CLEAN DEVELOPMENT MECHANISM

**CDM-MP87-A02**

# Concept Note

# Harmonized approach for monitoring the methane concentration in biogas and landfill gas (LFG)

Version 01.0

**United Nations**
Framework Convention on
Climate Change

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# 1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its 111th meeting (EB 111), considered the concept note "Improving clarity and consistency of methodological products".

2. At EB 111, the Board requested the secretariat and the CDM Methodologies Panel (MP) to:

   (a) Recommend a new methodological tool containing a repository of data/parameters that are common among different methodologies; and

   (b) Update the default factors in methodologies that are found to be not conservative in accordance with the latest science.

3. At its 86th meeting (MP 86), the MP agreed on the potential scope of the new tool and agreed to conduct a road test with:

   (a) Methodologies that apply the concentration of methane in biogas or in landfill gas (LFG);

   (b) Methodologies that apply the diesel generator emission factor for off-grid applications and the kerosene emission factor for lighting for off-grid applications.

# 2. Purpose

4. The purpose of this concept note is to respond to the mandate in paragraph 3 (a) above to discuss a harmonized approach for monitoring the methane concentration in the biogas and in the LFG. The mandate in paragraph 3 (b) above is being addressed in separate stream of work.

# 3. Key issues

5. The road-test was conducted following the steps below.

## 3.1. STEP 1. Identification of methodologies and methodological tools

6. Under this step, methodologies and methodological tools were selected by applying a search filter of Sectoral Scope 13 (Waste handling and disposal). The results are displayed in Table 1 below.

**Table 1. Approved methodologies and methodological tools under Sectoral Scope 13**

| Small-scale methodologies | Large-scale methodologies | Methodological Tools |
|---|---|---|
| **AMS-III.D.:** Methane recovery in animal manure management systems - Version 21.0 | **AM0057:** Avoided emissions from biomass wastes through use as feed stock in pulp and paper, cardboard, fibreboard or bio-oil production - Version 3.0.1 | **TOOL06:** Project emissions from flaring - version 3.0 |
| **AMS-III.E.:** Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment - Version 17.0 | **AM0073:** GHG emission reductions through multi-site manure collection and treatment in a central plant - Version 1.0 | **TOOL08:** Tool to determine the mass flow of a greenhouse gas in a gaseous stream - version 3.0; |
| **AMS-III.F.:** Avoidance of methane emissions through composting - Version 12.0 | **AM0080:** Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants - Version 1.0 | **TOOL14:** Project and leakage emissions from anaerobic digesters - version 2.0 |
| **AMS-III.G.:** Landfill methane recovery - Version 10.0 | **AM0083:** Avoidance of landfill gas emissions by in-situ aeration of landfills - Version 1.0.1 | |
| **AMS-III.H.:** Methane recovery in wastewater treatment - Version 19.0 | **AM0089:** Production of diesel using a mixed feedstock of gasoil and vegetable oil - Version 2.0 | |
| **AMS-III.I.:** Avoidance of methane production in wastewater treatment through replacement of anaerobic systems by aerobic systems - Version 8.0 | **AM0093:** Avoidance of landfill gas emissions by passive aeration of landfills - Version 1.0.1 | |
| **AMS-III.L.:** Avoidance of methane production from biomass decay through controlled pyrolysis - Version 2.0 | **AM0112:** Less carbon intensive power generation through continuous reductive distillation of waste - Version 1.0 | |
| **AMS-III.Y.:** Methane avoidance through separation of solids from wastewater or manure treatment systems - Version 4.0 | **ACM0001:** Flaring or use of landfill gas - Version 19.0 | |
| **AMS-III.AF.:** Avoidance of methane emissions through excavating and composting of partially decayed municipal solid waste (MSW) - Version 1.0 | **ACM0010:** GHG emission reductions from manure management systems - Version 8.0 | |
| **AMS-III.AJ.:** Recovery and recycling of materials from solid wastes - Version 8.0 | **ACM0014:** Treatment of wastewater - Version 8.0 | |
| **AMS-III.AO.:** Methane recovery through controlled anaerobic digestion - Version 1.0 | **ACM0022:** Alternative waste treatment processes - Version 3.0 | |

