CDM: form for proposed new small scale methodologies (F-CDM-SSC-NM) (version 01)

(To be used for proposing a new small scale methodology in accordance with article 15 and 16 of the simplified modalities for small-scale CDM project activity categories. This form is not to be used in case of large scale methodologies).

Name of person/entity submitting this form:	Tokyo Electric Power Environmental Engineering Co., Inc (TEE)Mitsubishi UFJ Securities Co., Ltd. (MUS)
Title of the proposed small scale methodology:	Avoidance of methane emissions through the chemical treatment of organic industrial wastewater
Please suggest type to which the new proposed methodology (category) belongs to:	☐ Type I Renewable energy projects ☐ Type II Energy efficiency improvements ☒ Type III Other project activities

Information for completing the form

For proposing a new small scale methodology all sections below should be completed. Approved small scale methodologies shall be used as a reference for language and structure used. If necessary, attach files or refer to sources of relevant information.

1. Technology/measure: please specify and provide reference to the exact technology/measure the proposed small scale methodology is applicable to and describe in detail the applicability conditions of the proposed methodology.

1. This methodology comprises technologies and measures that avoid the production of methane from biogenic organic matter in wastewaters being treated in anaerobic systems. Due to the project activity, the anaerobic systems[1] are replaced by chemical treatment systems based on the use of flocculents.

2. The flocculent-based wastewater treatment system should be designed so that retention time of the wastewater will be less than one day.

3. This methodology may be used in combination with other methodologies (e.g. AMS-III.H, AMS-III.I, AMS-III.Y) to provide a comprehensive solution to wastewater treatment. In such cases, where the baseline emission, project emission or leakage calculations conflict or overlap, then the calculation approach which results in the most conservative estimation of the emission reductions should be selected.

Justification:

Applicability Condition 1: This is a simple description of the project type to be included in the methodology.

Applicability condition 2: This requirement is added to ensure that there is insufficient time for an anaerobic environment to develop in the flocculent-based treatment system. A typical flocculent-based treatment system will consist of hoppers for storage of the flocculant, a device for mixing of the flocculant with the wastewater stream, and a separator to remove the solid floc material from the remaining wastewater. Residence time is likely to be less than one hour.

Applicability condition 3: It is likely that this methodology would be used in conjunction with other methodologies – as with the project activity described in the sample PDD that accompanies this new methodology application. Flocculent treatment is well suited to providing the final treatment to wastewater which has already had preliminary treatment through other mechanical or biological means. There are some instances where the calculation approaches of the other methane avoidance methodologies differ somewhat from each other (and therefore also from this methodology), and therefore it is considered useful to stipulate how to deal with such cases. Without this guidance, even in case of small variation in approach, it would theoretically require a request for clarification or revision before a project could apply the methodologies in combination.

2. Boundary: please specify the project boundary of the proposed methodology.

4. The Project Boundary is the physical, geographical sites where:
   - (a) The wastewater treatment would have taken place and the methane emission occurred in absence of the project activity.
   - (b) The wastewater treatment takes place in the project activity
   - (c) The sludge is treated and disposed of in the baseline situation
   - (d) The solid waste extracted from the flocculation process is treated and disposed of in the project situation

3. Baseline: please specify the baseline scenario and the way baseline emissions are calculated.

[1] As defined in 2006 IPCC Guidelines for National Greenhouse Gas inventories Volume 5, Chapter 6, Wastwater treatment and discharge, table 6.3 and 6.8. Under this methodology, anaerobic lagoons are ponds deeper than 2 meters, without aeration, ambient temperature above 15 degrees Centigrade, at least during part of the year, on a monthly average basis, and with a volumetric loading rate of Chemical Oxygen Demand above 0.1 kg COD/m^3/day.

