pumps and Controls

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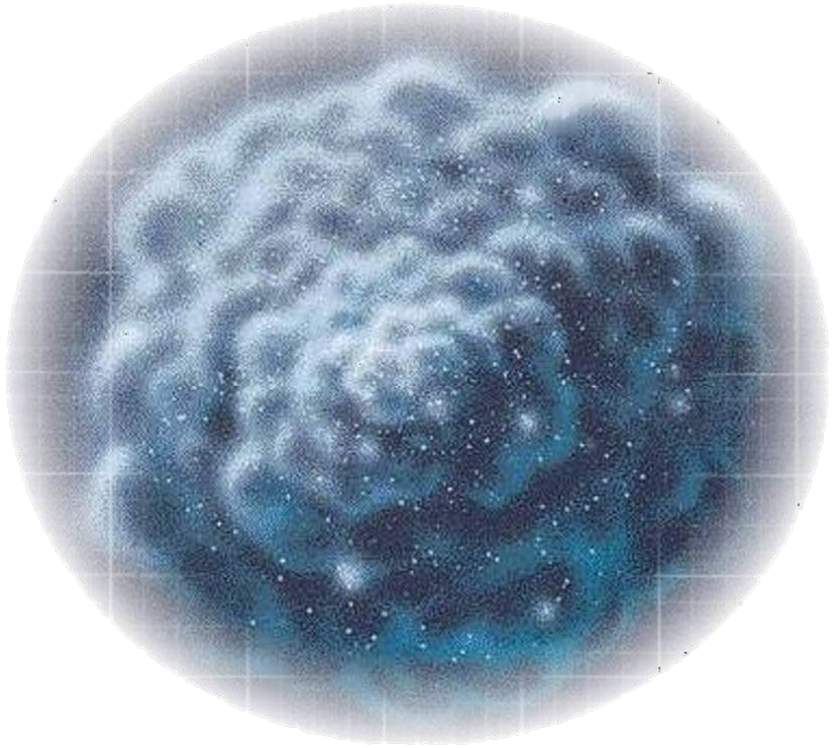
Landfill Gas Generation



LFG is a product of the decomposition of waste.

1 pound of garbage equals ~4 cubic feet of gas

Landfill Gas Generation

Here is the result of LFG if it is not accounted for.

Landfill Gas Effect – Pumps & Sensors

- We call it gas effect; you can call it a problem.
- It is a problem when you have pumps in a gas well, leachate collection sump (riser) or condensate sump and they also feel the positive pressure as gas is being created or negative pressure if a vacuum is being applied to collect the gas.
- Positive gas pressure will help push liquid into the pump while negative pressure is going to add to the system head loss that the pump must overcome.

Landfill Gas Effect – Pumps & Sensors

- Positive or negative gas pressure have an adverse effect on the accuracy of a submersible level sensor (transducer or transmitter).

Landfill Gas Effect – Pumps & Sensors

- For example: If the sensor is in a sump with 24" of liquid above the sensor, its display meter will read 24". If this same sump has 35" of positive gas pressure as well as 24" of liquid, then the meter will read 59".

Example of positive gas pressure.

