Monitoring report form for CDM project activity
(Version 06.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	Poechos I Project	
UNFCCC reference number of the project activity	0086	
Version number of the PDD applicable to this monitoring report	2	
Version number of this monitoring report	2	
Completion date of this monitoring report	03/04/2018	
Monitoring period number	7	
Duration of this monitoring period	From 01/04/2013 to 31/12/2015	
Monitoring report number for this monitoring report	2	
Project participants	Sindicato Energético S.A. (SINERSA) VERT CONSERVATION PTE LTD	
Host Party	Peru	
Sectoral scopes	1 : Energy industries (renewable - / non-renewable sources)	
Applied methodologies and standardized baselines	ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version 12.1.0	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	88,223 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	90,337[1] tCO_2 per two years and 9 months.	

[1] Estimated Annual ERs = 0.56893 tCO_2/MWh * 57,740 MWh = 32,850 tCO_2 per year. As the monitoring period is two year and 9 months the expected emission reduction is 32,850 tCO_2 *(2+9/12) = 90,337.5 tCO_2 , or 90,337 to be conservative.

SECTION A. Description of project activity

A.1. General description of project activity

>>The Project is a hydroelectric power plant located in Peru, in the North-western Department of Piura and has an installed capacity of 15.2 MW.

This monitoring report covers the period 01/04/2013 – 31/12/2015, during the monitoring period the plant produced 166,274MWh of electricity.

The objective of Poechos I Hydroelectric Plant is renewable electricity generation to be supplied to the Peruvian National Inter-connected Electric Grid (hereafter referred to as SEIN).

The Project generates electricity without emitting GHGs and supplies this electricity to the SEIN, displacing fossil-fuel based generation that would otherwise be supplied to the grid. Thus, the project will displace carbon dioxide emission.

Poechos I Hydroelectric Plant has reduced in this monitoring period 88,223 tCO_{2e}. Methane and carbon dioxide that emitted to the atmosphere as a result of the construction and operation of the Project are negligible. Therefore, there is no need to monitor leakage, and such emissions were not taken into account when calculated emission reductions (ERs).

Poechos I Hydroelectric Power Project takes advantage of the existing Poechos reservoir, constructed between 1971 and 1974, exclusively for the irrigation system named Chira-Piura.

The technology employed is based on 2 conventional Kaplan turbines (7.8MW each) coupled to 2 three-phase synchronous generators (each of 9.5 MVA nominal capacity). The water is discharged into a tailrace channel (capacity 45 m^3 /s) connected to the existing energy dissipater (stilling basin) of the bottom outlet and, hence, is fed back to the irrigation system.

The construction of the Project started in June 2002 and the Project was commissioned in April 2004 with an expected plant operating life of 40 years.

The spatial extent of The Project boundary is the National Electric Grid (SEIN). The Project is connected to the SEIN through the Sullana Substation - which belongs to Electronoroeste S.A. (ENOSA).

Relevant dates for the project:

- HPP Poechos I was commissioned in 01/04/2004, and it has been in operation since then.
- The registration date of the project was 14 Nov 2005 and the first crediting period was 01 April 04 - 31 March 11.
- The renewal date of the crediting period was given on 09 Jun 2012 and the new crediting period is 01 April 11 – 31 March 18.

Monitoring report is based on the monitoring plan defined in Project Design Document (PDD).

A.2. Location of project activity

>>The Project is located in the North-western Peruvian Department of Piura, in the Sullana Province, in the Lancones District, in the Lancones Town. The project site is 40 km from the Sullana district (capital of the Sullana Province), and 30 km from the Peruvian-Ecuadorian border. The plant is located within the property of Poechos dam, built over the Chira River. The power house is located 81 meters above sea level.

The coordinates of the project site are: Latitude: -4.68437, Longitude: -80.52519.

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Peru (host Party)	Sindicato Energético S.A. (SINERSA)	No
Sweden	VERT CONSERVATION PTE LTD	No

A.4. Reference to applied methodologies and standardized baselines

>>Title of the methodology: ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” Version 12.1.0

For more information regarding the baseline methodology and monitoring methodology, please refer to: http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT

This methodology also refers to the latest approved version of the following tool: Tool to calculate the emission factor for an electricity system (Version 02.2.1).

A.5. Crediting period type and duration

>>Renewable crediting period, seven (7) years, with the option of renewing the contract for two other 7-year crediting periods (total 21 years).

The second crediting period is 01/04/2011 – 31/03/2018

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

>>The technology employed is based on conventional Kaplan turbines (2) and generators (2) that are widely used all over the world.

The penstock of the powerhouse is connected to the existing steel pipe of the bottom outlet. The penstock is bifurcated in two penstock pipes leading to a powerhouse with two generating units each of 7.6 MW capacity. The generating units consist of two Kaplan turbines coupled to synchronous generators (3-phase) each of 9.5 MVA nominal capacity. The part of the powerhouse in which the main equipment is installed is an underground reinforced concrete structure, whereas the other part is an above ground steel structure. The water is discharged into a tailrace channel (capacity 45 m^3/s) connected to the existing energy dissipater (stilling basin) of the bottom outlet and, hence, is fed back into the irrigation system. The control building is installed adjacent to the powerhouse. This building contains the control room, offices and auxiliary installations. The control room is equipped with a moderns system for automatic and remote control (SCADA).

