Department of Defense Landfill Database:

A Collection of DoD-Wide Landfill Data for the Assessment of Implementing the Flex Energy Powerstation for Landfill Gas to Energy Projects

SERDP/ESTCP Project #SI-200823

Southern Research Institute Project #12704

Demonstration and Verification of a Turbine Power Generation System Utilizing Renewable Fuel: Low BTU Landfill Gas

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FINAL Version 2.0

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List of Acronyms	
Acronym	*Definition*
ADEQ	Arizona Department of Environmental Quality
BTU	British thermal units (energy, usually thermal or chemical)
BTU/h	British thermal units per hour (rate of energy transfer or use)
cf	Cubic foot (volume)
CH_4	Methane
CIWMB	California Integrated Waste Management Board
CO_2	Carbon dioxide
CO_2e	Equivalent carbon dioxide – a measure of GHG emissions taking into account (1 tonne CH4 is equivalent to 21 tonnes CO2e).
DoD	United States Department of Defense
EIA	Energy Information Administration
ESTCP	Environmental Security Technology Certification Program (DoD)
ETV	Environmental Technology Verification program
GHG	Greenhouse Gas
HQDA	Headquarters Department of the Army
k BTU	Thousand British Thermal Units (energy, usually thermal or chemical)
kN	Thousand Newtons (weight)
kWe	kilo Watt (electric) (rate of energy use or transfer), 0.001 MWe
kWe h	kilo Watt hour (electric) (energy), 0.001 MWe h
lb	pound
LFG	Landfill Gas
LMOP	Landfill Methane Outreach Program (U.S. EPA)
m^3	Cubic meter
MSW	Municipal Solid Waste
MWe	mega Watt (electric) (rate of energy use or transfer), 1000 kWe
MWe h	mega Watt hour (electric) (energy), 1000 kWe h
OACSIM	Office of the Assistant Chief of Staff, Information Management
SIP	Sustainable Infrastructure Program (ESTCP/DoD)
T&D	Transmission and distribution
U.S. EPA	Environmental Protection Agency
VBA	Visual Basic for Applications
yd^3	Cubic yard

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Department of Defense Landfill Database Report

View Database Report

A Collection of DoD-wide Landfill Data for the Assessment of Implementing the Flex Energy Powerstation®

ESTCP Project Number SI-200823

1. INTRODUCTION

1.1. Background

Southern Research Institute has undertaken a project funded by the US Department of Defense (DOD), Environmental Security Technology Certification Program (ESTCP)/ Sustainable Infrastructure Program (SIP) to demonstrate and independently validate the benefits of the application of the FlexEnergy Microturbine in a landfill gas application. The turbine utilizes a thermal oxidizer in place of a combustor in a normal microturbine, allowing for assurance of destruction of methane and other contaminants, but also allowing the turbine to operate on very low energy content fuel sources, including landfill gas that may not be suitable for typical landfill waste to energy systems. To better assess the potential for DOD-wide implementation, Southern Research developed a database of DOD owned landfill sites. Potential benefits of implementing the Flex Energy Technology DOD-wide include:

Expanded use of both renewable and domestic energy resources for sustainable and secure energy production

- Emissions reductions via offset of vented and/or flared landfill gas
- Emissions reduction associated with offset of utility power production
- Cost savings associated with the reduction in electrical purchases from the grid
- Cost savings associated with the reduction in fuel needed to flare landfill gas
- An estimated payback of approximately 3-6 years, depending on site specifics
- Extended power generation life-cycle for landfills by 20 plus years due to low-energy landfill gas requirements

Based on an initial review, a single comprehensive source of landfill data for all DOD facilities was not readily available. Therefore, at the request of ESTCP, Southern Research developed a national database of such sites for the DOD. This effort entailed:

(1) a literature review to obtain published information regarding existing landfills, status, and detailed characteristics;
(2) contacting DOD staff in each service branch in the environmental or facilities areas to determine if additional information regarding landfills is available in internal reports, documents, and databases;
(3) contacting landfill gas management and other contractors, regulatory agencies (state and federal), and other agencies (i.e. U.S. EPA's LMOP – Landfill Methane Outreach Program) to obtain DoD landfill and site specific information.

