



Statement of Qualifications

2014



CAPABILITES STATEMENT Introduction

GC Environmental, Inc.

520 Edison Way, Reno, Nevada 89502 | Washoe County

T: (775) 209-1056

www.GC-Environmental.com

Company Background

GC Environmental, Inc., (GCE) is pleased to present this Statement of Qualifications for your review and consideration. We pride ourselves in providing the highest quality process engineering, landfill gas, geotechnical engineering, environmental, biology, cultural resources management and energy conversion for a wide variety of clients throughout the United States and the world.

GCE's technical staff has extensive and diversified experience ranging of general and highly specialized design and construction level services with the Principals of the firm have been involved in the environmental, geotechnical, and landfill gas industries for over 40 years. Our professional staff is comprised of civil, mechanical and electrical engineers/designers, geologists, geotechnical engineers, hydrogeologists, environmental assessors, field technicians, biologists and archaeologists with a wide range of experience.

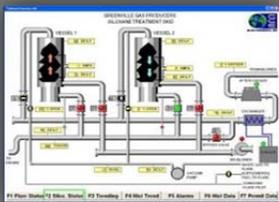
As an example of our recognized expertise, The Solid Waste Association of North America (SWANA) selected GCE to prepare the Landfill Gas Manual of Practice (MOP), a comprehensive guide for landfill owner/operators. GCE personnel also participated with both the City of Los Angeles and Orange County to prepare the methane regulations for building development in gassy areas. GCE has been performing environmental, geotechnical engineering and construction management services since 1979. GC Environmental, Inc. is a California corporation founded in 1991, maintains a Class C Contractors license (#709413), certified small business by the State of California Office of Small and DVBE. With offices in Anaheim, California; Reno, Nevada; and Portland, Oregon, GCE professionals have extensive experience in managing complex environmental problems and providing creative, flexible and cost-effective solutions for our clients across the Country and many parts of the World.

Key members of GCE's professional staff are highly experienced in dealing with local, state and federal regulatory agencies, and negotiating on behalf of our clients. Our professional staff is ideally suited to provide a broad range of services and offer the following benefits:

- ◆ Seasoned senior staff with specialized experience
- ◆ Past performance and proven ability to meet clients' needs
- ◆ Capability to perform work in a timely and cost-effective manner
- ◆ Commitment of top management
- ◆ Efficient project organizational structure

Clients in need of specialized engineering services frequently request "turnkey" services that take a project from the conceptual design phase through permitting, construction, and operations. Advantages of "turnkey" capabilities enables our clients to maintain a consistency in services provided, the ability to better control project completion time frames and, most importantly, the ability to negotiate a single contract rather than several different contracts for the same project. GCE provides this full range of turnkey design/ build/operate capabilities to clients throughout the US and globally. GCE has provided engineering and/or construction management services for some of the largest, smallest, and most technically challenging sites in the nation and internationally.

Contact: Dean Stanphill, P.E. - President
775-209-1056
dstanphill@gc-environmental.com



CAPABILITES

Process Engineering

Contact: Dick Prosser, P.E.
714-632-9969
rprosser@gc-environmental.com



A good example of an ideal user for a small landfill is a nearby regional hospital that can utilize both heat and power from an engine. Larger landfills can generate more gas than most hospitals can use, so nearby industry would be a better candidate. Power generation is common because power lines are usually near a landfill. GCE truly did "write the book: on Operations and Maintenance for LFG systems!"

GC Environmental, Inc. (GCE) and our personnel have been providing process engineering services for oil, gas, and biogas projects for over 35 years. Engineering services have been provided for a variety of projects for oil fields, refineries, landfills, and anaerobic digesters. This statement of qualifications (SOQ) describes some of the services performed by GCE and our personnel along with information in our in-house process engineering capabilities. As a practical consideration, GCE personnel does not limit ourselves to just process engineering solutions, other factors are considered including equipment cost, materials of construction, equipment life, serviceability, flexibility and reliability to provide working solutions. If the equipment GCE designs are not able to function reliably over a broad range of operating conditions and without a great deal of maintenance, then the project will not be profitable.

