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ENVIRONMENTAL ASSESSMENT

POWER PURCHASE AGREEMENT FOR RENEWABLE ENERGY FROM LANDFILL GAS - INCREASED GENERATING CAPACITY FROM THE CHESTNUT RIDGE SANITARY LANDFILL

Anderson County, Tennessee

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TENNESSEE VALLEY AUTHORITY
DECEMBER 2010

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TENNESSEE VALLEY AUTHORITY

DECEMBER 2010

The Purpose and Need

The Tennessee Valley Authority (TVA) proposes to enter into a power purchase agreement (PPA) with WM Renewable Energy LLC (WMRE) for the additional power generated at the Chestnut Ridge Sanitary Landfill in Anderson County, Tennessee (Attachment 1). This additional power would be generated by two new landfill gas (LFG)-powered reciprocating engines; presently, there are four reciprocating engines in use, and WMRE proposes to add two additional engines.

East Tennessee and Anderson County, in particular, are areas of rapid residential and commercial growth. This growth represents a generally increasing need for power in the TVA power service area. 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 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. 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. The proposed project is to utilize LFG, which would otherwise be combusted by flares into the atmosphere, as an energy source for generating additional electricity.

Background

Chestnut Ridge Sanitary Landfill, operated by WMRE, is a municipal solid waste disposal facility on the border of Anderson and Knox counties in east Tennessee (Attachment 1). TVA has had an active PPA with WMRE since 1992 for the purchase of power generated by the existing reciprocating engines, which have a 3.2 megawatt (MW) generating capacity. The area where the current generation facility is located was substantially disturbed during the site preparation phase of constructing the landfill, which began operation in 1982.

Proposal

The addition of two reciprocating engine systems would increase the amount of electricity generated at the landfill from 3.2 MW to 4.8 MW, thereby also reducing the amount of LFG being incinerated in the flares or escaping directly into the air (i.e., fugitive emissions) and reducing methane (a greenhouse gas) emissions from Chestnut Ridge landfill.

Actions proposed for this project include:

- Installing two additional power generation units, which are rated at 2,233 horsepower at 100 percent load and have a heat input of 17.85 million British thermal units per hour per engine. Each unit would consist of one Caterpillar Model G3520C reciprocating internal combustion engine, one electrical generator, auxiliary systems to connect with the gas collection and control system, 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 flares for control of excess gas.

- Replacing one of the two existing open flares (there are currently two open flares and one enclosed flare) with a 2,000 standard cubic feet per minute (scfm) open flare, for a total of 6,500-scfm open-flare capacity (this would be a reduction of 2,500 scfm in current flare capacity).

- Constructing a new 2,100 square foot modular building to house the new generating units. The existing generating units are contained within a 4,300-square-foot building on the landfill site. This building is an aboveground modular building. If the two additional reciprocating engines could not be fit into the existing building, they would be placed in a new building next to the existing building. The area where the new modular building would be placed has already been prepared; preparation occurred when the existing four engine systems were installed in 1992.

Necessary Permits or Licenses
WMRE has obtained a new Title V Operating Permit and a Prevention of Significant Deterioration (PSD) Permit for six reciprocating engine systems from the Tennessee Department of Environment and Conservation (TDEC), Tennessee Air Pollution Control Board (Attachment 2).

The Decision
TVA needs to decide whether to enter into a PPA with WMRE to purchase the power from the addition of two LFG-fueled engine systems.

The landfill is on private land, but the installation of the additional engines would not likely occur if TVA did not purchase the additional generated electricity. Accordingly, 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.

The study area for this EA includes the 0.3-acre area where the two reciprocating engines would be installed. This area was previously cleared and prepared for the existing engines at the time of their installation (1992), leaving enough space for installing additional engines. Additional surface disturbance would not be required to install these two engines. For cultural resources impact analysis, TVA considers the archaeological area of potential effect (APE) to be the footprint of the proposed facilities where ground disturbance would occur and the architectural APE to be a 0.5-mile radius around the proposed new facilities.

