

**Document Type:** EA-Administrative Record  
**Index Field:** Environmental Assessment  
**Project Name:** Memphis Biogas Generation (PPA)  
**Project Number:** 2012-14

**POWER PURCHASE AGREEMENT FOR RENEWABLE  
ENERGY FROM BIOGAS - INSTALLATION OF  
GENERATING CAPACITY AT MEMPHIS WASTEWATER  
TREATMENT PLANT  
Shelby County, Tennessee**

**DRAFT ENVIRONMENTAL ASSESSMENT**

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March 2012

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## **Purpose and Need for Action**

The Tennessee Valley Authority (TVA) proposes to enter into a 20-year power purchase agreement (PPA) with the City of Memphis, Tennessee, to purchase electric power generated at the M. C. Stiles Wastewater Treatment Plant (WWTP) located on city property at 2303 North Second Street, Memphis, Tennessee 38217. This power would be generated by a new biogas-fueled engine and power generator at the proposed site. The City of Memphis would be responsible for construction and operation of the generation facility.

TVA produces or obtains electricity from a diverse portfolio of energy sources such as nuclear, fossil, hydro, solar, wind, and biomass. In order to help fulfill the objectives of its 2011 Integrated Resource Plan (IRP; TVA 2011) and 2008 Environmental Policy (TVA 2008), TVA has recently undertaken efforts to diversify and expand the contribution of renewable and low greenhouse gas-emitting sources in its generation portfolio. The purpose of the proposed PPA would be to assist in meeting these objectives.

The proposed facility would utilize biogas, which is primarily methane, as an energy source for generating electricity. Biogas is produced as a natural part of decomposition occurring during wastewater treatment. The biogas would otherwise be collected and combusted, as currently done, by flaring into the atmosphere, or sold commercially. The utilization of biogas for the production of electricity would qualify as a renewable power source. The more energy generated from renewable resources such as biogas, the less energy would need to be generated from nonrenewable resources such as fossil fuels.

## **Background**

The M. C. Stiles WWTP, operated by the City of Memphis, is a municipal wastewater treatment facility within the City of Memphis, Shelby County, Tennessee (Figure 1). The facility operates under Tennessee National Pollutant Discharge Elimination System (NPDES) Permit TN 0020211. The WWTP includes facilities (buildings, piping, valves, pumps, and two sludge lagoons) for water treatment and disposal of municipal sewage, as well as a collection and flaring system for biogas generated by the sludge lagoons. Discharge of treated wastewater from the facility is at Mississippi River Mile 738.8, at the confluence of the Wolf and Mississippi Rivers.

In 2006, the WWTP completed an upgrade of its biogas collection system. The WWTP currently has two 12-acre covered anaerobic wastewater lagoons. All the biogas is centrally routed from the collection system for this wastewater treatment process to a single point in the existing blower building. A portion of the biogas is currently sold to a local industry and the remaining gas is flared.

Under its Energy Efficiency Conservation Block Grant (EECBG) Program, the Department of Energy is supplying a grant (Project SW04010) of approximately \$ 1,772,399 for the project to add a 2-MW biogas-fired generation system at the WWTP. This amount constitutes the major portion, if not all, of the cost of the project. DOE has categorically excluded (DOE CX B5.1) the grant and project under their agency procedures for implementing the National Environmental Policy Act (NEPA). The DOE CX form and supporting information are provided as Attachment 1. TVA does not currently have an applicable categorical exclusion for the TVA decision to be made. TVA has, therefore, prepared this environmental assessment (EA) under NEPA and TVA's NEPA implementing procedures to assess the potential impacts of the proposal.



Figure 1. Location of M. C. Stiles Wastewater Treatment Plant in Memphis (Shelby County), Tennessee. Source Google maps 2012.

### **Other Environmental Reviews and Documentation**

This EA tiers from TVA's final environmental impact statement (EIS) for its Integrated Resource Plan (TVA 2011).

### **Permits, Licenses, and Approvals**

On September 12, 2011, the facility received Air Pollution Control Permit 00702-02PC (Attachment 2) from the Shelby County Health Department authorizing the construction and initial operation of the cogeneration unit/facility and establishing allowable emissions, opacity levels, monitoring requirements and use of pertinent best management practices (BMPs). The facility is

subject to the requirements of 40 CFR Part 63, Subpart ZZZZ, “National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines,” as well as the requirements for Generators that are applicable under the New Source Performance Standard (NSPS), 40 CFR Part 60, Subpart JJJJ, “Standards of Performance for Stationary Spark Ignition Internal Combustion Engines.” No other permits are required for the construction or operation of the proposed cogeneration facility.

### **Alternatives**

TVA is considering two alternatives: the No Action Alternative and the Proposed Action Alternative under which TVA would enter into a PPA to purchase power from the proposed facility. The action would result in the installation of a biogas-fueled engine system that would provide electric generating capacity from the facility. The study area for this EA includes the area where the reciprocating engine, new underground piping, and short transmission line for the interconnect would be installed.

