DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

Landfill Guidelines

An Approach to Support Climate Change - Friendly Landfill Investments

FINAL DRAFT (Revised: June 9, 2010)

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1. US EPA Model LandGEM 3.02:
   http://www.epa.gov/ttn/catc/products.html

2. Landfill Methane Outreach Program International LFG Modeling:
   http://www.epa.gov/lmop/international/tools.html

3. 2006 IPCC Guidelines for National GHG Inventories (Waste),Volume 5, Section 3:
   http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html

4. World Bank website with essential information:
   http://web.worldbank.org/wbsite/external/topics/extsdnet/0,,pagepk:64885161~contentmdk:22339544~pipk:5929285~thesitepk:5929282,00.html

5. Development and Climate Change: A Strategic Framework for the World Bank Group. October 12, 2008, on Climate Change page:
   http://beta.worldbank.org

6. World Bank Environmental Assessment:
   http://web.worldbank.org/wbsite/external/topics/environment/extenvass/0,,menupk:407994~pagepk:149018~pipk:149093~thesitepk:407988,00.html

7. IFC Environmental, Health, and Safety Guidelines Waste Management Facilities, December 10, 2007:
   http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_WasteManagement/$FILE/Final+-+Waste+Management+Facilities.pdf

8. ADB Climate Change Programs:
   http://www.adb.org/documents/brochures/climate-change/default.asp

9. Clean Energy and Environment Program:
   http://www.adb.org/documents/clean-energy/ce-evolution.pdf

10. Carbon Market Initiative:
    http://www.adb.org/clean-energy/cmi.asp

11. Methane to Market Partnership:
    http://www.methanetomarkets.org/

12. EU Landfill Directive:
    http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:182:0001:0019:EN:PDF

13. The Clean Air Act:
    http://epw.senate.gov/envlaws/cleanair.pdf

14. Information on the Clean Air Act:
    http://www.epa.gov/air/caa/index.html

15. US EPA Model LandGEM 3.02:
    http://www.epa.gov/ttn/catc/products.html

16. Landfill Methane Outreach Program International LFG Modeling:
    http://www.epa.gov/lmop/international/tools.html

17. Landfill Guidelines list of technical consultations 2010:
    IDBDOCS-#35171997-IDBDOCS-#35168320-v1-
    Landfill_Guidelines_list_of_technical_consultation_2010

ABBREVIATIONS

ADB	Asian Development Bank
AfDB	African Development Bank
CAA	Clean Air Act
CC-Criteria	Minimum Climate Change Performance Criteria
CDM	Clean Development Mechanism
CEIF	Clean Energy Investment Framework
CERs	Certified Emission Reductions
CHP	Combined Heat and Power
EA	Environmental Assessment
EBRD	European Bank for Reconstruction and Development
ECC	Sustainable Energy and Climate Change Unit
ESIA	Environmental and Social Impact Assessment
EU	European Union
EPAs	Environmental Protection Authorities (local)
GHG	Greenhouse Gas
IDB	Inter-American Development Bank
IEA	International Energy Agency
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ISWA	International Solid Waste Association
kW	Kilowatt
LAC	Latin America and the Caribbean
LandGEM	Landfill Gas Emission Model
LFG	Landfill Gas
LFGTE	Landfill Gas to Energy
MDBs	Multilateral Development Banks
MSW	Municipal Solid Waste
MW	Megawatt
NMOC	Non-Methane Organic Compounds
O&M	Operation and Maintenance
SW	Solid Waste
SWM	Solid Waste Management
UNFCCC	United Nations Framework Convention on Climate Change
US/USA	United States of America
US EPA	United States Environmental Protection Agency
WB	World Bank Group

Landfill Guidelines

An Approach to Support Climate Change - Friendly Landfill Investments

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I. EXECUTIVE SUMMARY

1.1 The Inter-American Development Bank (IDB) is developing Guidelines for particular sectors and sub-sectors known to contribute to climate change. These Guidelines aim to provide the clear and quantitative Minimum Climate Change Performance Criteria (CC-Criteria) necessary for IDB to support projects, as well as guidance on assessing and reducing the greenhouse gas (GHG) emissions of projects.[1] The purpose of the Landfill Guidelines is to set forth an approach to financing new Landfills and Landfill Gas (LFG) plants in a manner consistent with IDB's commitment to protecting the environment and reducing the adverse impacts of climate change.[2] Under these guidelines, IDB establishes innovative rules for funding landfill projects, requiring GHG mitigation by collection and destruction of LFG.