Alternatives and Comparison

The No Action Alternative. Under the No Action Alternative, TVA would not purchase additional power from the facility, and two additional LFG-fueled engine systems would not

be installed by WMRE. TVA would continue purchasing power generated from the four existing engine systems, and the excess LFG that could not be processed by the four existing engines would continue to be flared to the atmosphere, with a maximum capacity of 9,000 scfm.

The Action Alternative. Under the Action Alternative, TVA would enter into a PPA to purchase additional generation from the WMRE facility. Two additional LFG-fueled engine systems would be installed, and one of the open flares would be downsized from a 4,500 scfm to a 2,000-scfm capacity.

Comparison of Alternatives

As the landfill waste decomposes, additional LFG would be generated as a natural part of the process. LFG levels will continue to rise as additional waste is added to the landfill and the older waste decomposes (Figure 1). This increase in LFG would increase the amount of methane that would need to be combusted if the capacity of the existing LFG-fueled engines were not increased. The landfill is accepts approximately 400,000 tons of waste per year. For modeling purposes, years 2010 through 2039 have been estimated to receive the same amount of solid waste that was recorded for 2009, although these amounts will vary in reality (Figure 1).

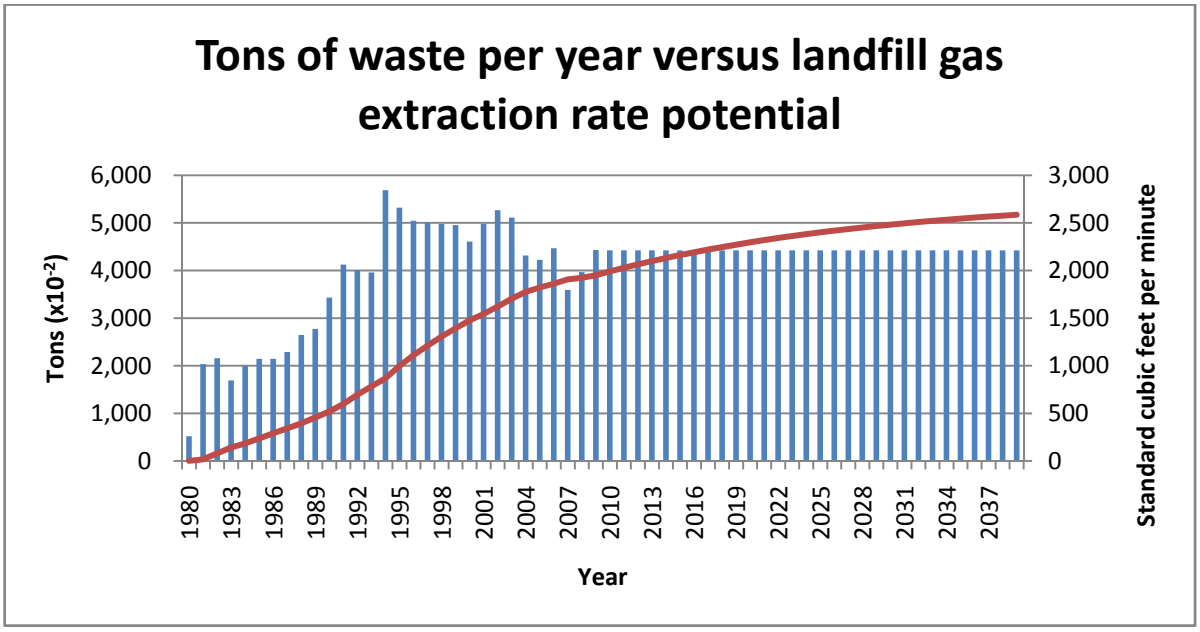


Figure 1. Projected Estimation of Landfill Gas Extraction Potential (Red Line) and Amount of Solid Waste (Blue Bars) Contained Within Chestnut Ridge Sanitary Landfill