The Project does also contain a 60 kV open-air switchyard with one main transformer of 29 MVA capacity. The power plant will be connected to the national grid through a new 60 kV overhead transmission line. The transmission line has a length of 38km and will be connected to the existing Sullana substation

GENERATION EQUIPMENT

TECHNICAL DATA - SUMMARY

Turbines

	DESCRIPTION	TURBINE 1	TURBINE 2
	Manufacturer	ALSTOM	ALSTOM
A	Type	Kaplan	Kaplan
B	Nominal Power [MW]	7.8	7.8
C	Number of blades	6	6
D	Arrangement	Vertical	Vertical
E	Nominal speed [rpm]	400	400
F	Minimum discharge [m^3/s]	9	9
G	Maximum discharge [m^3/s]	22.5	22.5
H	Velocity for increase power [MW/min]	1	1
I	Velocity for decrease power [MW/min]	1	1
J	Minimum Power [MW]	2.5	2.5
K	Suspended solids limitations	No	No

Generators

	DESCRIPTION	UNIT 1	UNIT 2
	Manufacturer	ALSTOM	ALSTOM
A	Power [MVA]	9.5	9.5
B	Speed [rpm]	400	400
C	Runaway speed [rpm]	1007	1007
D	Number of phases	3	3
E	Minimum time for synchronization [min]	1	1
F	Current A	548.8	548.8
G	Excitation Vcc	129	129
	Acc	487	487
H	Nominal voltage generation [V]	10,000	10,000
I	Power factor	0.8	0.8

During this monitoring period the power plant has operated normally according to the water availability and approved energy dispatch. There have been some cuts in the energy production due to the maintenance of the irrigation infrastructure. The project sponsor takes advantage of these stops to perform inspections and maintenance of the generation units.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

>>Not deviation applied to this monitoring period

B.2.2. Corrections

>>Not applicable

B.2.3. Changes to the start date of the crediting period

>>Not applicable

B.2.4. Inclusion of monitoring plan

>>Not applicable

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

>>Not applicable

B.2.6. Changes to project design

>>Not applicable

SECTION C. Description of monitoring system

>>It is required that the project operator calculate the Project's ERs based on most recent available information, following The ERs Calculation Procedure (ERCP) presented in this report. The project operator must gather and process information needed to monitor ERs. All data required for calculating the Emission Margin will come from the COES information system and project meters. Electricity production by the plant and any internal usage will be metered continuously to account for the net level of electricity sold to the grid, and these records and sales receipts will be cross-referenced with COES data (which will itself contain a record of the plant output, along with all other plants in the SEIN).

Data gathering and processing should be done monthly by the Operator, as follows:

	○ At the end of each month:
COES (Data Provider)	○ Report of hourly generation of the plants in the SEIN (measurement: 15' or 30' [2]) ○ Report of dispatch merit orders for "hours of maximum demand ○ Report of net energy sold to the grid. ○ Use real NECs per power plant in the SEIN
Operator (Data processor)	○ Report of the Project hourly generation of the meters of the project ○ Verification of final client (ENOSA) report of the Project's generation sold to the grid – comparison with own records. The operator will verify that the sum of electricity reported of Poechos II and Poechos I in each hour is equal to the net electricity to the grid metered in the meter of Sullana. ○ Monthly data filling in all the spreadsheets required, following the ERCP ○ Monthly report

The Operator should calculate ERs on the basis of this MP (following the ERCP) for the purpose of claiming ERs credits. It is believed that the MP approach presented here will result in an accurate, yet conservative calculation of ERs. However some uncertainties may lead to a deviation of monitored ERs and the verified ERs, especially errors in the data monitoring and processed system. The Operator is expected to prevent such errors and the verification audits are expected to uncover any possible errors. The CERs would be granted ex-post verification.