Information was compiled from these various sources that included:

- Location (City, State)
- Year of Opening
- Year of Closure
- Status
- Size (land acreage)
- Volume of Landfill (cf)
- Contents
- Gas Production (cf/day)
- Gas Quality (BTU/cf)
- Collection System Present (yes/no)

Following consolidation of data, it was discovered that some data required modification from its original source to render it suitable for calculation of landfill gas and energy generation estimates. As a result, it should be noted that data provided here is preliminary, includes assumptions and estimates, and is based on currently available information.However, each landfill is unique, and energy produced from an individual landfill is dependent upon many variables, e.g., local climatic conditions, waste composition and landfill design. Further investigation of individual landfills should be completed to determine site specific feasibility of landfill energy systems.

1.2. Objectives

The objective of this task was to collect data on all landfills owned by the Department of Defense and to use that information to calculate gas production rates in order to determine which sites may be appropriate for the Flex Microturbine. Given the approximate nature of the source data and the gas production models, this material can only be used for a preliminary assessment, based on which more detailed site-specific study should be performed before making economic decisions. The database was designed as a preliminary screening tool.

1.3. Drivers

Energy security, environmental sustainability, improved reliability and long-term savings are all drivers for the subject technology. On October 5, 2009 President Obama issued an Executive Order (3) titled "Federal Leadership in Environmental, Energy and Economic Performance". This Order challenges all federal agencies to establish greenhouse gas emissions reduction targets, specifically "reducing energy intensity in agency buildings;" and "increasing agency use of renewable energy…". In addition, the DOD has committed to achieving energy independence, increasing energy security, reducing energy costs, and decreasing its 'bootprint' via implementation of sustainable, renewable energy technologies.

2. METHOD

2.1. Approach

Southern contacted environmental and facility mangers for various branches within DOD to identify and obtain information regarding landfills from a variety of existing internal DOD sources . Southern also contacted groups such as the US EPA's Landfill Methane Outreach Program and reviewed some state regulatory agency databases. In addition, Southern performed literature, internet, and other public searches to obtain additional landfill information. The database was developed using existing data sources only. No field data collection efforts were pursued under this project.

2.2. Database Parameters

Table 1 shows the original list of desired parameters for which information was sought during the data collection process. A checkmark represents data that was collected using the approach described in Section 2.1 which in turn determined the database fields. The information listed as N/A may be obtained through direct contact with each of the individual landfill sites. However, such a data collection effort is beyond the scope of this project.

Table 1: Database Parameters

		Data Collected	**Comments**
Primary Variables	Location	✓	
	Date of Opening	✓	Obtained year of opening for most sites
	Date of Closure	✓	Obtained year of closure for most sites
	Status	✓	
	Size	✓	Obtained acreage for most sites
	Depth	✓	Obtained depth for some sites, developed estimation method for remaining
	Volume	✓	Not available for all sites – surrogate used
	Contents	✓	Not available for all sites – MSW assumed
	Waste Acceptance Rate		N/A
Secondary Variables	Number of Cells		N/A
	Number of Closed Cells		N/A
	Number of Operating Cells		N/A
	Capacity of single Cell		N/A
	Gas Collection System Present	✓	Not available for all sites
	Gas Collection System Information		N/A
	Gas Production (cf/day)	✓	Calculated for most sites
	Gas Quality (BTU/cf)	✓	Estimated based on published averages
	Number of Vents		N/A
	Each Vent BTU Content		N/A
	Methane Content		N/A

2.3. Analysis Approach

After sufficient data was collected, analysts reviewed the data for discrepancies or obvious outliers, and developed estimates for missing parameters. Calculations of methane generation potential and energy generation potential were them completed based on the data provided. The primary assumptions and landfill data modifications are described below:

- Some sites had a range instead of an independent value for fields such as landfill depth. For those sites, the median value was substituted to facilitate numerical searches and calculations.
- In some cases, closing and/or opening dates were not provided or were unrealistic (i.e. there were a few sites that listed a predicted closing date multiple decades in the future). For these cases, data was corrected to assume a landfill age of 30 years, which is the average age of a typical landfill. For landfills with unavailable or unrealistic opening dates, the data was corrected to assume a 30 year life based upon the available closing date. In situations where an opening date was available, but a closing was not, for gas generation calculation purposes (see equation 4), the current year (2010) was inserted as the closing date.
- The majority of depth values were unavailable for the Army, Marine, and Navy sites. As a surrogate, the depths from each of the Air Force landfill sites were averaged, providing a mean landfill depth of 14.72 ft. This value was used as a surrogate depth for the other services.
- For gas production calculations, it was also necessary to determine a MSW total mass. To calculate this from volume data, a density factor was required. The MSW density profile displayed in Figure 1 was utilized[1]. For the purpose of this database, the median MSW density value of 10 kN/m^3 (.03183 ton/cf) was used.
- The methane generation potential, L_0, and methane generation rate, k, used in the first order decay model can vary widely from landfill to landfill and are partly dependent on waste composition and local climatic conditions. The values of L_0 and k used in the calculations were 2.72 cf/lb and 0.05 1/yr, respectively.