#### **The No Action Alternative**

Under the No Action Alternative, TVA would not purchase power from the facility, and the biogas-fueled engine system would not be installed by the City of Memphis. The biogas produced by the WWTP would continue to be flared to the atmosphere or sold.

#### **The Proposed Action Alternative**

Under the proposed action, TVA would execute a PPA with the City of Memphis. Under the PPA, TVA would purchase electricity from the facility for a 20-year period. The Proposed Action would result in the installation of a 2.0 megawatt (MW) electric generating facility fueled by biogas produced in the wastewater treatment process at the M. C. Stiles WWTP. The WWTP presently burns biogas emitted from the wastewater using an open flare. An existing gas collection and control system (GCCS) in the WWTP and filtration systems to remove particulate matter would supply fuel in the form of biogas (methane). Implementation of the proposal would reduce the amount of biogas being incinerated in the flare or escaping directly into the air (i.e., fugitive emissions) and continue to reduce methane (a greenhouse gas) emissions from the facility. The average amount of methane produced (694.4 standard cubic feet per minute - scfm) at the WWTP would be adequate to support one engine/generating unit at a capacity factor of 90 to 100 percent. For purposes of analyses, it is assumed the generator could operate up to 8,720 hours per year (i.e., 100 percent capacity factor).

All construction activities would occur within the site previously cleared and leveled within the WWTP boundaries. The proposed additions and modifications include the following (Figure 2):

- The new biogas-fueled engine and generating unit (Cummins engine and Power Generator Model QSV1G, described in Attachment 3) and auxiliary system/controls would be installed inside an existing building (Figure 2) previously used for dewatering sludge; and a heat radiator, expansion tank and exhaust muffler placed just outside the building. An electrical power supply is already available to the building.
- A transformer (Figure 2) would be sited in the existing leveled graveled lot near the building.
- Three or four power poles and a power line would be placed from the transformer/generation building to the interconnect point with the existing 23-kV

Memphis Gas, Light and Water (MGLW) distribution line (about 300 feet across the existing WWTP facility property).

- A short underground supply pipeline (dashed red line in Figure 2) across the WWTP site would be constructed to carry biogas from the existing centralized gas collection point to the new generation equipment in the former sludge dewater building. The associated ground disturbance would occur in an existing roadway, drive and previously leveled storage area. No previously undeveloped land would be disturbed.

