

COVERED SOURCE PERMIT (CSP) REVIEW (0652-01-C)
Covered Source Permit Application No. 0652-01

APPLICANT: County of Maui
Department of Environmental Management

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LOCATION Central Maui Landfill
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MAILING ADDRESS County of Maui
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SIC CODE: 4953 (Refuse Systems)

PROPOSED PROJECT:

The proposed project is for the installation and operation of an active landfill gas collection and control system (GCCS) for an existing municipal solid waste landfill modified after May 30, 1991.

The collection and control system is required to be installed pursuant to Federal New Source Performance Standards (NSPS) because the landfill fulfills the following criteria:

1. Expanded after May 30, 1991,
2. A design capacity of greater than 2.5 million megagrams (Mg) & 2.5 million cubic meters;
and
3. Has an estimated annual non-methane organic compound (NMOC) emission rate of greater than 50 Mg/yr.

The overall site plan for the Central Maui Landfill consists of six phases of development. Phases I, II, and III were the initial areas of the landfill. Phases I and II began accepting waste in 1987, with a vertical expansion in 1996. Phase III was not developed as a landfill, and is being used for co-composting of biosolids and green waste, and for production of biodiesel fuel.

Phase IV began accepting waste in 2005. Phases V and VI are for future expansion, and are currently being used by Ameron for quarrying operations. The capacity of each phase is as follows:

Phase	Capacity (cubic yards)	Capacity (Tons)¹
I and II	5,005,000	3,103,000
IV	1,393,000	864,000
V	2,494,000	1,546,000
VI	3,457,000	2,143,000
Total	12,349,000	7,656,000

¹ Density factor of 1,240 pounds per cubic yard assumed.

The initial installation of the GCCS will be for Phases I and II, and calls for the installation of 48 wells. The GCCS design for Phases IV, V and VI have not been finalized, but will be similar in layout to Phases I and II. Federal regulations for active landfills require the installation of the wells to be within 60 days of the date in which the initial solid waste has been in place for a period of 5 years or more.

Landfill gas(LFG) is collected by the landfill gas collection system, which consists of a network of vertical extraction wells, horizontal collectors and pipelines. The landfill gas is then routed to an inlet sump, where landfill gas condensate is collected. The landfill gas is then routed to a knockout vessel to remove particulate from the gas stream. Blowers provide vacuum to the LFG collection system and pressurize the LFG for delivery to the flare. LFG condensate is also routed to the flare for destruction.

The landfill GCCS equipment consists of the following:

1. Vertical Extraction Wells
2. Horizontal Connectors
3. Gas Collection System Piping
4. Condensate Collection and Management
5. Flare
6. Blower (2 @ 700 scfm initially; additional units to be added as needed)

The flare is designed to meet the following performance requirements:

- Maximum Btu/hr: 65 MMBtu/hr (2,045 scfm @ 50% CH₄)
- Minimum Btu/hr (LHV): 6.5 MMBtu/hr (204 scfm @ 50% CH₄)
- Minimum retention time: 0.6 seconds
- Minimum combustion temperature: 1600° F
- Destruction efficiency: weighted average destruction efficiency greater than 98% of volatile organic compounds (NMOC's) across the full range of gas flow rates.

The stack for the flare is approximately 11½ feet in diameter, 36 feet tall and is equipped with sample ports, temperature monitoring devices, propane pilot ignition system, UV flame detector assemblies, with a flame arrestor and pneumatic shutdown assembly at the flare inlet.

The extraction wells will be operated with a working vacuum that produces the highest sustainable flow of LPG without drawing in excessive air. Maximum well temperatures are to be maintained below 131° F (55° C) with an oxygen concentration of less than 5%. To demonstrate compliance with the operating parameter limits, the wells will be monitored monthly for pressure (vacuum) and temperature, along with methane, carbon dioxide, and oxygen concentrations. Wells determined to be operating outside of compliance limits will be adjusted by changing the amount of vacuum in the well.

