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POWER PURCHASE AGREEMENT FOR RENEWABLE ENERGY FROM LANDFILL GAS - INSTALLATION OF GENERATING CAPACITY AT THE WEST CAMDEN SANITARY LANDFILL ENVIRONMENTAL ASSESSMENT

Benton County, Tennessee

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Purpose and Need for Action

The Tennessee Valley Authority (TVA) proposes to enter into a power purchase agreement (PPA) with Waste Management Renewable Energy LLC (WMRE) to purchase electric power generated at the West Camden Sanitary Landfill in Benton County, Tennessee (Attachment 1) over a 20 year period. This power would be generated by three landfill gas (LFG)-powered reciprocating engines WMRE proposes to build at the landfill site.

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), 2007 Strategic Plan, and 2008 Environmental Policy, TVA has recently undertaken efforts to expand the contribution of renewable and low greenhouse gas-emitting sources in its generation portfolio.

LFG is generated as a natural part of landfill waste decomposition. The utilization of LFG from biomass for the production of electricity would qualify as a renewable power source. The more energy generated from renewable resources such as LFG, the less energy would need to be generated from nonrenewable resources such as fossil fuels. The proposed generating facility would utilize LFG as an energy source for generating electricity, which would otherwise be combusted by flares into the atmosphere.

The West Camden Sanitary Landfill is on private land and the generation facility would be constructed and operated by WMRE. TVA has prepared this environmental assessment (EA) under the National Environmental Policy Act (NEPA) and TVA's NEPA implementing procedures to assess the potential impacts of the proposal.

Proposed Action

Under the proposed action, the TVA would execute a PPA with WMRE that would result in the installation of a 4.8 megawatt (MW) electric generating facility fueled by LFG from the West Camden Sanitary Landfill. The PPA would allow TVA to purchase electric power for a 20-year period. The landfill is operated by WMRE. It presently has an open flare which burns excess LFG emitting from the decomposing buried waste. It is connected to a gas collection and control system (GCCS) in the landfill, and filtration systems to remove particulate matter which would also supply fuel in the form of LFG.

The installation of three reciprocating engine systems would result in an electric generating capacity of 4.8 MW at the landfill. Implementation of the proposal would reduce the amount of LFG being incinerated in the flare or escaping directly into the air (i.e., fugitive emissions) and reduce methane (a greenhouse gas) emissions from the landfill (Attachment 2). The new generating units would be placed within a 6,608 square foot (sq ft) building immediately adjacent to the landfill. The site is on a previously disturbed reclaimed landfill within the landfill boundaries. The proposed additions and modifications include the following:

- Construction of facility site including: a structural fill to level the site, road entrance, water and electric service, and gas line and perimeter road extension from the existing LFG collection and flare site (Attachment 3).

- Construction of a 6,600 sq ft building with capacity for four generation units which includes three proposed generators and space for one future generator.

- Installation of three power generation units, which are rated at 2,233 horsepower at 100 percent load and have a heat input of 17.85 million (MM) British thermal units (Btu) per hour per engine (Attachment 4). Each unit would consist of one Caterpillar Model G3520C reciprocating internal combustion engine, one electrical generator, auxiliary systems to connect with the GCCS, a filtration system to remove particulate matter, a treatment system to compress and dehydrate the gas before use, and connectors to the existing open process flare for control of excess gas.

- The existing 4,000 standard cubic feet per minute (scfm) open flare would be replaced with another open flare of the same capacity. The replacement 4,000 scfm flare would be located closer to the generating units to allow for better vacuum to be applied to the GCCS.

Background

West Camden Sanitary Landfill, operated since 1994 by Waste Management, Inc., is a municipal solid waste disposal facility near Camden, Tennessee. The previous Benton County landfill had reached its capacity to handle more refuse and was closed. The newer landfill has been operating a gas collection and control system with an open utility flare for gas combustion since 1997. The flare of the LFG combusting system is operated with a flame present at all times. The current capacity of this landfill after a 2002 expansion is over 19 MM cubic meters of storage volume. The former Benton County landfill was included in the 2002 expansion; it was later excavated and the material was placed in the new landfill. Currently, 162 acres of the West Camden Sanitary Landfill facility are permitted for solid waste disposal.

