Monitoring report form for CDM project activity
(Version 07.0)

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

MONITORING REPORT		
Title of the project activity	Conversion of SF_6 to the Alternative Cover Gas SO_2 at RIMA Magnesium Production	
UNFCCC reference number of the project activity	UNFCCC CDM 2486	
Version number of the PDD applicable to this monitoring report	Version 04	
Version number of this monitoring report	Version 01	
Completion date of this monitoring report	04/02/2020	
Monitoring period number	4rd monitoring period of 2nd Crediting Period	
Duration of this monitoring period	Period (01/01/2019 - 31/12/2019)	
Monitoring report number for this monitoring period	-	
Project participants	RIMA Industrial S/A Nordic Environment Finance Corporation (NEFCO) and Electrabel NV/SA	
Host Party	Brazil	
Applied methodologies and standardized baselines	AM0065 - Replacement of SF_6 with alternate cover gas in the magnesium industry (version 02.1)	
Sectoral scopes	9 : Metal production	
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
	-	293,888 tCO2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	302,725 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

The purpose of the project activity is substituting sulphur hexafluoride (SF_6), a high global warming potential (GWP) gas, with a non-global warming sulphur dioxide (SO_2) gas at RIMA magnesium factory.

SF_6 is used as a cover gas to prevent oxidation of the molten magnesium during production and casting of magnesium metal products, and typically escape to the atmosphere. SF_6 is considered a non-reactive gas, and is ideally suited for this kind of protection as a "covering" for molten magnesium (hence the term "cover gas"). Although SO_2 is not a greenhouse gas, this gas has health impacts, therefore new latest environmental/safety high control technology was transferred to RIMA, to ensure safe handling of SO_2.

The primary objective of RIMA Project is to help Brazil meet the eight Millennium Goals (United Nations, 2008) as established by United Nations – eradicate extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality, improve maternal health, combat HIV/AIDS, malaria and other diseases, ensure environmental sustainability and develop a goal partnership for development – contributing to the environmental, social and economic sustainability by reducing greenhouse gas (GHG) emissions.

The average estimated annual GHG emission reductions are 301,196 tCO_2 equivalents and the total estimated reductions are 2,108,374 tCO_2 equivalents by the project in the second 7-year crediting period.

Relevant dates for the project activity:

- On 10 March 2007, after the registration of the first CDM project developed by RIMA, the company Board started to think and discuss about a second CDM project. During the month of March/07, the possibility to switch the cover gas SF_6 to a non-green house gas started to be discussed inside RIMA;
- In January 2008, RIMA closed the ERPA (Emission Reduction Purchase Agreement) with 33 Asset Management;
- In February 2008, an applicable CDM methodology AM0065 was approved and publicized by EB, consultants to develop CDM process were contacted and RIMA started construction of the room to install the SO_2 gas supplier,
- Between June-July 2008, after a long period testing with SO_2 gas, the first results were not good. The testing and adjustment continued through all validation period as well, and little by little good results started to appear. During all testing period, withdrawing the project activity was always a possibility as there was no income generation and huge adaptation efforts as the SO_2 is a toxic and dangerous gas;
- On 31 October 2008, the full change of the gas supplying system was done;
- Between April-June 2009, the completely decommissioning and disposal of all piping and pumping equipment used for previous cover gas SF_6 was done;
- On 02 July 2009, this project was approved;
- In 06 January 2011, was approved by the CDM Executive Board the monitoring plan revised and issued on 20 December 2010 by Rima. The changes occurred on monitoring plan was revised during the second verification for the period from 01/01/2010 to 30/06/2010;
- In November 2012, after understandings between RIMA and 33 Asset Management signed the term to terminate the ERPA (Emission Reduction Purchase Agreement);
- In February 2014, RIMA announced to UNFCCC the withdrawal of 33 Asset Management as project participant;
- In February 2014, RIMA announced to UNFCCC the addition of Electrabel NV/SA as project participant. RIMA does not have ERPA (Emission Reduction Purchase Agreement) with Electrabel NV S/A;

- In October 2014, RIMA closed the ERPA (Emission Reduction Purchase Agreement) with Nordic Environment Finance Corporation (NEFCO) valid until December 2017. This ERPA involves CER of this project; and
- In June 2015, RIMA closed a second ERPA (Emission Reduction Purchase Agreement) with Nordic Environment Finance Corporation (NEFCO) valid until June 2021. This ERPA involves CER of this project.
- The date of 01/07/2016 is the end of deadline of the first crediting period of emission reductions of this project.
- In October 2015, RIMA contracted DOE AENOR to does the validation of new PDD regarding the second crediting period of this project.
- After process of review of all documents and information related of this project, the DOE AENOR issued the validation report dated 18/10/2016.
- In the day of 02/11/2016 the DOE AENOR submitted to the CDM registration team the request the renewal of crediting period of this project containing the validation report and associated documents.
- The second crediting period of this project was approved by UNFCCC in 20/01/2017.

RIMA clarify that the emission reductions achieved on this monitoring period was calculated during the period of 01/01/2019 until 31/12/2019, which is included in second crediting period.

Total emission reductions achieved in this monitoring period: 293,888

Company Profile

RIMA Industrial S/A, the project owner, was founded in 1987 operating in several areas as mining, engineering, agriculture-livestock and tourism and has a diverse line of products such as silicon metal, pure magnesium, magnesium alloys, calcium silicon alloys, magnesium-iron-silicon, iron-silicon 75%, inoculants, specialty cored wires and magnesium die cast pieces.

RIMA is a member of International Magnesium Association (IMA). IMA and United States Environmental Protection Agency (EPA)'s Partners created the "SF_6 Emission Reduction Partnership for the Magnesium Industry"[1]. They join companies committed to eliminate SF_6 emissions from magnesium production and casting processes by year-end 2010.

In conference of International Magnesium Association (IMA) in june of 2014, the Environmental Responsibility Award[2] was presented to RIMA, regarding your Primary Magnesium Production Process (where CDM project RIMA is installed). After presenting the paper "RIMA's Process: Green Magnesium From a Fully Integrated Plant" during 2011 IMA Annual Conference in Prague, German carmaker AUDI AG and RIMA Industrial decided to make a complete Life Cycle Assessment (LCA) of RIMA's primary magnesium process. PE International, a German consultancy for sustainability, conducted a comprehensive LCA that evaluated the environmental impact of the RIMA magnesium process. The RIMA Process Study showed that RIMA's plant greenhouse gas emissions are only 10.1 Kg CO_2eq/Kg Mg when the average of other companies that use the same technology is 25.8 Kg CO_2eq /Kg Mg.

