RRD-GAS-008A

EXTENT OF GAS

SUBSLAB PRESSURE MONITORING

RECOMMENDED REQUIREMENTS DOCUMENT

Subject: Subslab Differential Pressure Monitoring

1.0 BACKGROUND

The Blue Ribbon Commission Gas Group has agreed to recommend that reducing and maintaining methane gas formation pressures in the Mississippi River Alluvial Aquifer (MRAA) to equal to or less than hydrostatic pressure across the Bayou Corne gas area is necessary in order to lift the mandatory evacuation order. This Recommended Requirements Document (RRD) defines the technical requirements for obtaining ORW operational data to address this overall objective. The intent of this RRD is to provide recommended requirements for use by the appropriate state agencies when directing the development of a comprehensive work plan for addressing the RRD objective.

This RRD for collecting subslab pressure monitoring data has been prepared with consideration of the following site conditions:

- There is methane gas bubbling to the surface in the community.
- Shallow well NSDMW15 in the Bayou Corne community consistently has gas pressure sufficient to lift the water out of the well when the wellhead valve is opened.
- The gas in the community has been evaluated and determined to be either thermogenic or a mix of thermogenic and biogenic gas.
- The gas pressure in the MRAA below the community at is at least 58 pounds per square inch (psi).
- Methane has been detected below floor slabs at two locations.

This RRD has been prepared as part of the overall GAS-08 BRC task. This BRC task addresses the extent of the gas in the MRAA and overlying aquitard and the monitoring of the gas for changes over time. This RRD establishes the procedures and equipment required to determine if there is currently gas pressure below the floor slabs in the communities that may require long-term monitoring.

2.0 Objective and Scope

The technical objective of this RRD is to monitor differential pressures between underneath the floor slabs and the occupied spaces of homes or structures.

The geographic scope of this RRD is the slab-on-grad homes and structures in the Grand Bayou and Bayou Corne communities, Assumption Parish, LA. The pressure recording period should be at least one week to allow for a range of barometric changes to be monitored. The number of ports and locations to be monitored must be representative of the overall site conditions in the community.

APPENDIX 1

SUGGESTED PROCEDURES

1.0 Introduction

This appendix is intended for use as a procedural reference for obtaining the data required in the RRD. In preparing the work plan to address this RRD, procedures can be modified as applicable to obtain the data necessary to address the objectives and scope in Section 2.0. Because of anticipated low differential pressures, key elements to meeting the objective are the installation of sealed sample ports and the recording micromanometer.

2.0 Specialized Equipment

2.1 Sealed slab sample ports

For accurate differential pressure measurement between below the floor slab and the overlying occupied space, a correctly installed sealed sample port installed in the floor slab is required. It is recommended that after the hole is drilled through the floor slab using a rota-hammer, the sample port should be sealed into the concrete using the appropriate epoxy or similar permanent sealant.

If instrumentation-style shut-off (i.e. valved) quick connects are used, it may be advantageous to permanently install and seal a small diameter female pipe coupling into the concrete slightly below the top of the slab. Either the male or female side of the quick connect can then be threaded into this female into this coupling. Examples of instrumentation shut-off quick connects can be found at Swagelok (http://www.swagelok.com/products/quick-connects.aspx) and other specialty valve and tubing manufacturers.

If an instrumentation shut-off quick connect is not used, then a ball shut-off valve should be installed on the top if the sample port to maintain the integrity of the system for pressure monitoring. This valve should remain closed at all times that the sample port is not being used.

2.2 Micromanometer and recorder

The Micromanometer needs to be able to meet the pressure and data logging requirements outlined in the definitions. Attachment 1 contains the specification sheets of two example micromanometers that meet the pressure requirements. One instrument has an internal data logging capabilities and the other requires connection to a computer to record data. The manometer should be calibrated and checked before each use using a standardized pressure gauge capable of reading low pressures. The range of the instrument should be ±1,000 Pascal (±4 inches of water column) or less with a resolution of 0.1 Pascal (0.0004 inches of water). The instrument should be capable of recording differential pressures for up to seven days at 15-minute intervals (~700 data points). The micromanometer should be capable measuring and recording both positive and negative pressures.

2.3 Barometric Pressure Recorder

Barometric pressure changes can affect the flow of vapor between the underside of the floor slab and the occupied space. Therefore it is important that barometric pressure be recorded at or near the site

throughout the monitoring period. Barometric pressure should be recorded using a standard barometric pressure transducer and recording device. These are commonly available from environmental instrument suppliers (e.g. http://www.microdaq.com/tandd/tr-7u/three_channel_data_logger.php)

3.0 Definitions

- *Micromanometer*—An electronic instrument capable of measuring and recording differential pressures down to 0.1 Pascal (0.0004 inches of water).
- *Differential pressure*—Differential pressure is the difference in absolute pressure between two monitoring points. In the context of this RRD, differential pressure is the difference in the absolute pressure between below the floor slab and the overlying occupied space.