5. The baseline scenario is the situation where, in the absence of the project activity, degradable organic matter in wastewater is treated in anaerobic systems and methane is emitted to the atmosphere. Baseline emissions are:

(a) Methane produced in the anaerobic baseline wastewater treatment system(s) that is / are being replaced with the flocculent treatment system ($BE_{ww,treatment,y}$);

(b) Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river / lake / sea etc. ($BE_{ww,discharge,y}$);

(c) Methane emissions from anaerobic decay of the final sludge produced in the baseline situation. If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected ($BE_{s,final,y}$).

$$BE_y = BE_{ww,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y} \qquad \textbf{(1)}$$

Where:

$BE_{ww,treatment,y}$	Methane produced in the anaerobic baseline wastewater treatment system(s) that is/are being replaced with the flocculent treatment system(s) (tCO_2e)
$BE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc (tCO_2e)
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced (tCO_2e)

6. In the determination of baseline emissions using formula (1), historical records of at least one year prior to the project implementation shall be used. This shall include COD removal efficiency of the wastewater treatment systems, amount of dry matter in sludge, power and electricity consumption per m^3 of wastewater treated, amount of final sludge generated per tonne of COD treated and all other parameters required for determination of baseline emissions.

7. In case one year of historical data are not available, the parameters shall be determined by a measurement campaign in the baseline wastewater systems of at least 10 days. The measurements should be undertaken during a period that is representative for the typical operation conditions of the systems and ambient conditions of the site (temperature, etc.). Average values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%) associated with this approach as compared to one-year historical data.

8. The baseline emissions from the anaerobic wastewater treatment system(s) are estimated as follows:

$$BE_{ww,treatment,y} = \sum_{i,m}\left(Q_{ww,m,y} * COD_{removed,i,m,y} * MCF_{anaerobic,i}\right) * B_o * UF_{BL} * GWP_{CH4} \quad \textbf{(2)}$$

where

$Q_{ww,m,y}$	Volume of the wastewater treated during the months m, during year y, for the months with ambient average temperature above 15 degrees C (m^3)
i	Index for baseline wastewater treatment system
$COD_{removed,i,y}$	Chemical oxygen demand removed[2] by the anaerobic wastewater treatment system i in the baseline situation in the year y for the months m with ambient average temperature above 15 degrees C ($tonnes/m^3$)
$MCF_{anaerobic,i}$	Methane correction factor for the anaerobic baseline wastewater treatment system i replaced by the project activity, value as per table III.xx.1
$B_{o,ww}$	Methane producing capacity for the wastewater (IPCC default value for domestic wastewater of 0.21 kg CH4/kg COD[3])
UF_{BL}	Model correction factor to account for model uncertainties (0.94)[4]
GWP_{CH4}	Global Warming Potential for CH_4 (value of 21)

To determine $COD_{removed,i,m,y}$: as the baseline treatment system(s) is different from the treatment system(s) in the project scenario, the monitored values of the COD inflow during the crediting period will be used to calculate the baseline emissions *ex post*. The COD removed by the baseline system(s) shall be based on the removal efficiency of the baseline systems estimated as per paragraphs 7 or 8 above.

9. The Methane Correction Factor (MCF) shall be determined based on the following table:

Table III.xx.1. IPCC default values[5] for Methane Correction Factor (MCF)

Type of wastewater treatment and discharge pathway or system	**MCF Value**
Discharge of wastewater to sea, river or lake	0.1
Aerobic treatment, well managed	0
Aerobic treatment, poorly managed or overloaded	0.3
Anaerobic digester for sludge without methane recovery	0.8
Anaerobic reactor without methane recovery	0.8
Anaerobic shallow lagoon (depth less than 2 metres)	0.2
Anaerobic deep lagoon (depth more than 2 metres)	0.8
Septic system	0.5

[2] Difference of inflow COD and the outflow COD.
[3] The IPCC default value of 0.25 kg CH_4/kg COD was corrected to take into account the uncertainties. For domestic wastewater, a COD based value of $B_{o.ww}$ can be converted to BOD_5 based value by dividing it by 2.4 i.e. a default value of 0.504 kg CH_4/kg BOD can be used.
[4] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.
[5] Default values from chapter 6 of volume 5. Waste in *2006 IPCC Guidelines for National Greenhouse Gas Inventories*

10. Methane emissions from degradable organic carbon in treated wastewater discharged in e.g. a river, sea or lake are determined as follows:

$$BE_{ww,discharge,y} = Q_{ww,y} * COD_{ww,discharge,BL,y} * MCF_{ww,discharge,BL} * B_o * UF_{BL} * GWP_{CH4} \quad \textbf{(3)}$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year y (m^3)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)[6]
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in year *y* (tonnes/m^3)
$MCF_{ww,discharge,BL}$	Methane correction factor based on the discharge pathway (e.g. into sea, river or lake) of the wastewater (fraction) (MCF as per table III.xx.1)