In addition to well monitoring, the landfill surface is required to be monitored on a quarterly basis. If the surface readings exceed 500 parts per million of methane, corrective action is required. The landfill is also required to perform a monthly cover inspection to check for air infiltration or landfill gas migration. Other monitoring devices on the landfill gas collection and control system include a continuous temperature monitor for the flare and a continuous recording flow meter for recording landfill gas flow to the flare.

AIR POLLUTION CONTROL EQUIPMENT:

All of equipment to be installed is for air pollution control of the MSW landfill gas. The collection and control system is required by NSPS to be designed and operated to reduce NMOC by 98 weight-percent, or to reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen.

APPLICABLE FEDERAL REQUIREMENTS:

New Source Performance Standards (NSPS):

40 CFR Part 60, Subpart WWW - Standards of Performance for Municipal Solid Waste Landfills;

40 CFR Part 60, Subpart A - Standards of Performance for New Stationary Sources, - General Provisions;

The facility is subject to NSPS because the following criteria have been satisfied:

1. *The landfill was modified or constructed after May 30, 1991.* The landfill was initially scheduled for closure in 2001, but was not closed until 2005. To accommodate for the additional time the landfill was to be operational, the permitted design capacity was increased.
2. *The maximum capacity exceeds 2.5 million megagrams and 2.5 million cubic meters.* The application states that the capacity of all phases is 7,656,000 tons and 12,349,000 cubic yards. Converting to metric units to enable comparison with federal triggering levels, the aforementioned values equate to 6,945,406 megagrams and 9,441,488 cubic meters.

Landfills subject to the Federal requirements are also required to calculate annual NMOC emissions generated by their facility. Facilities that exceed 50 Mg/yr are required to install and operate a landfill gas collection and control system. Annual NMOC emissions from the Central Maui Landfill are in excess of 50 Mg/yr, requiring the installation of the landfill gas collection and control system.

National Emission Standards for Hazardous Air Pollutants (NESHAP):

40 CFR Part 63, Subpart AAAA - National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills

40 CFR Part 63, Subpart A - National Emission Standards for Hazardous Air Pollutants for Source Categories, - General Provisions;

The facility is subject to NESHAP for landfills because waste was accepted after November 8, 1987, the design capacity is greater than 2.5 million megagrams and 2.5 million cubic meters, and the estimated uncontrolled nonmethane organic compound (NMOC) emissions is equal to or greater than 50 megagrams per year. Facilities are not subject to the NESHAP regulations unless the 50 Mg/yr annual emission limit is exceeded.

The NESHAP rule adds startup, shutdown and malfunction requirements, adds operating condition deviations for out-of-bounds monitoring parameters, requires timely control of bioreactor landfills, and changes the reporting frequency for compliance reporting from annually to every six months.

APPLICABLE STATE REQUIREMENTS:

Hawaii Administrative Rules (HAR)

Chapter 11-59, Ambient Air Quality Standards

Chapter 11-60.1, Air Pollution Control

Subchapter 1, General Requirements

Subchapter 2, General Prohibitions

11-60.1-31 Applicability

11-60.1-32 Visible Emissions

11-60.1-33 Fugitive Dust

11-60.1-38 Sulfur Oxides from fuel combustion

Subchapter 5, Covered Sources

Subchapter 6, Fees for Covered Sources, Noncovered Sources, & Agricultural Burning

11-60.1-111 Definitions

11-60.1-112 General fee provisions for covered sources

11-60.1-113 Application fees for covered sources

11-60.1-114 Annual fees for covered sources

Subchapter 8, Standards of Performance for Stationary Sources

Subchapter 9, Hazardous Air Pollution Sources

NONAPPLICABLE REQUIREMENTS:

PREVENTION OF SIGNIFICANT DETERIORATION (PSD):

The regulations for MSW landfill gas control are based upon Maximum Achievable Control Technology (MACT) standards. PSD requires the use of Best Available Control Technology (BACT), a less stringent standard. Therefore a PSD review is not required for this project.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT) REQUIREMENTS:

BACT standards do not apply to MSW landfills. If landfill emissions exceed 50 megagrams per year, the landfill is required to install a gas collection and control system subject to Maximum

Achievable Control Technology (MACT) standards. MACT standards are more stringent than BACT standards, so BACT does not apply.