Benton County, Tennessee's air quality is in attainment status for small particulate matter ($PM_{2.5}$) and for ozone levels (the 8-hour standard).

The area where the proposed generation facility would be built has been previously disturbed during the site preparation phase of constructing the landfill and the reclamation of the previous Benton County landfill.

Presently, the LFG being collected from the West Camden landfill is being incinerated using an open flare unit. The United States Environmental Protection Agency (USEPA) estimates that a LFG-to-energy (LFGTE) project can capture 60-90 percent of the LFG being emitted from a landfill; the remainder escapes as fugitive emissions to the atmosphere (USEPA LFG Energy Project Development Handbook). As solid waste continues to be added to the landfill and the existing and future waste decomposes, more LFG will be generated. The facility is not classified as a major hazardous air pollutant (HAP) facility and the installation of generating engines would not change that classification.

Other Environmental Reviews and Documentation

This EA tiers from TVA's IRP final environmental impact statement (EIS), titled *TVA's Environmental and Energy Future* (TVA 2011).

Permits, Licenses, and Approvals

The landfill facility is subject to the New Source Performance Standards (NSPS) requirements of 40 CFR 60, Subpart WWW for Municipal Solid Waste Landfills. This facility is also subject to the Maximum Achievable Control Technology (MACT) requirements of 40 CFR 63 Subpart AAAA – National Emission Standards for HAP: Municipal Solid Waste Landfills.

Prevention of Significant Deterioration (PSD) permits are required from the Tennessee Department of Environment and Conservation (TDEC) in order to restrict emissions from new or modified sources in places where air quality already meets or exceeds primary and secondary ambient air quality standards.

WMRE applied for (Attachments 5 and 6) and obtained (Attachment 7) a new Title V Operating Permit and a PSD Permit for three reciprocating engine systems from TDEC, Tennessee Air Pollution Control Board. The application had a 45-day public comment period commencing on December 24, 2009.

Alternatives

The study area for this EA includes the area where the three reciprocating engines would be installed. TVA considers the archaeological area of potential effect (APE) to be the footprint of the proposed facilities at the land fill site where ground disturbance would occur and the architectural APE to be a 0.5-mile radius around the proposed new facilities.

TVA is considering two alternatives: the No Action Alternative and an Action Alternative where TVA would enter into a power purchase agreement that involves installation of three LFG- fueled engine systems that would provide electric generating capacity from the facility.

The No Action Alternative

Under the No Action Alternative, TVA would not purchase power from the facility, and three LFG-fueled engine systems likely would not be installed by WMRE. The excess LFG produced by the landfill would continue to be flared to the atmosphere at up to 4,000 scfm.

The Action Alternative

Under the Action Alternative, TVA would enter into a PPA to purchase electric power generated from the proposed WMRE facility. Three LFG-fueled engine systems would be installed by WMRE along with the building, site preparation, new flare, and associated facilities. The LFG produced by the landfill and collected by WMRE would be used in the engines to produce up to 4.8 MW of electric power.

<u>Comparison of Alternatives</u>

As the landfill waste decomposes, LFG is generated as a natural product of the process. LFG levels will continue to rise as additional waste is added to the landfill and the older waste decomposes. This would increase the amount of LFG that would need to be combusted if the LFG-fueled engines were not installed. The landfill accepts approximately 680,000 tons of waste per year and is expected to have a capacity for 30 years. When the landfill expands as planned, the GCCS would likewise be expanded within the disturbed area in order to collect the LFG, as part of the normal operations.

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

If engines are not installed, then the LFG collected at the landfill would continue to be flared and no electric power would be produced from its combustion. As the amount of LFG produced by the landfill increases, WMRE would have to consider increasing flare capacity.

Preferred Alternative

TVA's Preferred Alternative is the Action Alternative under which TVA would enter into a PPA with WMRE to purchase power generated from the installation of three LFG engine systems at the West Camden Sanitary Landfill.

Environmental Analysis for Resources Not Adversely Impacted

Through internal scoping of the proposed action, TVA has determined that wetlands, aquatic ecology, terrestrial animals and floodplains would not be adversely impacted by the proposed project.

Wetlands--The proposed project is located within the Southeastern Plains ecoregion. Land use/land cover data indicates wetlands comprise approximately 10 percent of the overall land use (Sohl 2011) in the project area. Wetlands in this region are primarily associated with floodplain and riparian areas, reservoir shorelines, and embayments.