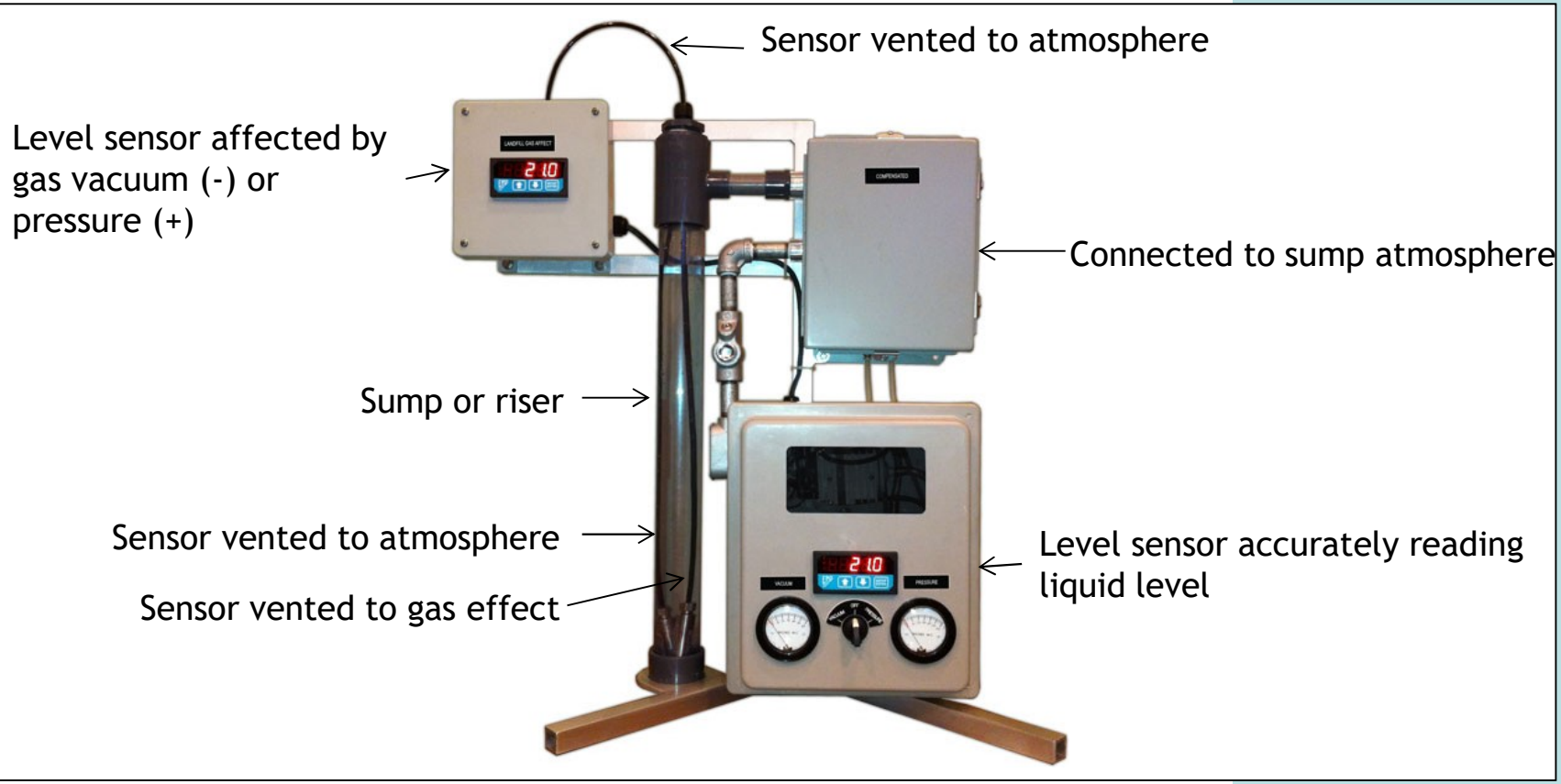
Landfill Gas Effect – Pumps & Sensors

- If you have the same liquid level, but now the sump is under vacuum of 35” and you programmed the level meter to start at 55”, your pump will not start until the level reaches 90” of liquid depth and then shut off at 47” if the shut off set point is set at 12”.

- If the system switches from pressure to vacuum effect the pump will behave erratically, causing excessive wear and early failure.

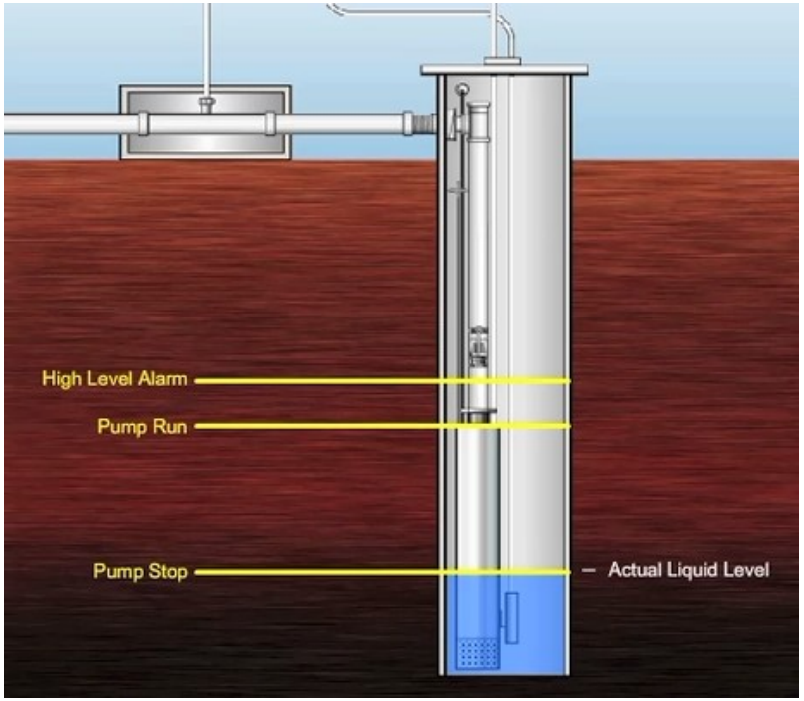
Example of negative gas pressure (vacuum).