CONSOLIDATED EMISSIONS REPORTING REQUIREMENTS (CERR):

The facility is not subject to the consolidated emissions reporting rule (CERR) since annual emissions for each criteria pollutant does not exceed 100 tons per year (5 tpy for lead).

SYNTHETIC MINOR APPLICABILITY:

The facility does not propose any operational restrictions to not exceed major source emission levels. Therefore, the facility is not a synthetic minor source.

COMPLIANCE ASSURANCE MONITORING:

Compliance Assurance Monitoring (CAM) applies to facilities that fulfill all of the following criteria:

1. Facility is a major source that is required to obtain a part 70 (Title V) or 71 (Federal Plan) permit.
2. Facility is subject to emission limitation or standard for the applicable pollutant.
3. Facility uses a control device to achieve compliance.
4. Potential pre-control emissions of applicable pollutant are at least 100 percent of major source amount.

Although the facility fulfills all of the aforementioned criteria, it is exempted from CAM requirements since it is subject to a federal standard (NSPS or NESHAPS) promulgated after November 15, 1990. The landfill NSPS was promulgated on March 12, 1996, and thus the landfill gas collection and control equipment are exempt from CAM provisions.

INSIGNIFICANT ACTIVITIES/EXCEPTIONS:

There were no insignificant activities listed in application.

ALTERNATIVE OPERATING SCENARIOS:

No alternate operating scenarios were proposed by the applicant.

PROJECT EMISSIONS:

To calculate the NMOC emissions from landfills, a three-tiered approach is used. The tier calculations provide an estimate of NMOC emissions as a function of three variables:

1. NMOC concentration in LFG, (C_{NMOC});
2. Methane generation rate constant, (k); and
3. Refuse methane generation rate potential (L_0)

Tier 1 calculations use default values and yield conservative NMOC emission rates. Tier 2 calculations use site-specific NMOC concentrations and are determined by performing EPA test methods 25C or 18. Tier 3 calculations use both site-specific NMOC concentrations and methane generation rates. If tier 1 calculations indicate emissions greater than 50 Mg/yr, the landfill has the option of installing a gas collection and control system or performing additional tier (tier 2 and tier 3) calculations.

To determine tier 1 landfill NMOC emissions, the EPA-approved LandGEM emissions model was used. The program calculates NMOC and HAP emissions based upon a first-order decay equation. Although default rates are provided for C_{NMOC} (4,000 ppmv), k (0.02/yr) and L_o (100 m^3/Mg) and are required to be used in order to comply with the NSPS/Emission Guideline, the model provided by the applicant used the following input values:

1. Potential Methane Generation Capacity (L_o) = 100 m^3/Mg of waste;
2. Methane Generation Rate (k) = 0.05 yr^{-1} ; and
3. NMOC concentration in LFG of 4,000 ppmv.

The LandGEM program runs using the parameters previously described provided the following results:

LANDFILL SURFACE NMOC EMISSIONS (with control and collection system)	
Calendar Year	2007
LandGEM NMOC generation rate, Mg/yr (tpy)	262.8 (289.7)
Landfill Gas Collection Efficiency (%)	75%
NMOC Surface Emission Rate, Mg/yr (tpy)	65.7 (72.4)
Landfill gas generation rate (M^3/yr)	1.833E+07

Although the applicant did not use the default values in order to comply with federal regulations, the program output shows NMOC emissions exceeding 50 Mg/yr. Upon completion of the tier 1 analysis, the applicant did not perform tier 2 or tier 3 calculations and instead chose to install a landfill gas collection and control system. The emissions using the tier 1 values are as follows:

Pollutant	Emissions (tons/year)	Surface Emissions (tons/year)	Flare Emissions (tons/yr)
1,1,1-Trichloroethane (methyl chloroform) - HAP	5.370E-02	1.343E-02	8.056E-04
1,1,2,2-Tetrachloroethane - HAP/VOC	1.548E-01	3.871E-02	2.323E-03
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	1.992E-01	4.980E-02	2.988E-03
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	1.626E-02	4.065E-03	2.439E-04
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	3.403E-02	8.507E-03	5.104E-04
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	1.706E-02	4.264E-03	2.558E-04
Acrylonitrile - HAP/VOC	2.803E-01	7.008E-02	4.205E-03
Benzene - No or Unknown Co-disposal - HAP/VOC	1.245E-01	3.112E-02	1.867E-03
Carbon disulfide - HAP/VOC	3.703E-02	9.258E-03	5.555E-04
Carbon tetrachloride - HAP/VOC	5.161E-04	1.290E-04	7.741E-06
Carbonyl sulfide - HAP/VOC	2.468E-02	6.171E-03	3.703E-04
Chlorobenzene - HAP/VOC	2.360E-02	5.900E-03	3.540E-04
Chloroethane (ethyl chloride) - HAP/VOC	7.034E-02	1.759E-02	1.055E-03
Chloroform - HAP/VOC	3.004E-03	7.509E-04	4.506E-05
Dichlorobenzene - (HAP for para isomer/VOC)	2.589E-02	6.472E-03	3.883E-04

Pollutant	Emissions (tons/year)	Surface Emissions (tons/year)	Flare Emissions (tons/yr)
Dichloromethane (methylene chloride) - HAP	9.973E-01	2.493E-01	1.496E-02
Ethylbenzene - HAP/VOC	4.095E-01	1.024E-01	6.143E-03
Ethylene dibromide - HAP/VOC	1.576E-04	3.939E-05	2.363E-06
Hexane - HAP/VOC	4.770E-01	1.193E-01	7.155E-03
Mercury (total) - HAP	4.879E-05	1.220E-05	7.318E-07
Methyl ethyl ketone - HAP/VOC	4.294E-01	1.073E-01	6.441E-03
Methyl isobutyl ketone - HAP/VOC	1.596E-01	3.990E-02	2.394E-03
Perchloroethylene (tetrachloroethylene) - HAP	5.146E-01	1.286E-01	7.718E-03
Toluene - No or Unknown Co-disposal - HAP/VOC	3.013E+00	7.533E-01	4.520E-02
Trichloroethylene (trichloroethene) - HAP/VOC	3.086E-01	7.714E-02	4.628E-03
Vinyl chloride - HAP/VOC	3.826E-01	9.566E-02	5.739E-03
Xylenes - HAP/VOC	1.068E+00	2.671E-01	1.603E-02
Total HAPS		2.21E+00	1.32E-01

Since only tier 1 calculations were performed, the emissions levels presented will be overstated and it is recommended by AP-42 that “different values for L_o and k may be appropriate in estimating landfill emissions for particular landfills and for use in an emissions inventory.”

To obtain a more accurate emissions estimate, AP-42 recommends that actual flow data and methane generation rates be used. The data will be available since both parameters are required to be measured, either continuously (flow rate) or in conjunction with the initial performance test (methane generation rate).

In addition to the landfill surface, emissions will also be generated by the combustion of landfill gas in the flare. Emissions generated by the flare are as follows:

Flare Heat Capacity	65	MMBtu/hr
Hours of Operation	8,760	hr/yr
Annual Heat Capacity	569,400	MMBtu/yr
Methane flow rate	3.37E+08	ft ³ /yr
PM emission rate	1.700E-05	lb/ ft ³ methane
Hydrogen Sulfide Emissions	30.87	lb/hr

Pollutant	Emission Factor (lbs/MMBTU)	Flare Emissions (lb/yr)	Flare Emissions (g/s)	Flare Emissions (tons/yr)
Nitrogen Oxides	6.00E-02	34,164	0.49	17.08
Carbon Monoxide	1.50E-01	85,410	1.23	42.71
Particulate Matter	1.00E-02	5,722	0.08	2.86
Sulfur Oxides	-	58.03	8.35E-04	0.03

Notes:

NO_x and CO emission factors provided by manufacturer.