A field survey was conducted of the proposed project area in September 2001. The project area lies within a previously developed landfill and there are no wetlands present in the areas proposed for construction and operation of the LFG-fueled engine systems. As the land use has not changed, the 2001 study results are deemed relevant and representative of current conditions. Thus, the proposed action is consistent with Executive Order (EO) 11990.

Aquatic Ecology--The area where the proposed generation facility would be placed has been previously disturbed during the site preparation phase of constructing the landfill, and the reclamation of a previous landfill. No watercourses were identified within the project area. Therefore, no impacts to the aquatic ecology would occur.

Terrestrial Animals--Habitat assessments at the proposed project site were conducted in August 2011. The project area occurs in a landscape severely disturbed by the construction of a new landfill as well as the reclamation of a previous landfill. No wildlife habitat was observed within the project area or the immediate vicinity, any wildlife occurrence would likely be minimal and no additional impacts would be expected.

Floodplain--The project site is not located within a floodplain. This review and determination of no effect satisfies the requirements for compliance with EO 11988, Floodplain Management.

Environmental Analysis for Resources Minimally Impacted

The project's potential impact on plants, water quality, noise, hazardous and nonhazardous wastes, transportation and environmental justice were found to be minimal. These resources, along with environmental justice are evaluated in the following sections.

This review and determination of no effect satisfies the requirements for compliance with EO 13112, Invasive Species, EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, and EO 11514, Protection and Enhancement of Environmental Quality

Plants--Within the footprint of the proposed action, the native vegetation has been cleared and all that remains are areas of herbaceous weedy species. Since almost 100 percent of the action area has been previous cleared of all native vegetation, no additional impacts to terrestrial plant communities would be expected.

Since there would be additional disturbance to the soil during construction of the generating facilities, and associated actions, such as road and gas-line construction, there is potential for the introduction and spread of invasive plant species to the site and surrounding areas (USDA 2007). Several invasive plants are currently present in the area (EDDMapS 2011). It is recommended that disturbed areas be revegetated with native or non-native, non-invasive species.

Water Quality--The area where the proposed facilities would be located has been substantively altered from any natural condition by previous development. As such, installation of the three new LFG-powered reciprocating engines at the landfill site would not involve significant disturbances as compared to present conditions. During construction, ground disturbance would be minimized and all work done in accordance to best management practices (BMPs). The project site is already cleared of vegetation, meaning that an increase of storm water runoff from an increase in impervious surface area from the proposed facilities would be minimal.

Noise--The addition of three reciprocating engine systems would increase noise generation at the landfill. The closest private residence to the engine building is about a half mile away. U. S. Highway 70 is adjacent to the project area; it and the landfill operation are the dominant sources of noise in the vicinity.

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), per engine at a distance of 50 feet from the engine (Caterpillar 2006). Since the engines would be housed within closed buildings, the majority of this sound would be muffled. Employees working within the buildings would wear standard hearing protection per Occupational Safety and Health Administration standards. Stack exhaust would be vented to the outside of the building, so a portion of this noise could be audible to the public. Free-field exhaust noises per stack would be 86.1 dBA at a distance of 50 feet from the stack (Caterpillar 2006).

The location where the engines would be installed is approximately 200 feet away from the closest road (Mount Carmel Road). 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, each engine would generate about 16 decibels (dB), and each exhaust would 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 traffic is approximately 80 dB (American Speech-Language-Hearing Association 2003).

Because of the proximity of the project location to the highway and the active landfill, noise resulting from the proposed action would not significantly increase from its present noise conditions. Further, the density of residences in the vicinity of the project is very low so no additional noise reduction systems would be necessary.

Hazardous and Nonhazardous Wastes--The West Camden Sanitary Landfill is a Class 1 Municipal Solid Waste Facility, which means that it is permitted to handle standard municipal solid waste (e.g., yard waste, construction and demolition debris, biosolids). It does not accept any hazardous or biohazardous waste materials. Since no hazardous materials are accepted, they are not a component of the emitted LFG. No new hazardous secondary pollutants are expected to be generated by the proposed engine combustion of LFG, as opposed to continuing to combust LFG with the present flare configuration.