Landfill Gas Effect – Pumps & Sensors



Landfill Gas Effect – Pumps & Sensors

- Why should we care?
- What will it affect?
- What harm could it cause?



Landfill Gas Effect on an Electric Pump

- Running an electric pump dry may cause:
  - Undue wear of pump and motor;
  - Overheating of the motor;
  - Introduction of air into discharge piping which may cause an air lock.

Landfill Gas Effect on a Pneumatic Pump

- Running a Pneumatic Pump under pressure may cause:
  - Excess moisture in the exhaust gas line;
  - Introduction of gas into discharge piping which will cause the pump to stall due to an air lock.

- Operating a Pneumatic Pump under vacuum will cause an elevated liquid level before pumping can occur.

Landfill Gas Effect on a Pneumatic Pump

Pneumatic Pump Demonstration Video

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Landfill Gas Effect

The How & Why of Breakout Junction Boxes

- Reason to use:
  - Prevent migration of landfill gas into the control panel
  - Simplify installation and maintenance
  - Increase overall safety of the pump and control system
  - Reduce operation problems
  - Reduce replacement costs
  - Increase life of sensors, controls and pumps

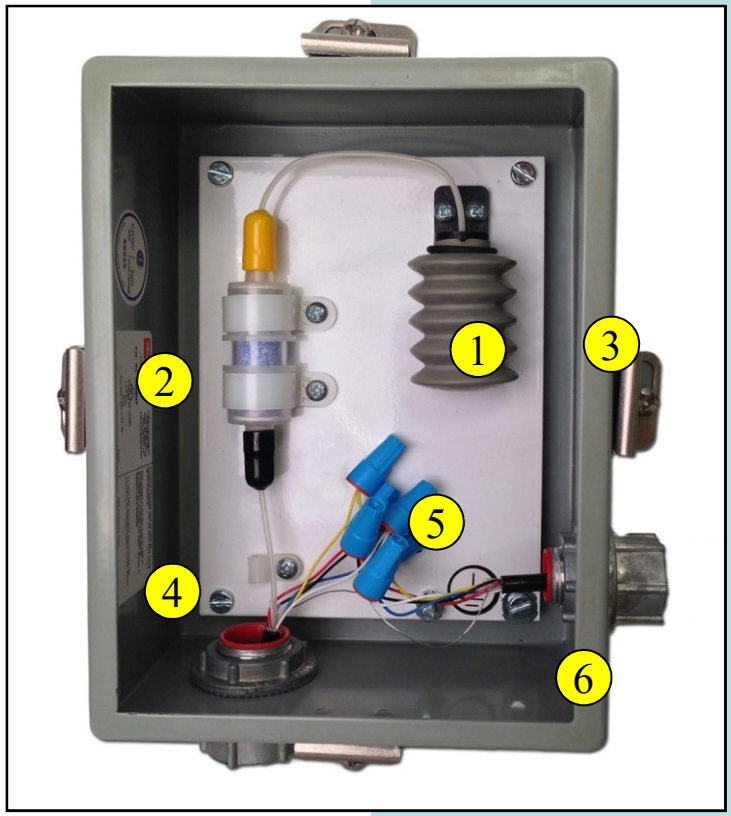
Follow the electrical code and use common sense when installing breakout junction boxes.

Landfill Gas Effect – Junction Box

- Standard junction boxes will not hold a pressure or vacuum over two to five inches of water column.
- To combat the gas effect you need a junction box designed and tested to withstand both pressure and vacuum applied.
- If the junction boxes leak when under a vacuum, it will contaminate the landfill gas. If under pressure, then they become a source of fugitive landfill gas.