PM emission factors from AP-42, Chapter 4.2 Municipal Solid Waste Landfills (11/98), Table 2.4-5

SO₂ emission rate of 1.88 lb/lb H₂S provided by the applicant,

AIR QUALITY ASSESSMENT:

To determine the ambient air impact from the gas collection and control system, the EPA approved SCREEN3 modeling program was used. Parameter settings used in the assessment included simple terrain, default meteorology, and a rural input setting. Building downwash was not considered, since no buildings are located in the vicinity of the landfill. The analysis only addressed emissions from the flare since it is the only point source of emissions. The input parameters used are:

EMISSION RATES AND STACK PARAMETERS FOR AIR MODELING

EMISSION RATES					STACK PARAMETERS			
SO ₂ (g/s)	NO _x (g/s)	CO (g/s)	PM ₁₀ (g/s)	Pb (g/s)	Height (m)	Temp (K)	Velocity (m/s)	Diameter (m)
1.000	1.000	1.000	1.0	N/A	11.2	922	5.850	3.130

The result from the model demonstrated that the normalized concentration was 5.453 µg/m³ per g/s. The normalized concentration is then multiplied by the actual emission rate for the pollutants in question. A summary of the ambient air quality impacts is shown in the following table:

Normalized Concentration =			5.453	µg/m ³ per g/s				% of std.
Pollutant	Avg. Period	Emission Rate (g/s)	Time Factor	CONCENTRATION (µg/m ³)				
				Conc.	Background ¹	Total	Std	
CO	1-HR	1.23	1.0	6.71	3,876	3882.7	10,000	38.8
	8-HR	1.23	0.7	4.70	1,055	1058.0	5,000	21.2
NO _x	Ann.	0.49	0.2	0.53	9.0	9.53	70	2.2
PM	24-HR	0.06	0.4	0.13	119	119.13	150	79.4
	Ann.	0.06	0.2	0.07	25	25.07	70	35.8
SO ₂	3-HR	8.35E-04	0.9	0.0041	64.0	64	1,300	4.9
	24-HR	8.35E-04	0.4	0.0018	21.0	21	365	5.8
	Ann.	8.35E-04	0.2	0.0009	2.0	2	80	2.5

¹ Background concentration for PM₁₀ obtained from Kihei Monitoring Station, 2005. Remainder of background concentrations obtained from Kapolei Monitoring Station, 2005.

The air modeling demonstrates that the operation of the equipment complies with State and Federal ambient air quality standards.

OTHER ISSUES:

The applicant also requested an exemption from the NSPS landfill regulations for leachate wells. The application states that the landfill GCCS *may* include future connections to leachate manholes and cleanout risers, and requests an exemption from the temperature and concentration requirements. Federal regulations permit establishing higher temperature or concentration values at a particular well, provided that supporting data demonstrates that the elevated parameter does not cause fires or significantly inhibit anaerobic decomposition by killing methanogens. However, no supporting data was provided with the request. Since no supporting data was provided, the exemption from temperature and concentration requirements will need to be revisited if/when the future connections to leachate manholes and cleanout risers are added to the system.

SIGNIFICANT PERMIT CONDITIONS:

None; permit conditions taken verbatim from applicable federal regulations.

CONCLUSION AND RECOMMENDATION:

The construction and operation of the gas collection and control system for the Central Maui Landfill complies with all applicable state and federal requirements. Recommend issuance of covered source permit pending 30 day public comment period and 45-day EPA review.

Kevin Kihara
11/15/2007