In today's society, there are also other considerations. It is not enough just to engineer and construct highly successful energy recovery plants. In our modern society, there are complex environmental considerations that also have to be dealt with. GCE also considers the impact of our designs on environmental permits and can tailor our solutions to assist in achieving regulatory compliance while helping to protect our clients from future emissions liability.

Our process engineering, plant engineering, and construction expertise was originally gained through the 1970's designing oil and natural gas process equipment. GCE process engineering has developed new processes for use with biogas which is designed to remove siloxane from biogas gas, remove CO₂ from LFG using carbon molecular sieve membranes, landfill flow modeling in porous media, and evaluating health and safety to residences living near landfills.

Our experience with oil and gas development uses gas sweeteners using iron sponge, CO₂ removal using amine, triethylene glycol dehydrators, low temperature separation units to remove liquid hydrocarbons from natural gas, oil treaters, electrostatic dehydrators, free water knockouts, lease custody transfer units, meter provers, vapor recovery systems for gasoline loading terminals, and water treatment systems.

As a part of process engineering specialization, GCE evaluates the preferred gas use options. The simplest method for gas use is typically power generation, however it is not always the best. To evaluate the best approach, it is necessary to evaluate the local value of power, and nearby industries and/or potential energy users. GCE has exceptional skills designing and constructing advanced control systems using SCADA over Ethernet to monitor and control projects. GCE will design, construct, and train personnel in the use of these systems.

Process Engineering

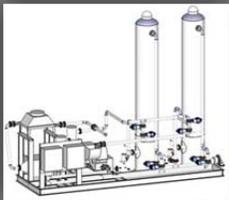
- ◆ Integrating Flare Station Operation with Recovery Plant Operation (important for NSPS compliance)
- ◆ Landfill Gas Utilization Studies
- ◆ Process Engineering
- ◆ LFG energy Plant Design
- ◆ LFG User Burner and Control Modifications
- ◆ PLC Control Software
- ◆ SCADA Systems
- ◆ Preparation of Engineering Plans and Specifications
- ◆ Plant Construction
- ◆ Condensate Water Collection and Treatment and Disposal



CAPABILITES

Landfill Gas

GCE have three principals that are certified instructors that routinely teach the SWANA operation and maintenance courses on behalf of SWANA.



Landfill Gas, Recovery and Treatment

- ◆ Integrating Flare Station Operation with Recovery Plant Operation
- ◆ Landfill Gas Utilization Studies
- ◆ Process Engineering
- ◆ LFG Processing Plant Design
- ◆ LFG User Burner and Control Modifications
- ◆ PLC Control Software
- ◆ SCADA Systems
- ◆ Preparation of Engineering Plans (Civil, Mechanical, Electrical, Chemical, Structural, etc.) and Specifications
- ◆ Plant Construction
- ◆ Condensate Water Collection and Treatment and Disposal

GCE's founder has been involved in the landfill gas industry since its inception in the late 1970's. Our professional staff possesses significant experience in addressing and solving some of the most important environmentally sensitive issues facing landfill owners and operators, municipalities and other solid waste clients.

GCE's personnel has investigated, designed, constructed and/or operated over 100 gas control, recovery and treatment systems for various landfill projects throughout the United States and abroad. GCE stands out among other solid waste engineering firms by its extensive process design and hands-on operations and maintenance background which provide a thorough understanding of LFG subsurface gas dynamics and optimum blower-flare facility design. Our expertise enables us to provide our clients with a complete system design that will meet the project's requirements and optimize the construction costs and schedule. The designs include complete detailed drawings and specifications of all materials and equipment.

In addition to gas systems, GCE has the expertise to provide designs for gas condensate and leachate collection, extraction and treatment systems. GCE offers creative solutions to such problems and we assist our clients in obtaining the necessary permits for treatments and appropriate disposal of the liquids. GCE has designed and constructed condensate water disposal systems using pressure atomized and air atomized spray nozzles in LFG systems.

Operations and Maintenance

We "wrote the book" on Operations and Maintenance! The Solid Waste Association of North America (SWANA) selected GCE to prepare the Landfill Gas Manual of Practice (MOP), a comprehensive guide for landfill owners/operators. This MOP is currently available for sale by SWANA and is one of their most sought after publications.