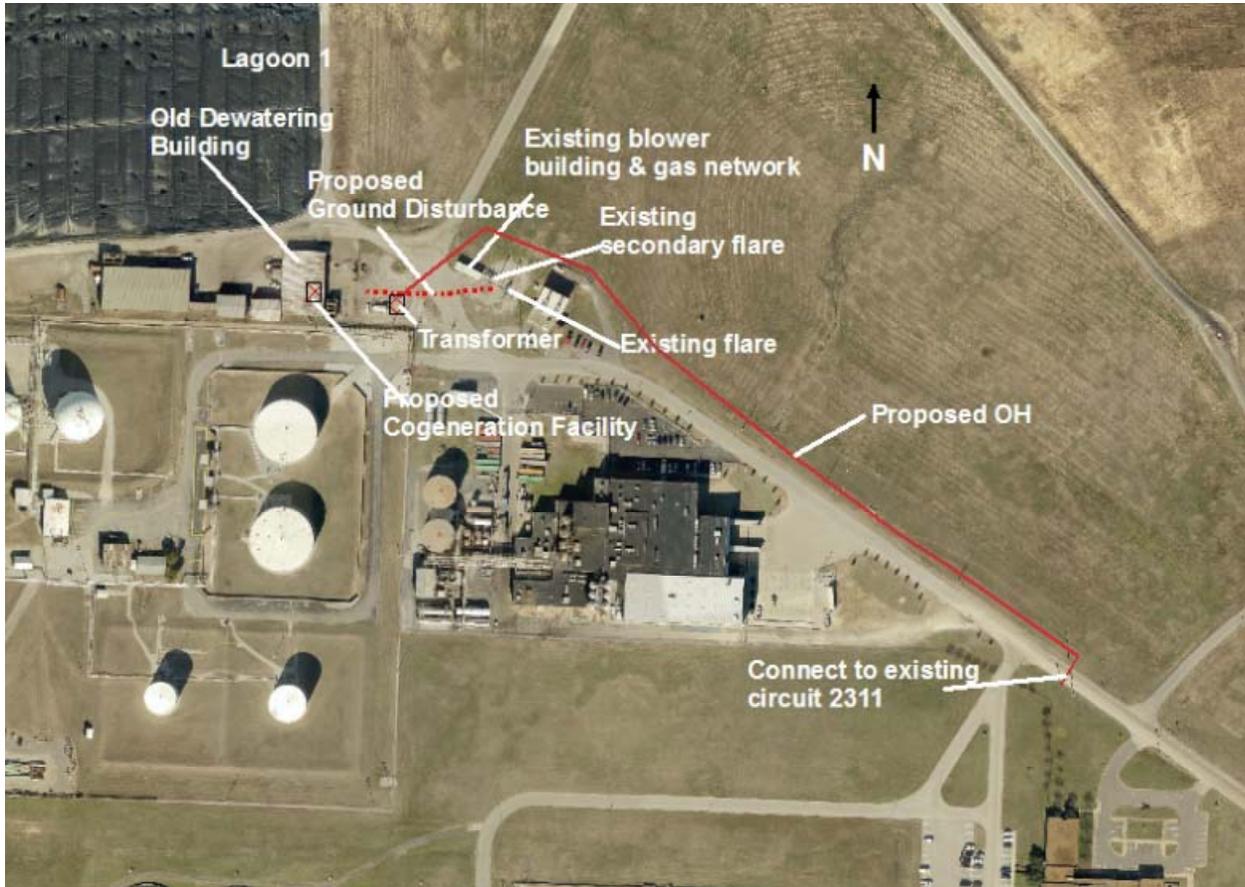


Figure 2. Project area modifications to support installation and operation of biogas-fueled generation capacity at the M. C. Stiles Wastewater Treatment Plant in Memphis (Shelby County), Tennessee

**Notes:** OH is an overhead transmission line. Circuit 2311 is the existing distributor power line.

### Comparison of Alternatives

Biogas is generated as a natural process occurring in the wastewater lagoons. Currently, the WWTP produces an average of 694.4 standard cubic feet per minute (scfm) of biogas. This gas would be created regardless of which alternative is selected for its use. The capacity of the existing flare is 2,500 scfm. Although it may operate 24 hours a day/7 days per week, the flare is not operating near its capacity. The difference between alternatives would be that for the No Action Alternative the biogas would continue to be flared to the atmosphere or sold. For the Proposed Action Alternative, the biogas would be used to run an engine and generator system

to produce power. The installation would modestly increase the secondary pollutant air emissions relative to the flare. However, overall biogas-fueled projects are considered environmentally favorable because they generally improve air quality when compared to emissions from other energy sources powered by nonrenewable fuel sources. Potential for all other incremental impacts to resources would be none for the No Action Alternative and none or minor for the Proposed Action Alternative.

For safety purposes, biogas producing facilities must have the capability to flare all of the biogas adequately, as if no biogas were being used in the engine. The flare is outfitted with pilot lights and auto re-light safety features in order to maintain a constant flame. These measures would continue to ensure air quality compliance in case of engine failure. Flares are also necessary to burn excess biogas in case more is emitted by the wastewater treatment than the engine can process at a given time. Any excess biogas that could not be processed by the engine would continue to be flared to the atmosphere or sold.

### **Preferred Alternative**

TVA's Preferred Alternative is the Proposed Action Alternative under which TVA would enter into a PPA with the City of Memphis to purchase power generated from the installation of the biogas-fueled, engine/generation system with a 2.0 MW capacity at the M. C. Stiles WWTP.

## **Affected Environment and Environmental Consequences**

### **Site Description**

The M. C. Stiles WWTP is located at the confluence of the Wolf River with the Mississippi River in Shelby County, Tennessee. The environ of the M. C. Stiles WWTP is a developed, highly altered and urbanized industrial, commercial and residential setting within the City of Memphis. Nearby facilities include an airport, municipal landfill, barge unloading facility and to the south across the mouth of the Wolf River is a high-density residential development. The project site itself has been extensively leveled and altered from natural conditions. On site the only natural vegetation feature remaining is an area of riparian trees and vegetation at the far southern edge near the mouth of the Wolf River and very small, intermittent patches along the Mississippi River.

### **Resources Not Adversely Impacted**

Through internal scoping of the proposed action, TVA has determined that wetlands, water quality, aquatic habitats and ecology, hazardous and non hazardous wastes, floodplains, cultural resources, threatened or endangered species and minorities as considered under environmental justice, would not be adversely impacted by the proposed project.

Wetlands. The proposed project is located within the Mississippi Alluvial Plain Ecoregion, (Omernick et al. 2011) of extreme western Tennessee. Forested wetlands are the dominant natural plant communities in this region. Within the proposed project footprint, however, there are no wetlands present and there would be no indirect, direct or cumulative impacts to wetlands from either the No Action or Proposed Action Alternatives. Therefore, the proposed action is consistent with Executive Order (EO) 11990 Protection of Wetlands.

Water Quality, Aquatic Habitats and Ecology. The area where the proposed generation facility would be placed has been previously and substantively disturbed from natural conditions during the original site preparation phase of constructing the WWTP. The project site is already cleared of natural vegetation, meaning that an increase of storm water runoff from an increase

in impervious surface area from the proposed facilities would be none to minimal. No watercourses were identified within the project area. As such, installation of the biogas-fueled reciprocating engine and ancillary equipment at the WWTP would not involve significant disturbances as compared to present conditions. During construction, ground disturbance would be minimized and all work done in accordance to construction best management practices, which should effectively preclude off-site direct, indirect or cumulative effects to water quality, aquatic habitats or aquatic ecology.

Hazardous and Nonhazardous Wastes. The M. C. Stiles WWTP does not handle hazardous waste or biohazardous waste materials. Since no hazardous materials are accepted, they are not a component of the emitted biogas. No new hazardous secondary pollutants are expected to be generated by increased engine combustion of biogas, as opposed to continuing to combust biogas with the present flare configuration. The Proposed Action Alternative would not directly, indirectly or cumulatively affect present WWTP wastewater disposal operations.