| Small-scale methodologies | Large-scale methodologies | Methodological Tools |
|---|---|---|
| **AMS-III.AX.:** Methane oxidation layer (MOL) for solid waste disposal sites | **ACM0024:** Natural gas substitution by biogenic methane produced from the anaerobic digestion of organic waste - Version 1.0 | |
| **AMS-III.BA.:** Recovery and recycling of materials from E-waste - Version 3.0 | | |
| **AMS-III.BE.:** Avoidance of methane and nitrous oxide emissions from sugarcane pre-harvest open burning through mulching - Version 1.0 | | |
| **AMS-III.BJ.:** Destruction of hazardous waste using plasma technology including energy recovery - Version 1.0 | | |

## 3.2. STEP 2. Identification of methodologies and methodological tools that determine emission reductions based on the concentration of methane in the biogas and in the LFG

7. The next step was to check which of the identified methodologies and methodological tools use the concentration of methane in the biogas or in the LFG to determine baseline emissions (BE), project emissions (PE) or leakage (L) by reviewing the requirements of the methodology, in particular the monitored parameters. It was observed that:

   (a) in some methodologies, the measurement of concentration of methane is a requirement;

   (b) in other methodologies, emission reductions (ERs) are calculated based on the emissions of methane avoided that do not involve the ex-post monitoring of methane concentration;

   (c) finally, in some methodologies reference is made to another methodology or tool to determine the methane concentration (e.g. ACM0001 and TOOL14 make reference to TOOL08, and AMS-III.AO makes reference to AMS-III.H.).

8. Table 2 and Table 3 below include the long list and short list of methodologies, where the latter represents a listing of methodologies that require measurement of methane concentration.

**Table 2. Check of methodologies under Sectoral Scope 13 that involve the monitoring of methane concentration**

| Methodology or methodological tool | Contains requirements to monitor the methane concentration? (Y/N) | How methane concentration is monitored |
|---|---|---|
| **AMS-III.D.:** Methane recovery in animal manure management systems - Version 21.0 | Y | - |
| **AMS-III.E.:** Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment - Version 17.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.F.:** Avoidance of methane emissions through composting - Version 12.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.G.:** Landfill methane recovery - Version 10.0 | Y | - |
| **AMS-III.H.:** Methane recovery in wastewater treatment - Version 19.0 | Y | - |
| **AMS-III.I.:** Avoidance of methane production in wastewater treatment through replacement of anaerobic systems by aerobic systems - Version 8.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.L.:** Avoidance of methane production from biomass decay through controlled pyrolysis - Version 2.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.Y.:** Methane avoidance through separation of solids from wastewater or manure treatment systems - Version 4.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.AF.:** Avoidance of methane emissions through excavating and composting of partially decayed municipal solid waste (MSW) - Version 1.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.AJ.:** Recovery and recycling of materials from solid wastes - Version 8.0 | N | ERs are not determined neither based on methane avoidance nor based on ex-post monitoring of methane concentration. |
| **AMS-III.AO.:** Methane recovery through controlled anaerobic digestion - Version 1.0 | N | Reference to AMS-III.H. is made to monitor ex-post the methane concentration. |

| Methodology or methodological tool | Contains requirements to monitor the methane concentration? (Y/N) | How methane concentration is monitored |
|---|---|---|
| **AMS-III.AX.:** Methane oxidation layer (MOL) for solid waste disposal sites | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.BA.:** Recovery and recycling of materials from E-waste - Version 3.0 | N | ERs are not determined neither based on methane avoidance nor based on ex-post monitoring of methane concentration. |
| **AMS-III.BE.:** Avoidance of methane and nitrous oxide emissions from sugarcane pre-harvest open burning through mulching - Version 1.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AMS-III.BJ.:** Destruction of hazardous waste using plasma technology including energy recovery - Version 1.0 | N | ERs are not determined neither based on methane avoidance nor based on ex-post monitoring of methane concentration. |
| **AM0057:** Avoided emissions from biomass wastes through use as feed stock in pulp and paper, cardboard, fibreboard or bio-oil production - Version 3.0.1 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AM0073:** GHG emission reductions through multi-site manure collection and treatment in a central plant - Version 1.0 | Y | - |
| **AM0080:** Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants - Version 1.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **AM0083:** Avoidance of landfill gas emissions by in-situ aeration of landfills - Version 1.0.1 | Y | - |
| **AM0089:** Production of diesel using a mixed feedstock of gasoil and vegetable oil - Version 2.0 | N | ERs are not determined neither based on methane avoidance nor based on ex-post monitoring of methane concentration. |
| **AM0093:** Avoidance of landfill gas emissions by passive aeration of landfills - Version 1.0.1 | Y | - |
| **AM0112:** Less carbon intensive power generation through continuous reductive distillation of waste - Version 1.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |

| Methodology or methodological tool | Contains requirements to monitor the methane concentration? (Y/N) | How methane concentration is monitored |
|---|---|---|
| **ACM0001:** Flaring or use of landfill gas - Version 19.0 | N | Reference to the TOOL08 is made to monitor ex-post the methane concentration. |
| **ACM0010:** GHG emission reductions from manure management systems - Version 8.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **ACM0014:** Treatment of wastewater - Version 8.0 | Y | - |
| **ACM0022:** Alternative waste treatment processes - Version 3.0 | N | ERs are determined based on methane avoided and do not require ex-post monitoring of methane concentration. |
| **ACM0024:** Natural gas substitution by biogenic methane produced from the anaerobic digestion of organic waste - Version 1.0 | Y | The methodology makes reference to the parameter $F_{CH4,NG,y}$ without further elaborating the monitoring provisions. The methodology may need to be revised in order to propose guidance to determine this parameter. |
| **TOOL06:** Project emissions from flaring - version 3.0 | Y | - |
| **TOOL08:** Tool to determine the mass flow of a greenhouse gas in a gaseous stream - version 3.0 | Y | - |
| **TOOL14:** Project and leakage emissions from anaerobic digesters - version 2.0 | N | Reference to the TOOL08 is made to monitor ex-post the methane concentration. |

9. Table 3 below, which is a subset of Table 2 above, lists the methodologies and tools that include procedures for measurement of methane concentration.

**Table 3. Shortlisted methodologies and methodological tools under Sectoral Scope 13 that include procedures for the monitoring of methane concentration**

| Small-scale methodologies | Large-scale methodologies | Methodological Tools |
|---|---|---|
| **AMS-III.D.:** Methane recovery in animal manure management systems - Version 21.0 | **AM0073:** GHG emission reductions through multi-site manure collection and treatment in a central plant - Version 1.0 | **TOOL06:** Project emissions from flaring - version 3.0 |
| **AMS-III.G.:** Landfill methane recovery - Version 10.0 | **AM0083:** Avoidance of landfill gas emissions by in-situ aeration of landfills - Version 1.0.1 | **TOOL08:** Tool to determine the mass flow of a greenhouse gas in a gaseous stream - version 3.0; |

| Small-scale methodologies | Large-scale methodologies | Methodological Tools |
|---|---|---|
| **AMS-III.H.:** Methane recovery in wastewater treatment - Version 19.0 | **AM0093:** Avoidance of landfill gas emissions by passive aeration of landfills - Version 1.0.1 | |
| | **ACM0014:** Treatment of wastewater - Version 8.0 | |

## 3.3. STEP 3. Compilation of the monitoring requirements for methane concentration from the different methodologies

10. Tables 4, 5 and 6 below compare measurement procedures, the denomination of the parameter, parameter description and units across methodologies. In order to facilitate the assessment, the elements from the monitoring tables were grouped and compared. The first group includes the denomination of the parameter, the parameter description and the parameter units.

11. The tables also include elements from the ISO standard ISO 2540:2010(E) (Stationary source emissions — Automatic method for the determination of the methane concentration using flame ionisation detection (FID)). This standard specifies the principle, the essential performance criteria, and Quality Assurance and Quality Control (QA/QC) procedures for automatic method for continuous or periodical measurement of the methane concentration in wet or dry gaseous stream of stationary sources, using flame ionisation detection.