To determine $COD_{ww,discharge,BL,y}$: as the baseline treatment system(s) is different from the treatment system(s) in the project scenario, the monitored values of the COD inflow during crediting period will b used to calculate the baseline emissions *ex post* . The outflow COD of the baseline systems will be estimated using the removal efficiency of the baseline treatment systems, estimated as per paragraphs 7 or 8.

11. Methane emission from anaerobic decay of the final sludge produced in the baseline situation are determined as follows:

$$BE_{s,finalm,y} = S_{final,BL,y} * MCF_{s,BL,final} * DOC_S * UF_{BL} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(4)}$$

Where:

$S_{final,BL,y}$	Amount of dry matter in final sludge generated by the baseline wastewater treatment in the year *y* (tonnes). It will be estimated using the monitored amount of dry matter in final sludge generated by the project activity ($S_{final,PJ,y}$) corrected for the sludge generation ratios of the project and baseline systems as per formula 6 above.
DOC_S	Degradable organic content of the final sludge generated in the year *y* (fraction, dry basis). It shall be estimated using default values of 0.5 for domestic sludge and 0.257 for industrial sludge.
$MCF_{s,BL,final}$	Methane correction factor of the disposal site that receives the final sludge in the baseline situation, estimated as per the procedures described in AMS-III.G
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value 0.5)
F	Fraction of CH_4 in biogas (IPCC default of 0.5)

Justification:

The principles underlying the baseline emissions are identical to AMS-III.I or AMS-III.Y, therefore the same approach is used to calculate baseline emissions. The only difference is removal of references to sludge, which would not be suitable for treatment by flocculents (this does not however apply to final sludge, which can still be a baseline emission source).

[6] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

4. Leakage: please specify if leakage emissions can occur and how they should be calculated.

12. The ingredients of the flocculant powder must be clearly identified, and traced back to their original source. For each constituent it should then be determined if it is obtained from a waste source or from a deliberately manufactured source, according to the following definitions:

‘**Waste Source’** – to be defined as a waste source, it must be demonstrable that the constituent either:

i. is a waste product which has little or no market value; or

ii. is a by-product or co-product which may have some market value but is currently not sold to the market, or is available in excess, and is therefore, in effect wasted[7].

‘**Manufactured Source**’ is defined as all other sources other than waste sources.

13. The portion of the flocculent which is determined to be from a Manufactured Source should be considered as a potential source of leakage emissions. Such leakage emissions are to be calculated according to the following formula:

$$Leakage_y = \sum_i Q_{floc,manuf,y} * EF_{floc,manuf,i} \qquad \textbf{(5)}$$

where

$Q_{floc,manuf,y}$ is the quantity of flocculent consumed by the project activity and considered as being from a Manufactured Source in year *y*

i is the index for each constituent of the flocculent which is considered to be from a Manufactured Source

$EF_{floc,manuf,i}$ is the emission factor for the manufacturing process of each constituent of the flocculent *i* considered to be from a Manufactured Source. A default emission factor of 7.9 tCO_2e / t is to be applied.

Justification:

One possibility would be to ignore leakage from flocculent manufacture, as emissions from this source are likely to be negligible. This would be consistent with the approach taken in AM0054, where upstream emissions from the production of emulsion additive ingredients can be considered as ‘zero’. However, in this methodology it is proposed to take a more conservative approach, in order to promote transparency.

This methodology draws the distinction between the flocculant’s ‘manufactured component’ and ‘waste component’. This distinction is important when it comes to assessing the risk of leakage occurring in the manufacturing of the flocculent. Common chemical components used in flocculants are based on waste sources from other industries, such as paper sludge, or fly ash. It is not necessary to consider the use of such items in the flocculent as a potential leakage source, as the industry producing such wastes will continue to produce this waste, regardless of its application as a flocculent or not. On the other hand, where an ingredient is manufactured specifically to be used as a flocculent, then the leakage emissions occurring in that manufacturing process should be taken into account. Therefore the leakage issue need be examined only with regard to the ‘manufactured component’.

