John E. Murphy PE, BCEE

Senior Associate

Mr. Murphy has over 36 years of experience on a wide array of environmental and civil engineering projects. He has strong technical and management skills in directing multiple subconsultants, in-house technical staff and field personnel, as well as client communications, project implementation, interaction with regulatory authorities, project presentations and ensuring that Stantec's services are executed to the client's satisfaction. He is considered an expert in landfill gas management including odor and migration control, gas collection and processing, flaring systems and energy recovery and power generation facilities.

EDUCATION

Bachelor of Science, Civil Engineering, Northeastern University, Boston, Massachusetts, 1977

Master of Science, Environmental Engineering, Northeastern University, Boston, Massachusetts, 1985

REGISTRATIONS

Registered Engineer #4410, State of Rhode Island

Professional Engineer #46266, State of Florida

Professional Engineer #22939, State of Connecticut

Professional Engineer #32030, Commonwealth of Massachusetts

MEMBERSHIPS

Member, Solid Waste Association of North America

Member, American Academy of Environmental Engineers

Member, Water Environment Federation

National Civil Engineering Honor Society, Member, Chi Epsilon National Civil Engineering Honor Society

Member, New England Water Environment Association

PROJECT EXPERIENCE

Landfill Gas Collection, Control and Renewable Energy

LFGTE Power Plant Siloxane Reduction System (SRS) Cost-Benefit Analysis and Construction Documents Development, Washington Electric Cooperative, Coventry, Vermont

The Landfill Gas to Energy (LFGTE) power plant has experienced a significant increase in the deposition of silica within the engines due to rising levels of siloxanes in the recovered landfill gas. This has resulted in substantially greater maintenance of the engines including oil changes, spark plug replacements, cleaning of heads, and more frequent repairs or replacement of other components. A cost-benefit analysis to evaluate the technical feasibility and construction and operational costs of current technologies for reducing siloxanes in LFG and compare that against the cost savings with SRS of less frequent maintenance and increased power production from greater uptime. The Cost-Benefit analysis concluded the installation of SRS was technically feasible and would have a payback period of 6 years. Based on the findings from the Cost-Benefit Study, WEC directed the advancement of the project to development construction documents and request for proposals from qualified contractors. Technical requirements for design drawings and specifications were prepared and an RFP for construction bidding was issued. Bids were reviewed and a recommendation to award the contract was made. Presently, WEC is seeking a Certificate of Public Good from the VT Public Service Board through the 248j process and engineering support is being provided. Technical assistance has also been provided to WEC during the drafting of a new Title V Air Pollution Control Permit for the engine and SRS flare emissions.

John E. Murphy PE, BCEE

Senior Associate

LFGTE Power Plant EPC Contract Documents Development and Construction Services, Washington Electric Cooperative (Casella Waste Landfill), Coventry, Vermont

As a result of the positive findings by Stantec on the technical and economic viability of constructing a landfill gas to energy (LFGTE) facility at the Casella Landfill, Washington Electric Cooperative (WEC) retained Stantec to prepare the project documents to Engineer-Procure and Construct (EPC) the power plant. As project manager, Mr. Murphy directed and oversaw all aspects of the development of the EPC contract documents for the LFGTE Facility. Under Mr. Murphy's leadership and technical expertise, the engineering services performed for this project included: (1) updating the gas model based on presently available data and determining current and future electrical generation potentials; (2) making an assessment of the existing gas collection system and recommending improvements to optimize recovery; (3) reviewing regulatory approval and permitting requirements; (4) conducting field sampling and investigations for analysis of subsurface conditions and gas quality; and (5) preparing Request for Proposal (RFP) documents to be issued to qualified potential Engineer-Procure-Construct (EPC) power generation teams for final design and construction of the plant. Further, Mr. Murphy is currently leading the engineering effort for construction management services including on-site inspection and construction administration. The 4.8 MW LFGTE power plant construction was completed and generation of electricity to the utility grid in July 2005.

LFG Production Study and System Assessment, Washington Electric Cooperative (Casella Waste Landfill), Coventry, Vermont

Washington Electric Cooperative, a local supplier of electricity to the Montpelier area, is exploring "Green Power" opportunities such as landfill gas recovery from the Casella Waste Landfill in Coventry, VT. As project manager, Mr. Murphy led the project team in preparing landfill gas generation models for the site as well as assessing the existing gas collection system suitability for long term service to provide gas to electric generation units. Mr. Murphy was responsible for preparing a letter report to the client presenting the findings of the investigation work, results of the gas modeling, and conclusions about the long-term viability of implementing a gas-to-energy project.