(a) Data/Parameter denomination, unit and description

**Table 4. Comparison of the measurement procedures among the different shortlisted methodologies (PART 1)**

| Methodology | Data / parameter | Data unit | Description |
|---|---|---|---|
| **AMS-III.D.** | $w_{CH4}$ | % | Methane content in biogas in the year *y* |
| **AMS-III.G.** | $w_{CH4,y}$ | %, volume basis | Methane content in landfill gas in the year *y* |
| **AMS-III.H.** | $w_{CH4,y}$ | % | Methane content in the biogas in the year *y* |
| **AM0073** | $f_{CH4,RG,h}$ | Fraction | Volumetric fraction of methane in the captured biogas on dry basis in hour *h* |
| **AM0083** | $MC_{CH4,v,k,y}$ | $tCH_4/m_3$ | Monitored content of methane in venting well/header *k* in year *y* |
| | $MC_{CH4,s,i,c,q}$ | $tCH_4/m^3$ | Monitored methane content from surface emissions during insitu aeration in zone *i* in location *c* in quarter *q* |
| | $MC_{CH4,v,k,bl\_campaign}$ | $tCH_4/m^3$ | Monitored methane content in venting well/header *k* during the baseline campaign |
| **AM0093** | $MC_{CH4,s,i,c,q}$ | $tCH_4/m^3$ | Monitored methane content from surface emissions during aeration at location *c* in zone *i* in quarter *q* |

| Methodology | Data / parameter | Data unit | Description |
|---|---|---|---|
| | $MC_{CH4,s,i,c,m}$ | $tCH_4/m^3$ | Monitored methane content from surface emissions during aeration at location *c* in zone *i* in month m during the baseline campaign |
| | $MC_{CH4,v,k,q}$ | $tCH_4/m^3$ | Monitored content of methane in venting well *k* in quarter *q* |
| | $MC_{CH4,v,k,m}$ | $tCH_4/m^3$ | Monitored content of methane in venting well *k* in month *m* during the baseline campaign |
| **ACM0014** | $w_{CH4,biogas,y}$ | $kgCH_4/m^3$ | Concentration of methane in the total biogas supply in the outlet of the new digester at reference conditions |
| **TOOL06** | $v_{i,RG,m}$ | - | Volumetric fraction of component i in the residual gas on a dry basis in the minute m where i = $CH_4$, CO, $CO_2$, $O_2$, $H_2$, $H_2S$, $NH_4$, $N_2$ |
| **TOOL08** | $v_{k,t,db,m}$ | $m^3_{\text{gas k}}/m^3_{\text{dry gas}}$ | Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis |
| | $v_{k,t,wb,m}$ | $m^3_{\text{gas k}}/m^3_{\text{wet gas}}$ | Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a wet basis |
| **ISO 25140:2010(E)** | $\varphi_{CH4,o}$ | Volumetric fraction | Methane volume fraction on wet basis at operating conditions |
| | $\gamma_{CH4,s}$ | g/L | Methane mass concentration on wet basis at operating conditions |
| | $\gamma_{CH4,(H2O)0}$ | g/L | Methane mass concentration on dry basis at operating conditions |

(b) Source of data, measurements procedures (if any) and monitoring frequency

**Table 5. Comparison of the measurement procedures among the different shortlisted methodologies (PART 2)**

| Methodology | Data / parameter | Source of data | Measurements procedures (if any) | Monitoring frequency |
|---|---|---|---|---|
| **AMS-III.D.** | $w_{CH4}$ | - | The fraction of methane in the biogas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) or, with periodic measurements at a 90/10 confidence/precision level by following the "Standard for sampling and surveys for CDM project activities and Programme of Activities", or, alternatively a default value of 60% methane content can be used. Option chosen should be clearly specified in the PDD.<br><br>It shall be measured using equipment that can directly measure methane content in the biogas - the estimation of methane content of biogas based on measurement of other constituents of biogas such as $CO_2$ is not permitted. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place, and on the same basis (wet or dry) | - |