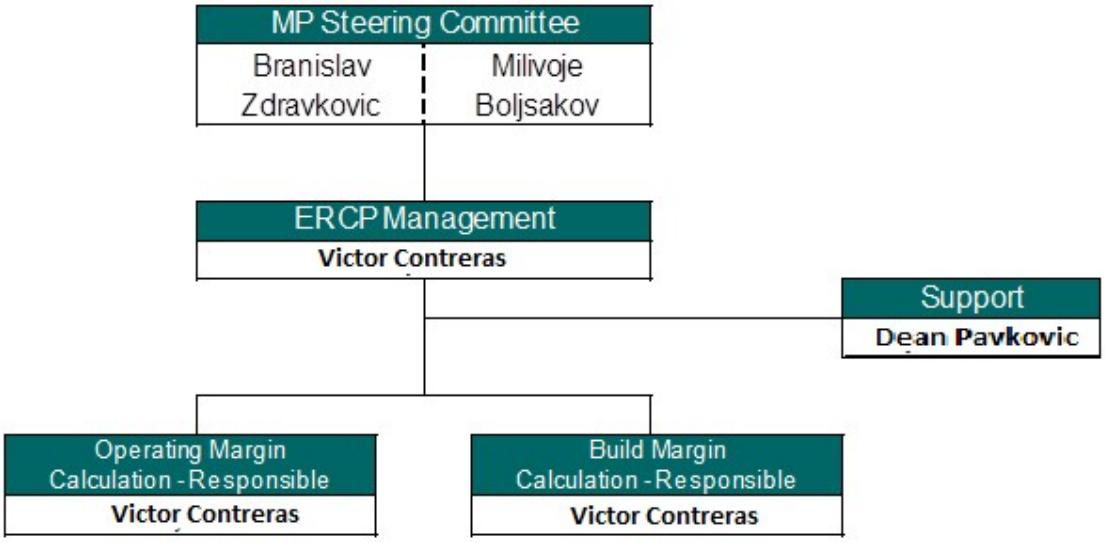
The baseline emissions are calculated originally using 2 spreadsheets: "Procedure of calculation of monthly order of merits" and "Poechos I DDA-OM.xls". It was decided to merge both spreadsheets in only one spreadsheet aiming to improve the accuracy in the results since now numbers of both spreadsheets are linked; the spreadsheet is called "Poechos I DDA-OM.xls". In addition, it has included also a spread sheet called "Poechos I EGh net electricity check.xls". This spread sheet will verify that the sum of electricity reported of Poechos II and Poechos I in each hour is equal to the net electricity metered in Sullana. Also in the last workbook of this spreadsheet it has been included a crosscheck with the invoices of the electricity sold.

[2] Half an hour measurement is still acceptable if total SEIN production calculated with it does not deviate greatly (i.e. less than 1%) from total SEIN generation calculated with the 15-minute measured data.

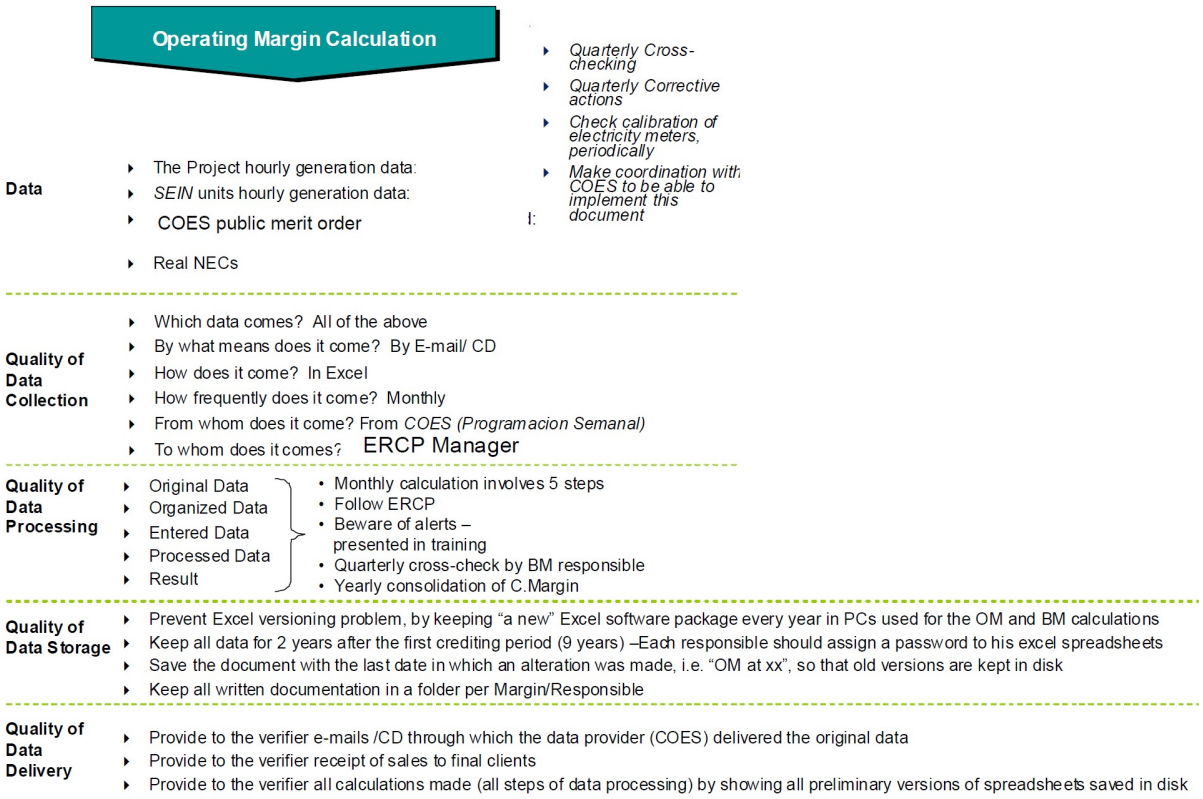
As this monitoring period covers three calendar years, three Poechos I DDA-OM.xls spreadsheets has been prepared to measure the emission reductions of the months occurred between 01/04/2013 – 31/12/2015. The names of those spreadsheets are:

1. Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls
2. Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls
3. Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls

Emission Reductions Calculation Procedure(ERCP)
ERCP Organizational Structure



Monitoring Plan (MP) – Emissions Reductions Calculation Procedure
ERCP Quality Control