Washington Electric Cooperative LFGTE 5th Genset Expansion, Coventry, Vermont

Updated LFG Generation Model for the NEWSVT Landfill site in Coventry, VT based on latest waste input data and future waste disposal capacity and filling rate. Based on the results and advice of Mr. Murphy, WEC decided to proceed with installation of a 5th engine-generator unit (genset) adding 1,600 kW of generating capacity at the site and increasing total output to 8.0 MW. Prepared optional site layout plans for the 5th Genset Expansion to demonstrate the feasibility of expanding the plant and to determine which layout would be preferred from a operational, cost and regulatory standpoint. Developed preliminary design documents and narrative of the proposed plant expansion for submittal by WEC to the Public Service Board for securing a Certificate of Public Good (CPG) under Vermont statute Act 248. Currently leading the design team including civil, structural, architectural and electrical disciplines for development of final construction documents for the 5th Genset Expansion. A major challenge of the plant expansion implementation is to minimize interruption of the plant operation during construction to limit the financial impact on WEC from lost power sales as well as mitigate odors and emissions. Mr. Murphy is responsible for coordinating the plant expansion work with the various key parties to the project including the Co-op, the plant operator, the landfill owner and their engineer and the designated construction contractor. The expanded plant construction work went online in 2009. Mr. Murphy is providing on-going technical assistance and operations analysis.

Aquatera Utilities - Landfill Gas to Energy Business Case Due Diligence Review, Grande Prairie Landfill, Alberta, Canada

Directed preparation of a comprehensive due diligence review on the technical, economic and regulatory viability of the development of a 1.5 MW to 2.0 MW LFGTE plant at the Grande Prairie Landfill owned and operated by Aquatera Utilities. Aquatera had commissioned a study of implementing a landfill gas to energy project and before proceeding with final plans to build the plant, sought an independent due diligence review of the study findings and recommendations. The due diligence review included independent modeling of the gas generation and recovery projections with and without leachate recirculation and bioreactor operation, conceptual layout of gas collection systems for the existing landfill phase and future phases 2-6, an evaluation of greenhouse gas (GHG) offsets and eligibility under the Alberta Emissions Offset Registry, assessment of capital and O&M costs, and financial pro formas for various operating scenarios.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Aquatera Utilities - Landfill Gas to Energy Design and Construction Support Services, Grande Prairie Landfill, Alberta, Canada

The LFGTE Business Case Review concluded implementation of the project would be favorable to Aquatera from technical, financial, environmental and regulatory perspectives. Aquatera authorized Stantec to proceed with preparation of a Preliminary Design Report for the Landfill Gas to Energy Project. Mr. Murphy was assigned the leader for the landfill gas system design including the gas collection wellfield, gas cleanup and compression (GCC) systems, and treated gas transmission pipeline to the gen-sets. The preliminary design deliverables included development of the design basis for improvements to the existing wellfield and collection system, layout and configuration for the GCC equipment, routing and profile of the gas transmission pipeline and performance criteria for the gas treatment and electric generation equipment. Subsequent to the approval of the Preliminary Design Report, detailed design drawings, specifications and contract documents were developed for LFGTE facilities. Tender documents were issued in three separate contracts for the wellfield and gas collection system improvements, gas cleanup and compression system and generation building. Construction support included review and processing of submittals, resolving issues in the field that arose during construction and conducting regular construction progress meetings with the Contractor and Aquatera.

Central Landfill - Phase IV LFG System Design, Johnston, Rhode Island

The RIRRC was reaching the filling capacity of their present landfill area, and needed to initiate filling in the new Phase IV landfill area. As project manager, Mr. Murphy designed a gas collection system, incorporating layered horizontal gas collection trenches, to effectively control landfill gas during active filling operations. The gas collection system design and design report were submitted in conjunction with the site operation permit application to RIDEM for approval and site opening.

Central Landfill - Phase V Landfill Permitting LFG Management System, Johnston, Rhode Island

The Phase V cell of the Central Landfill will extend the useful life of the site through the year 2012. As project manager, Mr. Murphy directed the efforts in preparing the landfill gas management documents associated with the site permit application to the RI Department of Environmental Management. An LFG Management Report, describing landfill gas control procedures during active operation of the landfill as well as for closure and post-closure periods, was prepared for the permit application. Preliminary layout plans, cross-sections and details were developed for interim and final landfill gas collection systems directed to a 7,500-scfm gas recovery and flaring station. Other tasks associated with preparing the permitting documents included modeling landfill gas generation rates, calculating gas system headlosses for determining optimum header sizes, and a description of contingency measures to be implemented in the event of odors/emissions, gas migration, noise, personal injury, and fires/explosions.