Using the data collected and the assumptions and estimates described above, the following equations from the EPA's Landfill Gas to Energy Handbook[2] were applied.

$$Volume\ (cf) = Size\ (acre) * 43560\ (ft^2/acre) * Depth\ (ft) \quad (1)$$

$$Waste\ in\ Place\ (tons) = Volume\ (cf) * [\rho\ (lb/yd^3) \div 2000\ (lb/ton) \div 27\ (ft^3/yd^3)] \quad (2)$$

$$Annual\ LFG\ Generation\ (cf) = Waste\ in\ Place\ (tons) * 2000\ (lb/ton) * 0.10\ (cf/lb) \quad (3)$$

$$LFG\ Generation\ during\ current\ year\ (cf) = 2L_oR(e^{-kc} - e^{-kf}) \quad (4)$$

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[1] Zekkos, et al.,"Unit weight of Municipal Solid Waste," *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 132, No. 10, October 2006, pp. 1250-1261, (doi 10.1061/(ASCE)1090-0241(2006)132:10(1250))

[2] EPA. 1996. U. S. Environmental Protection Agency. Turning a liability into an asset: a landfill gas to energy project development handbook. September 1996

Where: L_o *= Total methane generation potential of the waste (cf/lb)*
R = Average annual waste acceptance rate during active life (lb)
k = Rate of methane generation (1/year)
t = Time since landfill opened (years)
c = Time since landfill closure (years)
and

L_o *= 2.72 (cf/lb)*
k = 0.05 (1/yr)

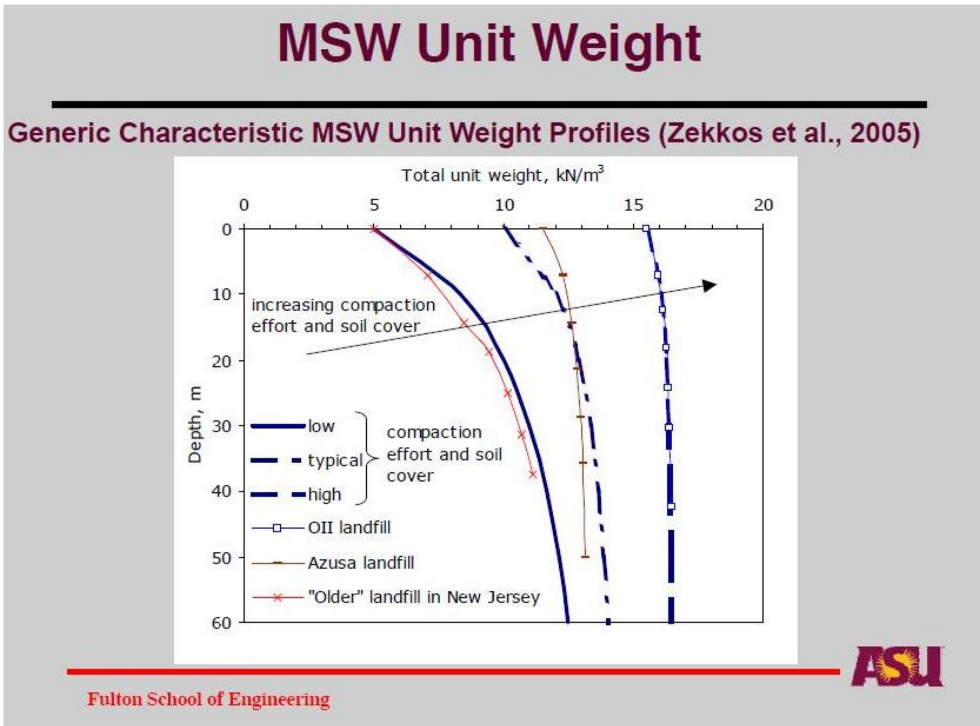


Figure 1: MSW Unit Weight Profile[3]

2.4.Database Development

The collected and calculated data was entered into a Microsoft Excel 2007 spreadsheet, which serves as a searchable database. A single, macro-enabled spreadsheet file, which may be filtered and sorted using custom algorithms, was developed using Visual Basic for Applications (VBA), an included feature of Microsoft Office. The database uses provides a single user-viewable spreadsheet report as the primary interface. Additional sheets invisible to the user are utilized as a form of data memory. A “Search Form” pop-up screen is the primary user interface. The search form allows the user to apply a variety of user-selectable search filters, which searaches the data and outputs the final tabulated list of results in the “Search Results” sheet.