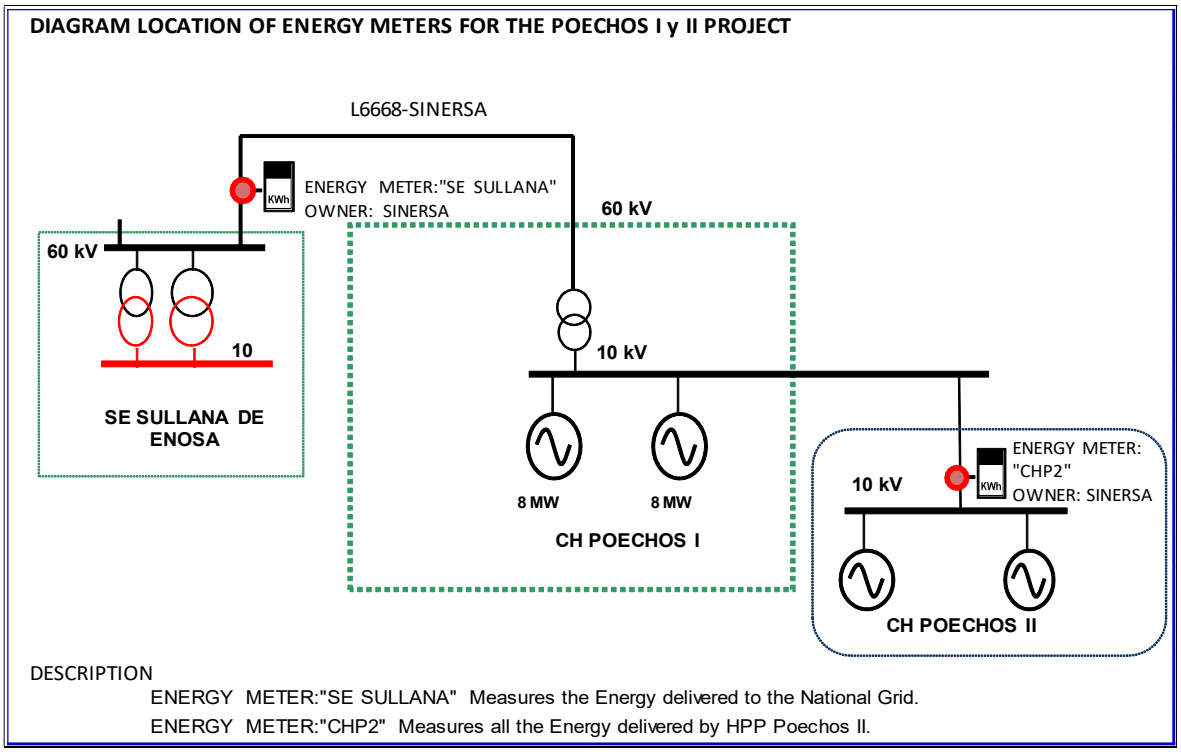


Electricity Meter Location

The net electricity to the grid of Poechos I is metered in the energy meter of Sullana. However, the project participant built recently other hydro power plant called Poechos II which its energy is also metered in the energy meter of Sullana. Poechos II also has its own energy meter located in its facility.

Therefore the net electricity to the grid of Poechos I is the electricity metered in the meter of Sullana minus the energy metered in the energy meter of Poechos II.

Figure 1. Diagram location of energy meters for Poechos I



During this monitoring period there were some training activities for engineers and technicians regarding securities issues and operation of the electronic equipment. Also virtual classes have been given by TECSUP to the mechanics of the plant about operation and maintenance of pumping equipments.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	**$EF_{grid, BMy}$**
Unit	tCO_2/MWh
Description	Build margin CO_2 emission factor in year y (tCO_2/MWh) calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
Source of data	Calculated according to the "Tool to calculate the emission factor for an electricity system (Version 02.2.1)" based in COES annual statistics. The last one was published in year 2009.
Value(s) applied	0.50665 tCO_2/MWh
Choice of data or measurement methods and procedures	In terms of vintage of data, project participants have chosen option 2: For the second crediting period, the build margin emission factor is calculated ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.
Purpose of data/parameter	Baseline emission calculation
Additional comments	-

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data/parameter:	**$EF_{grid,CM,y}$**
Unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Measured/calculated/default	Calculated
Source of data	Project sponsor's own calculations based on COES and project data. The results of the calculations are in: o Workbook 12, cell C14 of the Spreadsheet "Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls" for the period 01 Apr 2013 -31 Dec 2013 o Workbook 15, cell C14 of the Spreadsheet Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls" for the period 01 Jan 2014 -31 Dec 2014 o Workbook 15, cell C14 of the Spreadsheet Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls" for the period 01 Jan 2015 -31 Dec 2015
Value(s) of monitored parameter	o 0.56247 for the period 01 Apr 2013 -31 Dec 2013 o 0.53489 for the period 01 Jan 2014 -31 Dec 2014 o 0.50998 for the period 01 Jan 2015 -31 Dec 2015
Monitoring equipment	No especial monitoring equipment was needed. There is a Monitoring Plan and pre-programmed spreadsheets such that the Project sponsor only need to collect the information as described and apply the formulas as instructed in the Monitoring Plan
Measuring/reading/recording frequency:	Calculated yearly. The proportion of data to be monitored was100% and the data have been archived electronically.
Calculation method (if applicable):	As per the "Tool to calculate the emission factor for an electricity system" based on COES and project data
QA/QC procedures:	-
Purpose of data/parameter:	Calculation of baseline emissions
Additional comments:	-