Broadrock Renewables LFG Management Facilities Final Design and Construction Management, Central Landfill, Johnson, Rhode Island

Project Manager leading team on implementation of the landfill gas collection and treated gas transmission facilities for the 40 MW Combined Turbine Generation (CTG) project owned and operated by Broadrock Renewables. This LFGTE Plant is the largest of its type in the northeast and will generate the equivalent electricity to power 50,000 homes. Responsible for modeling of gas generation and recovery to determine optimum sizing of a new sitewide perimeter header system with piping ranging from 18" to 36" for handling peak flows of up to 16,000 scfm. Prepared gas collection system and treated gas transmission pipeline design plans and profiles along with construction details. Developed technical specifications and construction cost estimate. Coordinated with LFGTE project EPC team on integration of gas collection and transmission facilities with the Gas Compression and Cleanup (GCC) facilities which will use state-of-the-art technologies for removing hydrogen sulfide and siloxanes from the landfill gas. Currently providing construction administration and management services to Broadrock Renewables.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Ridgewood Renewable Power – 40 MW Combined Cycle Gas Turbine Plant, Central Landfill, Johnston, Rhode Island

Developed a master plan for reconfiguration and optimization of the landfill gas collection system in conjunction with the consolidation of the LFGTE facilities and construction of the proposed 40 MW gas turbine plant. Mr. Murphy directed the effort for preparation of a comprehensive engineering report and preliminary design plans of the reconfigured and upgraded sitewide gas collection and recovery systems. The engineering report evaluated the current LFG system layout, design criteria, operational issues, and maintenance requirements. Recommendations were made for improvements to the LFG collection system to: maximize gas recovery and delivery to the proposed LFG turbine plant; address operational problems including high vacuums, air leaks, condensate blockages and flooded wells; and reduce O&M costs. Preliminary drawings were prepared of the upgraded and reconfigured gas collection and recovery systems showing the proposed sitewide header system, including the Phase VI Landfill expansion implemented in stages from 2010 when the new turbine plant will be on-line through 2013 when the Phase VI Landfill will be in full development. The preliminary drawings also included a site layout of new gas recovery facilities to handle up to 16,000 scfm of landfill gas. Mr. Murphy led the project team in the preparation of the engineering report and preliminary design plans.

Central Landfill Gas-to-Energy Project, Johnston, Rhode Island

As project manager, provided planning, design and construction management of landfill gas recovery facilities at the Rhode Island Solid Waste Management Corporation Central Landfill. Facilities in this project encompassed more than 200 extraction wells, approximately eight miles of collection piping, flaring equipment, and a 15.0 mw LFG-to-Electric power plant. Several options were evaluated for utilization of the extracted gas including transportation to state hospital facilities in Cranston, RI via a 5-mile gas transmission main. A feasibility study that assessed the technical, environmental, economic and permitting issues determined the gas transmission pipeline was a less favorable alternative than on-site power generation. This project also included a utility corridor study to evaluate the interconnection of the power export lines to the utility's grid.

LFG Condensate Treatment System, Johnston, Rhode Island

As project manager, directed and implemented treatability studies for removal of contaminants from landfill gas condensate in order to meet regulatory standards. Designed pretreatment system consisting of oil/water separation, filtering, and activated carbon treatment to comply with the industrial pretreatment permit requirements. Other responsibilities included coordinating industrial pretreatment effluent sampling and analysis and preparation of discharge self-monitoring reports.

Landfill Gas to Energy Due Diligence Study, Delhi, NY

Delaware County Electric Cooperative (DCEC) serves the power needs of communities in the Catskills area of Upper NY State. DCEC, hoping to expand its green power base, desired to explore the feasibility of developing a landfill gas to energy (LFGTE) facility at the county landfill site in nearby Walton, NY. Mr. Murphy headed the team effort on conducting a comprehensive due diligence study to determine if an LFTGE project at the county landfill was technically feasible and commercially viable for DCEC. The Due Diligence Study included developing an LFG generation model, conducting a site inspection to assess existing collection gas system infrastructure, evaluating gas treatment systems and engine-generation equipment, and assessing permitting requirements for noise and emissions. As a result of the LFGTE Due Diligence Study favorable findings and recommendations, DCEC concluded they would go forward with development of a 1.0 megawatt gas to energy facility.

Feasibility Study Evaluation, Rose Hill Landfill, South Kingstown, Rhode Island

As project manager, evaluated landfill gas collection and destruction alternatives developed by a Feasibility Study for the closure of this Superfund Site. Tasks undertaken included assessment of the technical viability, costs and feasibility of remedial alternatives; projections of landfill gas and condensate generation rates; and recommendations of landfill gas collection and destruction technologies.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Delaware County LFGTE Power Island – Construction Phase, Walton, New York

Responsible for leading the Stantec team in providing engineering support services for the construction phase of the 1,200 KW landfill gas to energy (LFGTE) power plant at the Delaware County Landfill in Walton, NY for the Delaware County Electric Cooperative (DCEC). Engineering support services included participation in pre-construction and construction progress meetings with DCEC , contractors, and subcontractors, reviewing submittals, responding to contractor RFI's, reviewing construction activities and progress and advising DCEC of any issues that might delay progress, and reviewing vendor equipment specifications and drawings to confirm compliance with the contract documents. In addition to construction management services, assisted DCEC in evaluating the potential quantity of Greenhouse Gas (GHG) Reduction Credits by converting projected landfill gas recovery rates into equivalent tons of carbon dioxide (CO_2) that would be precluded from entering the atmosphere by combustion in the new LFGTE genset. Advised DCEC on selection of equipment necessary for verifying GHG credits including LFG flow meters and gas analyzers.