GCE has the knowledge and experience to provide LFG control and recovery system operation and maintenance services. GCE relies on an extensive body of knowledge in LFG and process operations which come as a result of broad hands-on operating experience in LFG investigation, system testing, and repair and operations. A thorough understanding of the fundamentals and advanced concepts in LFG dynamics contributes to this capability.

Also important is our understanding and background of the conventions applied in the oil and chemical process industries to both design and operation. This experience demands extra precaution when designing plants and this is reflected in our systematic approach to LFG system operation, maintenance, monitoring and troubleshooting.

Monitoring and adjusting landfill gas extraction wells are essential to comply with environmental regulations and provide sufficient methane quality and quantity for energy recovery. Proper operation can enhance gas capture efficiency and regulatory compliance while poor operation can lead to gas migration, regulatory compliance issues, or air infiltration and a reduction in landfill gas generation caused by poisoning anaerobic bacteria.

GCE truly did "write the book: on Operations and Maintenance for LFG systems!"

Contact: Dick Prosser, P.E.
714-632-9969
rprosser@gc-environmental.com



CAPABILITES

Landfill Gas

GCE's founder has been involved in the landfill gas industry since its inception in the late 1970's



GCE operating services and experiences are unmatched in the industry.

GCE teaches people to use a five stepwise procedure to tune LFG extraction wells. Steps include to identify problems or potential problems at a site, make repairs or corrections, well field monitoring and well balancing, document work which is important for Title 5 and NSPS landfills. This can include elevated methane concentrations in probes, surface emissions, groundwater contamination, poor LFG quality, elevated LFG temperature, header settlement, cracks or breaks in the header, water restrictions, and mechanical damage. All data is entered into an electronic database. These steps are our procedures published in the SWANA Landfill Gas Operation and Maintenance Manual of Practice to make well adjustments.

GCE and our principals have been designing projects and teaching people how to operate them for over 35 years. GCE has the knowledge and experience to provide LFG control and recovery system operation.

Operations and Maintenance

- ◆ Plant Start-up, Troubleshooting, and Long-Term Operation
- ◆ Personnel Training (Landfill Gas, Process Equipment Operation, Health & Safety)
- ◆ Plant Performance, Equipment and Safety Audits
- ◆ Emergency Response Assistance
- ◆ Operation and Maintenance Manual Preparation.

Regulatory Compliance and Permitting

GCE assists the clients develop strategies for responding to directives from local, state and federal regulatory agencies. GCE personnel possess extensive experience in interacting with agencies such as the Environmental Protection Agency (EPA), California Department of Health Services, California Regional Water Quality Control Boards (RWQCBs), California Integrated Waste Management Board (CIWMB), South Coast Air Quality Management District (SCAQMD), Bay Area Air Quality Management District (BAAQMD), Air Pollution Control Districts (APCDs), County Departments of Health and other agencies.

Regulatory Compliance and Permitting

- ◆ Permit to Construct and Operate
- ◆ Assistance in Developing Regulatory Strategies
- ◆ Air Emissions Calculations
- ◆ Health Risk Assessment and Modeling
- ◆ EPA Title V Permits

Construction / Construction Assistance

GCE, a licensed contractor, can provide a variety of field services including; manage contractors and subcontractors, perform construction observation, solicit bids, equipment start-up, and perform long term operation and maintenance. GCE can also do all of the above as a turnkey project. Advantages of this later approach are rapid project completion and single point responsibility.

Following regulatory agency approval of the design of a gas system, GCE personnel assist our clients in implementing the design.