Data/parameter:	**$EF_{grid,OM,y}$**
Unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Measured/calculated/default	Calculated
Source of data	Project sponsor's own calculations based on COES and project data. The results of the calculation are in: o Workbook 12, cell C12 of the Spreadsheet "Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls" for the period 01 Apr 2013 -31 Dec 2013 o Workbook 15, cell C12 of the Spreadsheet Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls" for the period 01 Jan 2014 -31 Dec 2014

	○ Workbook 15, cell C12 of the Spreadsheet Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls" for the period 01 Jan 2015-31 Dec 2015
Value(s) of monitored parameter	○ 0.72994 for the period 01 Apr 2013 -31 Dec 2013 ○ 0.61961 for the period 01 Jan 2014 -31 Dec 2014 ○ 0.51996 for the period 01 Jan 2015 -31 Dec 2015
Monitoring equipment	No special monitoring equipment was needed. There is a Monitoring Plan and pre-programmed spreadsheet such that the Project sponsor only need to collect the information as described and apply the formulas as instructed in the Monitoring Plan
Measuring/reading/recording frequency:	Calculated for this monitoring period. The proportion of data to be monitored was100% and the data have been archived electronically
Calculation method (if applicable):	As per the "Tool to calculate the emission factor for an electricity system" based on COES and project data
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

Data/parameter:	**$EG_{m,y}$ and $EG_{n,h}$**
Unit	MWh
Description	Net electricity generated by power plant / unit m, or n in year y or hour h.
Measured/calculated/default	Measured
Source of data	COES records. Raw data has been gotten form the web page of COES. Period: 01/04/2013 to 31/12/2015.
Value(s) of monitored parameter	See dispatch hourly data of all power plants in: ○ For the period 01 Apr 2013 -31 Dec 2013 see Workbooks 3 to 11, of the Spreadsheet "Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls" ○ For the period 01 Jan 2014 -31 Dec 2014 see Workbooks 3 to 14, of the Spreadsheet Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls" ○ For the period 01 Jan 2015 -31 Dec 2015 see Workbooks 3 to 14, of the Spreadsheet Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls"
Monitoring equipment	The information was provided by COES. No monitoring equipment was necessary for the project operator other than computers to down load the information.
Measuring/reading/recording frequency:	Directly measured every 15 minutes by power plants energy meters and reported to COES. This data was processed and recorded hourly by project participant in "Poechos I DDA-OM.xls" spread sheet. The proportion of data to be monitored was 100% and the data will be archived electronically.
Calculation method (if applicable):	No applicable
QA/QC procedures:	Data has been taken from COES official information
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

Data/parameter:	**$EG_{PJ,h}$**
Unit	MWh
Description	Electricity displaced by the project activity in hour h of year y
Measured/calculated/default	Calculated
Source of data	Calculated based in information provided by project electricity meters
Value(s) of monitored parameter	Real hourly data of Poechos I during year April 1st, 2013 to December 31st, 2015. The values are in column “EJ” in the monthly workbooks of the spread sheets: o Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls o Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls The values are in column “EL” in the monthly workbooks of the spread sheets: o Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls

<table>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td></td><td>Sullana Meter</td><td>Poechos II Meter</td></tr>
<tr><td>Manufacturer</td><td>Power Measurement</td><td>Schneider Electric</td></tr>
<tr><td>Type</td><td>ION 7600</td><td>ION 7650</td></tr>
<tr><td>Accuracy class</td><td>0.2</td><td>0.2</td></tr>
<tr><td>Serial Number</td><td>PL-0305A001-01</td><td>PJ-1004A406-02</td></tr>
<tr><td>Calibration frequency</td><td>3years</td><td>3 years</td></tr>
<tr><td>Previous Calibration</td><td>May 18, 2012</td><td>May 18, 2012</td></tr>
<tr><td>Date of last calibration [3]</td><td>October 01, 2015</td><td>October 02, 2015</td></tr>
<tr><td>Validity</td><td>OK</td><td>OK</td></tr>
</table>

✓ The calibration interval for the electricity metering system was performed at least once every three years.
✓ SINERSA has a quality control procedure, based on the comparison of the electricity measures in equipment of TOTAL meter at with the patron meter.
✓ The result of the calibration was documented in a Calibration Test Protocol.
✓ The procedure of calibration is in document “CHP2-Procedimiento calibracion de medidores.docx”

</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Directly measured every 15 minutes by power plants energy meters. This data was processed and recorded hourly by project participant in “Poechos I DDA-OM.xls” spread sheet. The proportion of data to be monitored was100% and the data was archived electronically.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>The net electricity to the grid of Poechos I is calculated as the difference between the energy meter of the substation of Sullana and the meter of the hydropower plant of Poechos II.</td></tr>
<tr><td>QA/QC procedures:</td><td>Sales records to the SEIN or to the final client were used to ensure consistency.</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comments:</td><td>-</td></tr>
</table>

Data/parameter:	**$EG_{PJ,y}$**
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Measured/calculated/default	Calculated

[3] According to the PDD, the calibration interval for the electricity metering system should be performed every 3 years, in this monitoring period the calibration was done on 01/10/2015 (around 4.5 months later). The result of the calibration test confirms, that the meter equipments are operated according with its accuracy class. However according with the “GUIDELINES FOR ASSESSING COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS” (EB52) the net energy for the calculation of ER has been adjusted applying the maximum permissible error of the meter equipment for the period: 18/05/2015 to 02/10/2015.