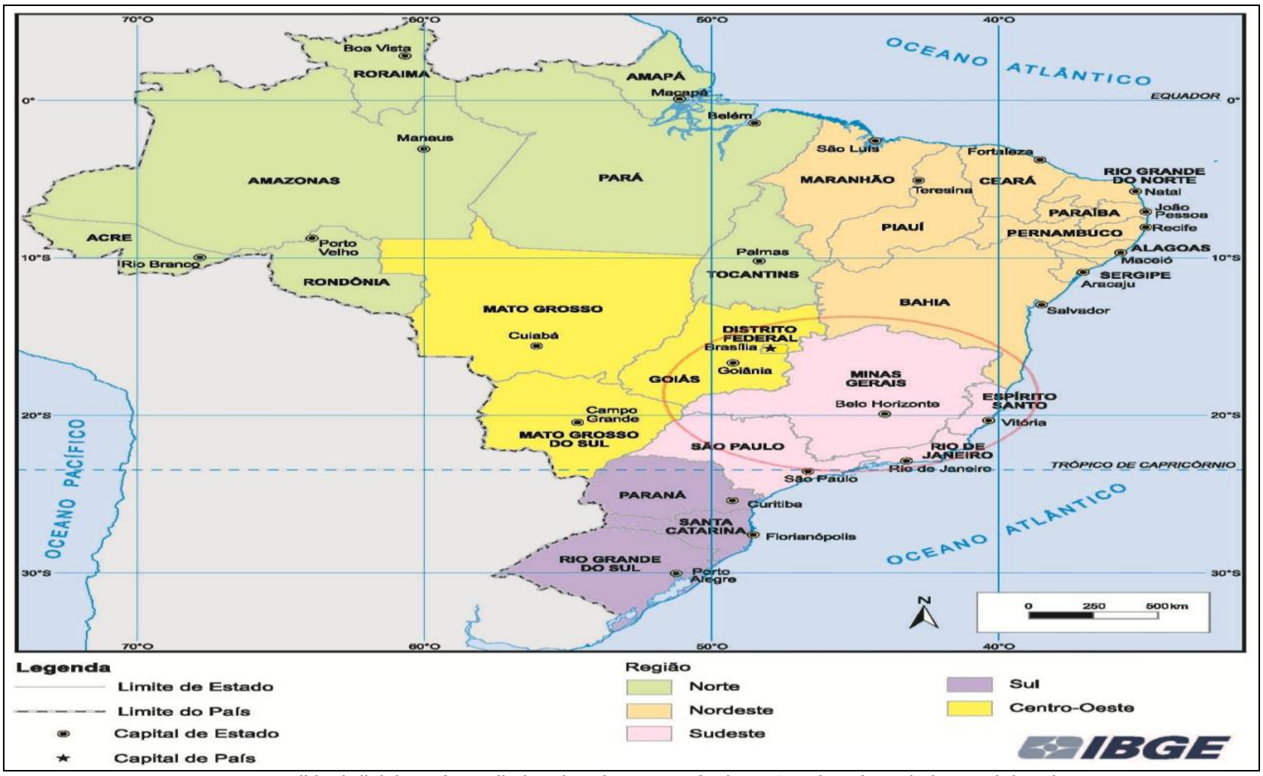
RIMA is the world's 4th largest producer of Silicon Metal, the 2nd largest Magnesium Die Caster, as well as the only magnesium producer on south hemisphere. RIMA is also the only one integrated magnesium plant in the world. Manufacturing magnesium from the raw material (dolomite), induction/casting, and die casting.

RIMA has environmental and social responsibility evidenced by its initiatives through Vicintin Foundation[3]. Vicintin Foundation objective is social acting through the articulation of three sectors: government, private companies and communities. The foundation implements several activities in health, education and environment areas in Belo Horizonte and Minas Gerais state.

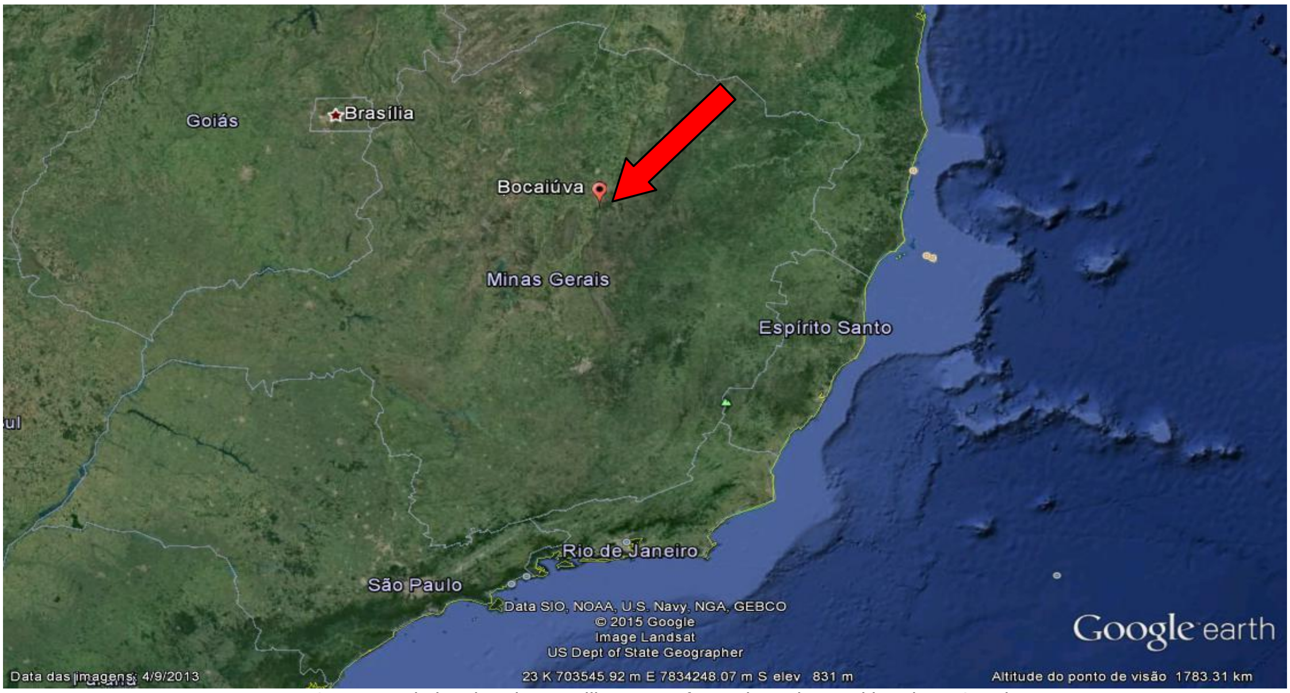
[1] For more information see: http://www3.epa.gov/highgwp/magnesium-sf6/.
[2] For more information see: http://www.intlmag.org/newsroom/news_070114.cfm.
[3] For more information see: http://www.vicintinfoundation.org/.

A.2. Location of project activity

The project activity is located in Bocaiuva city, Northern region of Minas Gerais state, Midwest region of Brazil. Bocaiuva city is 369 km from Belo Horizonte, the capital of the state[4]. The project geographic coordinates is latitude 17° 36'07" South and longitude 43º 48' 28" West.



Map 1 – Political division of Brazil showing the state of Minas Gerais, where is located the city of Bocaiuva.(Source: Political map of Brazil[5], 2015)



Map 2 – Record showing the satellite town of Bocaiuva, located in Minas Gerais. (Source: Google Earth[6], 2015)

[4] Available at : http://bocaiuva.mg.gov.br/index.php?option=com_content&view=article&id=67&Itemid=78.
[5] Available at: http://portaldemapas.ibge.gov.br/portal.php#mapa97. Retrieved on 28 September 2015.

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	RIMA Industrial S/A	No
Norway	Nordic Environment Finance Corporation (NEFCO)	
Netherlands	Electrabel NV/SA	

A.4. References to applied methodologies and standardized baselines

- AM0065 - Replacement of SF_6 with alternate cover gas in the magnesium industry (version 02.1);
- Combined tool to identify the baseline scenario and demonstrate additionality (version 06.0);[7]

A.5. Crediting period type and duration

Type of crediting period: Renewable crediting period (second crediting period)

Start date of crediting period: 02/07/2016

Length of crediting period: 7 years 0 months

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

RIMA produces magnesium crystals from dolomite, by silico-thermic process under vacuum. Magnesium crystals are then further processed in Fusion Area into ingots or transferred in liquid form to Die Casting Area.

During the molten of magnesium to manufacture ingots or die casting pieces, was used a cover gas to protect the metal against oxidation. RIMA was utilized sulfur hexafluoride (SF_6) as cover gas which has high global warming potential and was substituted by sulfur dioxide (SO_2). The technology was transferred from Austria.

RIMA project was installed the necessary piping, equipment and procedures (including staff safety equipment and training) required to switch from SF_6 to SO_2.

[6] Available at: http://www.google.com/earth/.Retrieved on 01 October 2015.
[7] The methodology and combined tool can be found at the following link: https://cdm.unfccc.int/methodologies/DB/GNX2U6RAUIP1UD1IP3CRDPVPPIGSS0.

Figure 1 - Previous Situation: SF_6 supplying system at Die Casting Area.
One cylinder per die casting machine.

Figure 2 - Previous Situation: One centralized SF_6 supply system for Fusion Area

Figure 3 – SF_6 supplying system decommissioning scene

The project itself consisted of the following elements:

- Installation of new piping, pumping, metering and other equipment needed to pump SO_2 over the molten magnesium in order to protect the metal. The project removed piping and pumping equipment used to protective cover gas SF_6. Removed equipment was sent to final disposal or scrap;

- Installation of gas cabinet or cylinder storage area with leak monitors and emergency ventilation system;

- Installation of redundant/back-up melt protection technology in case accidental SO_2 leakage requires system shut-down and/or repair;

- Control and monitoring of SO_2 emissions are in compliance with the local environmental regulations;

- Held staff technical training for proper handling procedures, to reduce dangerous accidental exposure to SO_2;

- Developed and trained staff for emergency response plan;
- Back-up power/generator for gas mixing system and necessary controls, compressors, etc. Capable of running independently for 12 hours;
- Provided personal safety equipment: protective wear and gears, respirator, dosimeter and monitors when operating in an environment under SO_2; and
- Developed and executed Maintenance Plan for equipment and gas distribution system to assure safe and consistent operation.