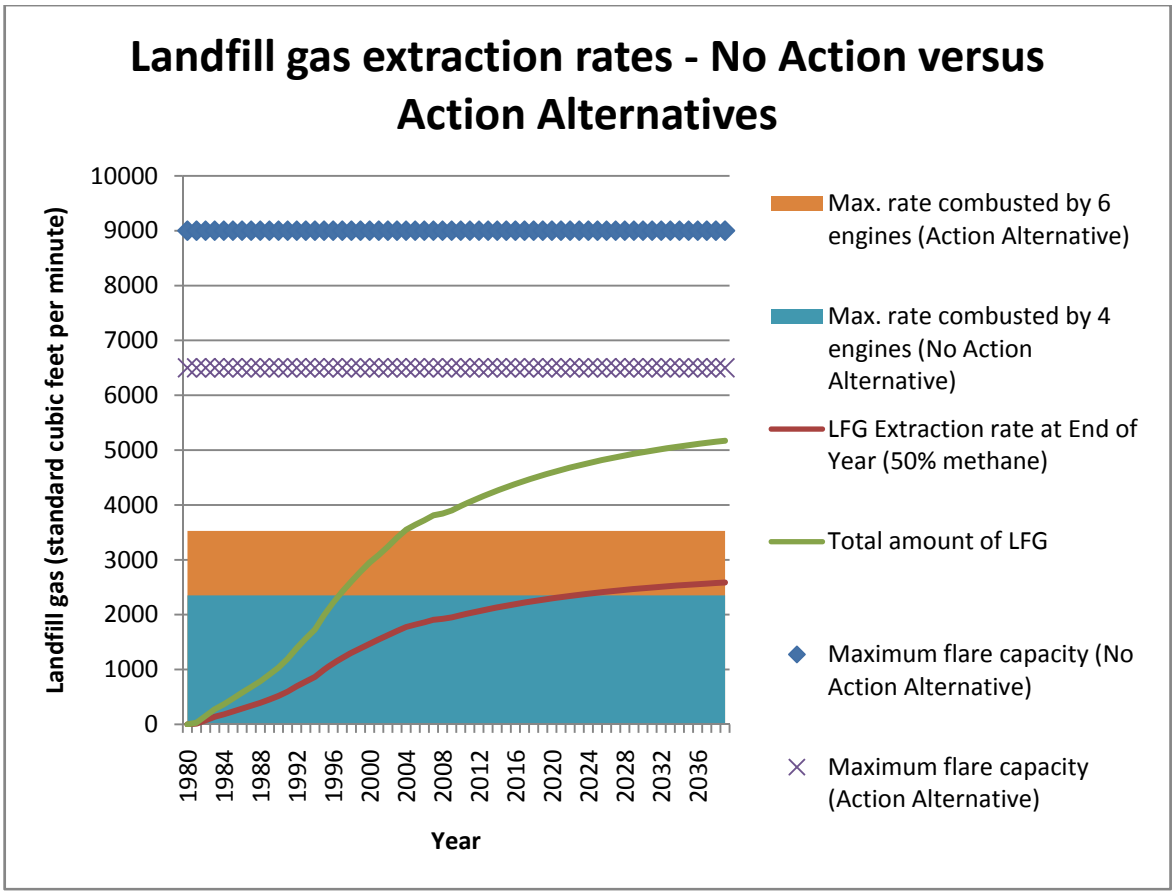
For safety purposes, LFGTE facilities must have the capability to flare all of the LFG adequately, as if no LFG was being combusted in the engines. The flares are outfitted with pilot lights and auto re-light safety features in order to maintain a constant flame. These measures are to ensure air quality compliance in case of complete 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. Estimates of landfill gas emission are yearly averages, and can vary depending on the temperature, precipitation, and the type of solid waste that is decomposing; this can cause the LFG emission rate to vary. Any excess LFG

that could not be processed by the six engines would be flared to the atmosphere at a maximum rate of 6,500 scfm. This would be a reduction of 2,500 scfm when compared to the No Action Alternative.

Estimates of LFG extraction rates assume an extraction efficiency of 50 percent (Figure 2). This means that an additional 50 percent of LFG needs to be flared because it could not be captured within the engine systems. Since the flares must be able to combust all of this LFG in case of engine failure, flare capacity must be able to handle an LFG rate above the total LFG emission estimate, plus additional capacity for a safety buffer.