[3] Zekkos, et al.,”Unit weight of Municipal Solid Waste,” *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 132, No. 10, October 2006, pp. 1250-1261, (doi 10.1061/(ASCE)1090-0241(2006)132:10(1250))

An additional feature of the system gives the user the ability to add landfill sites to the database without having to manually alter the database sheet, helping to maintain data integrity. The algorithm finds the first available row, populates it with the new data, then automatically generates a new Southern Research site number. In addition, users may view the entire raw data set, but may not make changes or edits to the existing data set. A password is required to make changes (i.e. updates in closure status, gas collection systems, etc.)

Once the user enables the search mechanism, the database interface allows the user to search via the following fields in any combination:

- Branch
- State
- Year of Closure
- Volume
- Gas Production (cf/day)
- Gross Power Generation Potential (kW)

The user can search up to a maximum of nine states; other than that there are no constraints within the search filter. The filters default to inactive; once a criterion is selected, associated filter(s) activate.

Detailed instructions regarding use of the database are provided in Appendix C.

3. DATA SUMMARY

3.1. Total Available Landfills

Southern was able to collect data on a total of 471 landfills from multiple sources. The breakdown of landfill locations by branch is as follows:

- 250 Air Force
- 121 Army
- 73 Navy
- 21 Marines
- 5 National Guard
- 1 Joint Forces or DOD-Civilian

As is mentioned in section 2.3, several sites did not have sufficient information regarding size (surface area), opening or closing dates, depth or contents to calculate a gas production rate accurately. Although surrogates for depth, contents, operating dates and size could be utilized, it should be noted that these surrogate values may not necessarily represent the landfill precisely. For sites in which there was not enough data, even with the estimates and assumptions utilized, to calculate gas production, no estimates are provided in the database. The total numbers of sites for which sufficient information is unavailable is:

- 85 Air Force
- 28 Army
- 57 Navy
- 9 Marines
- 4 National Guard

3.2. Potential Methane Production

Based on the data collected and calculated estimates of landfill gas production, total estimates of landfill gas productions from all sources within each branch were generated. It is assumed that, typically, the landfill gas composition is approximately 50-55% CH_4 and 45-50% CO_2. Based on these estimates, the total daily methane production rate for DOD landfills is calculated in Table 2 for current (2010) landfill conditions. It should be noted that methane generation rate will decrease significantly over time. Also, as stated previously, estimates for several landfills were excluded due to lack of data.

Table 2: Potential Methane Production

Constituent	Gas Composition by Volume	Air Force (cf/day)	Army (cf/day)	Navy (cf/day)	Marines (cf/day)	N Guard (cf/day)	Joint Forces (cf/day)	Total (cf/day)
CH4	50-55%	4,400,000-4,900,000	28,000,000-31,000,000	1,900,000-2,100,000	8,300,000-9,200,000	3,200-3,500	500-550	43,000,000-47,000,000
CO2	45-50%	4,000,000-4,400,000	26,000,000-28,000,000	1,700,000-1,900,000	7,500,000-8,300,000	2,800-3,200	450-500	39,000,000-43,000,000

3.3. Potential Power Production

Based on the total methane production for the services, analysts evaluated the potential applicability of the Flex Microturbine at the DOD facilities. For each site, the estimated power production rate was calculated based on the following[4]:

- Landfill gas generation rate (cf/day)
- Assumed methane content of 50%
- BTU content of landfill gas of 500 BTU/scf
- Collection efficiency for generated landfill gas of 80%
- Gross heat rate of 15000 BTU/kW-hr for the Flex Powerstation

Since the Flex unit currently is available only in a 250kW capacity, sites where generation potential of 300 kW or greater were identified as applicable sites. Based on this analysis, there appear to be 63 DOD sites where the Flex Microturbine can be applied. Note that this only considers maximum potential gas production, and does not account for project economics, site feasibility (physical, geographical, logistical), landfill gas collection, or other such variables.

[4] EPA. 1996. U. S. Environmental Protection Agency. Turning a liability into an asset: a landfill gas to energy project development handbook. September 1996

The total potential electric power generation based on DOD-wide landfill gas production rates at sites where the Flex unit may be applicable is approximately 108MW.