Floodplains. A review of FEMA Flood Insurance Rate Maps indicates that the project location and the WWTP itself are outside the 500-year floodplain. This review and determination of no effect for both the No Action and Proposed Action Alternatives satisfies the requirements for compliance with EO 11988, Floodplain Management.

Cultural Resources. The construction and operation of the M. C. Stiles WWTP has resulted in significant ground disturbance including mechanized vegetation removal and deep excavation, in addition to deposition and compaction of soils. For the proposed undertaking, the Area of Potential Effect (APE) for archaeological resources consists of the footprint of the construction of the short on-site gas line from the existing biogas collection point and flare site to the proposed engine within the existing former sludge dewatering building and the three to four power poles necessary for interconnection to the existing MGLW electric service. The APE for historic architectural resources consists of a 0.5-mile radius surrounding the proposed power generation unit.

Under the No Action Alternative there would be no ground disturbing activities. Therefore, there would be no potential for effects to cultural resources.

Under the proposed action, ground disturbing activities would include all excavation and grubbing during construction and installation of the reciprocating engine, new underground piping, and a short transmission line for the interconnect. However, because the APE for archaeological resources has undergone substantive ground disturbance due to the construction and operation of the M. C. Stiles WWTP and has no intact archaeological deposits, these activities have no potential to affect historic properties. In addition, there are no historic architectural resources within the 0.5-mile radius APE. By letter of November 10, 2010 (Attachment 4), the Tennessee State Historic Preservation Officer has indicated that there are no National Register of Historic Places listed or eligible properties affected by this undertaking.

Threatened or Endangered (T&E) Species. The organisms with the most potential (albeit very low) for occurrence on the WWTP site are listed terrestrial plants. However, a February 2012 review of the TVA Regional Natural Heritage database indicates that no federal and one state-listed plant species (goldenseal) are known from within five miles of the M. C. Stiles WWTP in Shelby County, Tennessee. Habitat to support the goldenseal does not occur within, or adjacent to, the action area. No designated critical habitats for plant species are known from within five miles of the proposed project. No populations of rare plants have been reported to occur within the footprint of the M.C. Stiles WWTP facility. However, more than five miles north

of the project area, (within the same Ecoregion), are three state-listed species that have the potential to occur within the peripheral areas of, or adjacent to, the WWTP facility (but not within the project area). These three species (cedar elm - state special concern, copper iris - state threatened, and creeping spot-flower - state special concern) are common coastal plain species that have expanded northward

Even though potential habitat for the three state-listed plant species is present along the southern periphery of the property or along the narrow strip of remaining intermittent riparian vegetation along the property boundaries of the WWTP, the footprint of the proposed action area has been previously cleared of vegetation for facility construction and operation. The location for proposed new minor construction activities would be unlikely to harbor rare plant populations. No direct, indirect or cumulative impacts to T&E plant species are expected as a result of adopting either alternative.

A review of the TVA Natural Heritage database during February 2012, indicates that one federally endangered (Interior least tern), one federally threatened (Piping plover), and one federally protected (Bald Eagle) terrestrial animal species have been reported from Shelby County, Tennessee, and two state-listed species (Mississippi kite and Swainson's warbler) reported from within five miles of proposed activities.

Under the No Action Alternative, the actions associated with construction or operation of the generation facility supported by biogas for the WWTP or the transmission of the power generation and transport of power by biogas would not occur, and there would be no project-related impacts to protected wildlife populations or habitats due to TVA actions.

Potentially suitable habitat for the least tern and piping plover occurs on the WWTP site at the shallow ponds north of the covered anaerobic wastewater lagoons. No suitable habitat for these or other listed aquatic or terrestrial animal species occurs in the immediate vicinity of the components of the proposed generating facility. No designated critical habitat for federally protected species exists within the project area. The proposed actions are not expected to directly, indirectly, or cumulatively impact federally or state-listed terrestrial animal species, or their habitats.

As there would be no off-site effects to aquatic habitats or ecology under either alternative, there would be no direct, indirect, or cumulative impacts to federally or state-listed aquatic species or their habitats as a result of the implementation of either alternative. The requirements of Section 7 of the Endangered Species Act are, therefore, satisfied.

Environmental Justice. Although under the Proposed Action Alternative there would be a temporary increase of workers during installation of the engine/generator system, that work would not create or remove any permanent jobs at the WWTP or have other potentially major effects. There would be no change in current operations of the WWTP which could substantively affect nearby residences as a result of this project. Therefore, it would not cause any disproportionate effects on low-income or minority populations in Shelby County as described in EO 12898 (federal actions to address environmental justice in minority populations and low-income populations). TVA is not subject to this Executive Order, but it considers environmental justice impacts as a matter of policy.

## Resources Minimally Impacted

The project's potential impact on air quality, terrestrial plants, and potential for proliferation of invasive plants, terrestrial animals, noise, transportation and visual aesthetics were found to be minimal and insignificant. These resources are evaluated in the following sections. This review and determination of a no effect satisfies the requirements of EO 13112, Invasive Species; EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds; and EO 11514, Protection and Enhancement of Environmental Quality.