One of the flares has been proposed for replacement, instead of just leaving it in place, because replacement of one of the flares would increase the efficiency of the flares. Larger capacity flares are operated using multiple burners that can be adjusted as LFG concentrations require. If burners are not being used, they can create cool spots within the flare that reduce the flare's efficiency.

If additional engines are not installed, at some point in the future, the four engines would no longer be able to process all of the extractable LFG (Figure 2). The installation of two additional engine systems instead of just four allows for one of the engines to be taken offline for repairs, while still having the capability to combust more than the estimated average amount of available LFG. The calculated values for air quality emission estimates provided in this EA assume that all six engines are running constantly. This assumption provides the maximum possible power that could be generated by the project. In practice, however, running all six engines would be unnecessary because their combined capability would far exceed the average LFG emission at this time.



Source: Waste Management of Tennessee
Note: LFG extraction rate assumes 50 percent extraction efficiency

Figure 2. Projected Amount of Landfill Gas Generated by Chestnut Ridge Sanitary Landfill and Processing Capabilities of Four and Six Reciprocating Engine Systems

Environmental Analysis for Resources Minimally Impacted

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

Noise. The addition of two reciprocating engine systems would increase noise generation at the landfill. The closest private residence to the engine building is about 800 feet away; a cemetery and pastureland lie across the road from the building. The landfill is approximately 1.5 miles away from a rock quarry and associated businesses (e.g., sand, gravel, rock, and asphalt suppliers). Interstate Highway (I-) 75 is adjacent to this area; it is the dominant source 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 requirements. 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 additional engines would be constructed (the same location where the four existing engines currently reside) is approximately 200 feet away from the closest road (East Wolf Valley 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 interstate, the active landfill, and the nearby quarry, the additional sound generation would not significantly alter the environment from its present noise conditions. Further, the density of residences in the vicinity of the project is very low, and the nearest residence is at a distance of 800 feet from the engine building.

Hazardous and Nonhazardous Wastes. The Chestnut Ridge 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 (Waste Management of Tennessee 2009). 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 increased engine combustion of LFG, as opposed to continuing to combust LFG with the present flare configuration. The Action Alternative would not affect present landfill waste disposal operations.

Water Quality. Since the area where the facilities would be located has already been significantly altered, no new land-disturbing activities would need to be undertaken to install the proposed engine systems. The project site is already cleared and graveled; paving would not be necessary, meaning that an increase of storm water runoff from an increase in impervious surface area would not occur. Protective material (e.g., a Subtitle D composite liner of clay and high-density polyethylene) already lines the landfill itself to prevent leachate from entering into the groundwater. The leachate is collected and transported for treatment to a local publicly owned treatment works (Waste Management of Tennessee 2009). Seven groundwater wells sample water quality quarterly (Waste Management of Tennessee 2009).

Biological Resources. Seventy-three species classified as federally and/or state-listed as threatened or endangered by TDEC have been observed in Anderson County, Tennessee (TDEC 2009). These are primarily associated with streams, caves, bluffs, and woods. The nearby visual buffer of trees and brush would not be disturbed for the installation of the two additional LFG-to-energy (LFGTE) systems; terrestrial species would not be impacted by this project because there would be no additional ground disturbance. The facilities would be located on previously and significantly disturbed land adjacent to the landfill that has

already been cleared and graded. No suitable habitat for federally and state-listed species exists within the footprint of this previously altered environment. Nuisance and invasive species would not be introduced or promoted as a result of the installation or use of the engines. Aquatic species would not be impacted by this project because there would not be an increase in storm water runoff, and landfill leachate is already collected and treated (as discussed in the water quality section).

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

Wetlands. According to the United States Fish and Wildlife Service's (USFWS) National Wetlands Inventory, the closest wetlands area (a freshwater pond) is approximately 2,500 feet away from the project site, located on private land (USFWS 2010). No impact to wetlands would occur because of the nature of this project. This review and determination of no effect satisfies the requirements for compliance with EO 11990, Protection of Wetlands.