LFG System Final Design; Landfill Closure/Commercial Development, Reading, Massachusetts

This former landfill is being reclaimed for commercial development to include retail and restaurant facilities. Although the site stopped receiving wastes in the mid-1980s, low levels of landfill gas are still being generated and present health and safety concerns. As project manager, Mr. Murphy led the project team efforts on the design of gas recovery and destruction systems to protect the buildings and site from gas emissions and possible migration. The gas system design was coordinated with the proposed commercial development including the use of horizontal collection trenches under the buildings and vertical extraction wells around the perimeter areas of the site. The site was subject to a Corrective Action Alternatives Analyses (CAAA) in accordance with the Massachusetts DEP regulations. The gas system design was prepared to conform to the approved CAAA. Design activities included preparation of gas collection and flaring system plans and details, gas generation modeling, construction cost estimate, and development of technical specifications.

Landfill Gas Management Design - KMVP Radio Tower Relocation, Phoenix, Arizona

Developed a landfill generation model at the City of Phoenix SR85 Landfill for assessment of required mitigation measures to the construction of a control building on the landfill for the relocation of a radio tower for KMVP. Prepared final design plans and specifications for the under building gas migration control system. Provided technical documents and supporting information for completing the Municipal Solid Waste Management Plan - Type III Modification Application to AZ Department of Environmental Quality (ADEQ) to install the gas migration control facilities.

Atomic Energy of Canada Limited (AEC) Assessment of Concentration and Emission of Methane Gas Hazard from the Bulk Material Landfill at the Chalk River Laboratories, Ontario, Canada

Provided technical assistance of modeling methane gas generation from digested sludge deposited in the Bulk Materials Landfill at the AECL Chalk River Laboratories. Gathered data on sludge generation quantity and characteristics from the primary and secondary wastewater treatment processes at the Chalk River Laboratories to develop input parameters for the modeling of methane generation potential of the landfilled sludge over 100 year timeframe using Stantec's proprietary LFG modeling software. The generation of methane from sewage sludge placement within the Bulk Material Landfill (BML) and emission levels of combustible gases determined from dispersion modeling were the basis of assessing the need for mitigation measures. If the results of the quantitative and qualitative analysis of emissions levels from the methane generation may occur above explosive limits then mitigation measures would need to be implemented, including gases that might accumulate within leachate storage tanks. The findings and conclusions from the methane generation modeling and analysis determined explosive emission levels would not be reached over the 100 year period and special mitigation measures would not be required.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Landfill Gas to Energy Feasibility Study, Santa Cruz County, Arizona

Provided technical and economic assessments of the feasibility of implementing a landfill gas to energy (LFGTE) facility at the Rio Rico Landfill for Santa Cruz County, AZ. The landfill occupies approximately 25 acres and has sufficient capacity to serve the County's needs to the next 20 years. The feasibility study included an analysis of landfill gas generation based on waste filling history and projections which were plugged into Stantec's proprietary LFG model along with site specific waste decomposition characteristics. The model predicts a recoverable landfill gas peak flow rate of 500 scfm and a continuous sustainable flow rate of at least 300 scfm through 2038. Various technologies for beneficial use of the LFG were assessed for their technical economic and regulatory viability including as a medium Btu boiler fuel, upgrade to pipeline quality gas for distribution and on-site electric generation. The study recommended the preferred option of electric generation using 1.0 MW reciprocating genset unit and selling the electricity to Tucson Electric Power. A financial pro forma was prepared for the 30 year life cycle of the project and included capital and O&M costs, electricity revenue, and projected income from Renewable Energy Credits and sale of greenhouse gas credits. The final report was issued in December 2009 and included an implementation plan and schedule.

LFG Modeling and Migration Control Study, Plymouth Trial Court House, Plymouth, Massachusetts

The Commonwealth of Massachusetts had developed concept level plans for construction of a new Court House to serve Plymouth County. The Court House was to be built adjacent to an old landfill site and concerned was raised about potential gas migration. As project manager, Mr. Murphy developed a gas generation model to project the future levels of landfill gas generation and made an assessment of the possibility of gas migration to the Court House. Alternatives for controlling gas migration were evaluated and a report prepared on the findings and recommendations. Other responsibilities included reviewing the regulatory issues and permitting requirements concerning construction of gas collection and destruction systems.