In the case where a component of the flocculent is designated as being from a Manufactured Source, a default value is given to calculate potential leakage. This default is a conservative value based on a study of a variety of materials that can potentially be used as flocculents. The main types of potential ingredient for use as flocculents are analysed as follows:

[7] This definition is in line with the Meth Panel’s Draft Guidance on Apportioning of Emissions to Co-Products and By-Products, available from http://cdm.unfccc.int/Panels/meth/035/mp_035_an11.pdf

Fly / organic ash

This would fall into the 'waste source' category. Usually more than 80% of the flocculent (by mass) would comprise of this ash.

Inorganic polymers

Aluminium sulfate and poly aluminium chloride the prime candidates from this category for use as an effective flocculent additive. Analysis using the Japan Environmental Management Association for Industry's JEMAI-LCA Pro database[8] indicates that when conservative assumptions are applied, the maximum level of emissions from a mixture of aluminium sulfate (50%) and poly aluminium chloride (50%) would be 1.14 tCO_2e / tonne of inorganic polymer produced. This is based on a full lifecycle analysis from primary resource extraction to delivery of the polymer to a potential project site.

Organic polymers

A large variety of potential organic polymers can be used as flocculents, with both anionic and cationic properties. Detailed breakdowns of lifecycle GHG emissions for some of the more obscure organic polymers are difficult to establish, as they are not produced in large quantities. However, a study by LCA Europe of the main emissions involved with production of different types of plastics gives a comparison of the emissions associated with some of the more common organic polymers[9]. This indicates that the most emissions intensive organic polymer is nylon, in part because of the use of adipic acid, whose production releases huge quantities of N2O into the atmosphere. The emission established for nylon is 7.9 tCO_2e / tonne nylon 66.

Solidifying agents

These are used in very small quantities, but would comprise less than 1% of the flocculent's ingredient, and their influence on the overall emissions associated with the flocculent's manufacture can be considered negligible.

Having reviewed the potential emissions from these various ingredients, the value of 7.9tCO2e/tonne of flocculent from 'manufactured source' is considered to be a conservative and appropriate value for application to any of the main flocculent types in current usage.

[8] Further information on this database can be found at: http://www.jemai.or.jp/CACHE/lca_details_lcaobj198.cfm For this analysis, Version 2.1.2 was used.

[9] This study is quoted at: http://www.natureworksllc.com/news-and-events/press-releases/2007/7-2-07-new-eco-profile.aspx The database itself can be found at http://www.lca.plasticseurope.org/index.htm .

5. Project activity emissions: please specify possible project activity emissions and how they should be calculated.

14. Project activity emissions consist of:

(a) CO_2 emission related to the power and fossil fuel used by the project activity facilities ($PE_{power,y}$);

(b) Methane emissions from degradable organic carbon in treated wastewater discharged in sea / river or lake ($PE_{ww,discharge,y}$);

(c) Methane emissions from treatment of the solid material extracted in the flocculation treatment in the project activity ($PE_{floc,y}$)

$$PE_y = PE_{power,y} + PE_{ww,discharge,y} + PE_{floc,y} \quad \textbf{(6)}$$

Where:

PE_y	Project activity emissions in year y (tCO_2e)
$PE_{power,y}$	Emissions on account of electricity or fossil fuel consumption in the year y (tCO_2e)
$PE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the project wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc (tCO2e)
$PE_{floc,y}$	Methane emissions produced in the treatment of the solid material extracted from the wastewater through the flocculation treatment process used in the project activity (tCO2e)

15. Project activity emissions from electricity and fossil fuel consumption ($PE_{power,y}$) are determined as per the procedures described in the methodological ‘Tool to calculate baseline, project and/or leakage emissions from electricity consumption’. The energy consumption of all equipment / devices installed by the project activity, *inter alia* all equipment used to treat wastewater and sludge shall be included. For project activity emissions from fossil fuel consumption the emission factor for the fossil fuel shall be used (tCO_2/tonne). Local values are to be used, if local values are difficult to obtain, IPCC default values may be used.