Services provided include:

- ◆ Landfill Gas System Construction
- ◆ Drilling and Installation of Landfill Gas Extraction and Monitoring Wells & Probes
- ◆ Third Party Construction Observation and CQA
- ◆ Soil and Groundwater Sampling
- ◆ Compliance Inspection

Operations and Maintenance

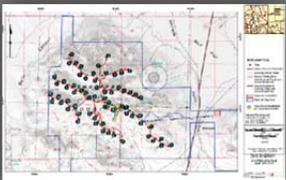
- ◆ Annual Facility Operation Reports
- ◆ Full-time Operation Staff
- ◆ Plant Start-up and Troubleshooting
- ◆ Personnel Training (Landfill Gas, Process Equipment Operation, Health & Safety)
- ◆ Equipment and Safety Audits
- ◆ Emergency Response
- ◆ Operation and Maintenance Manual Preparation



CAPABILITES

Geotechnical Engineering

Contact: Dean Stanphill, P.E. - President
775-209-1056
dstanphill@gc-environmental.com



Quality Assurance

Our CQA program consists of actions taken to provide confidence that our services conform to project and client requirements. GCE's main objective is to maintain a high standard of achievement through excellence and dependability in our work.

GCE geotechnical investigations provide the necessary information for a safe and economical design of public and coupled with this must be a complete understanding of geologic and seismic hazards that are specific to each unique site. Our field work will determine the subsurface soil conditions, depth of groundwater, and obtain soil samples for soil characterization to be tested in a laboratory. The information gained in the field is necessary for our professionals to make recommendations in the report on foundation engineering, design recommendations, lateral pressure analysis, construction monitoring, ground improvement design and slope stability analyses. These challenges must be met by specifically trained professionals in soil mechanics. Personnel are able to make design.

GCE has established significant Geotechnical Engineering capabilities to complement our wide range of other services. GCE personnel have over 25 years of applicable experience throughout California and Nevada on a wide range of projects. These projects have included water and wastewater treatment facilities, essential services buildings, dams, bridges, airports, roadways, parks, and renewable energy.

Geotechnical Engineering

- ◆ Due Diligence Geotechnical and Geologic Evaluations
- ◆ Subsurface Soil Investigations
- ◆ Geologic and Seismic Hazard Evaluations
- ◆ Fault Studies
- ◆ Slope Stability
- ◆ Shallow and Deep Foundation Design
- ◆ Lateral Earth Pressures
- ◆ Pavement Evaluations
- ◆ Pavement Design
- ◆ Drainage Design
- ◆ Settlement Analysis
- ◆ Soil Expansion/Collapse
- ◆ Soil and Rock Strength
- ◆ Rippability Studies

- ◆ Soil Classification
- ◆ Soil and Rock Permeability
- ◆ Corrosion
- ◆ Forensic/Expert Witness
- ◆ Geotechnical Services During Construction
- ◆ Earthquake Engineering
- ◆ Landfill Siting Design / Construction/Improvements

Construction / Construction Management

GCE has the necessary staff to keep the project on schedule and uses cost control techniques through the experience and project understanding that is necessary to manage multiple tasks in a tight schedule. The key to project understanding is define the scope of work, labor and expense budget and scheduled deliverables.

GCE has a fully networked computer system that is used for data management. Software available for use on our projects includes project and data management, spreadsheets, word processing, CADD, GINT, Winsim Design II process simulation software, Supervisory Control and Data Acquisition (SCADA) software to remotely control equipment, data analysis, and software for modeling of vadose zone, gas transport, free product phase plume, and dissolved product plume.

GCE's accounting system is set up to assist project managers in project setup, project budget tracking, and invoicing. The system helps project managers be aware of the project budget status at all times, and be able to communicate to their clients the status of the project budget upon request.



CAPABILITIES

Environmental Services



Innovative Technologies

GCE prides itself on innovation in its designs, computer programming and modeling capabilities. Project Managers, Task Leaders and QA/QC

Officers bring years of innovation to this type of project. Technologies previously utilized include:

- ◆ Soil vapor extraction
- ◆ Chemical treatment/soil fixation
- ◆ In-situ and ex-situ bioremediation
- ◆ Thermal treatment of organic vapors
- ◆ Groundwater extraction and treatment
- ◆ Dual-Phase Air-sparging/Vapor Extraction

Services provided by our hard Environmental Division are geared towards protecting and solving problems in earth, air and water sciences. This includes environmental engineering, earth sciences, geology, and hydrogeology. Our professional staff and field personnel have experience and a working knowledge of local geologic and groundwater conditions, knowledge of local regulatory requirements and procedures, and have established relationships with regulatory agencies that can substantially reduce overall project costs by expediting the regulatory review process.