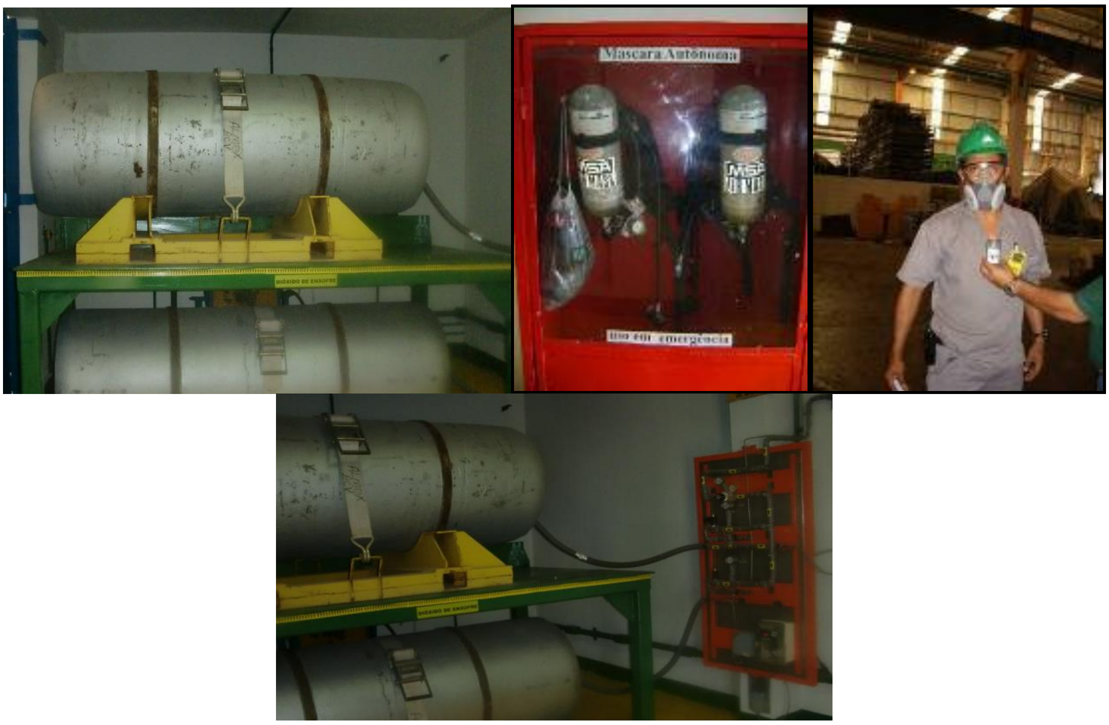
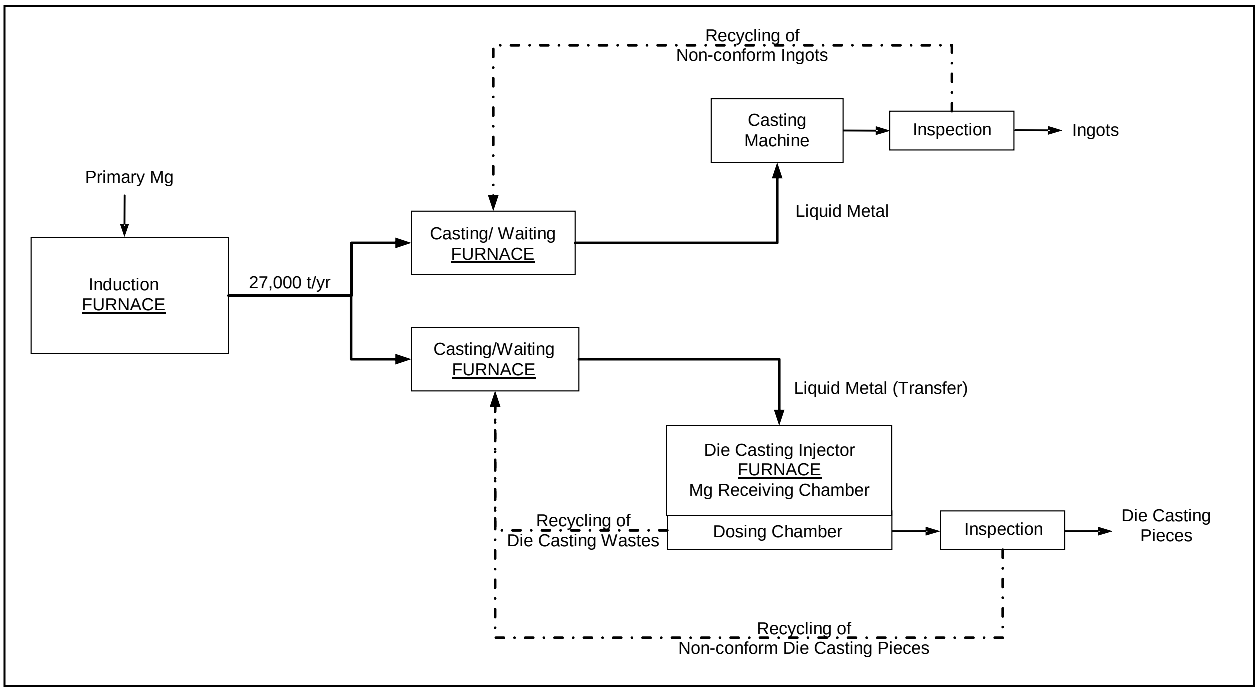


Figure 4 - Actual Situation: One SO_2 centralized supplying system for both Fusion and Die Casting Area.

Figure 5 – Previous Situation of SF_6 Gas Cylinder Storage Patio

Figure 6 – Actual Situation of SO_2 Gas Storage Patio

Magnesium Products Production



Flowchart 1 – Simplified RIMA Magnesium Production Process (Installed Capacity)

The induction furnace is where the magnesium crystals (primary magnesium) are melted with a salt protection, no SF_6 is used to protect the surface. The liquid magnesium is transferred to the next furnaces.

The casting furnaces, waiting furnaces, production of ingots and production of liquid metal are located in the Fusion Area of the RIMA plant. Liquid metal is then transported in containers by fork-lifts to the Die Casting Area, called as FSP (Casting Under Pressure) in RIMA.

In the Fusion Area:

- Until year 2016 there was 2 casting machines. In recent years Rima experienced an increase in the production of the magnesium (liquid metal and ingot) fusion area due to the growth in demand in several industrial consumer segments such as aluminium, aerospace, electronic (smartphone, computer chips) This growth contributed positively to Rima´s increase on the production of magnesium specially ingots.

  As consequence of this scenario, the frequency of use of the two casting machines has become continuous and uninterrupted.

  As shown in the PDD of the second crediting period, Rima projects that demand for magnesium ingots will continue growing in the next years.

  It happens that, in the event of any or both of the two existing casting machines, whether due to preventive or corrective maintenance, the ingot production is reduced and compromised until the maintenance procedures are finalized.

  Therefore, in order not to compromise Rima's magnesium casting operations, it was decided to install a third casting machine in 2017 year. The start-up of this machine was in August of 2017.

  Rima emphasizes that the installation of this third machine has the sole purpose of serving the operation and maintenance plan of the magnesium ingot stage. That is, there is no increase in the production capacity of magnesium.

  Finally, in the casting machines is necessary the use of cover gas;

- There are 11 furnaces, as follows:
  - Induction: are 03 induction furnaces used to melt the primary magnesium, with capacity to produced 27,000 t/yr of liquid magnesium;

   - Casting/Waiting: are 08 casting/waiting furnaces, commonly 6 furnaces operate as casting furnace and 2 as waiting furnace, where is necessary the use of cover gas. They receive the liquid magnesium (from induction furnaces), the alloying elements and production recycling (non-conform ingots, non-conform die casting pieces and die casting waste);

In the Die Casting Area:

- There are 12 units of die casting, where is necessary the use of cover gas. Die casting unit receives the liquid metal by container that is coupled at the unit. The liquid metal is injected into the first chamber, and then injected to the piece model.