1.2 The rate of urbanization in LAC is one of the fastest in the world; with an urban population increase from 196 million in 1975 to 358 million in 1995, requiring an 80% growth in urban sanitation services,[3] including increased landfill capacity. Therefore, the IDB and other Multilateral Development Banks (MDBs) operating in the region are increasingly requested to finance new landfills. LFG consists of approximately 50% methane (CH_4), a GHG that contributes 23 times more per ton to the greenhouse effect than carbon dioxide (CO_2). Globally, around 14% of the total GHG effect is connected to CH_4 emissions,[4] of which approximately 10% is emitted by landfills. Thus, roughly 1.4% of global GHG emissions are associated with landfills, of which approximately 0.13% is from LAC.

1.3 However, due to a lack of resources, institutional weakness, inadequate legislation and other environmental governance issues, in most cases Municipal Solid Waste (MSW) is disposed of in dumps or controlled landfills that do not fulfill minimum technical standards, rather than sanitary landfills. Most controlled landfills do not include an LFG management system, undermining the MDBs' objectives of supporting climate change mitigation efforts and commitment to protecting the environment.

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1 Directive B.11 of IDB's Environment and Safeguards Compliance Policy states that "the Bank encourages the reduction and control of greenhouse gas emissions in a manner appropriate to the nature and scale of operations."

2 These guidelines currently only apply to new LFG plants.

3 Diagnosis of Municipal Solid Waste Management in LAC; Joint publication from IDB and the Pan American Health Organization (1997).

4 IPCC, Contribution of Working Group I to the Fourth Assessment Report, 2007.

1.4 The IDB will support those Landfills and LFG projects[5] that are designed to use the best proven technology appropriate to the particular characteristics of each individual project. This includes LFG plant[6] technologies that ensure appropriate LFG collection and destruction. LFG technologies are available and there are approximately 1,400 Landfill Gas to Energy (LFGTE)[7] plants worldwide, most of them in the US and Europe. In connection with the United Nations Framework Convention on Climate Change (UNFCCC), an LFG plant may qualify as a Clean Development Mechanism (CDM) project, generating revenue through Certified Emission Reductions (CERs). This has made the construction of flaring LFG plants economically feasible. In many cases, extra revenue from energy sales has also made installing LFG energy generation plants economically feasible.

1.5 For a landfill or LFG project to be eligible for IDB financing, it is required to meet either approved CC-Criteria or guidelines or to commit to comply with those criteria. Compliance with the CC-Criteria must be verified during analysis or due diligence and confirmed prior to Board approval, or the borrower must commit to meeting the CC-Criteria during project implementation. In addition to GHG emissions, during the analysis process the project will also be evaluated for compliance with the Bank's environmental and social safeguard policies.

1.6 Even where LFG plants have a significant potential to contribute to reduce GHG emissions, in many cases projects do not move forward for economic reasons. Projects may not be economically feasible due to design, technical or operational reasons.

1.7 In light of changing global objectives on the control of CO_2 and other GHGs, as new data on GHG performance and mitigation options becomes available and as the Bank gains experience implementing these guidelines with projects, these guidelines and criteria will need to be periodically reviewed and updated. Such revisions may include refining criteria as well as proposing new criteria or mitigation measures. Projects that meet the CC-Criteria and guidelines when declared eligible for IDB financing will be grandfathered in with regard to any future changes specific to this sector or subsector. The grandfathering in of projects vis-à-vis the CC-Criteria and guidelines applicable at the eligibility stage will allow the IDB to react to new climate change developments while keeping its commitments to borrowers and clients.

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[5] LFG Project refers to the total project cycle including feasibility studies, design and build.