Landfill Gas to Energy Final Design, Santa Cruz County, Arizona

Overseeing the preparation of final design documents for the construction of a 1.0 MW LFGTE plant and gas collection facilities at the Rio Rico Landfill. Based on the findings and recommendations from LFGTE feasibility study, the Santa Cruz County Board of Commissioners voted to proceed with the full design and construction of the 1.0 MW plant. Design documents are being prepared for construction of a new wellfield and gas collection system and LFGTE facilities at the landfill site. The gas collection system includes a combination of vertical extraction wells for non-active areas and horizontal collection trenches in active filling areas which will be connected to a looped perimeter header to feed landfill gas to the new LFGTE plant. The plant will consist of a modular engine generator set inside an insulated container, a gas recovery and treatment skid, electric substation and ancillary facilities for storage of consumables such as oil and glycol and for waste products including condensate electricity will be exported to the Tucson Electric Power via 13.5KV line to the nearby grid in front of the landfill. Monitoring and trending of the LFGTE operations will be accomplished with a full SCADA package which will have both local and remote access via the Internet.

West St. Landfill Gas System Construction, Natick, Massachusetts

Mr. Murphy was brought into the project team, led by the Town of Natick's consulting engineers, to provide expertise on installation of landfill gas recovery and flaring systems. The landfill gas system consisted of wellfield and gas recovery/flaring facilities with a total capacity of 400 scfm. The landfill gas system was installed in conjunction with the conversion of the closed landfill into a Par 3 Municipal Golf Course. Mr. Murphy's responsibilities included: review of shop drawings and submittals for the gas processing, condensate management and flaring facilities; responding to contractor requests for information; addressing flare system field installation problems; and providing technical assistance during start-up. The landfill gas system construction and start-up was completed in time for the golf course to open for public use in August 2001.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Capital Power Corporation - Landfill Gas Study, Clover Bar Energy Centre, Edmonton, Alberta, Canada

Capital Power Corporation (CPC) owns and operates a Landfill Gas to Energy (LFGTE) power plant at the City of Edmonton Waste Management Centre (EWMC) where LFG is recovered from the Clover Bar Landfill. Stantec was retained by CPC to assess the remaining expectancy of landfill gas generation from the Clover Bar Landfill which is used to fuel engine-generators with a rated combined capacity of 4.8 MW. Mr. Murphy was responsible for performing the Landfill Gas Study and determining if there was sufficient quantity to operate the LFGTE power plant at commercially viable levels for the next 5 years or more. In addition to assessing the remaining LFG life expectancy, Mr. Murphy provided recommendations to CPC for steps that could be implemented to improve the accuracy of projecting future LFG recovery through additional study or analysis. The study included development of an LFG Generation Model based on historical records of waste filling and waste composition data projected out over a 30-year period. LFG recovery efficiency values were estimated based on the wellfield as-built information and landfill cap conditions. The LFG model was calibrated against LFG recovery records furnished by CPC for 2009 – 2013. A technical memorandum was produced which summarized the background documents and records provided, presented the LFG modeling results and trending analysis, projected electric generation output from the LFGTE power plant and provided conclusions and recommendations on methods of improving gas recovery projections.

Portable Flare Unit Registration, Central Landfill, Johnston, Rhode Island

In order to permit the construction and operation of a new 2,000-scfm landfill gas flare installed to control odors at the Central Landfill, approval by the Rhode Island Department of Environmental Management (RIDEM) pursuant to the regulations of Air Pollution Control No. 9 was required. As project manager, Mr. Murphy directed and coordinated the effort and provided technical oversight for preparation of all permit applications and development of necessary supporting documentation for securing approval by RIDEM through the registration process.

Central Landfill Main Flares Replacement, Johnston, Rhode Island

As project manager, headed the engineering activities related to replacement of the main landfill gas flaring system at the Central Landfill. The original flares, installed in 1988, were nearing the end of their useful life and did not meet present air quality standards. Prepared a preliminary design report for the flare system replacement that included an evaluation of current and long-term flaring capacity needs, alternative technologies for gas destruction and utilization, and new flare system layout including recovery equipment and flare stack. After review and approval of the Preliminary Design Report, plans and performance specifications for a replacement flare system were developed under Mr. Murphy's direction. In order to limit total nitrous oxides emissions, the replacement flare system incorporates state-of-the-art "Ultra-low NOx" technology. The complete flare system, including a new skid-mounted booster blower unit, was installed and placed into service in 2004.