Floodplain. The project site is located within the Flood Insurance Rate Map quadrant 47001C0260F, which has designated the area as a "no special flood hazard area" and has not been printed by the Federal Emergency Management Agency (FEMA) (FEMA 2010). No additional review is necessary because there would be no potential effects on a floodplain (Roger Milstead, TVA, personal communication, September 4, 2010). This review and determination of no effect fulfills the requirements for compliance with EO 11988, Floodplain Management.

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 I-75 and the existing local road network. No unusual traffic impacts would occur, nor would new roads be built because of this project. There would be a temporary increase in the number of workers at the site during installation, increasing the number of workers from eight to approximately 18 to 23 full-time employees for a period of one or two weeks. The most recent daily traffic counts conducted in the region counted an average 713 cars traveling near the landfill on East Wolf Valley Road; no traffic count sites were located on Fleenor Mill Road, which is where the landfill entrance and the driveway to the LFG engine systems are located (Tennessee Department of Transportation 2010). If each of the additional temporary workers traveled in a separate vehicle, it would account for an approximate 2 percent temporary increase in traffic. This would be an insignificant 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 of two new engine systems would not create or remove any jobs at WMRE. Therefore, it would not cause any disproportionate effects on low-income or minority populations in Anderson County. There would be no change in current operations of the landfill that could affect nearby residences as a result of this project.

Transmission. The increase in electrical generation is a relatively small increment (from 3.2-megawatt MW to 4.8-MW capacity) and would not require the upgrading of existing transmission lines used by the existing four reciprocating engine systems.

Affected Environment and Evaluation of Impacts on Cultural Resources, Air Quality, and Visual Resources

Site Description

The Chestnut Ridge Sanitary Landfill is located in Heiskell, Tennessee, in Anderson County, near the border with Knox County, about five north of the city limits of Knoxville. It is located near a major local interstate (I-75).

The terrain is primarily hilly and forested; the area is still largely rural except for a nearby rock quarry and associated businesses (e.g., sand, gravel, rock, and asphalt suppliers).

Impacts Evaluated

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

Cultural Resources

Affected Environment - Impacts on cultural resources were evaluated because of the project's proximity to Moore Cemetery and the potential for the presence of nearby burials or other historic features.

Area of Potential Effect - TVA considers the archaeological APE to be the footprint of the proposed facilities where ground disturbance would occur and the architectural APE to be a 0.5-mile radius around the proposed new facilities. The proposed facilities are confined to areas of previous ground disturbance from the landfill, and no archaeological resources would be affected by the proposed undertaking.

Environmental Consequences - Under the No Action Alternative, there would be no project-related effects to historic or archaeological resources. Likewise, no direct, indirect, or cumulative effects to these resources are expected along the proposed line route or switching station site under this alternative.

Under the Action Alternative, the proposed facilities would be confined to areas of previous ground disturbance from the landfill. On September 7, 2010, TVA's Cultural Compliance staff visited the project area to determine if any historic properties would be indirectly affected by the proposed undertaking. The visual line of site from the proposed facilities to any potential historic properties within the architectural APE is obstructed by vegetation and topography. No historic properties would be affected by the Action Alternative.

Pursuant to regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act, TVA consulted with the Tennessee State Historic Preservation Officer (SHPO) to assess potential impacts to historic properties (Attachment 3). In a letter dated September 29, 2010, the Tennessee SHPO concurred with TVA's determination that the proposed undertaking would not adversely affect any historic properties that are potentially eligible or currently listed in the National Register of Historic Places (NRHP) (Attachment 4).

Pursuant to 36 CFR §§ 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b), TVA also consulted with the federally recognized Indian tribes shown as those listed in Attachment 5 regarding

properties within the proposed project's APE that may be of religious and cultural significance to them and eligible for the NRHP. TVA received one response of no objection to TVA's findings from the Seminole Tribe of Florida's Tribal Historic Preservation Office (Attachment 6).