Implementation of the Action Alternative would not affect present landfill waste disposal operations. All hazardous and non-hazardous waste produced during construction (i.e., used oil, solvents, etc.) will be handled and disposed as required.

Transportation--The new engines would be shipped in containers approximately 11- by 6- by 6-feet each, weighing approximately 17,670 pounds apiece (Caterpillar 2009). The containers would be moved to the project site using a commercial trailer truck on US-70 and the existing local road network. There would be a temporary increase in the number of workers at the site during construction/installation for a period of one or two weeks. This would be an minor increase in vehicle traffic compared to the normal busy traffic route of trucks coming in and out of the landfill to drop off waste.

Environmental Justice--The installation new engine systems would not create or remove any jobs at WMRE or have other potentially major effects. Therefore, it would not cause any disproportionate effects on low-income or minority populations in Benton 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. There would be no change in current operations of the landfill that could affect nearby residences as a result of this project.

Affected Environment and Anticipated Impacts

Site Description

The West Camden Sanitary Landfill is located on the west side of Camden within the Southeastern Plains and Hills region of the Southeastern Plains Ecoregion of Tennessee (Griffith et al. 1998). The Southeastern Plains and Hills contain several north-south trending bands of sand and clay formations. The natural vegetation type is oak-hickory forest, grading into oak-hickory-pine to the south. Streams have increased gradient, generally sandy substrates, and distinctive faunal characteristics for west Tennessee.

The original terrain at the landfill site was primarily low rolling forested hills. Since the early 1990s, the site has been altered by grading to construct the landfill disposal cells. Overhead Bridge Road crosses the landfill site. The surrounding area is otherwise mostly forested and largely rural with the nearest residences about a half mile to the east of the site.

Impacts Evaluated

The impacts on threatened and endangered species, visual and cultural resources, and air quality were evaluated in greater detail because of the potential for these resources to be affected.

Threatened and Endangered Species

Affected Environment Plants - A review of the TVA Regional Heritage database indicates that no federally-listed and three Tennessee state-listed plant species are known to occur within five miles of the proposed additions to the West Camden Landfill (Table 1).

Table 1. Federally Listed Plants from Benton County and State-Listed Plants Known From Within a 5–Mile Radius of the Project Area

Common Name	Scientific Name	Federal Status	State Status (Rank)
Button snakeroot	*Eryngium integrifolium*	--	THR (S1)
Hairy umbrella sedge	*Fuirena squarrosa*	--	SPCO (S1)
Red turtlehead	*Chelone obliqua*	--	SPCO (S1)

State Status abbreviations: THR = Threatened, SPCO=Species of special concern
State rank abbreviations: S1 - critically imperiled with five or fewer occurrences

No known occurrences of federally or state-listed plant species or habitat to support these species are known on or immediately adjacent to the proposed facilities. No rare plants or their habitat were observed by TVA staff during a field visit in the immediate vicinity of the West Camden Landfill.

Affected Environment Terrestrial Animals - Based on review of the TVA Regional Natural Heritage database for records of terrestrial animals, one federally listed (gray bat) and no Tennessee state listed species have been documented within 3 miles of the project area. One federally listed terrestrial animal species, piping plover, and one federally protected species, bald eagle have been documented within Benton County, but are not known from within 3 miles of the project area (See Table 2). No federally or state listed terrestrial animal species or their habitat were observed by TVA staff during field surveys conducted in August 2011.

Table 2. Federally Listed Terrestrial Animal Species from Benton County, Tennessee and/or within a 3-mile Radius of the Proposed Project Area

Common Name	Scientific Name	Status[1]	
		Federal	State (Rank[2])
Birds			
Bald eagle	*Haliaeetus leucocephalus*	DM	PROT (S3)
Piping plover	*Charadrius melodus*	THR	TRKD (S2)
Mammals			
Gray bat	*Myotis grisescens*	END	PROT (S2)

Source: TVA data September 2011
[1]Status Codes: END = Listed Endangered, THR = Listed Threatened, DM = Recovered, Delisted, and Being Monitored, PROT = Protected, TRKD = Tracked
[2]State Ranks: S2 = Very rare and imperiled within the state or because of some factor(s) making it vulnerable to extinction; S3 = rare or uncommon in the state

Bald eagles were removed from the endangered species list, but are still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Both acts prohibit harm to eagles or their nests. Bald Eagles nest in forested areas near large bodies of water, such as rivers and reservoirs, where they forage (Bryan et al. 2005; Thompson et al. 2005). The closest documented active nest is greater than 12 miles from the proposed project area and will not be impacted by the proposed actions (USFWS 2007). Suitable habitat is not available for the bald eagle near the project area.