Gas Migration Investigation, Westford Landfill, Town of Westford, Massachusetts

As project manager, conducted the routine monitoring of the groundwater and soil matrix surrounding the Town's landfill site, capped several years ago. Elevated levels of landfill gas were detected in some of the monitoring probes along the perimeter of the site indicating gas migration was a problem. As a result, some residential structures were subject to the potential danger of accumulating explosive gases. Responsibilities also included coordinating the testing of the basement atmospheres of the abutting structures and installation of additional monitoring probes along the property boundary. This information was used to determine the need for gas migration remediation including the installation of an active extraction and flaring system. Mr. Murphy currently oversees the quarterly monitoring activities at the site and reporting to the DEP of site conditions including gas levels detected in monitoring probes.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Gas Migration and Odor Control, Central Landfill, Johnston, Rhode Island

The rapid growth of this site has caused landfill gas generation to exceed the capacity of the existing gas control facilities creating migration and odor nuisance conditions. To address this problem, a fast track gas control system was implemented. As the principal engineer for the gas collection system, Mr. Murphy was responsible for implementing a design-build approach to get a gas collection and flaring system on-line and operational less than a month from the client's request to proceed.

Gas Recovery System Assessment, Regional Landfill Site, Private Client, Massachusetts

As project manager, performed a landfill gas recovery study from a regional landfill site which was not meeting the quantity and quality expectations of the owner of a power plant using the LFG as a supplemental fuel. Responsibilities included leading the team to conduct a comprehensive assessment of the gas recovery system and developing recommendations for increasing LFG production, enhancing LFG quality, and improving system reliability. Specific areas addressed included: modeling of gas generation rates; determination of recovery factors; identifying potential system upgrades and developing conceptual designs; estimating construction and O&M costs for recommended improvements; performing a marketability analysis for alternate uses of the LFG; and defining contractual and regulatory impediments to system modifications or expansions. A tight deadline required the complete project to be performed within a two-week period.

Various Landfill Gas Recovery Facilities

As project manager, conducted the design of landfill gas recovery and flaring systems along with preparation of associated permit applications for landfill sites in Amesbury and Billerica, Massachusetts and Pasco County and Jacksonville, Florida.

North Landfill Gas Collection and Flaring Facilities, Jacksonville, Florida

As project manager, performed gas generation modeling and provided design and development of construction plans and specifications. The landfill site is comprised of four separate waste cells, and each was required to have its own collection well field. All four waste cells were linked to a common enclosed flaring system. Prepared the air quality permitting application for the flare systems. The recovery facilities design incorporated provisions for beneficial recovery of the gas for providing supplementary fuel to a nearby utility power plant.

Landfill Gas-to-Energy Projects Due Diligence Study, Georgetown and Sandtown, Delaware

Served as the lead technical advisor to O'Connell & Associates performing the due diligence study of landfill gas to energy projects to assess the long term landfill gas production capacity at two DSWA landfill sites. The Georgetown Landfill covers approximately 95 acres with 123 gas extraction wells and the Sandtown Landfill covers 102 acres with 91 gas extraction wells. The purpose of the study was to evaluate the technical feasibility of developing LFGTE facilities at the two regional landfills and establish gas recovery and power generation would be at commercially viable levels for the next 30 years. Tasks performed included site visits to inspect the gas recovery and flaring systems and gather background information, determination of historical and future projected waste input rates, modeling of gas generation and recovery rates, sensitivity analysis of gas recovery with varying assumptions of waste input and decomposition rates, projections of annual energy recovery volumes (mmBtu), and preparation of a comprehensive letter report with the results and conclusions.

Landfill Gas Migration Investigation, Acushnet, Massachusetts

As project manager, performed site investigation of gas migration from an adjacent landfill site to an apple orchard. Multiple monitoring programs were conducted and an in-depth report of gas migration programs was prepared for attorneys representing the orchard owner.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Landfill Gas Power Generation Facilities, Monroe/Livingston County, New York

As project manager, performed technical review of landfill gas power generation facilities at Waste Management of North America's landfill site. Responsibilities included third-party oversight of power plant construction which included four 900-kW LFG fueled engine-generators along with ancillary equipment, all housed in a block building.

Northampton Landfill Gas Controls, Northampton, Massachusetts

Directed the Stantec team for designing replacement flare system for the Northampton Landfill. Prepared a landfill gas generation study, including development of a gas generation and recovery model, to determine the appropriate size and performance criteria of the replacement flare system. The study recommended a 600 scfm enclosed flare unit and dual blower system with moisture knockout for the replacement flare system. Served as Senior Project Manager for development of final design plans and specifications suitable for construction of the replacement flare system. In addition to leading the design effort, oversaw the engineering activities for successfully securing regulatory approval of the replacement flare including preparation of an air quality permit application and landfill major modification permit application to MA DEP Western Regional Office. Close coordination by Stantec between the City and the operator of an LFGTE power plant at the site was vital during the design phase to ensure implementation of the replacement flare would work in harmony with the LFGTE facility and interruption of the existing flare operation would be minimized. Currently directing the construction management and inspection work for the replacement flare system. The flare was placed into initial service in late-June 2008.