Landfill Gas Effect – Junction Box

1. Bellows to seal backside of sensor
2. Desiccant dryer to keep sensor free of moisture
3. Four cover clamps for a gas tight seal
4. Clamp to secure sensor cable
5. Water-proof wire connectors to prevent corrosion
6. Gasketed hubs for liquid & gas tight seals



Landfill Gas Effect – Junction Box

Teflon Tape

Electrical Pipe Nipple

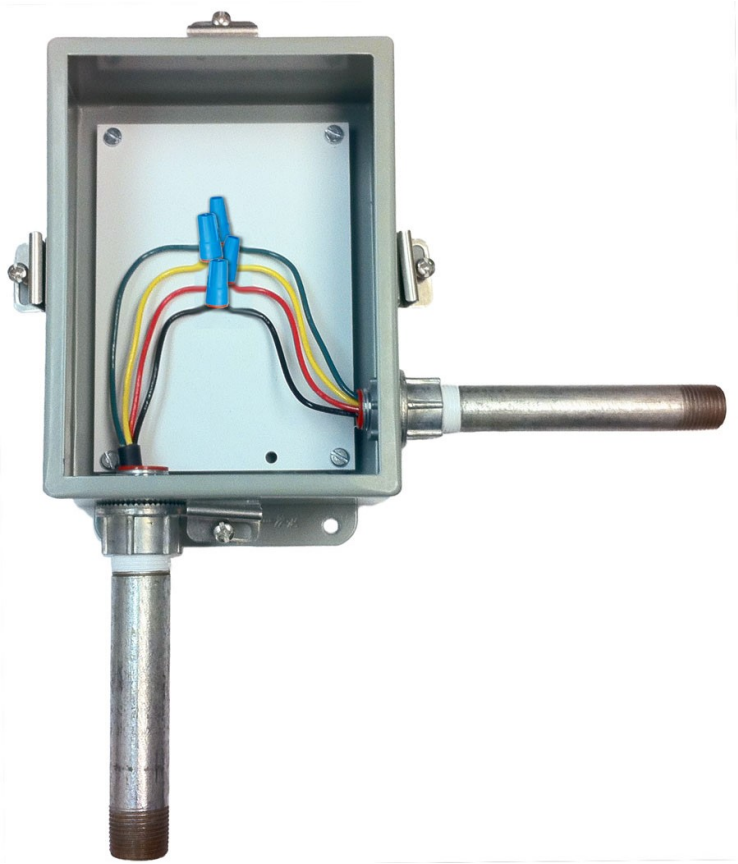
Myer's Hub

Water-proof wire connectors

Landfill Gas Effect – Junction Box

Note: When using screwed electrical fittings at a landfill, you should use Teflon® sealing tape on all of the thread joints to create a liquid and vapor tight seal. This tape will eliminate the conduit as a ground. This procedure requires you to pull a separate ground wire to maintain a good ground.

Landfill Gas Effect – Junction Box



Breakout Box assembled using:

Teflon Tape

Electrical Pipe Nipples

Myer's Hubs

Water-proof wire connectors

Landfill Gas Effect – Junction Box

Label Explanation:

"Because this breakout junction box is protected by an intrinsically safe circuit, does not store energy and is not a source of ignition, the box can be mounted directly to the riser or sump which is under gas effect. This close connection is what makes it work."

Landfill Gas Effect – Control Panel

- The main entry points for landfill gas getting in to the control panel includes:

  - The absence of seal-offs;
  - Seal-offs that have not been potted;
  - Location of the control panel directly above or adjacent to the riser;
  - Other openings in the control panel not made liquid and vapor tight.