Gray bats roost in caves year-round and typically forage over streams, rivers, and reservoirs (Tuttle 1976). The nearest gray bat record occurs approximately 2.1 miles from the project area. No recorded caves occur within the project area and no new caves were

identified in the project area during field surveys. No suitable foraging habitat for this species occurs at the project site.

Piping plovers are associated with shoreline habitats found along lakes and rivers (Elliot-Smith and Haig, 2004). These habitats do not occur within the project area or vicinity. Furthermore, this species does not breed in the region, and this record was from a migrating individual.

Affected Environment Aquatic Species - The TVA Regional Natural Heritage Project database (accessed August 30, 2011) indicated that two federally listed endangered, and one state-listed aquatic animal is currently known from Benton County and/or within a ten-mile radius of the proposed project area (Table 3). Information indicates suitable habitat supporting these aquatic species does not occur on or in the vicinity of the project site.

Table 3. Federally and State-listed[1] Aquatic Species Known From Benton County, Tennessee and/or Within a 10-Mile Radius of the Proposed Project Area

Common Name	Scientific Name	Federal Status[1]	State Status (Rank)[2]
Fish			
Lollipop Darter	*Etheostoma neopterum*	--	TRKD (S1S2)
Slenderhead Darter[4]	*Percina phoxocephala*	--	NMGT (S3)
Mollusks			
Orange-foot Pimpleback[3]	*Plethobasus cooperianus*	END	END (S1)
Pink Mucket	*Lampsilis abrupta*	END	END (S2)

Data Query: August 30, 2011
[1]Status Codes: END= Listed Endangered; NMGT = Listed in Need of Management; TRKD = Tracked by state Natural Heritage program.
[2]State Ranks: S1 = Critically Imperiled; S2 = Imperiled; S3 = Vulnerable
[3]Historical = Element occurrence is greater than 25 years old.
[4]Element occurrence known from Benton County but greater than 10 miles from project area.

Environmental Consequences - Suitable habitat was not identified in the project area for bald eagle, gray bat, or piping plover. No watercourses were identified within the project area. Therefore, no suitable habitat for federally or state listed aquatic species occurs within the project area. Because no known occurrences of federally or state-listed plant species or habitat to support these species are known on or immediately adjacent to the proposed project area,, there would be no direct, indirect, or cumulative impacts to federally or state-listed terrestrial animal species or their habitats as a result of the implementation of either alternative. The requirements of Section 7 of the Endangered Species Act would be satisfied.

Cultural Resources

Affected Environment - TVA has no record of cultural resources surveys within the West Camden Landfill. No archaeological sites have been recorded within this area or in the immediate vicinity. Due to the severity of the ground disturbance and alteration of the landscape resulting from the construction and operation of the land fill, there are no intact native soils in the landfill. Therefore, TVA has determined that the proposed project area contains no archaeological resources.

The area contained within a 1-mile radius of the proposed facility is dominated by forest and by the landfill itself. All vegetation within the landfill has been cleared, excavation has

removed the soil, and the natural topography has been significantly altered. The integrity of setting of this area has been severely affected by the construction and use of the landfill.

Environmental Consequences - Under the No Action Alternative there would be no ground disturbing activities at the proposed site for the generator facility. Therefore, there would be no potential for effects to archaeological resources and historic structures.

Under the Action Alternative ground disturbing activities would include excavation, grading, and construction at the proposed site for the generator facility. However, because there are no archaeological resources in the project area and because the integrity of setting of the area has been destroyed, the proposed undertaking has no potential to affect historic properties. Pursuant to 36 CFR Part 800.3(1), TVA has no further obligations under Section 106. There would be no potential direct, indirect, or cumulative impacts to cultural resources as a result of the action alternative.