[6] LFG Plant refers to the plant itself, including all the necessary technical installations such as collection systems, pump and regulation systems and flaring or a system for utilization of energy.

[7] LFGTE (Landfill Gas to Energy) means an LFG Plant that utilizes LFG for energy production.

II. INTRODUCTION

2.1 IDB is developing a Climate Change Strategy with a focus on sectors that contribute to GHG emissions, for which the Bank will promulgate good practices that encourage the use of appropriate GHG emissions reduction technologies. One selected subsector in the IDB climate strategy is Solid Waste Management (SWM) and landfills in particular. These guidelines delineate IDB's basic approach to financing landfill and LFG plant construction.

2.2 The most common method of handling waste in LAC is disposal in controlled landfills or open-air dumps. IDB already has a strategy for promoting best practices in Municipal Solid Waste (MSW) management.[8] As a result of good MSW management, anaerobic conditions occur in landfills, producing and emitting methane (CH_4), a GHG.

2.3 This document is divided into five parts: (i) a description of landfills in LAC and environmental aspects of constructing and operating landfills; (ii) a description of LFG generation in landfills; (iii) a summary of available LFG plant technologies and their economics; (iv) the practice of other MDBs and countries with regard to financing landfills and LFG plants; and (v) the proposed IDB approach to financing LFG plants.

III. GHG EMISSIONS FROM LANDFILLS IN LAC

A. Waste disposal at landfills

3.1 LAC is highly urbanized, with roughly 75% of its 500 million inhabitants living in cities. This concentrates solid waste and the corresponding waste management problems. In LAC, types of landfills include: (i) open and uncontrolled dumps; (ii) controlled dumps; and (iii) sanitary landfills, which feature a composite liner at bottom, a leachate drainage system, daily and final cover, compaction during operation and a monitoring plan in force. Most LAC cities still dispose of MSW in open dumps, but the most prosperous ones have begun to improve disposal practices and have introduced sanitary landfills. However, only 23% of collected waste is disposed of in sanitary landfills. Approximately 330,000 tons per day[9], corresponding to 0.66 kg/day per person, is disposed of in dumps or landfills. New data for Brazil reports that 0.60 – 1.20 kg/day per person is disposed of in dumps or landfills.[10] Most dumps and landfills are owned and operated by municipalities but, in recent years, some of the largest landfills have been taken

[8] IDB, "Manejo de Residuos Solidos – Lineamientos para un Servicio Integral, Sustentable e Inclusivo", Horacio Terraza.

[9] Diagnosis of Municipal Solid Waste Management in LAC; Joint publication from IDB and the Pan American Health Organization (1997).

[10] Methane to Market: Brazilian Country Profile (2008).

over by private companies under concessionary terms. Apart from disposal, incineration is used for hospital waste and very little MSW is composted.

B. The contribution of landfills to global GHG emissions

3.2 LFG consists of approximately 50% CH_4, a GHG that contributes 23 times more per ton to the greenhouse effect than CO_2. Roughly 14% of the GHG is connected to CH_4 emissions,[11] of which approximately 10% is emitted by landfills. Thus, roughly 1.4% of global GHG emissions are related to landfills, of which approximately 0.13% is from LAC.

IV. LFG GENERATION

A. LFG generation in general

4.1 When MSW is disposed of in landfills, anaerobic decomposition of organic matter, and thus LFG production, starts within a few months and as early as a few weeks. The main gas components are 40 – 60% CH_4, 25 – 50% CO_2, 3 – 15% N_2 and 0 – 4% O_2 (N_2 and O_2 from intrusion of atmospheric air into the landfill). LFG also contains trace amounts of other gasses and is typically saturated with moisture.

4.2 LFG production depends on several parameters: (i) temperature in the landfill – higher temperatures mean faster decomposition and LFG production; (ii) moisture content in the waste body, determined by the type of waste and precipitation in the area – optimal LFG production occurs at 50 – 60% or more; (iii) waste composition – the decomposable carbon content determines potential LFG production; (iv) structure of the waste – smaller particles afford better conditions for methane producing bacteria; (v) age of the waste – normally maximum production occurs 3 – 8 years after disposal, after which production progressively declines over the subsequent 30 – 75 years; and (vi) final cover use to prevent atmospheric air penetration, ideally not so tight as to prevent rainwater infiltration; and (vii) the design, operating plan and practices for waste filling at the site, particularly compaction and cover practices.

