IN THE NEWS

In the July 2003 issue of the APWA Reporter,the American Public Works Association selected the 'Rio Nuevo Landfill Stabilization Project' of the City of Tucson's Environmental Services department and their consultant/construction manager, Hydro Geo Chem, Inc.,as Project of the Year. Read more about HGC's study inside. Read the article at *www.apwa.net/Publications/Reporter/.*

Developing innovative technologies and solutions for landfill remediation projects is the focus of Hydro Geo Chem's new Landfill Technology Group. Combining expertise in landfill gas measurement, collection, and control; in-situ aerobic biodegradation; and anaerobic bioreactors, HGC's professionals have actively pursued new business in landfill remediation services. To request an information packet or browse recent media coverage of HGC's landfill work, visit *www.hgcinc.com/landfill.htm.*

ARIZONA HYDROLOGICAL SOCIETY HOSTS SECOND BIENNIAL SYMPOSIUM ON MANAGEMENT OF LANDFILLS IN ARID CLIMATES

March 17-20, 2004 Tucson, Arizona Radisson Hotel City Center

VOC Remediation
LFG Production Rate, Measurement, and Control
Geophysical Applications to Landfills
Measurement of Landfill Properties
Landfill Monitoring & Instrumentation
Aerobic and Anaerobic Bioreactors
Emerging Issues
Demonstrating Landfill Closure
Risk-Based Assessment for Closure
LFG Utilization
Covers and Liners
Regulatory Update
Landfill Stability
Landfill Remediation
How Clean Is Clean
NMOC Testing
Brownfields Issues
Experimental covers

The Symposium Call for Abstracts (due December 19, 2003) and copies of pertinent information can be found on our website: www.azhydro.soc. For additional information on the symposium contact Michael Geddis at Hydro Geo Chem: (520) 293-1500, extension-114 (mikeg@hgcinc.com).

EMPLOYEE PROFILE

James Peck,
P.E., J.D.
Senior Project Engineer and Corporate Counsel

James joined HGC in August 2003 to lead HGC's solid waste engineering services.

He holds both Bachelor of Science and Master of Science degrees in geological engineering, and is registered as a civil engineer and geological engineer in Arizona. He has over 10 years of experience as an engineer in the solid waste and environmental consulting industries.

James is also a licensed attorney and serves as in-house counsel to HGC.

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The HGC Gradient is published periodically, presenting trends in environmental science, technology, and water resources. If you have any questions, or know of someone who would benefit from receiving this publication, please contact Cheri Minckler at the contact information given above.

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inside

Hydro Geo Chem's
GRADIENT
Trends in Environmental Science and Technology
Landfill Edition 2

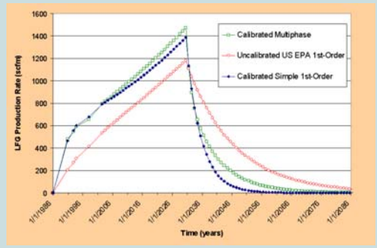
HGC Awarded Patent for Baro-Pneumatic Testing Method

Measuring LFG Generation Rates

Harold Bentley, Ph.D., Principal Scientist

HGC was awarded a U.S. patent in the spring of 2003 for the baro-pneumatic method. This method is a direct-measurement, landfill gas (LFG) estimation method. It is based on accurate measurement and analysis of the pressure response in the landfill to natural variations in barometric pressure.

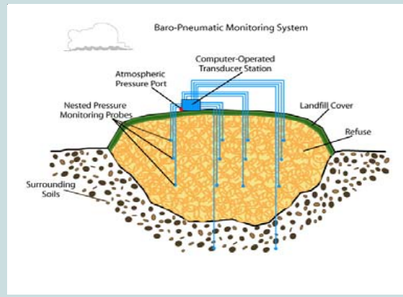
Current standard industry practice obtains values from available tabulated data rather than from site-specific measurements. These indirect methods commonly underestimate or over-predict LFG production by factors of 2 or more[1]. Overestimation could result in excessive costs to the landfill operator if an inaccurate estimate requires installation of an unnecessary LFG control system; underestimation could result in reduced revenue.



LFG to Energy Production through Time by Different Methods

HGC's baro-pneumatic method of direct measurement and estimation of LFG generation is not only more accurate and technically defensible than other direct or indirect methods, but is also less expensive to perform. The baro-pneumatic method of analyzing measured pressures to estimate LFG production on a site-specific basis appears to be technically superior to the current industry standard of estimating LFG production using a first-order decay model and parameter values obtained from available tabulated data.