Changes/investments regarding the equipment involved in the continuation of the project for the new period of crediting are not required.

In the Fusion Area, there was only one point of cover gas supply, while in the Die Casting Area, each unit injector has its own system of coverage of gas supply and some of them are supplied by the same supply point of Fusion Area.

Actually there is a central gas which provides the cover gas of dilute SO_2. Thus, there is a supply line for the Fusion Area and another line to the Die Casting Area.

Each equipment in both areas has its own system of coverage gas supply.

Liquid Magnesium transport

In its start, RIMA was only a ingot manufacture. Later, the Die Casting Area was constructed. The Die Casting Area was supplied/fed by the solid ingot produced in the Fusion Area of RIMA, which was re-melted to feed die caster, as is the common practice in the world.

Aluminum industry initiated to transport the metal in liquid form, and RIMA took this idea to make similar process for magnesium. But there is an extra difficult in doing similar process with Mg, as it could not have contact with air. Large effort of Research & Development was made.

As it is not possible to transport Mg for long distances in liquid state without cover gas, increasing the metal cost, RIMA decided to start transporting the Mg in liquid state directly from the Fusion Area to the Die Casting Area, inside the same plant, decreasing transport distance, and decreasing energy consumption to re-melt the ingots.

This is the reason RIMA is the only one integrated plant in the world, manufacturing magnesium from the raw material (dolomite), induction/casting, and die casting.

B.2. Post-registration changes

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

Section not applicable, therefore left blank on purpose

B.2.2. Corrections

Section not applicable, therefore left blank on purpose.

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

Section not applicable, therefore left blank on purpose.

B.2.4. Inclusion of monitoring plan

Section not applicable, therefore left blank on purpose.

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

Permanent changes were made in the monitoring plan which was approved on 06/01/2011

B.2.6. Changes to project design

1. In the previous monitoring period, Rima installed a third casting machine in fusion area for purpose of not compromise Rima's magnesium casting operations.

2. The installation of this third machine has the sole purpose of serving the operation and maintenance plan of the magnesium ingot stage. That is, there is no increase in the production capacity of magnesium.

3. This change have been approved by the Board as applicable from the period prior to this monitoring period. The PRC reference number is PRC-2486-001 and it was approved on 08/10/2018

4. The version number and the completion date of the revised PDD is version 4.0 dated on 15/06/2018.

5. The DOE validation report is version 1 dated on 15/06/2018

B.2.7. Changes specific to afforestation or reforestation project activity

Section not applicable, therefore left blank on purpose.

SECTION C. Description of monitoring system

The monitoring methodology is based on two main parameters to be monitored:

- Amount of Mg manufactured in project scenario; and
- Consumption of alternate cover gas in project scenario.

Project operator and manager is RIMA Industrial S/A. The company has maintenance and operations procedures, which include the monitoring of process variables, instruments calibration and quality control, according to company policies and engineering best practices. The CDM procedures were included into the ISO 9000 management system.

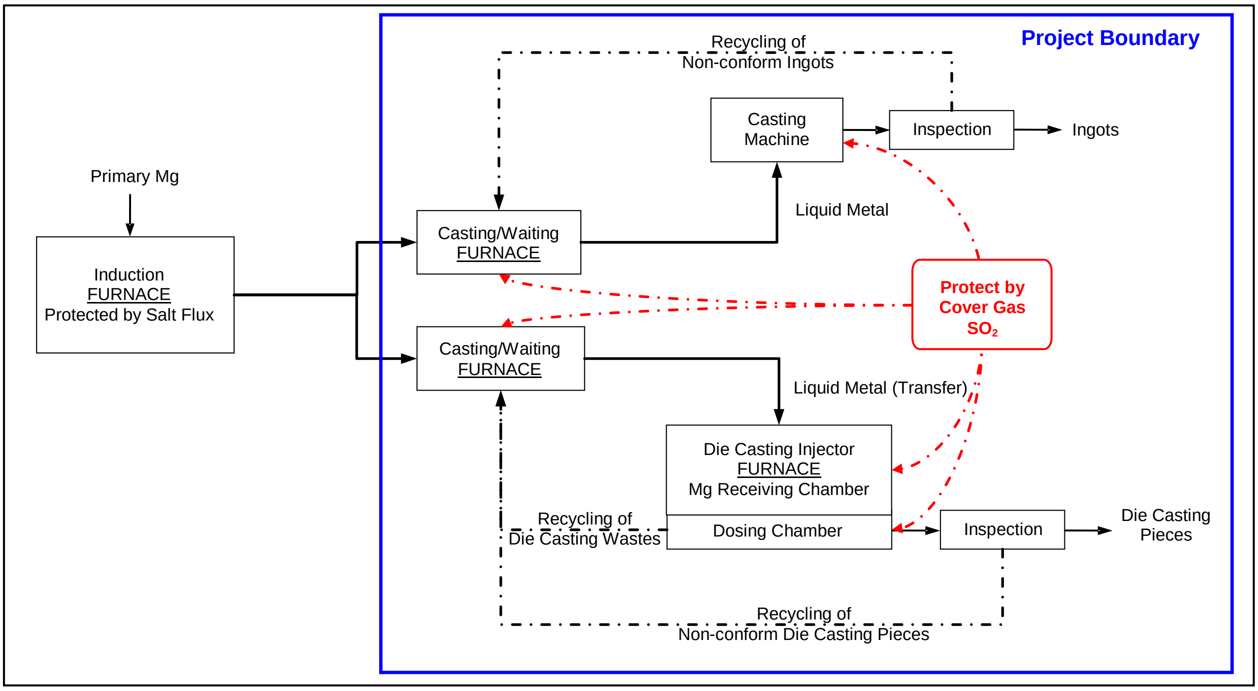
All data necessary for the monitoring of the project activity is normally monitored as part of plants operations. Therefore, there are several existing reports from which the information will be obtained, depending on the area involved. The data is kept electronically in the system, and back up available.

Monthly reports are produced from these data.

The calculation of emissions reductions is made through a Microsoft Excel spreadsheet, which contains formulae in accordance with the methodology. The data obtained from the consolidated reports are introduced in the spreadsheet and emissions reductions calculated automatically.

All monitored data related with the project activity will be stored until two years after the end of the crediting period.

These reports will be demonstrated to the auditor during the verification meeting.



Flowchart 2 – Simplified RIMA Magnesium Production Process (Project Boundary)

1. Magnesium Production Monitoring Procedure

Monitoring of magnesium production could be divided in 3 sectors:

1.1 Ingot Production

Cover gas is used during all casting process until the ingot has reached its solid form. The production will be monitored and registered separately per type of ingot.

The weight the produced ingots are performed in the Dispatch Area, and after quality inspection the non-conform ingots are returned to the casting furnace.

The produced ingots amount will be delivered from the scale (01 BAL 0004) of Dispatch Area. Monthly ingots gross production is aggregated summing all ingots type production in that month. Monthly gross production subtracting the non-conform ingots results in the monthly net production of ingots. This amount is the one used to calculated emissions reductions.

The amount sold is determined by the Sale Invoice and this amount is delivered from scale (01 BAL 0005) in the Gatehouse.

Sale invoice will be used to cross-check the produced amount as well as to verify if more than 70% of the produced amount is sold to the market. If this is verified, then the produced amount is used to calculate the emissions reductions. If not, the amount used for the calculation is the quantity sold.

1.2 Liquid Metal Production

This is a plant internal supply, from the Fusion Area to the Die Casting Area.

The liquid metal produced in the Fusion Area is injected in a container of 500 kg capacity. This container is transported by a fork-lift, and weighted all together before transporting the liquid metal to the Die Casting Area. The weight difference from [fork-lift + empty container] and [fork-lift + container with liquid metal] is used as the liquid metal production amount. The weights are registered in a form by the operator of fork-lift.

The produced liquid metal amount will be delivered from the scale (03 BAL 0001) in the Buffer Area in the Fusion Area. Monthly liquid metal production is aggregated summing all liquid metal type production in that

month. Monthly liquid metal production is added to net production of ingots to obtain the net production of Fusion Area.