Visual Resources

Affected Environment - Visual resources are evaluated based on existing landscape character, distances of available views, sensitivity of viewing points, human perceptions of landscape beauty/sense of place (scenic attractiveness), and the degree of visual unity and wholeness of the natural landscape in the course of human alteration (scenic integrity).

The new facility will be located within an existing landfill site. The area has a few residents to the east and west in the middle ground distances. The area is accessed by Mt. Carmel Road, a minor access road. Topography outside the boundary of the existing landfill is steep in all directions. Most views of the landfill are from the existing roadway and are brief due to road alignment. Scenic attractiveness of the project area is minimal and scenic integrity ranges from low to very low.

Environmental Consequences - Consequences of the impacts to visual resources are examined based on changes between the existing landscape and the landscape character after alteration, identifying changes in the landscape character based on commonly held perceptions of landscape beauty and the aesthetic sense of place.

Under the No Action Alternative, the facility would not be installed; resulting in no need for a change in current land use within the existing landfill site and the visual character would remain in its current state.

Under the Action Alternative, TVA would proceed with the PPA. WMRE would construct the proposed new facility and associated infrastructure and access road. The new facility would be constructed approximately 20 feet downhill from Mount Carmel Road and would be seen only briefly by motorists. The facility would likely not be seen by nearby residents due to road alignment and steep topography.

During the construction period there may be some minor visual impacts due to an increase in traffic along local roads, an increase in personnel in the area, and land disturbance for laydown and material storage areas. This would be temporary until all construction areas have been restored. There are no visual impacts anticipated during the operational phases of the project. Cumulative impacts due to construction of new facilities and associated infrastructure is expected to be minor and insignificant. Therefore, there would be no direct or indirect impacts and cumulative impacts to visual resources are expected to be minor.

Air Quality

Affected Environment - 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_2),
- ozone (O_3),
- nitrogen dioxide (NO_2),
- particulate matter whose particles are <= 10 micrometers (PM_{10}),
- particulate matter whose particles are <= 2.5 micrometers ($PM_{2.5}$),
- carbon monoxide (CO), and
- lead (Pb).

Benton County, Tennessee's air quality is in attainment with all the aforementioned NAAQS. The landfill is currently operated under a draft Title V Permit No. 548537. Because the facility reached a design capacity above 2.5 million kilograms of trash and a trash storage volume greater than 2.5 MM cubic meters after the effective date of the rule governing new municipal solid waste landfills, it is subject to the NSPS requirements of 40 CFR Part 60, Subpart WWW. The landfill has been operating a gas collection and control system (GCCS) in accordance with Subpart WWW since 1997. The landfill is also subject to Federal MACT (Maximum Achievable Control Technology) requirements of 40 CFR Part 63, Subpart AAAA: National Emission Standards for HAPs (hazardous air pollutant), Municipal Solid Waste Landfills. The facility is not currently a major HAP facility and would not become a major HAP facility after installation of the three reciprocating engines. The new facility; however, would be subject to the NSPS (New Source Performance Standards) for landfills. The proposed engines would be subject to the 40 CFR Part 60, Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines.

These regulations were promulgated to minimize the deterioration of air quality from existing and new air pollutant sources. Non-methane organic compounds (NMOCs), nitrogen oxides (NO_x), and CO, the secondary pollutants resulting from combusting methane, 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 $PM_{2.5}$.

LFG emissions from landfills are a natural part of the breakdown of waste. LFG is comprised primarily of methane (CH_4) and carbon dioxide (CO_2). It is formed by bacteria breaking down the waste material during the decomposition process. Less than 1 percent of LFG is NMOCs (USEPA 2010a). In an uncontrolled state, this LFG seeps out of cracks and fractures in the ground to the atmosphere as gas pressure builds within the landfill from the decomposition process.

Methane, or CH_4, is considered a compound of concern to air quality because of its potency as a greenhouse gas; when compared to CO_2, methane has a global warming potential approximately 21 times more powerful in its ability to warm the atmosphere than carbon dioxide (USEPA 2010a). Landfill gas containing methane is a potential odor nuisance; it is also a health hazard and potentially explosive in high concentrations. Because of these properties, landfill operators maintain methane concentrations at safe levels by collecting

and burning the methane as it is released from the landfill. Combustion (i.e., burning) breaks methane down into water, nitrogen oxides and carbon monoxide. Other by-products may be sulfur dioxide, and particulate matter. The proportions of these chemical compounds depend on the material decomposed to initially form the LFG.