4.3 Over the last thirty years several models for estimating LFG production and extraction have been developed: (i) the Zero Order Model assumes a constant amount of LFG is produced per year until all decomposable carbon is degraded. It does not include the effect of age of the waste and, therefore, is only appropriate for estimating national or global LFG emissions; (ii) the First Order Model assumes that waste decays exponentially over time. An often used First Order Model is the Landfill Gas Emission Model (LandGEM) 3.02 from the United

[11] IPCC, Contribution of Working Group I to the Fourth Assessment Report, 2007.

States Environmental Protection Agency (US EPA).[12] This model has been modified for some LAC countries; (iii) the Multi-phase Model accounts for specific amounts of different types of waste, including their carbon content, to estimate the LFG production from each type of waste. Such a model is used for estimation in CDM projects and can be found on the IPCC website.[13] Using these models as well as the appropriate input and parameters for the calculation requires expertise and experience in the waste and LFG fields to avoid, in particular, overestimating LFG production, which has been seen in many cases.

B. LFG potential

4.4 In 2003, a total of 1,150 LFGTE plants were identified worldwide.[14] However, the information is not exact as few countries have complete national data for LFG plants and much information is gathered in collaboration with local experts. The US EPA, however, has collected up-to-date information on 509 operational US LFG plants through 2009. New information and estimations from earlier data indicate that there were approximately 1,400 LFG plants worldwide in 2008.

4.5 The worldwide study[15] also looked at the real extraction rate (m^3 of LFG per ton of waste per year) from existing LFG plants.[16] The study showed an LFG extraction rate of 3 – 6 m^3 LFG per ton of SW per year during the lifetime of each landfill studied. In many cases the real and estimated LFG extraction rates differ and, as demonstrated by a 2007 World Bank (WB) study, most early estimations seem overly optimistic.[17] Only a limited number of LFG plants with energy generation facilities are operating in LAC. In four out of the five LAC projects analyzed in the WB study, gas extraction rates were 2 – 5 m^3 LFG per ton per year, except from one plant in which an extremely high level of leachate prevented extraction from gas wells, resulting in only 0.5 m^3 LFG per ton per year.

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12 US EPA Model LandGEM 3.02: http://www.epa.gov/ttn/catc/products.html; Landfill Methane Outreach Program International LFG Modeling: http://www.epa.gov/lmop/international/tools.html

13 2006 IPCC Guidelines for National GHG Inventories (Waste), Volume 5, Section 3: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html

14 ISWA magazine, Waste Management World, July – August 2004: "Landfill gas recovery plants, looking at types and numbers worldwide" by Hans Willumsen, LFG Consult.

15 *Ibid.*

16 Only up to about 50% of the generated LFG can be captured and used by systems.

17 World Bank Report "Design vs. Actual Performance and the Future for CDM Projects" (2007) by Horacio Terraza, Helvecio Guimaraes, the World Bank and Hans Willumsen, LFG Consult.

V. AVAILABLE LFG TECHNOLOGY AND ECONOMICS

A. LFG technology

5.1 An LFG plant consists of a collection, flare and utilization system. The most common collection system consists of vertically drilled wells equipped with perforated plastic pipes surrounded by gravel. The extraction system can also be constructed by horizontal perforated pipes in gravel trenches in the landfill. The horizontal system must be installed during filling of the landfill, which makes for easier LFG extraction during the active waste-disposal life of a site and, thus, better recovering more of the gas generated. Gas wells or horizontal gas collection pipes are attached to an LFG piping system (buried or on the surface) connected to a gas blower or compressor. This generates negative pressure for LFG extraction to a flare or energy production plant.

5.2 There are two types of flares: open flares and enclosed flares.[18] Only enclosed flares can control combustion and emissions reductions effectively. When LFG is burned in an enclosed flare or used for energy purposes, almost all CH_4 generated is destroyed, producing an almost CO_2-neutral emission. Depending on the design, the destruction and removal efficiency for enclosed flares is between 95 and 99%.