Gas Migration Control Study; Westford Landfill, Town of Westford, Massachusetts

As project manager, performed routine monitoring of perimeter gas probes along the property boundary of the landfill site abutting residential development revealed gas migration above the regulatory threshold of 25% Lower Explosive Limit (LEL) was occurring. A comprehensive study was undertaken under the direction of Mr. Murphy to develop and evaluate alternative strategies for controlling migration. A multi-tiered approach was recommended based on an assessment of technical feasibility, environmental impacts, health and safety considerations, feasibility, and costs. Mr. Murphy made a formal presentation of the report findings to the Town and submitted the study to the Massachusetts DEP for their review and approval.

LFG Production Study for Scholl Canyon Landfill Site, Glendale, California

Mr. Murphy provided his expertise with the assessment of the production of landfill gas at the Scholl Canyon Landfill site for the purpose of projecting long term prospects for recovery at commercially viable levels. The Scholl Canyon Landfill is a 440 acre site owned and operated by the Los Angeles County Sanitation District (LACSD) with a design capacity of around 33.5 million tons. The landfill gas modeling and analysis were used by the client to make an informed decision about the feasibility of developing a landfill gas-to-electricity facility. The analysis of the compiled site data allow the development of the various parameters for the gas generation modeling and evaluation of recovery by the existing facilities. The parameters assessed included: Past and future waste deposition quantities; waste decomposability characteristics; site volume and in-place waste density; gas collection system effectiveness and efficiency.

The output from various modeling runs were presented in table and graphic form covering the start of landfill operations to 30 years into the future. The model projected recoverable landfill gas production of 5,500 standard cubic feet per minute (scfm) at 50% methane for upwards of 20 years making development of and gas-to-energy project attractive.

Regional District of Nanaimo - Landfill Gas Control Plant and Wellfield Operation and Maintenance Manuals Peer Review, Nanaimo, British Columbia, Canada

The Regional District of Nanaimo (RDN) owns and operates a landfill in Nanaimo, BC which includes a wellfield gas collection system for recovery of landfill gas and delivery to a control plant where the gas is either combusted in a reciprocating engine-generator set for electric generation or sent to a flare for destruction. RDN retained Stantec to review the Operation and Maintenance Manuals for the Landfill Gas Control Plant and Wellfield in order to provide an expert opinion on the adequacy of the systems in determining with reasonable accuracy the quantity of Greenhouse Gas (GHG) offsets associated with recovery and destruction/utilization of the LFG from the site. Mr. Murphy performed the peer review and assessment of the O&M Manuals which included the following tasks:

- *Evaluate equipment and systems installed for monitoring, measuring and recording characteristics and quantity of gas recovered at the Control Plant to be used for calculating GHG offsets and assess level of accuracy, reliability and robustness for validating the data required to meet finanancial reporting standards*

** denotes projects completed with other firms*

- *Assess the operation and maintenance practices described in the LFG Wellfield O&M Manual for their suitability, thoroughness and completeness to ensure continual effective and efficient LFG recovery*
- *Prepare a technical memorandum summarizing the findings from the O&M Manuals review, conclusions on adequacy of the proposed systems and procedures and recommendations for modifications to meet GHG offsets validation best practice requirements.*

Landfills / Solid Waste

Northampton Landfill - Phase 3A and Phase 3B Closure Projects, Northampton, Massachusetts

Mr. Murphy provided his expertise in Landfill Gas management engineering for the design and construction phases of the Northampton Landfill Phase 3A and Phase 3B closure projects. The capping of Phases 3A and 3B total approximately 7 acres and included installation of gas extraction wells and well heads heaters and external piping, condensate traps, and isolation valves. Mr. Murphy oversaw the design engineering design and construction documents preparation of the LFG management facilities and performed the QA/QC review for the submittals. Mr. Murphy was also involved in the construction phase of the closure projects that included reviewing shop drawing and submittals on the LFG related components, providing interpretations of contract documents and addressing conflicts and issues raised in the field.

Northampton Landfill – Phase 5 Expansion Design and Permitting, Northampton, Massachusetts

Project Manager leading the Stantec team efforts on the design and permitting of the 50-acre horizontal expansion to the Northampton Regional Sanitary Landfill. The expansion will increase the life of the site approximately 28 years at the projected filling rate of 50,000 tons per year. Engineering services performed under Mr. Murphy's direction on this project have included: evaluating the feasibility of operating the new landfill as a bioreactor to accelerate stabilization and enhance landfill gas production; conducting a detailed hydrogeological study of the physical and chemical characteristics of overburden, bedrock and groundwater conditions of the proposed expansion area; developing conceptual designs of the Phase 5 expansion cells with liner and final grading elevations and leachate collection system layout, preparation of a stormwater management master plan; and development of a Leak Response Plan for the expansion area along with cost estimates for the Financial Assurance Mechanism (FAM) necessary to implement the LRP.