The baro-pneumatic method is based on scientifically sound gas flow principles. Average landfill pressures are a function both of LFG production rates and gas permeability. LFG production rate and gas permeability can be estimated by



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Baro-Pneumatic Method Used at St. Landry Landfill to Evaluate Energy Generation from Landfill Gas

Cheri Minckler, Chief Operations Officer

Evaluating Landfill Gas-to-Energy Projects

The results of HGC's project at the St. Landry Parish Landfill have positive implications for other small landfills in humid regions. Landfill gas-to-energy projects for these landfills are likely to be more economically feasible than originally estimated. Using HGC's optimized collection and control system designs, a typical landfill can expect 20 to 40% reduction in cost of the collection system and a 10 to 20% increase in gas collected.

Use of Baro-pneumatic Method at St. Landry Parish Landfill

HGC was retained by CLECO Power, LLC, to determine landfill gas (LFG) generation through HGC's patented method of baro-pneumatic measurement. This was the first use of the method in a humid environment. The purpose of estimating current and future LFG

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HGC Designs and Constructs Methane Abatement System in Abandoned Landfill for APS

Rich Petrus, Phoenix Operations Manager

Arizona Public Service (APS) encountered methane gas when installing a trench and conduit system in Tempe, Arizona, to convert existing overhead transmission lines to underground line installations. Discovery of the methane halted construction through the abandoned landfill. APS called in Hydro Geo Chem, Inc. (HGC) to provide a solution to the methane problem.

HGC identified those areas of the site that were or could be impacted by landfill gases, and developed four alternative venting methods for dealing with the problem. HGC then used numerical models to evaluate the effectiveness of each alternative. Based on information derived from the models, HGC developed a conceptual engineering design for the methane protection system that was the most cost effective.

The four alternatives (one passive and three active venting methods) were:

1. **Provide an alternative, high-permeability pathway to the surface for the landfill gas (LFG). For example, a gravel-filled barrier trench (passive).**

2. **Inject air into a constructed trench in order to maintain an air pressure gradient that would drive the LFG away from the APS access vaults and conduits (active).**

3. **Extract air from a constructed trench to reduce methane concentrations in the vicinity of the APS installations to non-hazardous levels (active).**

4. **Inject air into the APS conduit and/or vaults to produce a pressure gradient away from the vaults/conduits and sweep any methane from the installations and nearby soils (active).**

The simulations using the numerical models indicated that passive venting would not be fully effective in minimizing the explosion hazard in the conduits and vaults. Of the active venting methods, Method 4, the injection of air into the power line conduit and vaults, was recommended. This method is more direct and is therefore less sensitive to uncertainties related to methane distribution and soil permeability. Method 4 is approximately 50% less expensive than constructing a barrier trench system.

Following acceptance of the conceptual design by APS, HGC developed detailed designs, obtained the necessary permits for the project, and installed the system. The designed blower system consisted of two 10-horsepower, 200 cubic feet per minute blowers that provided ventilation to the utility lines and vaults. The system was equipped with an air-to-air heat exchanger to provide cool air to the lines and vaults. Additional features included a modem for system monitoring and alarm notification and a lighting system. Once the system was started on January 20, 2003, methane concentrations immediately dropped to non-detect levels in the manhole vaults. The project was completed on time for APS to energize the underground utilities.

HGC Wins Project of the Year Award, APWA

Modified from the July 2003 issue of the APWA Reporter, serving the community of public works professionals of the American Public Works Association

PROJECT OF THE YEAR: ENVIRONMENT LESS THAN $2 MILLION

Rio Nuevo Landfill Stabilization Project

Managing Agency: **Environmental Services, City of Tucson, Arizona**

Primary Contractor and Consultant: **Hydro Geo Chem, Inc.**

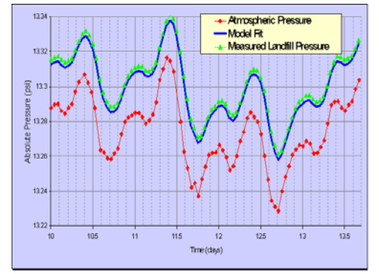
Composting principles were used as an innovative in-situ technique for the stabilization of three unlined landfills - the Nearmont, Congress, and A-Mountain landfills.