Cover gas is used during the transfer of liquid metal from the casting furnace to the container. During the container transport, cover gas is not consumed, but, the cover gas continues to protect the liquid metal.

In the case of liquid metal, the “sale” is an internal sale with no Sale Invoice issuance. Therefore, the “production amount” is the same of “sale amount”, thus, the production amount is used to calculate emissions reductions.

1.3 Die Casting Pieces Production

During the production of die casting pieces the cover gas is used for the protection of the liquid metal inside containers coupled the injectors, as well as, in the chambers of the dosing furnaces of injectors.

The production will be monitored and registered separately per type of die casting piece and per injector. During the production of pieces, rough edges and channels (wastes) are inevitable. These wastes are returned to the casting furnace. After quality inspection the non-conform die casting pieces are returned to the casting furnace.

For the calculation of total amount production of die casting pieces, is used the monthly average weight (per each type of pieces and per each injector) multiplied by the monthly amount of produced pieces (per each type of pieces and per each injector). The non-conform pieces quantity is also registered, making possible the calculation of net production, this amount is the one used to calculate emissions reductions.

During the first crediting period, the average weight is obtained through the random selection of two samples per work-shift, per each type of pieces and per each injector.

To the second crediting period this procedure was changed and the average weight is obtained through the random selection of one sample per work-shift, per each type of pieces and per each injector. See more details in section D.3 of this monitoring report.

The sample weight will be delivered from the scale (03 BAL 0002) in the Laboratory in the Die Casting Area and registered in spreadsheet.

The amount sold is determined by the Sale Invoice and this amount is delivered from scale (01 BAL 0005) in the Gatehouse.

There are 12 injectors installed and included in the emissions reductions:

Table 1: Identification of Injectors

Injector Number TAG[8]	
01	TV006
02	TV005
03	TV009
04	TV010
05	TV001
06	TV007
07	TV002
08	TV014
09	TV003
10	TV013
11	TV008
12	TV004

1.4 Total Amount of Magnesium Production

[8] It refers to the internal control for the identification of injectors.

All production data, of ingots, liquid metal and die casting pieces production are monthly compiled and registered by the control department in RIMA plant.

The sum of the Net Production of Ingots, the Total Liquid Metal Production and the Net Production of Die Casting Pieces is the Total Amount of Magnesium Production ($P_{Mg,PJ,k,j,y}$) used to calculate the emissions reductions, unless the value of the sale is less than 70% of the total amount of magnesium production. In this case it will use the total amount of sales.

Raw data source, measurement and determination of magnesium production output (PMg,PJ,k,j,y) used for the emissions reductions calculation, are the same used for determining the baseline SF_6 emission factor validated by the DOE TUEV-SUED.

1.5. Description of Weight scales, identification, location and calibration information

The weight scale involved in the project are presented in the table below:

Table 2 - Weight Scales identification and calibration information

Weighted Product	TAG	Equipment Model	Equipment Serial Nr	Location	Calibration Dates	Calibration Frequency
Production inputs	01 BAL 0041	2180	4080005707	Fusion Area	04-oct-18 25-sep-19	Annually
Die casting pieces	03 BAL 0002	KLD50/1	OF3982	Die Casting Laboratory	03-oct-18 24-sep-19	Annually
Liquid Metal (+ Fork-Lift)	03 BAL 0001	2180	10153062	Buffer Area, Platform	04-oct-18 25-sep-19	Annually
Ingots, SO2 gas cylinder	01 BAL 0004	SISTEMA/9091	6090002291	Dispatch Area	04-oct-18 24-sep-19	Annually
Truck Scale used for Sale Receipt	01 BAL 0005	8540	10367578	Company Out gate	03-oct-18 23-sep-19	Annually

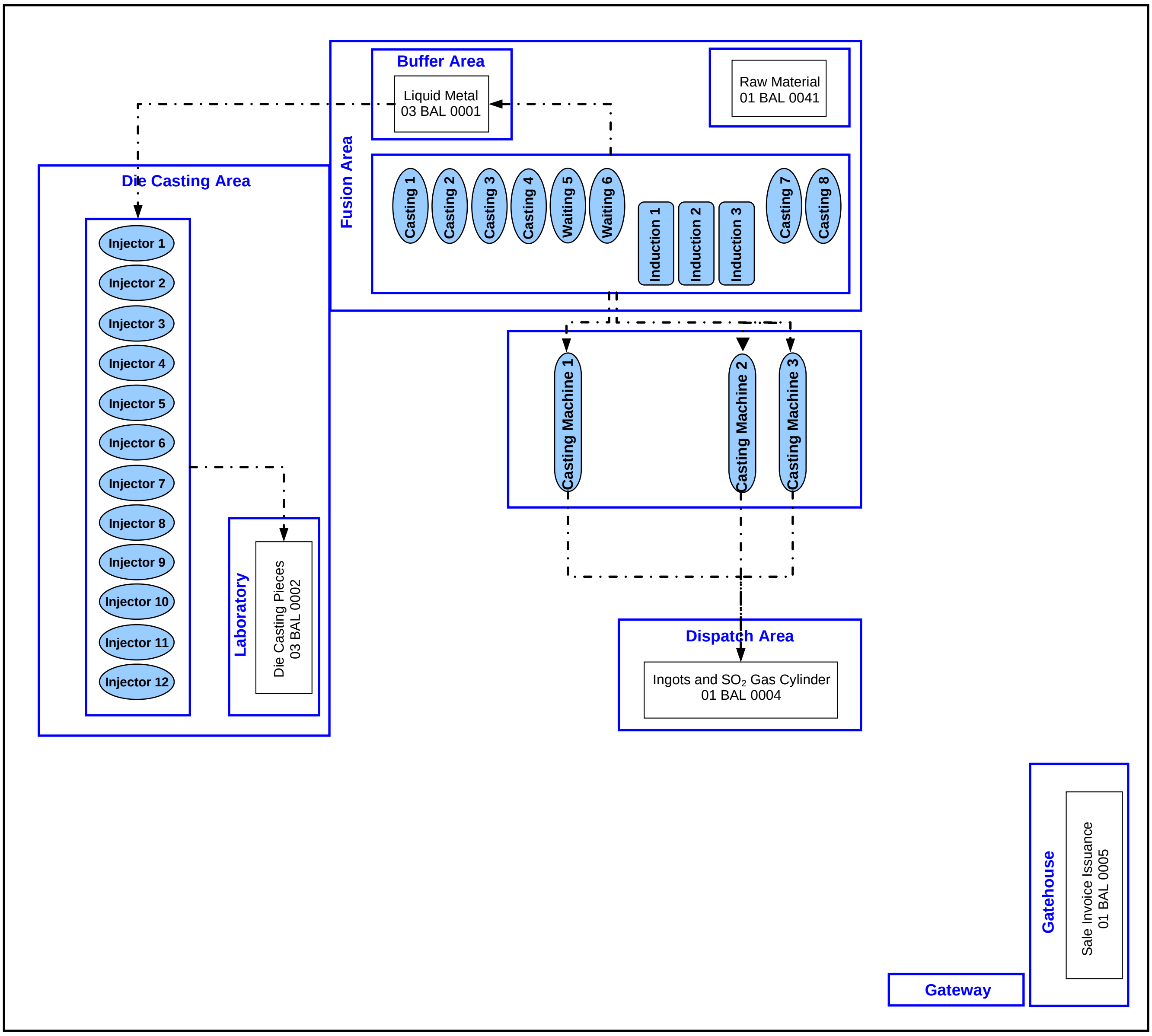
All scales were well calibrated, with no errors. Calibration certificates are available on site, and will be delivered to DOE.

We presented in the table above (table 2) the dates of the calibration of weight scales within the monitored period. However to demonstrate the calibration frequency, we are presenting too the date of the last calibration of the previous monitoring period.

Regarding the calibration frequency of equipment (scales and flow meters) and during the review of the PDD to the second crediting period the calibration frequency was adjusted from semi annual to annual.

The annual calibration periodicity to scales and flow meters is in accordance with the methodology AM0065 and too with the brazilian standard. In both situations is indicated to make the calibrations annually.