| Methodology | Data / parameter | Source of data | Measurements procedures (if any) | Monitoring frequency |
|---|---|---|---|---|
| **AMS-III.G.** | $w_{CH4,y}$ | - | The fraction of methane in the gas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) or, alternatively, with periodic measurements at a 90/10 confidence/precision level. It shall be measured using equipment that can directly measure methane content in the landfill gas – the estimation of methane content of landfill gas based on measurement of other constituents of landfill gas such as CO2 is not permitted.<br><br>The methane content measurement shall be carried out close to the location in the system where the landfill gas flow, temperature and pressure measurements are carried out, and at the same humidity content (dry or at known or measured/corrected for humidity content) | - |
| **AMS-III.H.** | $w_{CH4,y}$ | - | The fraction of methane in the gas should be measured with a continuous analyser or, alternatively, with periodic measurements at a 90/10 confidence/precision level. It shall be measured using equipment that can directly measure methane content in the biogas - the estimation of methane content of biogas based on measurement of other constituents of biogas such as CO2 is not permitted. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place | - |
| **AM0073** | $f_{CH4,RG,h}$ | Project proponents | Archive electronically during project plus 5 years | Continuously |
| **AM0083** | $MC_{CH4,v,k,y}$ | Project proponents | The measurements of the methane content will be carried out according to internationally recognized standards, using flame ionization detector, infrared sensors or similar | Continuous |

| Methodology | Data / parameter | Source of data | Measurements procedures (if any) | Monitoring frequency |
|---|---|---|---|---|
| | $MC_{CH4,s,i,c,q}$ | Project participants | The measurements of the methane content will be carried out according to internationally recognized standards, using flame ionization detector, infrared sensors or similar | Periodic (in the middle of each quarter during air-injection phase, annually during the post-injection phase) |
| | $MC_{CH4,v,k,bl\_campaign}$ | Project participants | The measurements of the methane content will be carried out according to internationally recognized standards, using flame ionization detector, infrared sensors or similar | Monthly during the baseline campaign |
| **AM0093** | $MC_{CH4,s,i,c,q}$ | Project participants | The measurements of the methane content will be carried out according to the section "Procedure for monitoring of methane emissions", using flame ionization detector, infrared sensors or similar | See the section "Procedure for monitoring of methane emissions" |
| | $MC_{CH4,s,i,c,m}$ | Project participants | The measurements of the methane content will be carried out according to the section "Procedure for monitoring of methane emissions", using flame ionization detector, infrared sensors or similar | Monthly during the baseline campaign |
| | $MC_{CH4,v,k,q}$ | Project participants | The measurements of the methane content will be carried out according to the section "Procedure for monitoring of methane emissions", using flame ionization detector, infrared sensors or similar | See the section "Procedure for monitoring of methane emissions" |
| | $MC_{CH4,v,k,m}$ | Project participants | The measurements of the methane content will be carried out according to the section "Procedure for monitoring of methane emissions", using flame ionization detector, infrared sensors or similar | See the section "Procedure for monitoring of methane emissions" |
| **ACM0014** | $w_{CH4,biogas,y}$ | Measured | Using calibrated continuous gas analyser | Either with continuous analyser or alternatively with periodic measurement at 95/10 confidence/precision level |

| Methodology | Data / parameter | Source of data | Measurements procedures (if any) | Monitoring frequency |
|---|---|---|---|---|
| **TOOL06** | $v_{i,RG,m}$ | Measurements by project participants using a continuous gas analyser | Measurement may be made on either dry or wet basis. If value is made on a wet basis, then it shall be converted to dry basis for reporting | Continuously. Values to be averaged on a minute basis |
| **TOOL08** | $v_{k,t,db,m}$ | - | Continuous gas analyser operating in dry-basis | Continuous if not specified in the underlying methodology/tool |
| | $v_{k,t,wb,m}$ | - | Calculated based on the dry basis analysis plus water concentration measurement or continuous in-situ analysers if not specified in the underlying methodology/tool | Continuous if not specified in the underlying methodology |
| **ISO 25140:2010(E)** | $\varphi_{CH4,\ o}$ | Measured by the gas analyser | The instrument shall be operated according to the manufacturer's instructions.<br><br>The measurement site, the measurement section and the sampling points shall be selected in accordance with applicable international or national standards.<br><br>The measured values at operating conditions of the waste gas shall be recorded by an internal or external data logging system and averaged in accordance with the measurement task.<br><br>The volume content of water vapour and oxygen (if necessary) in the waste gas shall also be measured in parallel and averaged over the sampling period of the methane measurement to express the methane concentration for dry waste gas conditions and, if required, oxygen reference conditions. | Continuous or intermittent |
| | $\gamma_{CH4,\ s}$ | Measured by the gas analyser<br>OR<br>Calculated if the methane concentration is measured in volumetric fraction | | |
| | $\gamma_{CH4,\ (H2O)0}$ | Calculated by discounting the humidity of the waste gas | | |