Our environmental staff includes registered / certified engineers, geologists, hydrogeologist, environmental assessors, technicians and CADD specialists who offer experience in mechanical, civil, and environmental engineering, modeling, design, geology, health risk assessment, and hydrogeology. For over 20 years our diversity of staff, combined with our turnkey project management services, provides our clients an opportunity to develop long-term relationships with a small company that can keep project costs to a minimum.

Environmental Services

- ◆ Phase I Preliminary Site Assessment
- ◆ Preliminary Endangerment Assessment (PEA)
- ◆ Environmental Assessment and Remediation
- ◆ Full Site Characterization
- ◆ Groundwater Monitoring
- ◆ Geologic and Hydrogeologic Investigations
- ◆ Underground Tank Services
- ◆ Remedial Action Planning
- ◆ Remedial Investigation/Feasibility Studies
- ◆ Remedial Design/Installation Permitting
- ◆ Construction Management
- ◆ Operations/Maintenance
- ◆ Site Closure and Decommissioning
- ◆ Regulatory Compliance
- ◆ Air Quality Services
- ◆ Title V Permitting Rule 1150.1 Compliance NSPS Subtitle D
- ◆ Lead, Mold, and Asbestos Consulting Services

Regulatory Understanding

Knowledge of and experience in dealing with complex and ever-changing environmental regulatory requirements and guidelines is a key component to successful project completion. These regulations and guidelines are overseen by many local, state and federal regulatory agencies and cover hazardous waste management, site characterization, work plan development, feasibility studies, remedial action planning, and permitting. Members of our staff have a wide breadth and depth of agency involvement and many have successfully negotiated early site closures on behalf of their clients.

Construction Services

GCE is a licensed General "A" HAZ engineering contractor in the state of California. Key GCE professionals offer over 65 years of combined construction management experience. Our staff has extensive experience in preparation of design specifications, construction documents and bid packages and routinely assists our clients with the selection of contractors. Our expertise in well installation, UST removal and installation, and remedial systems construction and operations, building protection and landfill cell liner installation includes large-scale projects, and smaller pilot and bench scale projects. Our experience includes installation of remedial systems for a variety of clients throughout the West.

Contact: Farideh Kia, PG, CHG, REA II
714-632-9969
fkia@gc-environmental.com



CAPABILITES

Cultural Resource Management Biological Resources

GC Environmental, Inc.

520 Edison Way, Reno, Nevada 89502 | Washoe County

T: (775) 209-1056

www.GC-Environmental.com

GC Environmental, Inc. (GCE) is pleased to present our cultural resource management and biological resources department. Our staff has provided environmental consulting in Nevada, California, Oregon, Utah and Arizona with combined experience over 45 years. This seasoned staff includes of archaeologists, ethnographers, paleontologists, planners, GIS analysis, archaeological field crews, wildlife biologists providing environmental analysis and recommendations. BLM NV Cultural Use Permit (CUP) #N-72782.

The professional staff have prepared hundreds of environmental and planning reports, recommendations and studies that comply with environmental regulations including the National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), National Register of Historic Places (NRHP), Native American Graves Protection Act, Section 106 compliance, Archaeological Resources Protection Act (ARPA), Historic American Buildings Survey (HABS), Historic American Engineering Record (HAER), Native American Tribal Consultation, Endangered Species Act (ESA) and Section 7 Consultation, preparation of Section 9 incidental take permits, habitat conservation plans, wetland inventory and assessment.