3.4.Potential GHG Offset

In addition to providing on site electrical power production from a renewable energy source, application of the Flex system or other power generation technologies will offset CO2 emissions as a result of offsetting the production of electricity from typical utility power generation systems. Instead of combusting the gas in a flare, as well as separately producing electricity (i.e. grid power), the Flex system would complete both operations using the single fuel source and offset one of the previous emission sources. The U.S. Energy Information Administration (EIA) Form 1605 provides domestic electricity emission factors, as well as an estimate of avoided GHG emissions when offsetting grid power generation. These factors are summarized in Table 3. For the purpose of this study, the national average for avoided emissions was used (.900 Metric tons CO_2e/MWh). When applied to equation 5, an estimate of avoided emissions was calculated.

$$\textit{Avoided Emissions (tons } CO_2e/yr) = GPGP\ (MW) * EF(CO_2e/MWh) * 8760\ (^{hr}/_{yr}) \quad (5)$$

Where:

GPGP = Gross Power Generation Potential (MW)

EF = EIA Emission Factor (CO_2e/MWh)

Total avoided emissions are estimated to be to be 850,000 tons CO_2e/yr if all of the potential sites utilized the Flex Microturbine. This offset calculation assumes that generated landfill gas LFG would otherwise be captured and flared. In many cases this is not the case. For cases where gas is vented directly, the avoided emissions may be significantly higher due to the higher global warming potential of vented methane as compared to carbon dioxide (from either flaring or power generation using the Flex system). Also, this does not account for any utilization of waste heat, which although difficult for many landfill applications, can significantly improve economics and GHG offset estimates. Therefore, this estimate represents a lower boundary to potential GHG emissions offsets.

4. CONCLUSIONS & RECOMMENDATIONS

Southern developed a database of Department of Defense owned and operated landfills, which includes a total of 471 sites throughout the four service branches and National Guard. Of those 471 sites, 63 have proven to be worth further investigation and analysis for application of the Flex Microturbine based on the analysis method presented in this report. Although a good initial estimate of the potential applicability of this technology, site specific feasibility assessments should be implemented for interested facilities that evaluate the specific site feasibility from an engineering, economic, logistical, and operational standpoint. The physical site requirements, costs for installing gas collection systems, operational and maintenance capability, current treatment systems, and other aspects can dramatically affect the feasibility of potential application of the technology.

In addition, additional technologies should be evaluated, as they can be applicable to different site conditions (i.e lower gas production rates may allow utilization of smaller generator technologies (30, 65, or 100 kW). Overall, the utilization of landfill gas and, potentially, other waste gas streams, at DOD facilities can provide significant economic, environmental, and energy security benefits to DOD, and contribute to the achievement of stated goals and objectives for the implementation of renewable domestic energy production.

Table 3: Electricity Emission Factors

Region	Emission Inventory[a]			Emission Reductions	
	Carbon Dioxide (Metric tons/ MWh)	Methane (kg/ MWh)	Nitrous Oxide (kg/ MWh)	Avoided Emissions[b] (Metric tons CO_2e/MWh)	Indirect Emissions[c] (Metric tons CO_2e/MWh)
(1) New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire and Maine	0.466	0.02647	0.00616	0.744	0.793
(2) New Jersey, Delaware, Pennsylvania, Maryland, West Virginia, Ohio, Indiana and Michigan	0.782	0.01404	0.01281	0.900	1.002
(3) Illinois and Wisconsin	0.638	0.01231	0.01048	0.900	1.151
(4) Missouri, Kentucky, Virginia, Arkansas, Tennessee, North Carolina, South Carolina, Louisiana, Mississippi, Alabama and Georgia	0.690	0.02556	0.01283	0.900	1.005
(5) Florida	0.678	0.02437	0.00856	0.788	0.840
(6) Texas	0.730	0.01351	0.00774	0.782	0.833
(7) Oklahoma and Kansas	0.867	0.01315	0.01236	0.900	0.990
(8) North Dakota, South Dakota, Nebraska, Minnesota and Iowa	0.875	0.01392	0.01414	0.900	1.160
(9) Colorado, Utah, Nevada, Wyoming and Montana	0.909	0.01158	0.01377	0.900	1.009
(10) New Mexico and Arizona	0.658	0.00762	0.00941	0.900	0.970
(11) Oregon, Washington and Idaho	0.147	0.01345	0.00337	0.781	0.833
(12) California	0.350	0.01831	0.00299	0.618	0.659
(13) Hawaii	0.858	0.03443	0.00777	0.849	0.905
(14) Alaska	0.749	0.01163	0.00461	0.859	0.916
(15) U.S. Territories	0.858	0.03443	0.00777	0.849	0.905
U.S. Average	0.676	0.01815	0.01053	0.900	0.959