(c) QA/QC procedures, and any comment

**Table 6. Comparison of the measurement procedures among the different shortlisted methodologies (PART 3)**

| Methodology | Data / parameter | QA/QC procedures | Any comment |
|---|---|---|---|
| **AMS-III.D.** | $w_{CH4}$ | - | - |
| **AMS-III.G.** | $w_{CH4,y}$ | - | - |
| **AMS-III.H.** | $w_{CH4,y}$ | - | - |
| **AM0073** | $f_{CH4,RG,h}$ | - | - |
| **AM0083** | $MC_{CH4,v,k,y}$ | Maintenance and calibration of equipment will be carried out according to internationally recognized standards. Where laboratory work is outsourced, one which follows rigorous standards (ISO 9001 or local equivalent) shall be selected | - |
| | $MC_{CH4,s,i,c,q}$ | Maintenance and calibration of equipment will be carried out according to internationally recognized standards. Where laboratory work is outsourced, one which follows rigorous standards (ISO 9001 or local equivalent) shall be selected | More frequent sampling is encouraged |
| | $MC_{CH4,v,k,bl\_campaign}$ | Maintenance and calibration of equipment will be carried out according to internationally recognized standards. Where laboratory work is outsourced, one which follows rigorous standards (ISO 9001 or local equivalent) shall be selected | - |
| **AM0093** | $MC_{CH4,s,i,c,q}$ | Maintenance and calibration of equipment will be carried out according to internationally recognized standards. Where laboratory work is outsourced, one which follows rigorous standards (ISO 9001 or local equivalent) shall be selected | - |
| | $MC_{CH4,s,i,c,m}$ | Maintenance and calibration of equipment will be carried out according to internationally recognized standards. Where laboratory work is outsourced, one which follows rigorous standards (ISO 9001 or local equivalent) shall be selected | - |

| Methodology | Data / parameter | QA/QC procedures | Any comment |
|---|---|---|---|
| | $MC_{CH4,v,k,q}$ | Maintenance and calibration of equipment will be carried out according to internationally recognized standards. Where laboratory work is outsourced, one which follows rigorous standards (ISO 9001 or local equivalent) shall be selected | - |
| | $MC_{CH4,v,k,m}$ | Maintenance and calibration of equipment will be carried out according to internationally recognized standards. Where laboratory work is outsourced, one which follows rigorous standards (ISO 9001 or local equivalent) shall be selected | - |
| **ACM0014** | $w_{CH4,biogas,y}$ | The project proponents shall define the error for different levels of measurement frequency. The level of accuracy will be deducted from average concentration of measurement | - |
| **TOOL06** | $v_{i,RG,m}$ | Analysers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard certified gas | As a simplified approach, project participants may only measure the content $CH_4$, CO and $CO_2$ of the residual gas and consider the remaining part as $N_2$.<br><br>Monitoring of this parameter is only applicable in case of enclosed flares and continuous monitoring of the flare efficiency |
| **TOOL08** | $v_{k,t,db,m}$ | Calibration should include zero verification with an inert gas (e.g. $N_2$) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period | The TOOL08 contains provisions in the Appendix to conduct the measurement of the methane concentration the LFG by sampling. |

| Methodology | Data / parameter | QA/QC procedures | Any comment |
|---|---|---|---|
| | $v_{k,t,wb,m}$ | Calibration should include zero verification with an inert gas (e.g. $N_2$) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period | The TOOL08 contains provisions in the Appendix to conduct the measurement of the methane concentration the LFG by sampling. |
| **ISO 25140:2010(E)** | $\varphi_{CH4,\ o}$<br>$\gamma_{CH4,\ s}$<br>$\gamma_{CH4,\ (H2O)0}$ | QA/QC shall include minimum frequency, among others, of the following checks:<br>- Calibration;<br>- Zero drift and Span drift;<br>- Response time;<br>- Regular maintenance;<br>- Cleaning or changing of particulate filters; | Frequency checks are different between continuous and intermittent measurements. |