Carbon monoxide, nitrogen oxides, sulfur dioxide, and particulate matter are regulated by state and federal laws, and facilities generating these compounds over a certain threshold amount must obtain permits to operate. The West Camden landfill currently does not have the potential to emit 250 tons per year or more of any regulated New Source Review (NSR) pollutant and is not a listed source with a potential to emit 100 tons per year or more. Therefore, the facility is not subject to NSR rules and is not a PSD (Prevention of Significant Deterioration) facility requiring additional restrictions for air quality.

Combusting LFG in a flare achieves the same methane safety goals as combusting LFG in an engine system, but it does not utilize the energy available within the gas source. Landfill gas-to-energy (LFGTE) projects are considered environmentally favorable because they improve air quality (USEPA 2010b). This is a result of the direct reduction of methane emissions; an indirect reduction of carbon dioxide emissions from the replacement of fossil fuels burned, and total greenhouse gas reductions. The combustion of both fossil fuels and LFG produce carbon dioxide; however, the USEPA does not consider carbon dioxide emitted from LFGTE 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 landfill gas is considered biogenic. LFGTE projects also enhance air quality by reducing volatile organic compound emissions.

The USEPA estimates that an LFGTE project can capture up to 60-90 percent of the LFG being emitted from a landfill; the remainder escapes as fugitive emissions to the atmosphere (USEPA 2010a).

A more detailed description of the proposed action is provided to explain how air quality impacts would be minimized. Each of the three power generation units has a Caterpillar Model G3520C reciprocating internal combustion engine, and electrical generator and auxiliary systems. The engines are low emission, lean burn, four-stroke, turbocharged, after cooled units rated at 2,233 brake horsepower and nominal heat rate of 14.53 MM Btu per hour. The LFG would be conveyed to the LFGTE system as well as the existing open flare process.

In order to be suitable for burning in the engines, the gas would be treated by filtering to remove particulates, compression and then dehydration. To meet the requirements of the LFG rules, the LFG treatment would be considered the non-methane organic compounds (NMOC) control device. Since the engines follow the control device, they would not be subject to control device requirements defined in Subpart WWW. The engines would be fueled only by LFG.

Environmental Consequences - Under the No Action Alternative, the three reciprocating engine/generator systems for electrical generation likely would not be installed. The flaring of all the collected LFG would continue with associated emissions and the amount of LFG produced annually would increase as mass of accepted waste increased.

Under the proposed action, a landfill gas to-energy system would be installed. A final construction permit has issued by TDEC (Attachment 7) that describes how the system

meets requirements of all applicable air quality regulations. Emissions from the three spark ignition reciprocating engines are shown in Table 4. All other activities at the LFGTE facility would have negligible emissions. The emissions estimate are based on continuous operation (8,760 hours per year) at full load, at the nominal horsepower rating of 2,233 BHP per engine, and heat input rating of 14.5 MM Btu/hr per engine. All the amounts in Table 4 are based on the manufacturer's performance data except volatile organic compounds (VOCs). Hourly VOC emissions are based on the Subpart JJJJ allowable 1.0 gram per horsepower per hour (g/hp-hr). Annual VOC emissions are based on 20 parts per million by volume (ppmv) concentration of NMOC in the engine exhaust.

Table 4. Criteria Pollutant Emissions for CAT G3520 C Engines

			Open Flare		Per Engine Basis		Total of Three Engines	
Pollutant	Emissions Factors	Units	Rate (lb/Hr)	Rate (ton/yr)	Rate[1] (lb/hr)	Rate (ton/yr)	Rate (lb/hr)	Rate (ton/yr)
NO_X	0.6	g/bhp-hr	7.81	34.67	2.95	12.93	8.85	38.78
CO	3.5	g/bhp-hr	43.07	188.63	17.21	75.4	51.64	226.2
PM[2,3]	48	Lb/MMcf CH_4	2.04	8.93	0.69	3.02	2.07	9.06
SO_2	500	Ppmv	20.25	88.72	2.20	10.62	6.61	31.86
VOC[4]	1.0 20	g.bhp-hr (outlet) ppmv (annual)	0.11	0.47	4.92	4.12	14.76	12.35

[1] 379.50 cf/lb-mole @ standard conditions
[2] 55% CH_4 on lb/hr, 50% CH_4 annual basis. Based on engine heat requirement more LFG is required to fuel the engine at the 50% annual CH4 concentration.
[3] PM for engine emissions is considered primarily $PM_{2.5}$ per AP-42.
[4] maximum VOC hourly emissions based on Subpart JJJJ allowable (1.0 g/BHP-Hr).
Annual VOC is based on 20 ppmv (7% O_2) concentration in exhaust.