4.0 Procedure

The steps below can be used to monitor the differential pressure between the bottom of a floor slab and the occupied space.

4.1 Step 1—Install floor probe

Install the floor sample port in the selected location in the floor slab. Care must be taken to permanently seal the port into the concrete of the slab. Epoxy of similar sealant is recommended. If an instrument shut-in quick connect is to be used, then, depending on the quick connect being used, the female or male side of the quick connect is screwed into the port fitting using Teflon tape to seal the pipe threads. If a valve port is to be used, the ball or similar shut in valve should be installed on the port using a similar connection.

4.2 Step 2—Check port for leaks

After the port is installed, if possible it should be checked for leaks. However it is acknowledged that the floor slab configuration might limit or prevent leak checking of the port. If it is possible to leak check the port, the applied pressure should be one inch of water column.

4.3 Step 3—Connect and configure micromanometer

Install the micromanometer on the sample port using appropriate connection tubing.

Set up the micromanometer and recording system to record and store pressures according to the manufacturer's setup procedures. Set up the system to record on a 15-minute or less time interval. Check that the clock is set to record at local time. If

Turn the recording system on to start the monitoring period.

Check the instrument readout positive and negative pressure direction by applying very low pressure on the end of the sample port tube. Low pressure can be done by gently blowing across the end of the sample port tube while monitoring the pressure readout. When pressure is applied to the sample port

tube, the readout should read positive pressure. This will mean if a positive pressure is measured during the monitoring period, the pressure on the underside of the floor slab is higher than in the occupied space. This pressure check should be recorded by the recording system so that the check data are available in the data file.

4.4 Step 4—Check system operation

After the system has been operational for several hours or overnight, it is important to download the data recorder to make sure the instrument is recording data properly. If it is working properly, it can be left unattended for the remainder of the monitoring period. If it is not working properly, then the micromanometer system must be repaired or adjusted to record the proper data.

4.5 Step 5—Download recorder and check data

At the end of the recording period, download the data to a field computer. The data file should be checked for completeness and integrity immediately upon downloading. The checks should include but are not limited to

- Completeness of the data record. Did the system record for the entire monitoring period and are the correct dates and times recorded correctly?
- Range of differential pressure values recorded. Are the differential pressures recorded in the ranges of expected values or are there outliers?

5.0 Attachments

5.1 Attachment 1

There are various micromanometers with the applicable pressure ranges with recording capabilities that can be used for collecting the subslab differential pressure data. Two examples of micromanometers that can be used to measure and record the differential pressures to the precision and accuracy required are included in Attachment 1.

- The FCO510 (http://www.furnesscontrols.com/difpres2.htm), is an industrial micromanometer that requires and external power supply.
- The DG-500 (http://www.energyconservatory.com/products/digital-pressure-gauges), is a battery powered field instrument that requires a computer for data logging.

6.0 FORMS

None but it is suggested that a data collection form be developed to record the installation, setup, and operation of the system.

DG-500 Digital Pressure Gauge

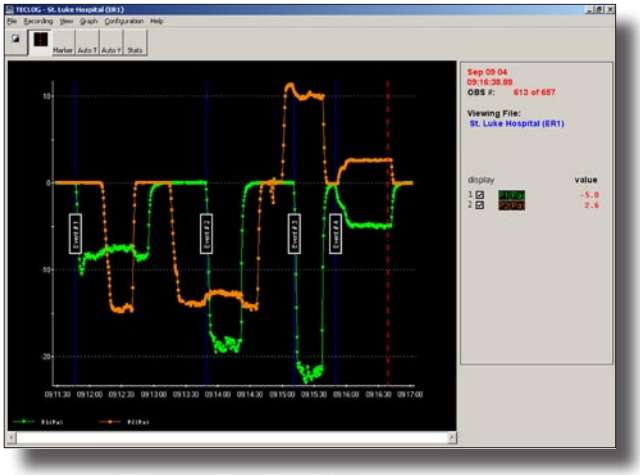
Today's building performance test procedures require diagnostic tools that are versatile, accurate and easy to use. The Energy Conservatory's new DG-500 Digital Pressure Gauge combines all these qualities into a sophisticated hand-held gauge that sets a new standard for performance testing equipment. The DG-500's advanced design gives you the power and flexibility needed to handle all types of building performance investigations.

The DG-500 Digital Pressure Gauge is a high resolution differential pressure gauge with 2 independent measurement channels. The DG-500's dual pressure channels and air velocity measurement features make it ideally suited for a wide range of building performance testing applications.