Cultural Resources

- Literature Search
- Field Survey
- Site and Isolate Recordation
- Site Monitoring
- Safety/Work Interruption Contingency Plan
- Preservation and Treatment Plans
- Draft and Final Report Preparation
- Quality Control Plan
- Site Testing and Evaluations
- Construction Monitoring and Mitigation

Our GIS personnel are proficient in utilizing ESRI GIS software used for mapping and analyzing data. Our staff has a strong background in cultural resources and biology which allow our GIS staff to interface effectively with project managers, crew chiefs and provide insight into real time data analysis, and develop maps that provide meaningful results. We collect spatial data to complete professional grade site maps and area of potential effect (APE) of our project. Upon completion of a project we provide shape files in accordance with BLM standards. An important approach to our outreach in the community is keeping close relationships with academic professionals. We have an intern program that uses advanced study UNR students from the Anthropology Department, provides students with hands on professional experience and keeps us involved with current research technology.

Biological Resources

- Endangered Species Act (ESA)
- Section 7 Consultation
- Habitat conservation plans
- Wetland inventory and assessment
- Threatened and endangered species
- Monitoring
- Permit compliance

We understand demanding schedules and our staff are accustomed to mobilizing on short notice, working under rigorous conditions, and delivering on demanding schedules. We have a great reputation with jurisdictional agencies because we maintain constant communication throughout the project; documents are easily readable, and technically credible.

Contact:

Lori Bigham – CRM Program Manager
775-544-3870 | lbigham@gc-environmental.com
Paul Sanchez M.A. - Senior Principal Investigator
775-741-9801 | psanchez@gc-environmental.com
Gregg Harmon - Principal Investigator
804-247-3338 | gharmon@gc-environmental.com



CAPABILITES

Energy Conversion

Contact: Dan Waiono, P.E.
503-234-7984
dwaineo@gc-environmental.com

Landfill Gas to Energy Recovery

There are several key steps and processes used to develop landfill gas (LFG) energy recovery systems.

Methane Investigation Quantification

An essential first task is to evaluate current landfill gas collection rates and extrapolate the data to predict the future collection rate. For landfills that have LFG collection systems, current collection rates evaluated careful analysis of current gas collection data, methane concentration in the collected gas (including an evaluation of the estimated accuracy of the data), historical and predicted future refuse fill rate, anticipated changes in refuse composition in the future, refuse moisture conditions, and an evaluation of the current gas system collection efficiency. Surface Concentration data can be used to estimate LFG flow using correlations developed by GCE. Existing data is evaluated using an exponential regression analysis to optimize the model constants.

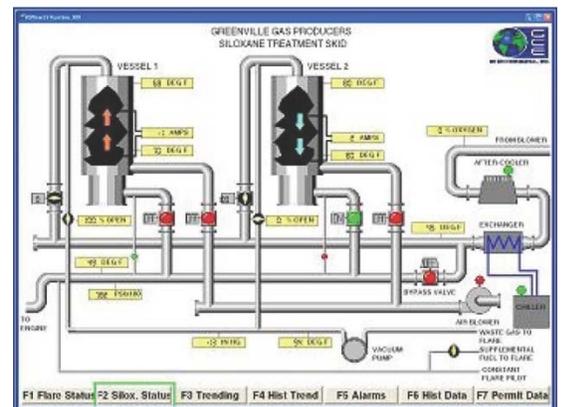
Determining the optimized model coefficients is just the first step of the analysis. By applying a typical methane yield for similar landfills, a decomposition rate constant (K) can be calculated. Similarly by applying a typical decomposition rate constant, a methane yield constant (Lo) can be calculated and a range of constants can be used to evaluate the future methane generation potential and provides a best-fit curve. This approach can help us evaluate risk by showing a range of methane generation that can be applied to a financial model. Gas modeling is performed for almost every landfill GCE provides services.

Methane Investigation Quantification

- ◆ LFG Sampling and Analysis
- ◆ Flow Measurement
- ◆ Dual Variable (Lo, K) Regression Analysis Optimization Calculations
- ◆ LFG Generation Modeling for Future Methane Collection
- ◆ LFG Quantification Reports (Bank Reports)