Air Quality. Through its passage of the Clean Air Act (CAA), Congress has mandated the protection and enhancement of our nation's air quality resources. National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants have been set to protect the public health and welfare:

- sulfur dioxide (SO<sub>2</sub>),
- ozone (O<sub>3</sub>),
- nitrogen dioxide (NO<sub>2</sub>),
- particulate matter whose particles are <= 10 micrometers (PM<sub>10</sub>),
- particulate matter whose particles are <= 2.5 micrometers (PM<sub>2.5</sub>),
- carbon monoxide (CO), and
- lead (Pb).

As of January 19, 2012 (Electronic CFR, Title 40. Part 81. Designation of Areas for Air Quality Planning Purposes), air quality in Shelby County, Tennessee, is classified as in attainment status for small particulate matter (PM<sub>2.5</sub>) and ozone levels (the 8-hour standard), as well as for all other (NAAQS). The WWTP facility is not classified as a major hazardous air pollutant (HAP) facility, and the installation of a generating engine would not change its classification.

The M. C. Stiles WWTP currently operates under provisions of Tennessee Department of Environment and Conservation (TDEC) Operating Air Permit No. 00702-01P, issued by TDEC on March 3, 1999. In September 2009, an application for a new permit was submitted. Since a new permit has not been issued, the WWTP is operating under the original permit. The WWTP produces non-methane organic compounds (NMOCs) that require collection and flaring of biogas, and has installed a biogas collection system and a 2,500-scfm flare station. The flare is currently operated continuously; however, it is not operating near its capacity as the wastewater lagoons produce about 694 scfm.

Other regulatory considerations for air quality include the following. As the WWTP is located in an attainment county; Nonattainment New Source Review (NSR) rules do not apply. The current facility is not subject to emission standards for hazardous air pollutants (NESHAPs), codified in 40 CFR Parts 61 and 63. The proposed cogeneration facility will be subject to 40 CFR, Part 63, Subpart ZZZZ, "National Emissions Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines," and the New Source Performance Standard, 40 CFR Part 60, Subpart JJJJ, "Standards for Performance for Stationary Spark Ignition Internal Combustion Engines".

Biogas emissions from WWTPs are a natural part of the breakdown of waste. In an uncontrolled state, this biogas would off-gas from the wastewater treatment process to the

atmosphere as gas formed from the decomposition process. Biogas is comprised primarily of methane, CH<sub>4</sub>, and carbon dioxide, CO<sub>2</sub>, formed by bacteria breaking down the waste material during the decomposition process. Non-methane organic compounds (NMOCs), nitrogen oxides, and carbon monoxide, are secondary pollutants which result from combusting methane (either in the existing flare or the proposed engine), and can react chemically in the atmosphere to form ozone [40 CFR Part 52, §52.21(b)]. Nitrogen oxides and sulfur dioxide can react chemically to form PM<sub>2.5</sub>. Less than 1 percent of biogas is NMOCs (USEPA 2010a).

Methane, or CH<sub>4</sub>, is a compound of concern to air quality because of its potency as a greenhouse gas. When compared to CO<sub>2</sub>, methane is approximately 21 times more powerful in its ability to warm the atmosphere (USEPA 2010a). Biogas containing methane is also an odor nuisance; a health hazard and is potentially explosive in high concentrations. Because of these properties, operators at WWTPs, such as M. C. Stiles, maintain methane concentrations at safe levels by collecting and flaring the methane as it is released from the wastewater processing lagoons. This combustion (i.e., burning) breaks methane down into water, nitrogen oxides, and carbon monoxide. Other by-products of combustion compounds in the biogas may be sulfur dioxide and particulate matter. The proportions of these later chemical compounds depend on the material decomposed to initially form the biogas.

Under the No Action Alternative, the reciprocating engine/generator system for electrical generation would not be installed. Methane and other volatile compounds being emitted from the WWTP would continue to be produced and the total amount of biogas produced annually would remain about the same, unless the WWTP capacity was increased. The WWTP would continue to operate the flare. Combusting biogas in flares achieves the same methane safety goals as combusting biogas in an engine system, but would not utilize the energy available within the gas source.

Under the Proposed Action Alternative, a biogas-to-energy system would be installed. The biogas system will meet requirements of all applicable air quality regulations, as described in the two aforementioned regulations. Emissions from both the flare and the spark ignition reciprocating engine operating under this alternative are characterized in Table 1. The small levels of emissions indicate that the effects from these emissions would be minor and insignificant.

Biogas utilization projects are considered environmentally favorable because they improve air quality (USEPA 2010b). This result accrues from the direct reduction of methane emissions; an indirect reduction or avoidance of carbon dioxide emissions from the replacement of fossil fuels burned, and total greenhouse gas reductions. Combustion by either the flare or engine would constitute controls on the WWTP emissions (Table 2). The combustion of both fossil fuels and biogas produce carbon dioxide; however, the USEPA does not consider carbon dioxide emitted from biogas projects to be a climate change contributor, "because the carbon was contained in recently living biomass and would have been emitted through the natural decomposition process" (USEPA 2010b). Therefore the carbon dioxide found in biogas is considered biogenic. Also, as methane is a greenhouse gas that has an effect on the atmosphere 21 times that of carbon dioxide, the conversion of methane to carbon dioxide by a biogas project would reduce potential effects related to total greenhouse gas emissions (Table 2). Biogas projects also enhance air quality by reducing volatile organic compound emissions.