<table>
<tr><td>Source of data</td><td>Calculated based in Information provided by project electricity meters.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The values are in the monthly workbooks of the spread sheets:
o Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls
o Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls
o Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th></th><th>Sullana Meter</th><th>Poechos II Meter</th></tr>
<tr><td>Manufacturer</td><td>Power Measurement</td><td>Schneider Electric</td></tr>
<tr><td>Type</td><td>ION 7600</td><td>ION 7650</td></tr>
<tr><td>Accuracy class</td><td>0.2</td><td>0.2</td></tr>
<tr><td>Serial Number</td><td>PL-0305A001-01</td><td>PJ-1004A406-02</td></tr>
<tr><td>Calibration frequency</td><td>3years</td><td>3 years</td></tr>
<tr><td>Previous Calibration</td><td>May 18, 2012</td><td>May 18, 2012</td></tr>
<tr><td>Date of last calibration [4]</td><td>October 01, 2015</td><td>October 02, 2015</td></tr>
<tr><td>Validity</td><td>OK</td><td>OK</td></tr>
</table>
✓ The calibration interval for the electricity metering system was performed at least once every three years.
✓ SINERSA has a quality control procedure, based on the comparison of the electricity measures in equipment of TOTAL meter at with the patron meter.
✓ The result of the calibration was documented in a Calibration Test Protocol.
✓ The procedure of calibration is in document “CHP2-Procedimiento calibracion de medidores.docx”
</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Directly measured every 15 minutes by power plants energy meters. This data was processed and recorded hourly by project participant in “Poechos I DDA-OM.xls” spread sheet. The proportion of data to be monitored was100% and the data was archived electronically.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>The net electricity to the grid of Poechos I is calculated as the difference between the energy meter of the substation of Sullana and the meter of the hydropower plant of Poechos II.</td></tr>
<tr><td>QA/QC procedures:</td><td>Sales records to the SEIN or to the final client were used to ensure consistency.</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comments:</td><td>-</td></tr>
<tr><td>Additional comment:s:</td><td>-</td></tr>
</table>

[4] According to the PDD, the calibration interval for the electricity metering system should be performed every 3 years, in this monitoring period the calibration was done on 01/10/2015 (around 4.5 months later). The result of the calibration test confirms, that the meter equipments are operated according with its accuracy class. However according with the “GUIDELINES FOR ASSESSING COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS” (EB52) the net energy for the calculation of ER has been adjusted applying the maximum permissible error of the meter equipment for the period: 18/05/2015 to 02/10/2015.

Data / Parameter:	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type i used in power unit m in year y
Measured/ Calculated / Default:	Default
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) of monitored parameter:	Diesel Oil = 72,600 Residual Fuel Oil = 75,500 Natural Gas = 54,300 Coal = 87,300 Landfill Gas = 46,200
Monitoring equipment:	-
Measuring/ Reading/ Recording frequency:	Dispatch data OM: Annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. Further guidance can be found in Step 3 of the Tool to calculate the emission factor for an electricity system; BM: For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Calculation method (if applicable):	-
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comment:s:	-

D.3. Implementation of sampling plan

>> Not applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

>> Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr)
$EG_{pj,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y*

(MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

The Baseline emission factor (EF_y) is calculated as a combined margin(CM) emission factor ($EF_{grid,CM,y}$), following the guidance in the Tool to calculate the emission factor for an electricity system, *Version* 02.2.1.According to the *Tool*, the baseline emission factor is calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$) where the weights W_{OM} and W_{BM}, by default in this crediting period, are 25% and 75% respectively (i.e., W_{OM} = 0.25 W_{BM} = 0.75).

This is presented below:

Estimated anthropogenic emissions were calculated for the Project following a 6-step-process:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine the operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin (BM) emission factor;
STEP 6. Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems
The power plant is connected to the national grid through a 60 kV overhead transmission line. The transmission line has a length of 38km and is connected to the existing Sullana substation – which belongs to Electronoroeste S.A. (ENOSA).

Electricity imports have been reported by the SEIN dispatch center. For the purpose of determining the operating margin emission factor, it is assumed a CO_2 emission factor(s) for net electricity imports 0 tCO_2/MWh;

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)
Since project participants considered only grid power plants for the calculation of the operating margin and build margin emission factor, this step is not taken in account.

Step 3: Select a method to determine the operating margin (OM)
The calculation of the Operating Margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:
1. Simple OM, or
2. Simple adjusted OM, or
3. Dispatch Data Analysis OM, or
4. Average OM.