16. Methane emissions from degradable organic carbon in treated wastewater discharged in e.g. a river, sea or lake are determined as follows:

$$PE_{ww,discharge,y} = Q_{ww,y} * COD_{ww,discharge,PJ,y} * MCF_{ww,discharge,PJ} * B_o * UF_{PJ} * GWP_{CH4} \quad \textbf{(7)}$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year y (m^3)
UF_{PJ}	Model correction factor to account for model uncertainties (0.94)[10]
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the project in year *y* (tonnes/m^3)
$MCF_{ww,discharge,PJ}$	Methane correction factor based on the discharge pathway (e.g. into sea, river or lake) of the wastewater (fraction) (MCF as per table III.xx.1)

17. Project emissions from the disposal of the solid waste (sludge) removed from the flocculation system following flocculent treatment *k* are determined as follows:

$$PE_{floc,y} = \sum_k Floc_{k,PJ,y} * MCF_{floc,treatment,k} * DOC_{floc} * UF_{PJ} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(8)}$$

Where:

$Floc_{k,PJ,y}$	Amount of dry matter in the flocculated sludge removed from the flocculent treatment system *k* in the project activity (tonne)
k	Index for project flocculent treatment system
DOC_{floc}	Degradable organic content of the flocculatedsludge generated in the year *y* (fraction, dry basis). It shall be estimated using default values of 0.5 for domestic sludge and 0.257 for industrial sludge.[11]
$MCF_{floc,treatment,k}$	Methane correction factor for the flocculent treatment system *k* (MCF values as per table III.xx.1)
UF_{BL}	Model correction factor to account for model uncertainties (1.06)[12]
DOC_F	Fraction of COD dissimilated to biogas (IPCC default value of 0.5)
F	Fraction of CH_4 in biogas (IPCC default of 0.5)

In case floc is composted, the following formula shall be applied:

$$PE_{floc,treatment,y} = \sum_k Floc_{k,PJ,y} * EF_{composting} * GWP_{CH4} \quad \textbf{(9)}$$

Where:

$EF_{composting}$	Emission factor for composting of organic waste (t CH_4/tonne waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (table 4.1, Chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default value is 0.01t CH_4/t sludge treated on a dry weight basis.

[10] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

[11] The IPCC default values of 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10 percent) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent), were corrected for dry basis.

[12] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

Justification:

The overall approach is in line with AMS-III.I and AMS-III.Y.

6. Monitoring: Please specify which parameters should be monitored and how they should be monitored.
18. Monitoring shall involve: (a) The amount of COD treated in the wastewater treatment plant(s) (COD_{in}, COD_{out}, $COD_{ww,discharge,y}$, $COD_{revmoved,k,y}$) shall be measured in accordance with national or international standards. The amount of wastewater entering and /or exiting the project activity shall be monitored continuously and recorded to provide the total volume of wastewater treated ($Q_{ww,y}$); (b) The amount of fossil fuel and electricity used by the project activity facilities; (c) The amount of flocculant powder used; (d) The amount of floc extracted from the flocculent wastewater treatment system, and its dry matter content. 19. The ingredients of the flocculant shall be monitored, in order to specify for each ingredient whether it is from a waste source or from a manufactured source. The DOE shall verify the source of any ingredients accounting for more than 5% of the flocculant powder's mass. 20. If the methane emissions from anaerobic decay of the floc were to be neglected because the floc is controlled combusted, disposed in a landfill with methane recovery, or used for soil application, then the end-use of the final floc will be monitored during the crediting period. 21. If the baseline emissions included the anaerobic decay of final sludge generated by the baseline treatment systems in a landfill without methane recovery, the baseline disposal site shall be clearly defined, and verified by the DOE.
7. Project activity under a programme of activities: if the proposed methodology is also intended for application to a project activity under a programme of activities (CPA of PoA) guidance on consideration of leakage when applying to the CPA of PoA shall be provided.
The project activity for which this new methodology is intended will not be a PoA. No additional guidance is provided.

Date you are delivering the contribution:	July 17th , 2009

Information to be completed by the secretariat	
F-CDM-SSC-NM doc id number	
Related to SSC-Submission number	
Date when the form was received at UNFCCC secretariat	