An aerobic bioreactor pilot test was designed in order to better understand the dynamics of a modern landfill. Similar to composting, in-situ aerobic degradation requires air and water to enhance the natural degradation process. Under aerobic conditions, methane generation does not occur and once air circulation begins, any existing methane is eliminated quickly.

The success of the Rio Nuevo Landfill Stabilization Project pilot test has exceeded expectations. Based on the results of the project, it was recommended that a full-scale system for the LSP at Nearmont, Congress, and A-Mountain landfills be designed.

Results indicated:

- the aforementioned landfills can be stabilized within the given time interval of three to five years,
- enhanced in-situ aerobic degradation can be operated safely and effectively, and
- the optimum degradation rates are achieved at temperatures between 130 and 160 degrees F.

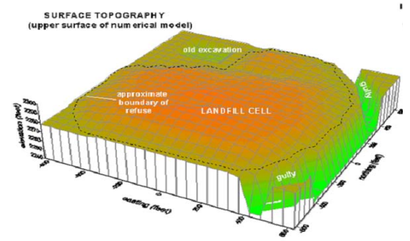


Baro-pneumatic pressure data analysis.

St. Landry Parish Landfill (cont. from p. 1)

generation was to evaluate the feasibility of developing a LFG-to-energy project at the St. Landry Parish municipal solid waste (MSW) landfill located in south Louisiana.

The St. Landry Parish Landfill is currently active and has been accepting MSW since January 1986. Current landfill rates are approximately 54,000 tons per year. The landfill presently covers an area of approximately 33 acres and is anticipated to occupy an area of approximately 80 acres when completed in 2030. Maximum waste thickness now exceeds 100 feet and is planned to top out at 140 feet. Amount of waste in place at the time of the study was 920,000 tons.



At St. Landry Parish, data collection consisted of: 1) measurement of barometric pressure and pressures at various locations and depths within the landfill, and 2) measurement of LFG composition at many of the same subsurface locations where pressure data were collected.

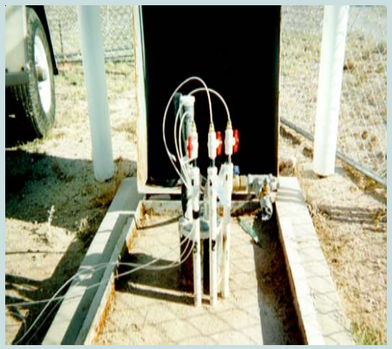
At the St. Landry Parish Landfill, the calibrated model predictions indicate that a LFG-to-energy facility using more than 600 standard cubic feet per minute of LFG would have been feasible at the landfill starting in 2002 and will remain feasible until 2033, a period of 31 years.

Baro-Pneumatic Method (cont. from p. 1)

analyzing the influence of barometric pressure on gas pressures in the landfill at various depths. LFG pressures increase with landfill gas production rates and decreased gas permeability. Using the measurements obtained from the landfill, HGC produces a 3-dimensional gas-flow model of the landfill.

This model can be used to develop or evaluate an engineering design for control or collection of the LFG. The model can be used to simulate the effects of varying the number, placement, and screened intervals of LFG extraction wells, thereby enabling the modeler to customize and optimize the landfill collection system design for a specific landfill.

The baro-pneumatic method uses very accurate and sensitive pressure transducers installed in borings, cone penetrometer installations, or existing LFG collection wells. Pressure is measured for several days using a computerized data acquisition system.



The main advantages of the baro-pneumatic approach are:

1. it is a site-specific measurement based on established flow and transport equations,

2. it is capable of providing the variable-time data necessary to calibrate a time-dependent LFG production model, and

3. it can provide a calibrated gas flow model that can be used to design an efficient LFG collection system.

Comparison of LFG generation rates (scfm)

LFG Estimation Method	1st order Decay	40CFR60 Tier III	LFG Collection	Baro-Pneumatic Method
City of Tucson Landfill	1400	---	550	740
Pima County Landfill	700	1200	<100	80
Lousiana Landfill	500	---	---	800
City of Tucson Landfill, south cell	---	---	---	200

[1] Walter, Gary R. 2003. Fatal flaws in measuring landfill gas generation rates by empirical well testing:Journal of Air & Waste Management Association, April 2003.