Flowchart location of the scales to weight the products (ingots, molten metal and die casting parts)



Flowchart 3 – Location of Scales

2) SO_2 consumption monitoring

In accordance to the latest version of the methodology AM0065, to ensure consistency between baseline and project calculations, the measurement method of alternate gas shall follow the same method conducted for SF_6.

For SF_6 was used the accounting method (Recording delivered purchases and inventory changes), and also was used the weight difference method (Measuring the difference in cylinder weight for gas used/returned) as auxiliary to ensure that all gas was consumed.

Therefore, the same methods will be used for SO_2, recording the cylinders inventory and weight. However the monitoring methodology requires that the project monitoring should be done per equipment.

Differing from the SF_6 small cylinders (50kg), that was installed one for each injector, due to the harmful characteristics of the new alternative cover gas, SO_2, there will have only one supply point, with one large gas cylinder.

Having more than one Gas Room or more than one cylinder to make possible the individual monitoring per equipment, would increase too much the investments costs and mainly the operation and maintenance procedures overloading the operators with safety procedures.

The procedures that will be performed to have consumption of SO_2 “per equipment” will be as follows:

At each SO_2 consumption point, was installed flow meters of the gas mix SO_2 and nitrogen to control the flow rate of SO_2 to each equipment.

From the flow rate at each consumption point and SO_2 total consumption measure at the Gas Room, the SO_2 consumption per equipment will be estimated per proportional calculation.

Flow rate of the gases exiting the Gas Room are measured separately for the gases going to Fusion Area and Die Casting Area. There are 4 modules containing 2 flow meters each. One flow meter measures the SO_2 and the other measures the N_2.

a. Description of SO_2 consumption

After several testing, RIMA fixed the concentration of SO_2 into 1% or below mixed with nitrogen.

During validation process, the estimated consumption of SO_2 used was 3 kg SO_2/tMg. However in practice the consumption during the first crediting period of this project was much lower than we estimated in the first PDD, as we can see in the table below, as follow:.

Table 3 – Average consumption of kg SO_2/tMg during the first and second crediting period of this project in all monitoring period

Monitoring period number	Period of monitoring period	Average consumption kg SO_2/tMg
1º	Jul-2009 – Dec-2009	0.61
2º	Jan-2010 – Jun-2010	0.65
3º	Jul-2010 – Feb-2011	0.54
4º	Mar-2011 – Oct-2011	0.65
5º	Nov-2011 – Jun-2012	0.48
6º	Jul-2012 – Sep-2012	0.40
7º	Oct-2012 – Dec-2014	0.45
8º	Jan-2015 – Dec-2015	0.42
9º	Jan-2016 – Jul-2016 (01-07-2016)	0.51
1º Monitoring of 2nd crediting Period	(02/07/2016 - 31/12/2016)	0.46
2º Monitoring of 2nd crediting Period	(01/01/2017 - 31/12/2017)	0.43
3º Monitoring of 2nd crediting Period	(01/01/2018 - 31/12/2018)	0.45
4º Monitoring of 2nd crediting Period	(01/01/2019 - 31/12/2019)	0.45

As can be noticed the estimated SO_2 consumption foreseen during the validation process was overestimated. At that time, RIMA took in account the lower efficiency of SO_2 as a cover gas, when compared with SF_6.

Project developers considered that the SF_6 has a 50% loss during its application, therefore they estimated a SO_2 consumption three times higher than the historical consumption of SF_6, and only after the project´s implementation the optimal SO_2 consumption could be defined, which proved to be lower than the predicted one.

It can be verified a certain oscillation in the SO_2 unit consumption. In integrated metal production factories as RIMA, is common to have variation in its raw material and inputs consumption, including SO_2. It is important to remind that RIMA is the world unique integrated factory of magnesium production, therefore is not possible to directly compare RIMA’s production data to other companies of the same segment. Other metals production, as aluminum, is common to have this integrated production.

In the case of SO_2 consumption, this variation occurs due to the variation in the fusion time required. The fusion time can vary, among other reasons, due to the differences in the ductility, chemical composition, etc. of the metal. These variations lead also to electric energy and other inputs consumption increase.

To the second crediting period RIMA projected the consumption of SO2 considering the average of consumption of baseline between the years 2013 and 2015 that amounted 0.451 kg SO_2/t Mg.

The average consumption of kg SO_2/tMg verified during the third monitoring period of this second crediting period of this project, month by month, as follow:

Table 4 – SO_2 consumption

Period	Mg production (t)	SO_2 consumption (t)	SO_2 unit consumption (kg SO_2/tMg)
January/2019	2,230.236	0.891	0.400
February/2019	2,293.978	0.896	0.391
March/2019	2,361.792	0.895	0.379
April/2019	2,390.424	0.891	0.373
May/2019	2,376.108	0.892	0.375
June/2019	2,398.325	1.783	0.743
July/2019	2,376.845	1.780	0.749
August/2019	2,363.811	0.890	0.377
September/2019	2,349.079	0.919	0.391
October/2019	2,361.255	0.891	0.377
November/2019	2,343.145	0.888	0.379
December/2019	2,298.742	0.894	0.389
Total / Average	**28,143.740**	**12.510**	**0.445**

The average consumption in the third monitoring period of the second crediting period was 0.445 kg SO2/t Mg, which is lower than the current baseline average consumption.

b. Description of Flow meters, identification, location and calibration information

The flow meters that measure SO_2/N_2 in the project are presented in the table below:

Table 5 - SO_2 flow meters identification

Table 5.1 – SO_2 Gas Room

SO_2 Gas Room (Manufacturer: Bronkhorst)			Latest Calibration Dates	
Gas	LOCAL	Serial Number	Calibration Date	Calibration Frequency
SO_2	Module 1	M7208479L	11-dec-18 06-dec-19	Annually
N_2	Module 1	M7208479D	11-dec-18 06-dec-19	Annually
SO_2	Module 2	M7208479K	28-sep-18 24-sep-19	Annually
N_2	Module 2	M7208479C	28-sep-18 24-sep-19	Annually
SO_2	Module 3	M7208479J	19-sep-18 10-sep-19	Annually
N_2	Module 3	M7208479B	19-sep-18 10-sep-19	Annually

SO_2	Module 4	M7208479I	23-oct-18 22-oct-19	Annually
N_2	Module 4	M7208479A	23-oct-18 22-oct-19	Annually

Table 5.2 – FUSION Area

FUSION Area (Manufacturer: Bronkhorst)			**Latest Calibration Dates**	
GAS	**Equipment**	**Serial Number**	**Calibration Date**	**Calibration Frequency**
Mix: (SO_2+ N_2)	Furnace 1	M2204607F	19-sep-18 18-sep-19	Annually
Mix: (SO_2+ N_2)	Furnace 1	M0208092G	22-sep-18 20-sep-19	Annually
Mix: (SO_2+ N_2)	Furnace 2	M1200474G	22-sep-18 20-sep-19	Annually
Mix: (SO_2+ N_2)	Furnace 2	M0208145L	14-sep-18 12-sep-19	Annually
Mix: (SO_2+ N_2)	Furnace 3	M2204607I	12-feb-18 06-feb-19	Annually
Mix: (SO_2+ N_2)	Furnace 3	M2202878D	12-feb-18 06-feb-19	Annually
Mix: (SO_2+ N_2)	Furnace 4	M2202878A	12-feb-18 06-feb-19	Annually
Mix: (SO_2+ N_2)	Furnace 4	M2202878C	12-feb-18 06-feb-19	Annually
Mix: (SO_2+ N_2)	Furnace 5	M0205260F	19-oct-18 14-oct-19	Annually
Mix: (SO_2+ N_2)	Furnace 5	M0208145E	19-oct-18 14-oct-19	Annually
Mix: (SO_2+ N_2)	Furnace 6	M1200474F	16-oct-18 09-oct-19	Annually
Mix: (SO_2+ N_2)	Furnace 6	M2204607E	16-oct-18 09-oct-19	Annually
Mix: (SO2+ N2)	Furnace 7	M0208145A	12-jan-18 08-jan-19	Annually
Mix: (SO2+ N2)	Furnace 7	M2204607L	08-jan-19 07-jan-20	Annually
Mix: (SO2+ N2)	Furnace 8	M2200568D	21-dec-18 18-dec-19	Annually
Mix: (SO2+ N2)	Furnace 8	M2204607U	21-dec-18 18-dec-19	Annually
Mix: (SO_2+ N_2)	Ingot Line 1	TV-012 [9]	09-oct-18 03-oct-19	Annually
Mix: (SO_2+ N_2)	Ingot Line 2	TV-011[10]	06-nov-18 31-oct-19	Annually
Mix: (SO_2+ N_2)	Ingot Line 3	TV-013[11]	23-oct-18 22-oct-19	Annually
Mix: (SO_2+ N_2)	Molten metal Transfer 1	M2200249B	01-feb-19 28-Jan-20	Annually
Mix: (SO_2+ N_2)	Molten metal Transfer 2	M0208145O	06-nov-18 04-nov-19	Annually
Mix: (SO_2+ N_2)	Molten metal Transfer 3	M2200568A	24-oct-18 22-oct-19	Annually