5.3 LFG may be used for energy generation if local energy market conditions make it feasible. The energy produced displaces fossil fuels and reduces GHG emissions from existing generation plants. There are several different types of LFG energy utilization systems: (i) gas engine or generator units are the most common way of producing electricity from LFG. Engine generator sets for small and mid-size plants are often housed in a container solution, generally delivered in units sized up to 1 MW. In some cases, heat from cooling the engine and exhaust gas are used for heating purposes. These Combined Heat and Power (CHP) systems achieve much more efficient energy use if there is a suitable use for recovered waste heat. Gas or steam turbines are used in some larger LFG plants; (ii) heat production in a boiler system is another popular use of LFG, as it can be burned in a furnace or boiler plant for producing hot water, steam or hot air for heating or drying; (iii) LFG is used directly in a variety of plants, including brickyard kilns, cement production, leachate evaporation, and others; (iv) LFG is refined into natural gas by removing components other than CH_4 (primarily CO_2) and injected into the natural gas network; (v) LFG is also used as vehicle fuel after removal of non-CH_4 elements and compression; and finally (vi) LFG can power fuel cells, but, because of high costs, this technology is not yet commercially viable.

[18] Flaring is done for environmental reasons (reduction of methane emissions) but mainly to reduce the risks of fire and explosion.

5.4 For LAC the most obvious solutions are (i) and (ii). Technology for power production from gas engine or generator units and boiler plants is well known and operation and maintenance expertise and spare parts are available in LAC.

B. LFG plant economics

5.5 Table 1 summarizes investment costs for the most LAC-appropriate LFG technology. Economics make it generally possible to build and operate LFG plants in LAC countries.

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Table 1: Investment costs for different items in an LFG plant[19]		
Components	**Costs**	**Cost (US$)/ton[20]**
Project preparation	10 - 15% of total investment	0.08 – 0.18 US$/ton
Collection system	30,000 – 50,000 US$/ha	0.15 – 0.40 US$/ton
Gas pump system[21]	75 – 200 US$/$m^3$LFG/hour	0.05 – 0.30 US$/ton
Flare system	40 – 80 US$/$m^3$LFG/hour	0.02 – 0.04 US$/ton
Gas engine/generator units	1,100 – 1,700 US$/$kW_e$ installed	0.60 – 1.10 US$/ton
Boiler plant	40 – 80 US$/$kW_{Heat}$ installed	0.17 – 0.34 US$/ton

5.6 Table 2 summarizes Operation and Maintenance (O&M) costs for the most LAC-appropriate LFG technology:

Table 2: Annual O&M cost for different LFG systems[22]	
Type of LFG plant	**Annual O&M Cost**
LFG plant with flaring system	4 – 8% of the total investment cost
LFG plant with boiler system	4 – 8% of the total investment cost
LFG plant with electricity production	10 - 12% of the total investment cost

[19] IDB Guidance Note on Landfill Gas Capture and Utilization; Horacio Terraza and Hans Willumsen, 2010.
[20] Tons of waste in place.
[21] This includes the blower or compressor, control and regulation and treatment.
[22] *Ibid.*

VI. OTHER MDBS APPROACH TO THE FINANCING OF LANDFILLS AND LFG PLANTS

6.1 Most MDBs have considered adopting strategies or frameworks for climate change. However, the IDB is the first MDB to propose specific guidelines and criteria for GHG emissions from landfills.

6.2 In 2005, the WB developed a carbon finance strategy focusing on three objectives: (i) ensuring carbon finance contributes to sustainable development; (ii) assisting in building, sustaining and expanding the international market for CERs, and (iii) strengthening the capacity of developing countries to benefit from the emerging market for CERs. The WB has launched several climate change initiatives[23] and, in October 2008, introduced a Strategic Framework for Development and Climate Change.[24] The latter delineates criteria for faster growth of low carbon energy projects (e.g. biomass projects). Prior to financing a landfill project the WB requires that an Environmental Assessment (EA)[25] be prepared during project preparation. There are no specific WB guidelines addressing GHG emissions for landfill projects. The International Finance Corporation (IFC) recommends methods to control and monitor landfill gas emissions, including recovery and pre-use or thermal destruction through an efficient flaring facility.[26]