**Table 1. M.C. Stiles WWTP Emission Summary (ton/yr)**

Source	VOCs <sup>1</sup>	CO	PM <sup>2</sup>	NO <sub>x</sub>	SO <sub>2</sub>
2,500-SCFM Flare	Minor, variable emissions which currently meet all CAA standards and Air Permit requirements.				
Fugitive Particulate	NA	NA	insignificant	NA	NA
CAT G3520C Engine <sup>3</sup>	6.27	60.0	0.82	13.63	0.23

**Notes:**

<sup>1</sup>Value for VOCs is non-methane hydrocarbons (NMHC)

<sup>2</sup> PM includes particles finer than 10 microns.

<sup>3</sup>Under normal operations and current biogas generation, the engine should be able to handle all of the biogas. These emission levels are minor and also readily meet all applicable CAA standards and requirements for the new Air Permit.

**Table 2. Greenhouse Gas Emissions (methane and carbon dioxide) from Sources at M. C. Stiles WWTP in Tons/Year**

Greenhouse Gas	Emission without Controls <sup>1</sup>	Emission with Controls <sup>1</sup>	Change in Emissions with Controls <sup>1</sup>
Carbon Dioxide			
Methane	4,599		
Total <sup>2</sup> CO <sub>2</sub> eq	96,579	9,218	- 87,361

**Notes:**

<sup>1</sup> Controls include either or both combustion in the flare or the engine powering the generator. Uncontrolled means that the biogas was neither combusted in the flare or the engine.

<sup>2</sup> Total CO<sub>2</sub> equivalents were calculated using equations provided in 40 CFR Part 98 – Mandatory Greenhouse Gas Reporting. The biogas annual production is 365 million cubic and it was assumed to contain about 43% methane.

The installation of the reciprocating engine could slightly increase the secondary pollutant emissions relative to the flare. These minor levels of emissions assume that the engine is operated near maximum load continuously. At the current gas generation of 1 million cubic feet per day (694.4 cfm) and a lower heating value of 400 British thermal units (Btu) per standard cubic feet (scf), the engine can burn all of the biogas (at maximum load the engine burns 768 cfm of gas). The increases in the emissions of the secondary pollutants would be associated with a decrease in the levels of any methane escaping from the WWTP as decomposition continues in the wastewater treatment process. Overall, this situation would be a benefit in view of methane's high potency as a greenhouse gas; although the quantity would be insignificant.

The generation of the minor amount of secondary emissions would also be somewhat compensated for by the decreased need to burn fossil fuels for this amount of power generation (up to 2.0 MW of new power generation). This benefit from the proposed project would be minor. Air quality compliance with standards prescribed under the federal CAA and TDEC regulations would continue to be achieved for the operation of the flare and the proposed generator engine. Compliance with applicable permit limits and mitigation measures would also assist in maintaining the minor nature of direct, indirect, and cumulative impacts to air quality.

Terrestrial Plants. Within the footprint of the proposed action, nearly all of the native vegetation has been cleared from the WWTP site. The remaining landscape is graveled lots, paved surfaces, and mown lawns with minor amounts of areas with herbaceous weedy species. The WWTP is situated within an urban setting within the City of Memphis

More broadly considered, the M. C. Stiles Wastewater Treatment Plant in Shelby County, Tennessee, is located within the Mississippi Alluvial Plain Ecoregion, which extends from southern Illinois, at the confluence of the Ohio River with the Mississippi River, south to the Gulf of Mexico (Griffith et al. 1998). Bottomland hardwood forests and cypress swamps, also referred to as forested wetlands, are the dominant natural plant communities in this region. A key factor in the development and maintenance of these communities is their ability to survive extended periods of flooding. Much of the land use within the broad region is agricultural, with some areas of deciduous forest. According to Griffith et al. (1998), soybeans, cotton, corn, sorghum, and vegetables are the main crops. Before cultivation, this area was covered by bottomland deciduous forest with an abundance of green and Carolina ash, elm, cottonwood, sugarberry, sweetgum, and water tupelo, as well as oak and bald cypress. Pecan is also present, associated with eastern sycamore, American elm, and roughleaf dogwood.

No additional direct, indirect or cumulative impacts to terrestrial plant communities or habitats would be expected as a result of either the Proposed Action or No Action alternative, since: 1) the action area has been previously cleared of all native vegetation, 2) no rare habitats or communities are found within the WWTP footprint.