The engine emissions represent the only change in emission sources at the facility under the proposed action. The emissions from gas collection system and flare would not change.

The emissions factors and emission rates that form the basis for hourly and annual emissions are all below or equal to those required by Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines. Subpart JJJJ emission factors, for LFG engines larger than 1,350 hp and manufactured after July1, 2010, are as follows:

nitrous oxides (NO_X)	2.0 g/bhp-hr
carbon monoxide (CO)	5.0 g/bhp-hr
volatile organic compounds (VOC)	1.0 g/bhp-hr

Other requirements of Subpart JJJJ include management practices and record keeping. The LFGTE system would also meet TDEC requirements for stationary reciprocating engines.

The installation and operation of the three reciprocating engines would increase the secondary pollutant emissions (Table 4). Under the current landfill operating permit only VOC emissions are estimated. The uncontrolled VOC emission for calendar year 2009 was 7.67 tons. This is based on the assumption that 25 percent of the gas produced was not captured and burned. The LFGTE system is projected to emit 12.35 tons per year of VOCs if the engines are run continuously (8,760 hours per year) at maximum load. The increases in the emissions of the secondary pollutants (Table 4) would have a concomitant decrease in the levels of methane escaping from the landfill as waste decomposition continues in the landfill. This would be a beneficial impact in view of methane's high potency as a greenhouse gas.

The generation of the secondary emissions (Table 4) may also be somewhat compensated for by the decreased need to burn fossil fuels for this amount of power generation (up to 4.8 MW of new power generation). Air quality compliance with standards prescribed under the federal CAA and the Tennessee's Air Quality Act would continue to be achieved. The project would continue to maintain a valid TDEC Title V Operating Permit. The increase of CO and NO_X emissions would also require the maintenance of a valid PSD Permit from the state of Tennessee.

Compliance with applicable permit limits and mitigation measures provided below would ensure potential impacts to air quality remain insignificant. Therefore, direct, indirect, or cumulative impacts to air quality would be minor.

Mitigation Measures

As a standard practice, under the Action Alternative, BMPs identified in the EA will be implemented to minimize potential environmental effects associated with the construction and operation of the proposed facility.

The TDEC Division of Air Pollution Control regulates emissions, imposes compliance requirements, and ensures monitoring compliance. Other than the routine commitments described above, TVA will not ask WMRE to use any additional mitigation measures for this project. Emissions from the engines, flare, exhaust stacks, and the landfill must remain within acceptable air quality levels and be monitored at regular intervals, as prescribed in regulations promulgated under the federal CAA and the Tennessee Air Quality Act, including the following:

- 40 CFR Part 63 Subpart AAAA - National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills as required by 40 CFR §§ 63.1930-63.1990
- 40 CFR Part 63 Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants: Stationary Reciprocating Internal Combustion Engines
- 40 CFR Part 60 Subpart WWW - Standards of Performance for Municipal Solid Waste Landfills
- 40 CFR Part 60 Subpart JJJJ - Standards of Performance for Stationary Park Ignition Internal Combustion Engines Visible Emission Standards in Title V and other air permits
- 40 CFR 63.6, Compliance with Standards and Maintenance Requirements, and 40 CFR 63.10(b), General Recordkeeping and Reporting 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 to measure

temperature. 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 flare must have the capacity to handle all of the LFG captured by the system in case of engine failure.

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Attachments

Attachment 1 - Location and Vicinity of Project

Attachment 2 -Construction Application

Attachment 3 - Grading Plans

Attachment 4 - Generator Specifications

Attachment 5 - Operating Permit Title V Draft

Attachment 6 - Revised Application Forms

Attachment 7 - Final Construction Permit