- Building pressurization and depressurization mapping - Accurately measure pressure imbalances from one room to another such as isolation suites or manufacturing clean rooms.
- Combustion safety testing - With 2 independent channels you can determine the effect of exhaust fans on both the combustion flue and the appliance room.
- Air handler and duct pressure measurements - Measure total external static pressure at the air handler, duct work static pressures and air velocity to help diagnose airflow performance problems.

Quality Features

- Simultaneous display of 2 independent differential pressure channels, A and B.
- Accurate pressure measurements, ± 1% of reading from –1,250 to +1,250 Pascals, or -5 to +5 in. H_20.
- Auto-zeroing of both measurement channels adjusts for position and temperature during operation.
- Choice of 4 time-averaging options, 1, 5, 10 second average and Long-Term or continuous average.
- Choice of velocity units on Channel B, fpm or m/s.
- A HOLD button temporarily freezes the most recent display readings.
- The DG-500 can be used along with a computer and TECLOG for Windows® software to conduct data logging of pressure measurements from both channels.



TECLOG is free data logging software that will record and graphically display pressure measurements from the DG-500. TECLOG is also capable of data logging from two DG-500 Gauges providing you with 4 channels of precision pressure measurement at a fraction of the cost of most pressure data loggers.

The DG-500's versatility and advanced features make it a "must have" tool for all performance testing contractors. Diagnostic tools from The Energy Conservatory are the cornerstones to more efficient, affordable, and healthy buildings and HVAC systems.

Call us for more information!

The ENERGY CONSERVATORY

DIAGNOSTIC TOOLS TO MEASURE BUILDING PERFORMANCE

specifications

Number of Independent Pressure Channels: 2

Pressure Range: –1,250 to +1,250 Pascals (-5 to +5 in. H_20)

Display Resolution: 0.1 Pa (0.0001 in H_20)

Accuracy: 1% of pressure reading or .15 Pa, whichever is greater.

Units of Measure: Channel A – Pascals, in. H_20
Channel B - Pascals, in. H_20, fpm, m/s

Auto-Zero: On start up and then once every 10 seconds

Time Averaging: 1, 5, 10 seconds and Long-Term (continuous update)

Operating Temperature Range: 32° F to 120° F (0° C to 48° C)

Storage Temperature Range: -4° F to 160° F (-20° C to 71° C)

LCD Display: 3.193 x 1.16 in. (8.11 x 2.946 cm)

Display Backlight: Manually operated, timed off after 10 minutes.

Power: 6 - AA alkaline batteries, supplied. AC power adapter optional.

Battery Life (Alkaline): Over 100 hours continuous use.

Auto-Off: After 2 hours from last keyed entry, unless disabled by user.

Weight: 16.5 oz. (0.468 kg)

Dimensions: 7.5 in. x 4 in. x 1.25 in. (19.5 cm x 10.16 cm x 3.175 cm)

Modes

Pressure/Pressure and Pressure/Velocity

Data Logging

Data logging of pressure measurements from both channels requires TECLOG for Windows®, available free at www.energyconservatory.com, and a serial cable to connect the DG-500 to a computer.

Digital Gauge Kit include:

DG-500 Digital Pressure Gauge, protective carrying case, static pressure probe, 10 ft (3 m) red hose, 15 ft (5 m) green hose, instruction manual, 2 year warranty.

Other building diagnostic products available from The Energy Conservatory

The Minneapolis Duct Blaster® measures the airtightness of duct work.

The IR-InSight™ Infrared Camera detects hidden air leakage paths in building cavities and components.

The TrueFlow® Air Handler Flow Meter measures the total amount of air moving through an air handler.

To Order, or for more information contact: **The Energy Conservatory**

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phone: 612–827–1117
fax: 612–827–1051
e–mail: info@energyconservatory.com
website: www.energyconservatory.com

Furness Controls

FC0510

Low Pressure

MICROPROCESSOR MICROMANOMETER

FC0510

- MENU DRIVEN
- LARGE LCD DOT MATRIX DISPLAY
- MEASURES FLOW AND DIFFERENTIAL PRESSURE READINGS DOWN TO 0.001 PASCALS
- VELOCITY AND CUBIC FLOW MEASUREMENTS
- COMPENSATION FOR TEMPERATURE AND ABSOLUTE PRESSURES

DESCRIPTION

The FC0510 Micromanometer is a microprocessor-based precision measuring instrument for ultra-low-range differential pressures. In addition, through its unique features and advanced software, it can display air velocity, volume flow, temperature and absolute pressure on its large dot matrix backlit liquid crystal display.

Furness Controls first developed electronic micromanometers more than 30 years ago and the FC0510 model represents the seventh generation of instrument through continuous development over this period.