[9] Manufacturer: Rucken
[10] Manufacturer: Rucken
[11] Manufacturer: Rucken

Table 5.3 – FSP Area – Die casting

FSP Area - Die casting (Manufacturer: Rucken)			**Latest Calibration Dates**	
GAS	**Equipment**	**Serial Number**	**Calibration Date**	**Calibration Frequency**
Mix: (SO_2+ N_2)	Injector 1	TV-006	21-nov-18 19-nov-19	Annually
Mix: (SO_2+ N_2)	Injector 2	TV-005	21-nov-18 19-nov-19	Annually
Mix: (SO_2+ N_2)	Injector 3	TV-009	21-nov-18 19-nov-19	Annually
Mix: (SO_2+ N_2)	Injector 4	TV-010	21-nov-18 19-nov-19	Annually
Mix: (SO_2+ N_2)	Injector 5	TV-001	14-nov-18 11-nov-19	Annually
Mix: (SO_2+ N_2)	Injector 6	TV-007	14-nov-18 11-nov-19	Annually
Mix: (SO_2+ N_2)	Injector 7	TV-002	23-oct-18 22-oct-19	Annually
Mix: (SO_2+ N_2)	Injector 8	TV-014	18-oct-18 17-oct-19	Annually
Mix: (SO_2+ N_2)	Injector 9	TV-003	05-nov-18 04-nov-19	Annually
Mix: (SO_2+ N_2)	Injector 10	Uninstalled	-	-
Mix: (SO_2+ N_2)	Injector 11	TV-008	25-oct-18 22-oct-19	Annually
Mix: (SO_2+ N_2)	Injector 12	TV-004	18-oct-18 15-oct-19	Annually

Due to the installation of third casting machine, Rima installed the flowmeter TV-013 (serial number) on this equipment to measure of cover gas. Before this flowmeter was installed in injector machine # 10 that at this moment is out of operation due to the low demand of pieces.

We presented in the table above (5.1, 5.2 and 5.3) the dates of the calibration of SO_2/N_2 flow meters within the monitored period. However to demonstrate the calibration frequency, we are presenting too the date of the last calibration to prove that the calibration was done within frequency.

As we mentioned before in this monitoring report, the frequency of calibration of the equipment included in this project changed to the second crediting period to the annual frequency instead semi annual.

The annual calibration periodicity to scales and flow meters is in accordance with the methodology AM0065 and too with the brazilian standard. In both situations is indicated to make the calibrations annually.

These calibrations are done by an external certified company.

3) SO_2 Environment monitoring

All air samples collected are analyzed and certified through the analyses from the chemical laboratory.

The specialized laboratories has approval from the Metrological Network of Minas Gerais state – RMMG for measurement of SO_2 and other procedures.

The RMMG is the organ in the Minas Gerais state responsible for the accreditation, certification and inspection of laboratories in accordance with the standard ABNT NBR ISO/IEC 17025:2005, possessing the formal recognition by the state government through the normative deliberation nº 89 of 15/09/2005 of Minas Gerais state environmental policy council – COPAM.

a. Occupational Monitoring (Worker Safety)

In according to NIOSH 6004 the sampling method and chemical analysis of SO_2 for purposes of occupational requires that the sample size must be between 40 and 200 liter, for a flow rate between 0.5 to 1.5 liters per minute.

The CDM project RIMA carried out the collection of samples for 60 minutes for a flow rate of 1 liters per minute, resulting in a sample size of 60 liters.

Sampling is performed by simple device attached in operator work cloth. The SO_2 is monitored by collecting air through a low flow sampler of a gravimetric Gillian Type Pump. The periodicity of monitoring is monthly.

Regarding SO_2 tolerance limits, the Brazilian Regulatory Standard - NR 15 (approved by the Ministry of Labor and Employment through Ordinance No. 3214 of 8 June 1978) sets in Table 1 of Annex 11, the SO_2 concentration limit of 10 mg/m^3.

The item 9.3.6.2 of Brazilian Regulatory Standard - NR 9 (approved by the Ministry of Labor and Employment through Ordinance No. 3214 of 8 June 1978) sets the action limit as the SO_2 concentration of 5 mg/m^3.

The highest monitored point was 0.90 mg/m^3 in month December/2019, where the legislation limit is 10 mg/m^3, and action level is 5 mg/m^3.

b. Neighborhood Air Quality Monitoring (External Monitoring)

In accordance with technical standards ABNT NBR 9,546 and 10,562 published by the Brazilian Association of Technical Standards - ABNT, the sampling method and chemical analysis of SO_2 for purposes of neighborhood air quality monitoring requires that the sample size must be between:

- 30 minutes, for a flow rate of 1 liter per minute;
- 1 hour, for a flow rate of 0.5 liter per minute; and
- 24 hours, for a flow rate of 0.2 liter per minute;

The CDM project RIMA carried out the collection of samples for 24 hours for a flow rate of 0.2 liter per minute, resulting in a sample size of 288 liters by measuring point.

Sampling is performed by pararosaniline method for determining the concentration of SO_2 in ambient air. The reference conditions are: 25° C/101.3 kPa, with a measuring range of 25 - 1050 $\mu g/m^3$ and the frequency of monitoring is four times a year.

Regarding SO_2 tolerance limits, until November 2018 the local legislation was based on Resolution number 003, of 28 June 1990 published the CONAMA – National Environmental Policies Council that established the SO_2 average concentration limit of 24 hours of 365 $\mu g/m^3$. This is the limit appointed on PDD approved to the second crediting period.

On 19 November 2018 the CONAMA published the Resolution number 491 that established a new limit of SO_2 average concentration limit of 24 hours in 125 $\mu g/m^3$.

It is important to point that during all period monitored of this project the results of measurements obtained always was below of both limits.

Measurements of SO_2 and environmental analyzes are carried out by specialized external laboratory with accreditation to the scope of analyzes.

SO_2 emissions should not exceed the regulation limit, if it occurs, the Emissions Reductions could not be claimed.

It was performed 4 sampling during the monitored period of this report:

1) 2019 March
2) 2019 June
3) 2019 September
4) 2019 December

Results are summarized in table on section D.2 – Data and parameters monitored (Parameter 4). We present data analysis performed during January/2019 to December/2019 only for comparison purposes.

Maximum concentration of air quality was identified during monitoring of September/19, at point 1 – Industrial Park, near RIMA office building, 23 µg/m^3, where the legislation limit is 125 µg/m^3.
Industrial Park, near RIMA office building

The SO_2 gas emissions and air quality did not exceed the regulatory limits during all monitored period. Therefore, it will not be necessary to disregard emissions reductions of this period.

c. Waste gas Emission Limit (Internal Monitoring)

In accordance with technical standards ABNT NBR 10,700, 10,701, 10,702, 11,966, 11,967, 12,020 and 12,022 published by the Brazilian Association of Technical Standards – ABNT and CETESB L9,240, the sampling method and chemical analysis of SO_2 for purposes of neighborhood air quality monitoring requires that the sample size must be: air sampling during 720 minutes in flow of 2,0 liter/min.

The CDM project RIMA carried out the collection of 3 samples for 20 minutes for a flow rate of 2.0 liter per minute, resulting in a sample size of 120 liters by measuring point. The air samples are collected at six fixed points, thus the total sample size is 720 liters.

Sampling is performed by air collection by an isokinetic flow sampler for determining the concentration of SO_2 in ambient air, SO_2 with a lower limit of detection is 3.4 mg/m^3 and the frequency of monitoring is four times a year.