Out of four options for the OM, the Dispatch Data Analysis OM was selected since Hourly data from each power plant on power generation and fuel type and fuel consumption are available.

Step 4: Calculate the operating margin emission factor according to the selected method

The formula for the OM emission factor ($EF_{grid,OM-DD,y}$) used was provided by the tool as follows:

$$EF_{grid,OM-DD,y} = \sum hEG_{PJ,h} * EF_{EL,DD,h} / EG_{PJ,y}$$

Where,

$EF_{grid,OM-DD,y}$ = Dispatch data analysis operating margin CO_2 emission factor in year, y (tCO_2/MWh)

$EG_{PJ,h}$	=	Electricity displaced by the project activity in hour, h of year, y (MWh)
$EF_{EL,DD,h}$	=	CO_2 emission factor for grid power units in the top of the dispatch order in hour, h in year, y (tCO_2/MWh)
$EG_{PJ,y}$	=	Total electricity displaced by the project activity in year, y (MWh)
h	=	Hours in year, y, in which the project activity is displacing grid electricity
y	=	Year in which the project activity is displacing grid electricity

Since hourly fuel consumption data is not available, the hourly emissions factor is determined based on the energy efficiency of the grid power unit and the fuel type used, as follows:

$$\mathbf{EF_{EL,DD,h} = \sum_n EG_{n,h} * EF_{EL,n,y} / \sum_n EG_{n,h}}$$

$EF_{EL,DD,h}$	=	CO_2 emission factor for grid power units in the top of the dispatch order in hour, h in year, y (tCO_2/MWh)
$EG_{n,h}$	=	Net quantity of electricity generated and delivered to the grid by grid power unit n in hour, h (MWh)
$EF_{EL,n,y}$	=	CO_2 emission factor of grid power unit, n in year, y (tCO_2/MWh)
n	=	Grid Power units in the top of the dispatch. At each hour, h, stack each grid power unit's generation using the merit order. The group of power units n in the dispatch margin includes the units in the top x% of total electricity dispatched in the hour h, where x% is equal to the greater of either: (a) 10% (if 10 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation); or (b) The quantity of electricity displaced by the project activity during hour h divided by the total electricity generation by the grid power plants during that hour, h.
h	=	Hours in year y in which the project activity is displacing grid electricity

The $EF_{EL,n,y}$ is calculated as per the guidance for the simple OM, using the option A2.

$$\mathbf{EF_{EL,m,y} = (EF_{CO2} * 3.6)/(\eta_{m,y})}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type i used in power unit m in year y (t CO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit m in year y (ratio)
m	=	All power units serving the grid in year y except low-cost/must-run power Units
y	=	Year in which the project activity is displacing grid electricity

Where several fuel types are used in the power unit, use the fuel type with the lowest CO_2 emission factor for $EF_{CO2,m,i,y.}$

The resulting DDA-OM emission factor was calculated as follows:

$EF_{grid,OM\text{-}DD,}y$ for the period 01 Apr 2013 -31 Dec 2013= $\sum h EG_{PJ,h} * EF_{EL,h} / EG_{PJ,y}$ = 26,975.65 / 36,956 = **0.72994 tCO_2/MWh**

$EF_{grid,OM\text{-}DD,}y$ for the period 01 Jan 2014 -31 Dec 2014= $\sum h EG_{PJ,h} * EF_{EL,h} / EG_{PJ,y}$ =

37,002.41 / 59,719 = **0.61961 tCO_2/MWh**

$EF_{grid,OM-DD,y}$ for the period 01 Jan 2015 -31 Dec 2015= $\sum hEG_{PJ,h} * EF_{EL,h} / EG_{PJ,y}$ = 36,188.66 / 69,599[5] = **0.51996 tCO_2/MWh**

Step 5: Calculate the build margin (BM) emission factor;

In terms of vintage of data, project participants have chosen option 2: For the second crediting period, the build margin emission factor is calculated ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. At the time of the validation submission the latest year that information that was publicly available was from the annual statistics of COES of year 2009.

The calculation of the build margin established in the renewed PDD was set in **0.50665 tCO_2/MWh**. This value would remain fix for the hold second crediting period.

Step 6: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as weighted average CM as follows

$$\mathbf{EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year, y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year, y (tCO_2/MWh)
W_{OM}	=	Weighting of operating margin emissions factor (%)
W_{BM}	=	Weighting of build margin emissions factor (%)

The following default values should be used for W_{OM} and W_{BM}:

W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period.