Visual impacts

Affected Environment - The landfill is approximately 166 acres in size. It is located near I-75 outside the Knoxville city limits off Fleenor Mill Road and Raccoon Valley Road in an area that it is still largely rural, with increasing commercial development related to the adjacent rock quarry. The landfill is partially shielded from view by trees, although it is visible from Fleenor Mill Road and I-75, and portions of East Wolf Valley Road. Flames resulting from the flaring of the LFG are visible at night, especially during the winter. Exhaust stacks for the engines are 21 feet tall above grade (Environmental Resources Management 2010); presently, there are four stacks (one per engine system) and three vertical flare structures.

Environmental Consequences - Under the No Action Alternative, there would be a total of four stacks and three flare structures within the 0.3-acre project area Emissions from these stacks are monitored by the degree of opacity, and acceptable limits are determined by the U.S. Environmental Protection Agency (EPA) (American Electric Power 2004). The open flares are presently monitored by the degree of emission opacity and are regulated by both the Tennessee Visible Emissions Opacity Matrix and Title V Permit No. 563001.

Under the Action Alternative, the number of flares would remain the same, but one of the flares would be downsized from 4,500 scfm to 2,000 scfm. Flare height may be smaller, since more LFG would be utilized in the engines instead of being combusted at the flares, thereby reducing the visual impact of flares at night to the surrounding area.

The implementation of the Action Alternative would not have a significant effect on the present viewshed. The visual line of site from the proposed facilities is partially obstructed by vegetation and topography, although the buildings and flares are visible from I-75 and Fleenor Road. Visible emissions will continue to be regulated as air quality parameters.

Air Quality

Affected Environment - Anderson County, Tennessee's air quality is designated nonattainment with respect to the National Ambient Air Quality Standard (NAAQS) for fine particulate matter ($PM_{2.5}$) and ozone (the 8-hour standard). In areas of nonattainment such as Anderson County, reductions in emissions are necessary in order to attain the NAAQS. Nonmethane organic compounds (NMOCs), nitrogen oxides, and carbon monoxide, 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 cannot be stopped because they are a natural part of the breakdown of waste. The LFG is formed by bacteria breaking down the waste material during the decomposition process. The LFG comprises approximately 50 percent methane, 50 percent carbon dioxide, and a small fraction (less than 1 percent) of NMOCs (United States Environmental Protection Agency [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 is considered a compound of concern to air quality because of its potency as a greenhouse gas; when compared to carbon dioxide, methane is approximately 21 times more powerful in its ability to warm the atmosphere than carbon dioxide (USEPA 2010a). Methane is an odor nuisance; it is also a health hazard and potentially explosive in high concentrations. Because of these properties, it is important for landfills to maintain methane concentrations at safe levels. This is accomplished by burning the methane as it is released from the landfill. Combustion (i.e., burning) breaks methane down into water and carbon monoxide; other compounds in the LFG are broken down into nitrogen oxides, sulfur dioxide, and particulate matter. The proportions of these chemical compounds depend on what material decomposed to initially form the LFG.

Carbon monoxide, nitrogen oxides, sulfur dioxide, and particulate matter are considered "secondary pollutant emissions," which means that they are pollutants formed by the destruction of a more dangerous pollutant, in this case, methane. These compounds are regulated by state and federal laws, and facilities generating these compounds over a certain threshold amount must obtain permits to operate. The increase in measurable emissions would place the landfill into a category requiring a PSD Permit from the State of Tennessee. A PSD designation means that it has the potential to emit an amount of a particular compound of interest per year above a threshold measurement. If the proposed additions are constructed, the facility will have the potential to emit 494.2 tons per year (tpy) of carbon monoxide and 141.9 tpy of nitrogen oxides. This increase in the amount of emissions results from the increased amount of LFG combusted in engines and a reduction in the amount of LFG combusted in flares; engines produce more secondary pollutants than flares. This may partially be due to lower incineration temperatures used in engines as opposed to flares. Flares that are open to the air provide an excess of oxygen, whereas the combustion in an engine system occurs within an enclosed space, which potentially limits oxygen supply. Limited oxygen supply can limit the amount of oxidation that can occur. Oxidation changes carbon monoxide into carbon dioxide.