[a] Emission inventory electricity emission factors are based on average emissions intensity of total electric sector generation for specified state-based regions and include transmission and distribution (T&D) losses incurred in delivering electricity to the point of use.
[b] Avoided emissions benchmark emission factors are based on average emissions intensity of fossil-fired generation for specified state-based regions, but do not exceed 0.9 metric tons CO_2e per MWh. Note that the Avoided emissions benchmarks do not include (T&D) losses.
[c] Indirect emission reductions emission factors for reduced purchases of electricity are based on average emissions intensity of fossil-fired generation for specified state-based regions and include transmission and distribution (T&D) losses incurred in delivering electricity to point of use.
Source: U.S. Energy Information Administration, October, 2007.

APPENDICES

Appendix A: List of Potential Power Production Sites

Southern Database Site #	Branch	Header Installation	Location	State	Status (active/closed/ closure in progress)	Gross Power Generation Potential (kW)
14	AIR FORCE	CAPE CANAVERAL AS	BREVARD	FL	ACTIVE	2,072
59	AIR FORCE	EDWARDS AFB	KERN CO	CA	ACTIVE	1,855
69	AIR FORCE	FE WARREN AFB	CHEYENNE	WY	CLOSED	377
115	AIR FORCE	KI SAWYER AFB	MARQUETTE CO	MI	CLOSED	550
210	AIR FORCE	SCOTT AFB	ST CLAIR CO	IL	CLOSED	444
215	AIR FORCE	TRAVIS AFB	SAN JOSE	CA	CLOSED	320
239	AIR FORCE	VANDENBERG AFB	SANTA BARBER CO	CA	ACTIVE	421
264	ARMY	CAMP ROBERTS	SACRAMENTO	CA	INACTIVE	355
265	ARMY	FT IRWIN	SAN BERNADINO CO	CA	ACTIVE	12,235
270	ARMY	ANNISTON ARMY DEPOT	BYNUM	AL	CLOSED	534

Southern Database Site #	Branch	Header Installation	Location	State	Status (active/closed/ closure in progress)	Gross Power Generation Potential (kW)
280	ARMY	SIERRA ARMY DEPOT	RENO	NV	ACTIVE	469
283	ARMY	MISSISSIPPI ARMY AMMUNITION PLANT	SLIDELL	AL	CLOSED	535
284	ARMY	HAWTHORNE ARMY DEPOT	MINERAL CO	NV	ACTIVE	608
285	ARMY	HAWTHORNE ARMY DEPOT	MINERAL CO	NV	ACTIVE	2,090
287	ARMY	MCALESTER ARMY AMMUNITION PLANT	MCALESTER	OK	CLOSED	663
289	ARMY	MCALESTER ARMY AMMUNITION PLANT	MCALESTER	OK	ACTIVE	992
291	ARMY	MILAN ARMY AMMUNITION PLANT	MILAN	TN	ACTIVE	3,628
292	ARMY	LONE STAR ARMY AMMUNITION PLANT	TEXARKANA	TX	ACTIVE	1,366
293	ARMY	COMBAT SUPPORT TRAINING CENTER AND CAMP PARKS	SAN JOSE	CA	ACTIVE	447
295	ARMY	FORT DIX	BURLINGTON CO	NJ	NONF	308
301	ARMY	FORT PICKETT TRAINING CENTER	BLACKSTONE	VA	CLOSED	416

Southern Database Site #	Branch	Header Installation	Location	State	Status (active/closed/ closure in progress)	Gross Power Generation Potential (kW)
314	ARMY	FORT GEORGE G MEADE	FORT GEORGE G MEADE	MD	CLOSED	721
315	ARMY	FORT GEORGE G MEADE	FORT GEORGE G MEADE	MD	CLOSED	677
316	ARMY	FORT BELVOIR	FORT BELVOIR	VA	CLOSED	860
317	ARMY	ABERDEEN PROVING GROUND	ABERDEEN PROVING GROUND	MD	ACTIVE	875
318	ARMY	ABERDEEN PROVING GROUND	ABERDEEN PROVING GROUND	MD	ACTIVE	772
321	ARMY	FORT GREELY	FAIRBANKS	AK	ACTIVE	8,165
322	ARMY	FORT WAINWRIGHT	FORT WAINWRIGHT	AK	ACTIVE	773
324	ARMY	REDSTONE ARSENAL	HUNTSVILLE	AL	ACTIVE	1,150
325	ARMY	FORT GORDON	AUGUSTA	GA	ACTIVE	364
326	ARMY	FORT GORDON	AUGUSTA	GA	CLOSED	374
331	ARMY	FORT STEWART	AUGUSTA	GA	ACTIVE	2,243