6.3 The Asian Development Bank (ADB) has a Climate Change Program,[27] a Clean Energy and Environment Program[28] and a Carbon Market Initiative.[29] To promote LFG projects, ADB has been a member of the Methane to Market Partnership since 2006.[30] The Partnership was established by the US EPA to promote methane and LFG capture and utilization for energy purposes. Like the WB, ADB requires an EA for landfill projects. Potential environmental impacts from LFG emissions must be included in the EA. ADB promotes inclusion of LFG plants in landfill projects though it is not a requirement to secure financing.

6.4 The African Development Bank (AfDB) launched the Clean Energy Investment Framework (CEIF) in March 2008. This framework sets an agenda for mainstreaming clean energy options and promoting investments in cleaner energy.

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23 World Bank website with essential information: http://web.worldbank.org/wbsite/external/topics/extsdnet/0,,pagepk:64885161~contentmdk:22339544~pipk:5929285~thesitepk:5929282,00.html

24 Development and Climate Change: A Strategic Framework for the World Bank Group. October 12, 2008, on Climate Change page: http://beta.worldbank.org/

25 World Bank Environmental Assessment: http://web.worldbank.org/wbsite/external/topics/environment/extenvass/0,,menupk:407994~pagepk:149018~pipk:149093~thesitepk:407988,00.html

26 IFC Environmental, Health, and Safety Guidelines Waste Management Facilities, December 10, 2007: http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_WasteManagement/$FILE/Final+-+Waste+Management+Facilities.pdf

27 Climate Change ADB Programs: http://www.adb.org/documents/brochures/climate-change/default.asp

28 Clean Energy and Environment Program: http://www.adb.org/documents/clean-energy/ce-evolution.pdf

29 Carbon Market Initiative: http://www.adb.org/clean-energy/cmi.asp

30 Methane to Market Partnership homepage: http://www.methanetomarkets.org/m2m2009/index.aspx

There are only a few landfills in Africa as most waste is disposed of in dumps. Only 5 - 10 LFG plants are in operation on the continent. The CEIF mentions LFG as a clean energy opportunity and encourages construction of LFG plants to reduce GHG emissions.

6.5 In the case of the European Bank for Reconstruction and Development (EBRD), projects must follow European Union (EU) Directives to qualify for support.[31] Before a landfill is constructed an Environmental and Social Impact Assessment (ESIA) must be carried out. At a minimum, LFG flaring is required and LFG should be utilized for energy purposes if economically feasible.

VII. OTHER GUIDELINES

7.1 Most developed countries have rules and requirements for LFG extraction and destruction for environmental and safety reasons but not climate change purposes. However the rules differ from country to country. In the EU, minimum requirements are established for all member states, but each of the countries can make further restrictions. The US has federal performance-based regulations regarding collection and control of LFG and some states have their own more stringent rules.

7.2 Minimum requirements for EU member states are contained in European Council Directive 1999/31/EC of April 26, 1999 on landfill waste (Landfill Directive).[32] The directive requires the implementation of appropriate measures in order to control the accumulation of LFG, including by reducing biodegradable waste content in landfills and landfill gas control. The rules are being implemented over time, but some countries have already outlawed disposal of organic waste in landfills. In those cases organic waste is incinerated, composted or rendered inert by Mechanical-Biological Treatment. Further, LFG from landfills receiving biodegradable waste must be collected, treated and used. Gas collected must be flared if it cannot be used to produce energy. The Directive's detailed requirements for collection, treatment and use of LFG are administered by local Environmental Protection Authorities (EPAs) and must be implemented so as to minimize damage to or deterioration of the environment and human health risks.