Combusting LFG in flares 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. LFGTE projects are considered environmentally favorable because of the reduction in methane release and because these projects produce energy that can replace energy generated by nonrenewable resources, such as fossil fuels. The combustion of both fossil fuels and LFG produce carbon dioxide, which is a greenhouse gas. In practical terms, 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). In other words, it would have been released as part of the natural cycle of breaking down carbon that was "fixed" in living organisms. Carbon dioxide from fossil fuels (e.g., coal, oil) would not be released to the atmosphere, unless the fuel source is burned, since oil and coal do not decompose.

USEPA considers the indirect avoidance of fossil fuel combustion (and the secondary pollutants from the burning of those fossil fuels) to be a favorable trade-off for the increase in emissions that occurs when changing from LFG-flare to LFG-engine combustion. In other words, the benefit of using the energy contained within LFG outweighs the cost of increased carbon monoxide and nitrogen oxide production. Overall, there is a substantial improvement to air quality by using a LFGTE system (USEPA 2010b). This is a result from the direct reduction of methane emissions, an indirect reduction of carbon dioxide emissions from the reduction of fossil fuels burned, and total greenhouse gas reductions.

Presently, the LFG released from the Chestnut Ridge Sanitary Landfill is partially being used to fuel four reciprocating engines. Excess gas is currently being incinerated using two open-flare units (controlling NMOC emissions from LFG) and one source performance standards enclosed flare (controlling gas escaping from refuse wells). As solid waste continues to be added to the landfill and the existing and future waste decomposes, the more LFG generates at the landfill (Figure 1). The facility is not classified as a major hazardous air pollutant facility, and the installation of two additional engines would not change its classification.

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).

Environmental Consequences - Under the No Action Alternative, the two additional reciprocating engine systems would not be installed, and the existing four systems would continue to combust LFG to produce electricity. Emission by-products from the incineration of LFG in both the four engines and the existing three flares are shown in Table 1. LFG would continue to be generated from the natural decomposition of waste materials accepted at the landfill and would increase in concentration as more waste breaks down (Figure 1).

Table 1. Pollutants Generated by Landfill Gas-To-Energy Engines - Current and Proposed Levels

Pollutant	Existing (tons/year)			Proposed (tons/year)			Increase From Existing Levels (tons/year)
	4 Engines	3 Flares	Total	6 Engines	3 Flares	Total	
NOx	48.68	32.82	81.50	74.53	109.12	183.65	102.15
CO	91.53	178.56	270.09	242.33	494.20	736.53	466.44
PM	9.35	7.95	17.30	16.77	29.18	45.95	28.65
SO_2	16.44	7.55	23.99	29.48	59.21	88.69	64.70
VOC	3.50	2.45	5.95	11.74	14.75	26.49	20.54
HAP	2.00	4.06	6.05	3.46	9.70	13.16	7.10

Abbreviations:
NOx = Nitrogen oxides
CO = Carbon monoxide
PM = Particulate matter
SO_2 = Sulfur dioxide
VOC = Volatile organic compounds
HAP = Hazardous air pollutants

Note: Values calculated are the maximum levels of pollutants possibly generated, assuming full fuel loads, 50 percent methane content in the LFG, and operation of 24 hours a day, 365 days a year.

The flow rate of LFG to each engine system has been estimated to be an average of 588 scfm, based on Waste Management's previous operational experience. The existing four LFGTE systems can process up to 2,352 scfm of LFG, which is the estimated amount of LFG that will be generated by 2022 (Figure 2); excess gas above that amount would need to be flared or may escape as fugitive emissions. The existing three flares would remain in

operation with the capacity to flare up to 9,000 scfm of LFG, well in excess of the amounts of LFG estimated to be generated at the landfill through 2035 (Figure 2).

Under the Action Alternative, the two additional reciprocating engine systems would be installed; six systems would be combusting LFG to produce electricity. Emission by-products from the incineration of LFG in the six engines and the three flares (one of the flares would be replaced) are also shown in Table 1. The LFG generated until 2040 (and possibly beyond) could be combusted by the six reciprocating engine systems, with excess capacity available in case of unanticipated spikes in LFG release (e.g., gas pockets within the landfill) (Figure 2). Flare capacity would still be available in case of excess gas volumes that could not be handled by the six engines. One of the three flares would be replaced, for a flaring capability of 6,500 scfm, which is still well in excess of the estimated amount of LFG generated by the landfill by 2035 (Figure 2).