Southern Database Site #	Branch	Header Installation	Location	State	Status (active/closed/ closure in progress)	Gross Power Generation Potential (kW)
332	ARMY	FORT CAMPBELL	CLARSVILLE	TN	ACTIVE	1,001
333	ARMY	FORT KNOX		KY	ACTIVE	6,218
334	ARMY	FORT POLK		LA	ACTIVE	605
335	ARMY	FORT BRAGG	CUMBERLAND CO	NC	CLOSED	2,409
336	ARMY	FORT BRAGG	CUMBERLAND CO	NC	ACTIVE	832
337	ARMY	FORT BRAGG	CUMBERLAND CO	NC	ACTIVE	1,048
338	ARMY	FORT JACKSON	FORT JACKSON	GA	ACTIVE	1,271
339	ARMY	FORT JACKSON	FORT JACKSON	GA	CLOSED	833
341	ARMY	YUMA PROVING GROUND	PHOENIX	AZ	ACTIVE	1,738
343	ARMY	NATIONAL TRAINING CENTER AND FORT IRWIN	FORT IRWIN	CA	ACTIVE	730
344	ARMY	FORT RILEY	MADISON	KS	CLOSED	1,176

Southern Database Site #	Branch	Header Installation	Location	State	Status (active/closed/ closure in progress)	Gross Power Generation Potential (kW)
345	ARMY	WHITE SANDS MISSLE RANGE	DONA ANA	NM	ACTIVE	1,293
349	ARMY	FORT SILL	FORT SILL	OK	ACTIVE	1,568
350	ARMY	FORT SILL	FORT SILL	OK	ACTIVE	1,045
351	ARMY	FORT BLISS	ALAMOGORDO	NM	ACTIVE	1,891
352	ARMY	FORT HOOD	KILEEN	TX	ACTIVE	3,222
353	ARMY	DUGWAY PROVING GROUND	SALT LAKE CITY	UT	ACTIVE	3,013
354	ARMY	FORT LEWIS	TACOMA	WA	CLOSED	804
355	ARMY	FORT DETRICK	FREDERICK	MD	ACTIVE	628
362	ARMY	FORT SILL	COMANCHE	OK	CLOSED	371
371	ARMY	FORT BENNING	HARMONY CH	GA	CLOSED	1,375
405	NAVY	NAVAL BASE SAN DIEGO	SAN DIEGO	CA	ACTIVE	949

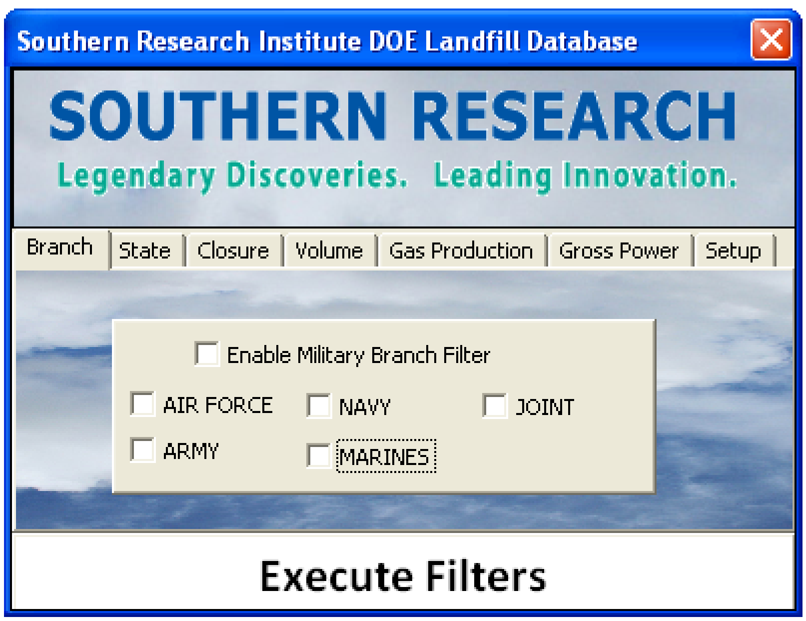
Southern Database Site #	Branch	Header Installation	Location	State	Status (active/closed/ closure in progress)	Gross Power Generation Potential (kW)
406	NAVY	NAVAL BASE SAN DIEGO	SAN DIEGO	CA	ACTIVE	2,722
440	NAVY	PEARL HARBOR	HONOLULU	HI	CLOSED	303
443	NAVY	WHIDBEY ISLAND NAVAL AIR STATION	WHIDBEY ISLAND	WA	CLOSED	350
448	MARINES	29 PALMS	SAN BERNARDINO CO	CA	ACTIVE	2,252
451	MARINES	SAN ONOFRE	SAN DIEGO CO	CA	ACTIVE	712
452	MARINES	MCAS EL TORO	IRVINE	CA	CLOSED	309
458	MARINES	MCB CAMP PENDELTON	SAN DIEGO CO	CA	OPEN	2,187
459	MARINES	MCRD SAN DIEGO	SAN DIEGO CO	CA	OPEN	14,940
465	MARINES	MCAS MIRAMAR	SAN DIEGO CO	CA	ACTIVE	2,396