7.3 In the US, landfill gas is regulated at the federal and state levels. Federally, the Clean Air Act (CAA)[33, 34] regulates pollutant emissions to ensure air quality meets specified health and welfare standards. The basic requirements are the same for both existing and new landfills. For any landfill with a design capacity greater than 2.5 million tons of waste that emits Non-Methane Organic Compounds (NMOC) at a rate of 50 tons/year, EPA requires installation of a gas collection

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[31] EU Landfill Directive: http://eur-lex.europa.eu/lexuriserv/lexuriserv.do?uri=oj:l:1999:182:0001:0019:en:pdf
[32] *Ibid.*
[33] The Clean Air Act: http://epw.senate.gov/envlaws/cleanair.pdf
[34] Information on the Clean Air Act: http://www.epa.gov/air/caa/index.html

and control system. To calculate NMOC, the landfill owner can use EPA's LandGEM Version 3.02.[35] In some states the requirements are stricter. In California, for example, LFG must be collected from landfills with only 450,000 tons of waste in place. However, the EPA aims to promulgate GHG regulations under the CAA in the near future that include methane emitted by large sources.

VIII. GUIDELINES TO BE FOLLOWED BY THE IDB TO FINANCE NEW LANDFILLS AND LFG PLANTS

8.1 IDB is committed to a long-term strategy supporting the development of LFG projects that reduce climate change impacts. Although some IDB operations include landfill construction, an IDB-financed landfill has yet to be built. However, several landfills are expected to be built in the next five years. With accelerated urbanization in LAC there is a growing need for new landfills and resources to finance them.

8.2 As a result, IDB faces and is likely to be faced in years to come with increasing country demand for landfill financing. IDB is developing tools to support landfill projects, including those necessary to estimate and mitigate GHG emissions. IDB will support the construction of landfills designed to meet CC-Criteria through the installation and monitoring of LFG management systems, including GHG destruction by flaring or energy utilization. IDB will also support good practices in estimating GHG emissions and potential reductions and the development of national and local regulations.

8.3 For a landfill or LFG project to be eligible for IDB financing, it is required to meet either approved CC-Criteria or guidelines or to commit to comply with those criteria. Compliance with the CC-Criteria must be verified during analysis or due diligence and confirmed prior to Board approval, or the borrower must commit to meeting the CC-Criteria during project implementation. .

8.4 Table 3 presents the CC-Criteria projects to qualify for IDB financing. The CC-Criteria are based on best practices and a realistic approach to the economic capacity of LAC cities to implement them. The guidelines and requirements of other MDBs and countries, described in section VII, are designed mostly to mitigate occupational safety risks and it is difficult to compare them with the CC-Criteria.

8.5 The CC-Criteria presented in Table 3 will be reviewed periodically to take into account new technological and institutional developments and the Bank's experience implementing these guidelines with projects.

[35] US EPA Model LandGEM 3.02: http://www.epa.gov/ttn/catc/products.html. *See also*: Landfill Methane Outreach Program International LFG Modeling: http://www.epa.gov/lmop/international/tools.html

IX. MINIMUM CLIMATE CHANGE PERFORMANCE CRITERIA (CC-CRITERIA)

9.1 Table 3 presents the requirements for new landfill construction and LFG design for landfill projects to be eligible for IDB support.

Table 3: At Eligibility Stage

Daily disposal(ton/day)	Landfill depth(m)	Design requirements
400 – 750	>10	When a landfill is designed to receive between 400 - 750 tons of MSW/day and the landfill is more than 10 m deep (from bottom liner to final cap), at a minimum a gas collection system[36] with open flares must be incorporated in the project design for climate change mitigation purposes.
>750	>10	When the landfill is designed to receive more than 750 tons of MSW/day and the landfill is more than 10 m deep (from bottom liner to final cap), an active gas collection system[37] and enclosed flaring must be incorporated in the project design for climate change mitigation purposes.[38]

9.2 For landfills which are designed to receive over 750 tons MSW per day it is recommended as good practice to carry out Feasibility Studies for Energy Utilization.

[36] Naturally induced exhaust systems, constructed and operated so that the flares are burning most of the time.

[37] Electro-mechanically induced exhaust systems (Gas blower/compressor that establishes a negative pressure in the collection system).

[38] In terms of operational efficiency, it is recommended that the LFG capture and flaring system is operational when the flow rate reaches a level of 500m^3/hour.