Air quality compliance with standards prescribed under the federal Clean Air Act and the Tennessee Air Quality Act will continue to be achieved. The project will continue to maintain a valid TDEC Title V Operating Permit. The increase in carbon monoxide and nitrogen oxide emissions will also require the maintenance of a valid PSD Permit from the State of Tennessee.

Cumulative Impacts

The addition of two reciprocating engines and the replacement of one of the existing flares would increase the secondary pollutant emissions (Table 1). The cumulative impacts of these emissions were evaluated under the PSD analysis.

The increases in the emissions of the secondary pollutants (Table 1) would be associated with a decrease in the levels of methane escaping from the landfill as waste decomposition continues in the landfill. This would be a benefit in view of methane's high potency as a greenhouse gas.

The generation of the secondary emissions (Table 1) may also be somewhat compensated for by the decreased need to burn fossil fuels for this amount of power generation (up to 2.4 MW of new power generation).

Mitigation and Conditions

The TDEC Division of Air Pollution Control regulates emissions, imposes compliance requirements, and ensures for monitoring compliance. TVA does not requiring any additional mitigation measures for this project. Emissions from the engines, flares, 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 Clean Air Act 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. 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 LFG captured by the system in case of engine failure.

Preferred Alternative

TVA's Preferred Alternative is the Action Alternative under which TVA would enter into a PPA with Waste Management to purchase power generated from the addition of two LFG engine systems at the Chestnut Ridge Sanitary Landfill.

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Involvement: NEPA Compliance

References

American Electric Power. 2004. *Decision Tree PM for Opacity for Sources Utilizing EPA Method 9*. Retrieved from <http://www.state.tn.us/environment/apc/pdf/titlev01.pdf>. (October 1, 2010).

American Speech-Language-Hearing Association. 2003. "Noise: Noise is Difficult to Define!" *Audiology Information Series*.

Caterpillar. 2006. *G3520C Gas Engine Technical Data Sheet DM5860-00*.

Caterpillar. 2009. *G3516 LE Gas Petroleum Engine LEHW0036-00 (11-09).*

Environmental Resources Management. 2010. *Construction Application for Two Reciprocating Engines for Waste Management Inc., Chestnut Ridge Sanitary Landfill, Heiskell, Tennessee.*

Federal Emergency Management Agency (FEMA). 2010. *Map Service Center*. Retrieved from <http://www.msc.fema.gov> (September 4, 2010).

Tennessee Department of Environment and Conservation (TDEC). 2009. "Rare Species Observations for Tennessee Counties." *Tennessee Natural Heritage Program*. Retrieved from <http://www.state.tn.us/environment/na/pdf/county.pdf> (October 1, 2010).

Tennessee Department of Transportation. 2010. Traffic History. Retrieved from <http://www.tdot.state.tn.us/traffichistory/>. (October 1, 2010).

The Engineering Toolbox. 2010. *Abatement and Distance From Source*. Retrieved from <http://www.engineeringtoolbox.com/abatement-distance-source-d_723.html> (October 14, 2010).

United States Environmental Protection Agency (USEPA). 2010a. *Landfill Methane Outreach Program Project Development Handbook*. Retrieved from <http://www.epa.gov/lmop/publications-tools/handbook.html> (September 30, 2010).

———. 2010b. *Landfill Methane Outreach Program Basic Information*. Retrieved from <http://www.epa.gov/lmop/basic-info/index.html> (October 14, 2010).

United States Fish and Wildlife Service (USFWS). 2010. "Wetlands Mapper." *National Wetlands Inventory*. Retrieved from <http://www.fws.gov/wetlands/Data/Mapper.html> (October 1, 2010).

Waste Management of Tennessee. 2009. *Chestnut Ridge Landfill.* Retrieved from <https://www.wmdisposal.com/static/files/fact_sheets/Chestnut_Ridge_Landfill.pdf> (August 18, 2010).