Appendix B: Database User Instructions

USER INSTRUCTIONS
DoD Landfill Database
SERDP/ESTCP Project #SI-200823
June 2011
Version 2.0

To Search The Database:

- Open the database in MS Excel.
- Enable Macros. A Security Warning may appear above the spreadsheet. If so, click the 'Options' button next to the warning, select 'Enable This Content' for Macros and ActiveX, and hit 'OK'.
- Click the 'Search' button in the top left corner to reveal the following interface:



- To enter selection parameters, click the tab(s) on the interface corresponding to your filter criteria.
  - For each search criteria tab utilized, be sure to check the 'Enable ____ Filter' checkbox. If a criterion is not desired for your search, be sure it is NOT checked.
  - You can search by the following parameters:
    - Branch (Army, Navy, Air Force, Marines, Joint (owned/operated by more than one service)
    - State
    - Closure Status (searches for landfill closed in a specific time period)
    - Volume (waste volume in the landfill – ft^3)
    - Gas Production (actual or estimated landfill gas production – ft^3/day)
    - Gross Power Output Potential (calculated based on gas production – kW)
- Click 'Execute Filters'
- Close the Search Box (the file may autosave)
- After viewing the results, click the 'Search' button in the top left to execute another filter.

<u>To View Raw Data or Enter New Data:</u>

- Open the database in MS Excel.
- Enable Macros. A Security Warning may appear above the spreadsheet. If so, click the 'Options' button next to the warning, select 'Enable This Content' for Macros and ActiveX, and hit 'OK'.
- Click the 'Search' button in the top left corner to reveal the search interface.
- Select the 'Setup' tab.
- To view Raw Data:
  - Click the 'Show Database Information' button.
  - A 'Data' Spreadsheet tab will open up.
  - Select this tab – all raw data can be viewed on this tab.
  - Click the 'Hide Database Information' button to hide the raw data tab.
- To Enter a New Landfill Location:
  - Enter the passcode for editing in the box below the 'Enter New Location' button (Passcode is: SI200823).
  - Click the 'Enter New Location Button' and input the requested information. A site number will automatically be generated – do not alter this number.
  - When done, click 'Save Changes' button on Setup Tab.
- To Edit Existing Landfill Information:
  - View the raw data as described above.
  - Unprotect the 'Data' worksheet (Review -> Unprotect Sheet -> Enter password: SI200823).
  - Edit the data as necessary (do not reconfigure rows and columns or other formatting – only alter data as necessary).

- Save changes
- Re-protect the ‘Data’ worksheet (Review -> Protect Sheet -> Enter password: SI200823).

Appendix C: Primary Contacts for Landfill Information

Contact	Title	Organization	Email Address
Myron H. "Skip" Amerine	Senior Integrated Waste Management Specialist	CIWMB	samerine@CIWMB.ca.gov
Ted Rauh	Program Director, Waste Compliance and Mitigation Program		trauh@CIWMB.ca.gov
Mark Leary	Executive Director		MLeary@CIWMB.ca.gov
William F. Eng, PE, CEM	Operations Directorate, Facilities Policy Division	HQDA, OACSIM	William.Eng@us.army.mil
Harry R. Hendler	Manager, Federal Projects Unit	ADEQ	Hendler.Harry@azdeq.gov
Bryan Leamons, PE	Engineer Supervisor, Solid Waste Management Division		LEAMONS@adeq.state.ar.us
Martin Lee, PE	PE, Solid Waste Section	FL Dept of Enviornmental Protection	Lee.Martin@dep.state.fl.us
Vern Novstrup, PE	DoD Service Liasion, Engineering Services Center	NAVFAC	vern.novstrup@navy.mil