Invasive Plants. Essentially all of the area associated with the M. C. Stiles WWTP has been modified by human disturbance and invasive species are expected to occur throughout the property. Executive Order 13112 defines an invasive species as any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem; and whose introduction does, or is likely to, cause economic or environmental harm or harm to human health (USDA 2007). Invasive plants occur as trees, shrubs, vines, grasses, ferns, and forbs. Some have been introduced into this country accidentally, but most were brought here as ornamentals or for livestock forage. These robust plants arrived without their natural predators of insects and diseases that tend to keep native plants in natural balance. According to Morse et al. (2004), invasive non-native species are the second leading threat to imperiled native species.

According to EDDMapS (2012), 179 exotic invasive plant species are reported from Shelby County. None of these species are presently listed as Federal Noxious Weeds (USDA 2007). Grasses such as Bermuda, blue, brome, cheat, foxtail, Johnson and vasey should be expected to occur within the vicinity. Common weedy forbs would include blue mustard, clovers (hop, red, white and yellow sweet), pepperweed, pineapple weed, puncture vine, red sorrel, smallseed false flax and several species of wild mustards.

Under the No Action Alternative, invasive plant species would continue to be spread in the area of disturbance around the M. C. Stiles WWTP facility. Under the Proposed Action Alternative there would be additional minor disturbance to the soil during construction of the gas line from the blower building to the generator building and the setting of three of four single power poles. Therefore, there is a minor potential for the introduction and spread of invasive plant species to the site and surrounding areas (USDA 2007). Because of the highly developed nature of the area to be disturbed; the continued maintenance of affected areas as gravel and paved surfaces or as maintained lawn areas; and the minor degree of potential disturbance, there are no special mitigation measures required.

Terrestrial Animals. The proposed activities would take place in a heavily modified landscape dominated by a large WWTP and its associated roads, graveled lots, maintained lawns, buildings and other facilities. The project site itself has been extensively leveled and altered from natural conditions. Within the footprint of the proposed action, native vegetation has been cleared and all that remains are graveled lots, paved surfaces, and maintained lawns (herbaceous habitat). Well to the south of the project area, but on the WWTP (near the mouth of the Wolf River), are patches of mixed-deciduous forest, early successional patches used as right-of-ways, hedgerows, other edge habitats and a riparian area. No caves or wading bird colonies have been documented within three miles of the proposed project area. The shallow ponds on the WWTP site located north of the covered anaerobic wastewater lagoons support several species of shorebirds from early spring through fall. A nesting population of the black-necked stilt, whose breeding range in Tennessee is restricted to a few sites near the Mississippi River, occurs on these ponds. No other unique terrestrial habitats are known to occur within five miles of the proposed project.

Common bird species capable of utilizing the predominant herbaceous habitat in the form of maintained lawns include eastern meadowlark, field sparrow, song sparrow, Indigo bunting, wild turkey, red-winged blackbird and other colonial blackbirds, Carolina wren, and mourning dove. White-tailed deer, eastern cottontail, striped skunk, and rodents such as white-footed mouse are mammals frequently associated with early successional habitats of this type. Reptiles that can be found in this habitat include northern black racer and black rat snake. Amphibians that utilize vernal pools in open, herbaceous habitat include spring peeper and upland chorus frog.

Under the No Action Alternative, the proposed actions would not occur, and biogas would continue to be flared into the atmosphere. There would be no project-related impacts to wildlife populations or habitats due to TVA actions.

Under the Proposed Action Alternative, the proposed project area would occur on an already disturbed site, where habitat present and available for use by terrestrial wildlife is limited to herbaceous vegetation (maintained lawn). Any wildlife currently using the project area may be temporarily displaced due to construction activities, but would likely return after construction is complete. The shallow ponds used by shorebirds would not be affected. This alternative is not expected to directly, indirectly, or cumulatively result in significant impacts to terrestrial wildlife or their habitats.

Noise. Ambient noise already includes that of a typical urban, industrial area, and operating WWTP with multiple interstate routes running within hearing distance. The WWTP is not the dominant source of noise in the vicinity. Under the No Action Alternative there would be no change to existing noise conditions.

Under the Proposed Action Alternative the addition of the reciprocating engine system would modestly increase noise generation at the WWTP. The closest private residence to the engine container is about a half mile away, across the mouth of the Wolf River. In a free-field state (i.e., a situation where there is no reflection of sound), the additional mechanical noise would be 85 decibels, A-weighted (dBA), at a distance of 23 feet from the engine (Attachment 4). Since the engine would be enclosed within a building, the majority of this sound would mostly be attenuated by the enclosing structure. Employees would wear standard hearing protection per Occupational Safety and Health Administration (OSHA) requirements.

Stack exhaust would be vented to the outside of the building, so a portion of this noise could, however, be audible outside. Worst case, in a free-field environment where nothing is reflecting, absorbing, or blocking sound, a source's noise level decreases by about 6 dBA every time the distance from the object is doubled (The Engineering Toolbox 2010). This means that at a distance of 200 feet from the engine and exhaust stacks, the engine (if unenclosed by the building could generate about 16 decibels (dB), and the exhaust could generate about 36 dB of sound if the equipment had no shielding or muffling. These noise levels are considered faint to moderate. In comparison, busy nearby traffic would create approximately 80 dB (American Speech-Language-Hearing Association 2003) in close proximity to the highways. The enclosing of the engine/generator within the building; the distance of approximately 4,000 feet to the nearest residential receptors (and farther to the Memphis Greenbelt Park) across the Wolf River; as well as, the intervening buffer screen of riparian vegetation along both banks of the Wolf River would provide more than sufficient attenuation of noise to low levels such that no additional noise reduction systems would be necessary. Because of the low level of additional noise generated, and proximity of the project location to the active WWTP, the minor additional sound would not significantly alter the environment from its present noise conditions.