[5] According to the PDD, the calibration interval for the electricity metering system should be performed every 3 years, in this monitoring period the calibration was done on 01/10/2015 and 02/10/2015 (around 4.5 months later).
The result of the calibration test confirms:

- The results of the test of Poechos II meter equipment (PJ-1004A406-02) indicate that the meter is within its class of accuary, class 0.2%
- The results of the test of SE Sullana meter equipment (PL-0305A001-01) indicate that the meter is within its class of accuary, class 0.2%.However, taking into account that the maximum error of the meter equipment in the calibration test was 0.2747% and in order to be conservative it had been used this error for all the period 18/05/2015 to 01/10/2015

According with the "GUIDELINES FOR ASSESSING COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS" (EB52) the net energy for the calculation of ER has been adjusted applying the maximum permissible error of the meter equipment for the period 18/05/2015 to 02/10/2015.
The formula used to adjust the energy is
EGh export= net energy hourly * (1- error%)
EGh import= net energy hourly * (1+ error%)
error%=0.2% Poechos II meter equipment + 0.2747% SE Sullana meter equipment =0.4747%

As Poechos I is in the second crediting period, the formula is:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * 0.25 + EF_{grid,BM,y} * 0.75$$

The resulting combined margin emission factor for the monitoring period are:

$EF_{grid,CM,y}$ for the period 01 Apr 2013 -31 Dec 2013
= 0.25*(0.72994) + 0.75*(0.50665) = **0.56247 tCO_2/MWh**

$EF_{grid,CM,y}$ for the period 01 Jan 2014 -31 Dec 2014
= 0.25*(0.61961) + 0.75*(0.50665) = **0.53489 tCO_2/MWh**

$EF_{grid,CM,y}$ for the period 01 Jan 2015 -31 Dec 2015
= 0.25*(0.51996) + 0.75*(0.50665) = **0.50998 tCO_2/MWh**

Value of the baseline emissions:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

For the period 01 Apr 2013 -31 Dec 2013 = 36,956*0.56247= 20,786 tCO_2
For the period 01 Jan 2014 -31 Dec 2014 = 59,719*0.53489= 31,943 tCO_2
For the period 01 Jan 2015 -31 Dec 2015 = 69,599*0.50998= 35,494 tCO_2

Total Baseline Emissions for the period 01 Apr 2013 to 31 Mar 2016 = 20,786 + 31,943 + 35,494 = 88,223 tCO_2

E.2. Calculation of project emissions or actual net removals

>> The project does not lead to any GHG emissions. Hydropower plants using existing reservoirs without increasing its capacity are classified as zero emission projects, for which there are no associated emissions in the Project boundary

E.3. Calculation of leakage emissions

>> According to the Baseline Methodology, project participants do not need to consider leakage

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals ($t CO_2e$)	Project GHG emissions or actual net GHG removals ($t CO_2e$)	Leakage GHG emissions ($t CO_2e$)	GHG emission reductions or net anthropogenic GHG removals ($t CO_2e$)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	88,223	0	0	0	88,223	88,223

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period ($t CO_2e$)	Amount estimated ex ante ($t CO_2e$)
88,223	90,337

E.6. Remarks on increase in achieved emission reductions

>> The achieved emission reductions during the monitoring period are smaller than those stated in the registered CDM-PDD is -2%.

In the other hand, the PDD has used an annual production close to 58 GWh/year or 159.5GWh for two years and 9 months. In this monitoring period from 01/04/2013 to 31/12/2015 the production of energy has been 166.274 GWh which is only 4% greater than the expected in the PDD.
The energy production of HPP Poechos I is not only related to an expected hydrology since it depends mainly on operation and functioning of an irrigation system (Poechos dam and reservoir, various canals and regulation structures), that is managed for that purpose (and not for hydropower production). The hydropower plant of Poechos I does not have any control over irrigation system operation and functions only as a secondary and passive user of water directed to irrigation users along Derivation canal and within Piura River valley. Therefore, the estimated production was not related only to hydrological parameters, as it is usual for run of river projects. For these reasons, we consider this small (4%) increase of the net energy during this monitoring period is normal and within the expectations.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Person/entity responsible for completing the CDM-MR-FORM
Organization name	Sindicato Energetico S.A. (SINERSA)
Street/P.O. Box	Av. Del Ejercito No 250, Oficina 403, Miraflores.
Building	Torre 29
City	Lima
State/region	Lima
Postcode	Lima 18
Country	Peru
Telephone	(51-1) 421-7359/222-4888
Fax	(51-1) 421-4997
E-mail	bzdrav@sinersaperu.com , branislav.zdravkovic@sinersa.com.pe
Website	
Contact person	
Title	General Manager
Salutation	Mr.
Last name	Zdravkovic
Middle name	
First name	Branislav
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☐ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	ONCE
Street/P.O. Box	Malecon 28 de julio 133 piso 7.
Building	
City	Lima
State/region	Lima
Postcode	Lima 18
Country	Peru
Telephone	(51-1) 2607926
Fax	
E-mail	lorenzoeguren@gmail.com
Website	
Contact person	
Title	General Manager
Salutation	Mr.
Last name	Eguren

Middle name	
First name	Lorenzo
Department	
Mobile	(51) 997029132
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☐ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	ONCE
Street/P.O. Box	Malecon 28 de julio 133 piso 7.
Building	
City	Lima
State/region	Lima
Postcode	Lima 18
Country	Peru
Telephone	
Fax	
E-mail	claudiamons@hotmail.com
Website	
Contact person	
Title	Director
Salutation	Mrs.
Last name	Monsalve
Middle name	
First name	Claudia
Department	
Mobile	(51) 990323909
Direct fax	
Direct tel.	
Personal e-mail	

Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.

Version	*Date*	*Description*
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report