Each FC0510 Micromanometer comprises a highly sensitive ultra-low-range differential pressure transducer capable of resolution down to 0.001 pascals. The instrument displays the pressure in one of 12 different measuring units as selected from the menu. Through the use of Pitot static tubes and laminar flow elements, flow velocity and volume flow can be displayed in a choice of 18 different measuring units. In addition, the FC0510 Micromanometer accepts 4-20 mA inputs from an absolute pressure sensor and a temperature sensor to provide automatic correction for mass velocity and flow, which can be displayed in a choice of six different measuring units.

A datalogging facility allows storage of measurements in the memory. Results can be downloaded to a computer or printer, using the RS232C output.

In addition to the display of differential pressure, the instrument can show peak, valley and an analogue bar graph of trend. Different windows in the display can be configured to show flow and differential pressure readings simultaneously.

The FC0510 Micromanometer measuring instrument is supplied complete with an aluminium carrying case, twin core silicon tubing and a 200mm long Pitot static tube. For the serious airflow and pressure measuring engineer the FC0510 offers the best test instrument available today.

Furness Controls

FCO510

Low Pressure

MICROPROCESSOR MICROMANOMETER

RANGES

Model 1:	**20.000/200.00 Pa,**	**Velocity 18.000 m/s**
Model 2:	**200.00/2000.0 Pa,**	**Velocity 57.000 m/s**
Model 3:	**2.0000/20.000 kPa,**	**Velocity 180.00 m/s**

Velocity ranges are stated for 1013 mb, 15°C

SPECIFICATION

Languages	English, French, German
Accuracy	0.25% of reading between 10% of lowest range and full scale, ± one digit below 10%, better than 0.025% FSD
Storage temperature	–10°C to 50°C
Working temperature	0°C to 45°C
Mains supply	90 to 250 VAC 50 – 60 Hz
DC supply	12 VDC min 350 mA
DC outputs	18 VDC 25 mA for 4 to 20 mA sensors
Media compatibility	Dry non-corrosive gases, 0 to 95% relative humidity non-condensing, compatible with construction materials
Materials in contact	Copper, stainless steel, mica, silicone grease, loctite, nickel, hytrel
Maximum overload	10 times instrument differential
Maximum static	10 bar applied to both "plus" and "minus" ports simultaneously
Pneumatic fittings	For 6 mm OD by 4 mm ID tube
Flow devices	Laminar element or Pitot tube
External sensors	4 to 20 mA loop powered. External source or 18 V internal supply
Temperature range	External sensor or preset value –100 to +800°C
Absolute pressure range	External sensor or preset value 0 to 11 bar
Relative viscosity range	0.1 to 3.0
Relative density range	0.1 to 3.0
Pitot K factor range	0.5 to 3.0
Duct cross-section range	0.1 to 10.0 m^2
Laminar flow range	0.001 to 9999.999 l/m
D.P. for laminar flow element	0.01 to 9999.99 pa
D.P. units	Pa, kPa, mmH_2O, "H_2O, µbar, mbar, mmHg, "Hg, thou, Nm^{-2}, PSF, PSI (model 2 and 3)
Velocity units	m/s, mph, ft/s, ft/m, km/h, Knots
Temperature units	°C, °F, °K
Absolute pressure units	kPa, mbar, bar, PSI, "Hg
Units for area	cm^2, m^2, in^2, ft^2
Volume flow units	mm^3/s, ml/s, ml/m, ml/h, cc/s, cc/m, cc/h, l/s, l/m, l/h, m^3/s, m^3/m, m^3/h, in^3/s, in^3/m, in^3/h, ft^3/m, ft^3/h
Mass flow units	Kg/s, kg/m, kg/h, lb/s, lb/m, lb/h
Display average time	0.3 to 20.0 seconds
Other functions	Peak hold, valley hold, volume flow, mass flow, time, date, automatic zero, display of up to three parameters
Outputs	0-5 VDC or 0-2.5-5 VDC
Temperature effect on zero with auto zero disabled	0.02% FSD per °C
Temperature effect on range	0.05% FSD per °C
Dimensions	300 x 125 x 250 mm
Accessories	Robust aluminium carrying case with storage for leads and tubes
Datalogger	Built-in datalogger for storage of test results. Includes RS232C output for downloading to a PC or printer
Weight	6 kilos

Agents Stamp:

ST-65 XXXXXXXXXX

Furness Controls Limited

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Web site: http//www.furness-controls.com

Furness Controls has a UKAS certified laboratory which offers pressure calibration from 0 to 40 kPa and Flow calibration from 0.1 ml/min to 2000 litres/min

nqa. ISO 9001 Registered

UKAS QUALITY MANAGEMENT 015

FCO510