Solid Waste Management Planning - MA Department of Environmental Management, Bureau of Solid Waste Technical Assistance Program*, Western Massachusetts

Project Engineer for development of solid waste management plans for designated regions and communities in Western Massachusetts under the Department of Environmental Management – Bureau of Solid Waste Technical Assistance Program. Solid waste management planning support services were provided to the regions of Lower Pioneer Valley and Franklin County and the individual communities of North Adams and Shirley. These communities were being faced with the required closures of their old unlined landfills and were in need of guidance and direction on options available to them for long term solid waste management. Mr. Murphy met with community leaders and regional officials to gather background information on current solid waste collection and disposal practices and to obtain data on future solid waste generation rates and characteristics. After reviewing the background information and data, assessments were made of the solid waste management needs for each region or community and evaluations of current applicable technologies for processing, recycling and disposal were prepared. Analyses of costs, environmental and socio-economic impacts were performed for each viable option. The findings, conclusions and recommendations from the investigations and assessments for the two regions and two individual communities were presented in separate reports to serve as guides on implementing solid waste management plans.

Solid Waste Alternatives Study, Northampton, Massachusetts

Overseeing the development of the Solid Waste Alternatives Study including directing efforts of a specialty subconsultant on the project, gathering and assessing background information on current waste generation conditions and management practices in the City by residents, commercial users and municipal functions, meeting with DPW officials to apprise them of findings and conclusions, and preparing documents for public presentation of the study. Mr. Murphy also prepared a landfill disposal rate sensitivity analysis to evaluate the costs and revenues associated with constructing and operating the landfill at various reduced waste filling rates to determine the breakpoint between positive revenue to the City and cost burden to the City. The results of the Solid Waste Alternatives Study will help guide the City Council in making a decision to either expand the landfill or opt for an out-of-town disposal option.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

Phase 4 Expansion, Northampton Landfill, Northampton, Massachusetts

As project manager of engineering services for the expansion of this landfill to fill the valley between a capped cell and an active phase, supervised various design activities and development of construction plans and specifications and prepared a DEP landfill expansion permit application. In addition to overseeing engineering services for the liner system, stormwater management, final grading, and slope stability, also evaluated impacts of the expansion on the active gas management system and prepared design details for extending and protecting the gas facilities.

Central Landfill Emergency Odor Control, Johnston, Rhode Island

As project manager, led a team formed by Stantec engineers, the site gas collection company field personnel, and RIRRC staff for the design, construction administration and start-up services to complete new gas collection and destruction facilities on a fast track basis to reduce odor complaints associated with the Central Landfill.
The rapid increase in generation on controlled landfill gas at the Central Landfill as a result of changing environmental conditions and growing expanse of the site without gas control had created nuisance odor conditions that needed to be addressed. Mr. Murphy was requested by RIRRC to develop and implement an emergency odor control program to abate the odor problems. The project team, led by Mr. Murphy, was able to reduce this project's odor complaints from several dozen per month to almost none.

In addition to the flare permit testing, Mr. Murphy was responsible for overseeing the operational activities of the landfill gas collection and recovery facilities pursuant to the monitoring and reporting requirements mandated by the DEP. Operational activities included monthly inspection and testing of the gas quality at 22 gas extraction wells, determining the total volume of gas recovered and flared each month, calculating the total volume of condensate collected and discharged, and evaluating the overall operating condition of the recovery and flaring equipment. Monthly reports are prepared in accordance with DEP requirements for the gas system operation.

** denotes projects completed with other firms*

John E. Murphy PE, BCEE

Senior Associate

PUBLICATIONS

SWANA's Landfill Gas 32nd Symposium. "*Improving Market Conditions for Landfill Gas to Energy to Make Smaller Landfill Sites Viable Candidates - A Case Study: Delaware County Electric Cooperative LFGTE Project*", 2008.

SWANA's 30th Annual Landfill Gas Symposium. *Landfill Gas Recovery and Control: Critical to the Successful Conversion of an Old Landfill to a Vibrant Retail Complex Reading Landfill - Reading Massachusetts*, 2007.

Inflow Investigation Techniques and Interpretations: Experience with a Large Community Collection System presented at the NEWEA Annual Conference - Boston, Massachusetts, 2004.

Design and Construction of Large Diameter Sewer Rehabilitation presented at the NEWEA Collection Systems Specialty Conference - Westford Massachusetts, 2002.

Grassroots Watershed Based Wetlands Planning, Paper for the ASCE 22nd Annual Conference of the Water Resources, 1995.