Landfill gas Energy Recovery Services

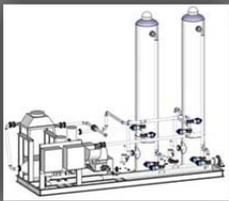
GCE's principals have been involved in the landfill gas energy recovery since its inception in the late 1970's. Prior to that, they were doing process and design engineering for oil and gas process equipment. We have designed compressor plants, a high BTU facility for use with a fuel cell, fuel gas compression and conditioning for engine fuel and medium BTU plants, modified boiler controls to fire landfill gas and natural gas simultaneously, performed research and development on processes to remove siloxane from landfill gas, and performed research and development for carbon molecular sieve membranes for CO2 removal. Oil and gas experience includes gas sweeteners using iron sponge, CO2 removal using amine, triethylene glycol dehydrators, low temperature separation units to remove liquid hydrocarbons from natural gas, oil treaters, electrostatic dehydrators free water knockouts, lease custody transfer units, meter provers, vapor recovery systems for gasoline loading terminals, and water treatment systems.



CAPABILITES

Siloxane Removal

Contact: Dan Waineo, P.E.
503-234-7984
dwaineo@gc-environmental.com



Considerations used in design of siloxane equipment

- ◆ Inlet gas temperature, pressure, and dew point
- ◆ NMOCs and Siloxanes in the inlet gas
- ◆ Siloxanes specified in the outlet gas
- ◆ Allowable gas pressure drop through the system
- ◆ Oxygen content in the landfill/waste water treatment plant gas
- ◆ Dry compressed air is available for system operation

Understanding Gas To Electrical Power

The importance of collecting gasses from landfill waste or wastewater treatment facilities for combustion in gas engines prevents harmful gasses from escaping to the environment and results in a positive influence on greenhouse gas emissions. Benefits of converting the gas to electrical power can supply clean energy to operations of the producing facility and surplus supplied to the public grid for utilization. Understanding the process of gas applications and the problems faced with organic silicon compounds contained in gas is the strength of GCE's process engineering innovations. Our process experience allows us to provide advanced gas treatment options to remove contaminants from landfill gas including siloxane and chlorinated hydrocarbons thus enhancing gas suitability.

Siloxane Removal Process

GCE has designed compressor plants, a high BTU facility for use with a fuel cell, fuel gas compression and conditioning for engine fuel and medium BTU plants, modified boiler controls to simultaneously fire landfill gas and natural gas, performed research and development on processes to remove siloxane from landfill gas, and performed research and development for carbon molecular sieve membranes for CO₂ removal.

A typical siloxane removal system use two or three adsorption beds to remove siloxanes. Alternating beds are online while the other beds are regenerating. GCE designs our system using tall tanks to hold additional media. The 3-D rendering shows a two tank system for a single engine system.

The goal is to provide a system that can undergo many regeneration cycles without the need to replace the media in the bed. Adsorption occurring in the beds is slightly exothermic so the gas leaving the beds will be hotter than the gas entering the beds.

The heat of adsorption is dependent on the amount of contamination and water in the gas. There is no control over this level of heating. Experience shows that the amount of heating will be nominally 20 deg F.

The key part of a siloxane removal system is the approach to bed regeneration. The approach used by GCE is to recirculate warm landfill gas to heat the bed. Vapor phase non methane organic compounds, including siloxane are separated from the recirculating landfill gas and burned in a flare or incinerator. Condensable are returned to the landfill. The nominal average gas usage is about 5-10 scfm during regeneration. Vacuum is applied to the bed to remove residual contamination in the bed prior to cooling and going back online.

Because the tanks are large, they are directly mounted to a concrete foundation. All peripheral equipment will be mounted on an equipment skid that will be mounted alongside the vessels. Interconnection piping will need to be welded in the field. The system is also designed for long life. Tanks and pipe in corrosive service will be made from stainless steel to eliminate corrosion. In extreme climates particular attention needs to be given to insulating hot equipment and protecting liquid pipes from freezing by heat tracing and insulation. The system will utilize a PLC control system that can be easily integrated into a SCADA system. A HMI touch screen will be provide for control of the process.



Offices

1230 N. Jefferson Street, Suite J
Anaheim, CA 92807

T: (714) 632-9969 | F: (714) 632-9968

107 SE Washington Street, Suite 243
Portland, Oregon 97214

T: (503) 234-7984 | F: (503) 231-6485

520 Edison Way
Reno, Nevada 89502

T: (775) 209-1056