## 3.4. STEP 4. Identification of commonalities and differences

12. From Step 3 above, the following observations were made:

(a) Differences and inconsistencies were identified with respect to the denomination, description and units of parameters in different methodologies and tools;

(b) Some differences may be attributed to the nature of small-scale and large-scale methodologies and are not necessarily inconsistencies. The monitoring requirements of small-scale methodologies are naturally less stringent than those of large-scale methodologies. However, even within small-scale or large-scale methodologies there are inconsistencies in the measurement procedures (e.g. the measurement of the concentration done on the same basis of the flow is mentioned in two methodologies, the use of the CDM sampling standard is mentioned in only one of the methodologies);

(c) Some methodologies contain requirements that are specific to the context in which it is applied and may need to be left out of scope for this work of standardisation, e.g. methodologies AM0083 and AM0093 contains specific methods and procedures to measure the methane concentration in wells and in the surface area of landfills that are not applicable to other methodologies where the methane concentration is measured inside a pipeline;

(d) Some methodologies do not contain the monitoring requirements of the parameter but instead refer to the monitoring requirements of methodological tools, e.g. ACM0022 makes reference to the TOOL14 whereas ACM0001 and the TOOL14 refer to the TOOL08 or other approved methodologies, e.g. AMS-III.AO refers to AMS-III.H;

(e) The methodological tools do not include an option for periodic measurement of the parameter but allow application of provisions from the methodologies for such

measurement, e.g. any sampling requirement included in the methodology may be used;

(f) In some specific instances, but not in others, international standards such as ISO standards are referred (e.g. requirements for the labs).

# 4. Proposed solutions

13. As assessed in the steps above, there is room to harmonize the monitoring of the methane concentration in the biogas and in the LFG. Such harmonization, however, should take into account the inherent differences in the monitoring requirements based on the context in which methodologies are applied, for example, the different project scales: installing and keeping a continuous track of the concentration of the methane in the collected gas may involve high costs (e.g. acquisition of a continuous gas analyser and installation of a supervisory computer monitoring system that continuously transmits the data read to a data storage system) that could bring financial burden to a small scale project claiming less than 60,000 CERs/year. Furthermore, there are some methodology-specific requirements that need to be excluded from the exercise.

14. In addition, harmonisation can be simplified by revising those methodologies and methodological tools that are referenced by other methodologies (e.g. ACM0001 refers to the TOOL08 to determine the methane concentration in the LFG collected; AMS-III.AO refers to AMS-III.H to monitor the methane concentration in the biogas collected). This would allow project developers to continue to refer to an existing methodology or tool whose application is specific to the developer's project type, rather than having to go through a new regulatory document that would potentially include a long list of parameters relevant to different types of methodologies from different sectoral scopes.

15. Finally, potential was identified to make more effective use of international standards for different methods to analyse the composition of a gas such as ISO 25140 (Determining the methane concentration using Flame Ionization Detector – FID), ISO 6145 (preparation of calibration gas mixtures), and ISO 25139 (Determination of the methane concentration using gas chromatography).

# 5. Subsequent work and timelines

16. Based on guidance from the Board, the MP will:

(a) Propose a harmonized approach to monitor the methane concentration of the biogas from wastewater treatment systems and manure treatment systems besides in the LFG, based on the requirements from approved CDM methodologies and tools drawing elements from international standards as required; and

(b) Revise the relevant methodologies and methodological tools applicable to the project types indicated above to make consistent reference to the proposed harmonized approach.

# 6. Recommendations to the Board

17. The MP recommended that the Board consider the concept note and provide further guidance regarding the work related to the revision of the methodologies listed in Table 3 above.

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**Document information**

| *Version* | *Date* | *Description* |
|---|---|---|
| 01.0 | 21 February 2022 | MP 87, Annex 2<br>To be considered by the Board at EB 113. |

Decision Class: Regulatory
Document Type: Information note
Business Function: Methodology
Keywords: biogas recovery, data collection and analysis, landfill gas, methane