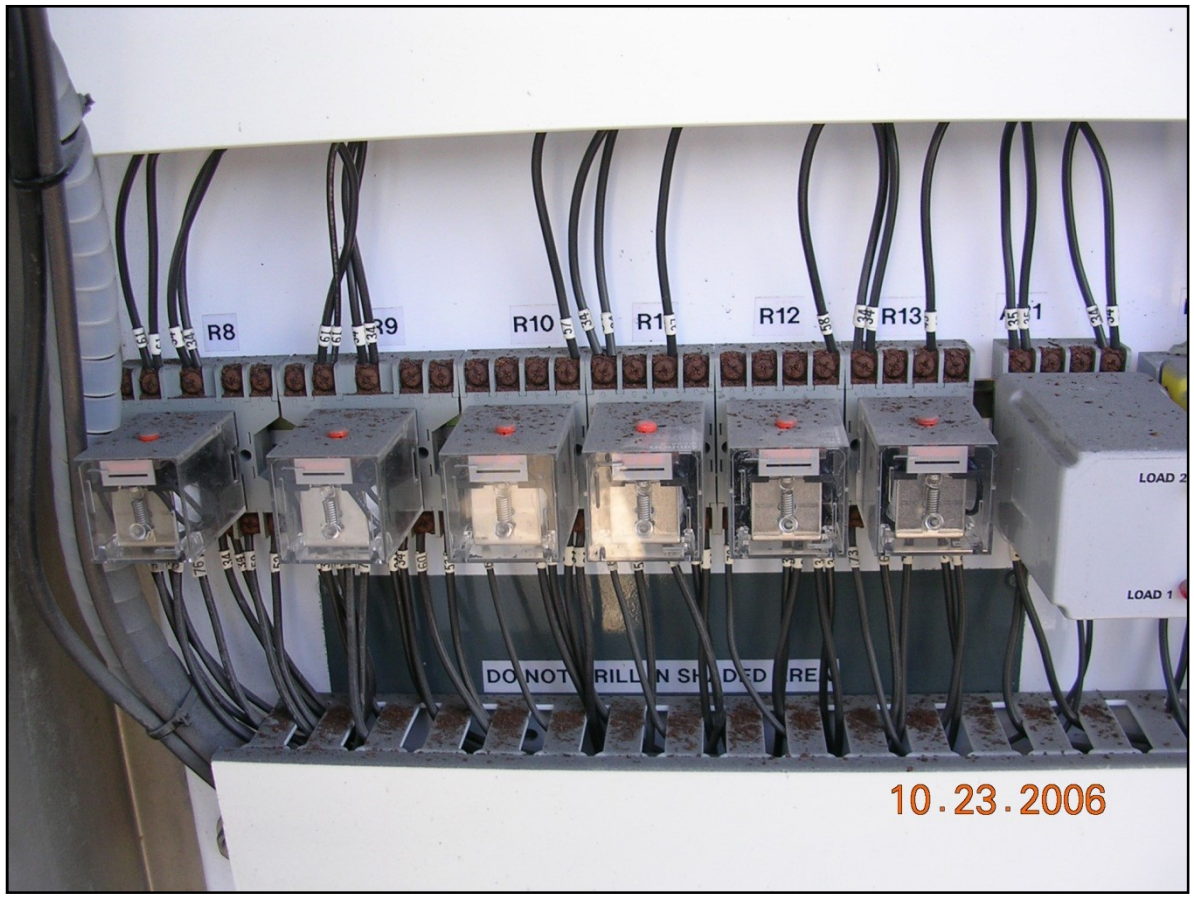
Landfill Gas Effect – Control Panel

A site visit to a landfill resulted in this discovery:

A seal off which had not been potted.

Landfill Gas Effect – Control Panel

Landfill Gas Effect – Control Panel



Landfill Gas Effect – Control Panel

Landfill Gas Effect – Summary

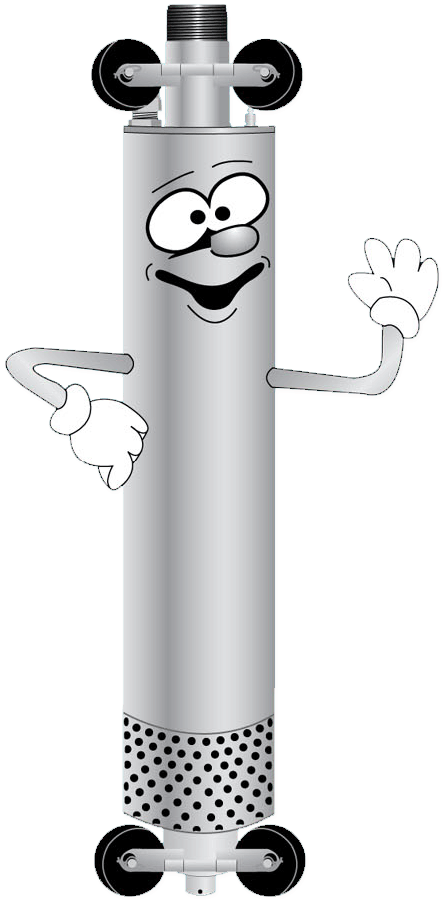
- Gas can cause level sensors to provide inaccurate readings resulting in pumps running dry or violation of the 12” liquid on top of the liner rule.

- Pumps may stall due to gas getting in to the discharge piping and causing air locks.

Landfill Gas Effect – Summary

- Breakout Junction Boxes capable of handling the pressure/vacuum should be used to ensure accurate level readings.

- Seal offs that are potted are a must to keep gas from getting into the control panel.



Questions?