Transportation. Under the No Action Alternative there would be no additional project related activity and no transportation effects. Under the Proposed Action Alternative, the new engine and generator (Attachment 3) would be shipped in a container, weighing approximately 20,705 pounds. The container would be moved to the project site using a commercial trailer truck on the existing local road network. There would be a minor temporary increase in the number of workers at the site during installation, for a period of one or two weeks. This would be a minor increase in vehicle traffic compared to the normal busy traffic route of trucks coming in and out of the industrial area and WWTP.

Visual Aesthetics. As noted earlier, the proposed project area is situated within the City of Memphis in Shelby County, Tennessee, at the confluence of the mouth of the Wolf and Mississippi Rivers at about MRM 738.8. There are buildings and appurtenances on the site that support the WWTP operation, as well as a flare stack that burns excess gas generated from the waste. Topography in the area is gently sloping. The existing scenic attractiveness is common to minimal and the scenic integrity ranges from moderate to very low. The WWTP is setback an entrance roadway off a secondary road (Second Street) about one mile west of US 51 and SR 3, three miles northwest of the junction of Interstates 40 and 69 and about two miles north of the Mississippi River bridge crossing of Interstate 40. Because of the river configuration and screening by riparian vegetation, the WWTP is visible only from Second Street, a short segment of far western Whitney Avenue and distantly from a portion of the I-40 bridge. It is predominantly screened from view along North Mud Island Road that serves as the primary access to the noted residential area south and across the mouth of the Wolf River. The remaining riparian vegetation on both sides of the mouth of the Wolf River also screens the WWTP from the residential area. Second Street and the western end of Whitney Ave serve as

the road access to the developed industrial/commercial area in which the WWTP is located. The area is otherwise a sparsely populated industrial area.

Under the No Action Alternative, TVA would not execute the agreement with the City of Memphis and the facility would not be built. Current operations of the WWTP would continue and no changes would occur to the existing scenic value.

Under the Action Alternative, TVA would agree to purchase power from the City of Memphis and the generation facility would be built as described. The new construction would generally not be visible from public roads and residences in the vicinity due to the existing vegetation and topography. Views available at the interior of the site would remain in context with the existing levels of development and landscape character. Increases in traffic would be temporary and indiscernible during construction phases of the project. With the only visible alterations being the siting of a short on-site power line and an external transformer, at completion and during operation of the proposed facility, there would be only minor impacts to existing scenic resources.

### **Mitigation Measures**

Due to the minor nature of air emissions and low potential for substantive environmental impacts (none to minor and insignificant for the various other resources), other than use of standard BMPs for construction activities, TVA does not require any mitigation measures for this project.

Additionally, TDEC regulates emissions, imposes compliance requirements, and ensures monitoring compliance. Emissions from the engines, flares, exhaust stacks, and WWTP must remain within acceptable air quality levels and be monitored at regular intervals, as prescribed in regulations promulgated under CAA and state requirements. Under those requirements, the flare must operate with a flame present at all times, and the presence of the flame or a pilot flare must be monitored using a thermocouple or similar device. In addition to the thermocouples, a continuous flow meter, an automatic relight system with a propane pilot supply tank, and a backup temperature controller would also be installed. The flares must have the capacity to handle all of the biogas captured by the system in case of engine failure.

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**Acronyms and Abbreviations**

APE	Area of Potential Effect
BMPs	Best Management Practices
CO <sub>2</sub> eq	Carbon Dioxide Equivalent
CAA	Clean Air Act
dB	Decibels
dBA	Decibels, A-weighted
EA	Environmental Assessment
EO	Executive Order
GCCS	Gas Collection and Control System (GCCS)
HAP	Hazardous Air Pollutant
MACT	Maximum Achievable Control Technology
MDEC	Mississippi Department of Environmental Quality
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NMOCs	Non-Methane Organic Compounds
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NSR	New Source Review
PM <sub>2.5</sub>	Small Particulate Matter
PPA	Power Purchase Agreement
PSD	Prevention of Significant Deterioration
scfm	Standard Cubic Feet per Minute
SR	State Route
TDEC	Tennessee Department of Environmental and Conservation
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency

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### **Figures**

Figure 1 Location and Vicinity of Project. Source Google maps 2012

Figure 2. Layout of M.C. Stiles Wastewater Treatment Plant and Modifications Associated with the Proposed Action

### **Attachments**

Attachment 1 - DOE Categorical Exclusion form and supporting information

Attachment 2 - Air Pollution Control Permit for the Biogas Generator

Attachment 3 - Generator Specifications

Attachment 4 - Correspondence from Tennessee State Historic Preservation Officer