Regarding SO_2 tolerance limits, the Normative Deliberation number 187, of 19 September 2013 by the COPAM – Minas Gerais States Environmental Policies Council, established the SO_2 average concentration limit of 1,800 mg/Nm^3.

Measurements of SO_2 and environmental analyzes are carried out by specialized external laboratory with accreditation to the scope of analyzes.

SO_2 emissions should not exceed the regulation limit, if it occurs, the Emissions Reductions could not be claimed.

It was performed 4 sampling during the monitored period of this report:

1) 2019 March
2) 2019 June
3) 2019 September
4) 2019 December

Results are summarized in table on section D.2 – Data and parameters monitored (Parameter 4). We present data analysis performed during January/2019 to December/2019 only for comparison purposes.

Maximum concentration of exhaust gas during the monitored period was 11.85 mg/Nm^3 in September/2019 at Chimney 4, where the legislation limit is 1,800 mg/m^3.

The SO_2 gas emissions did not exceed the regulatory limits during all monitored period. Therefore, it will not be necessary to disregard emissions reductions of this period.

4) Others parameters to be monitored:

Magnesium sales reports

According to the methodology AM0065, version 02.1, which states, “in order to dispel concerns that a company increases production levels just to gain CERs, project developers must show proof of sales of magnesium”, the magnesium sales must be compared with the total magnesium produced, so the emission reduction calculations can be based on the plant´s production data.

Sale and production amount should not have more than 30% difference. It is important to notice that to make this comparison, the liquid metal production is an internal sale, from the Fusion Area to the Die Casting Area with no sale receipt.

Calibration & Maintenance Procedures

As presented on this section in chapter 1-e and 2-b, respectively, the, weight scales and cover gas flow rate meter's calibration and maintenance are made by an external certified company, according to the service order of RIMA. The service order is programmed by an on-line management system, and near the next calibration/maintenance day, the responsible is notified automatically by the system.

INMETRO

(Brazilian Institute of Metrology, Standardization and Industrial Quality), an agency of the Federal Government of Brazil, under the Ministry of Development, Industry and Foreign Trade, which acts as Executive Secretariat of the Brazilian Council of Metrology, Standardization and Industrial Quality (Conmetro), collective body, which is the regulatory agency of the Brazilian System of Metrology, Standardization and Industrial Quality (Sinmetro) directs that the calibrations are performed on an annual basis - every 12 months.

Weight Scales and flow meters included in the CDM Monitoring Plan are listed on this section in the Table 2 and Table 5.

Emergency Procedures

All consolidated data are backed-up electronically by the central office. Also monthly consolidated data will be printed in paper and archived.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	**GWP_{SF6}**
Unit	tCO_2e/tSF_6
Description	Global Warming Potential of SF_6
Source of data	CDM EB69
Value(s) applied	22,800
Choice of data or measurement methods and procedures	Provided by the IPCC and EB69, Annex 3 to calculate the global warming potential of $SF_{6.}$ Prior to the renewal of a crediting period it should be assessed if GWP values have changed.
Purpose of data/parameter	Baseline emission
Additional comments	The GWP changed from 23,900 to 22,800 accordingly with 69th meeting EB. From January 2013 to calculate the ER it will be used the value of GWP 22,800.

Data/Parameter	**$C_{SF6,TOT,BL}$**
Unit	tSF_6
Description	Minimun of annual TOTAL consumption of SF_6 in the facility for the last three years prior to validation
Source of data	Industrial facility
Value(s) applied	Year / tSF_6: 2005 / 19.050 2006 / 21.550 2007 / 25.950

Choice of data or measurement methods and procedures	RIMA measurement method is a combined from 2 methods recommended by IPCC: • Recording delivered purchases and inventory changes (accounting method); and • Measuring the difference in cylinder weight for gas used/returned (weight difference method). The used cylinders are weighted to ensure that they are empty, if not, the cylinder is returned to the process to use its full content.
Purpose of data/parameter	Baseline emission
Additional comments	-

Data/Parameter	$\mathbf{P}_{\mathbf{Mg},BL,TOTAL,y}$
Unit	tMg/yr
Description	Amount of Mg products manufactured in baseline scenario in the facility in year *"y"* for each year *"y"* of the 3 years prior to the project. One year may be used if 3 years of data are not available (tMg/yr)
Source of data	Industrial facility
Value(s) applied	Year / tMg: 2005: 19,744 2006: 21,964 2007: 24,334
Choice of data or measurement methods and procedures	Production data is based in sale amount, and not gross production. All non-conformance products are excluded
Purpose of data/parameter	Baseline emission
Additional comments	-

Year	tMg
2005	19,744
2006	21,964
2007	24,334

Data/Parameter	$\mathbf{GWP}_{\mathbf{ALTGAS}}$
Unit	tCO_2e/t alternative gas
Description	Global Warming Potential of alternate gas.
Source of data	CDM EB
Value(s) applied	0
Choice of data or measurement methods and procedures	Prior to the renewal of a crediting period it should be assessed if GWP values have changed
Purpose of data/parameter	Baseline emission
Additional comments	SO_2 will be used as an alternative cover gas, thus generating no by-products which are greenhouse gases.

Data/Parameter	$\mathbf{DI}_{\mathbf{SF6,CON,BL,k,j}}$ **/**$\mathbf{DI}_{\mathbf{SF6,CON,BL}}$
Unit	Fraction
Description	A conservative factor portraying the Data Integrity of measured consumption of SF_6 in each equipment *"k"* in each segment *"j"* ($C_{SF6,CON,BL,k,j,}$) and measured total consumption of SF_6 in the facility ($C_{SF6,Total,BL}$). Default = 0.95.
Source of data	IPCC guidelines 2006.
Value(s) applied	Default= 0.95.
Choice of data or measurement methods and procedures	Following the IPCC recommendation, is used conservatively the lowest 0.95 uncertainty level. Prior to the renewal of a crediting period it should be assessed if the Conservative Factor default should be changed.

Purpose of data/parameter	Baseline emission
Additional comments	This value shall account for the uncertainty in SF_6 consumption. IPCC guidelines state that direct reporting has a 5% uncertainty level[12]. 0.95 shall be used as the default factor unless the project proponent can demonstrate to the DOE that their estimates of measured consumption of SF_6 in each equipment "*k*" in each segment "*j*" ($C_{SF6,CON,BL,k,j}$) or measured total consumption of SF_6 in the facility ($C_{SF6,CON,BL,k,j}$) are more than 95% accurate. Project proponents that submit monitoring data for measured consumption of SF_6 in each equipment "*k*" in each segment "*j*" ($C_{SF6,CON,BL,k,j}$) or measured total consumption of SF_6 ($C_{SF6,Total,BL}$) using two or more of measurement procedures listed in the monitoring section (e.g., both the weight difference and accounting method), and can consistently demonstrate a difference of less than 5% between these two estimates over the time series are allowed to multiply their SF_6 consumptions by a factor greater than 0.95. In no case should a factor of 100% be used.

Data/Parameter	**$DI_{SF6,CON,PJ,k,j,y}$**
Unit	%
Description	A conservative factor portraying the Data Integrity of $C_{SF6,CON,PJ,k,j,y}$ in each segment, per year. Default = 1.05.
Source of data	IPCC guidelines 2006.
Value(s) applied	Default= 1.05
Choice of data or measurement methods and procedures	Following the IPCC recommendation, is used conservatively the highest: 1.05 uncertainty level. Prior to the renewal of a crediting period it should be assessed if the Conservative Factor default should be changed.
Purpose of data/parameter	Baseline emission
Additional comments	This value shall account for the uncertainty in SF_6 consumption. IPCC guidelines state that direct reporting has a 5% uncertainty level[13]. 1.05 shall be used as the default factor unless the project proponent can demonstrate to the DOE that their estimates of $C_{SF6,CON,BL,k,j,y}$ are more than 95% accurate. Project proponents that submit monitoring data for $C_{SF6,CON,BL,k,j,y}$ using two or more of measurement procedures listed in the monitoring section (e.g., both the weight difference and accounting method), and can consistently demonstrate a difference of less than 5% between these two estimates over the time series should then be allowed to multiply their SF_6 consumptions by a factor smaller than 1.05. In no case should a factor of 100% be used.-

Data/Parameter	**DF_{SF6}**
Unit	Fraction
Description	Degradation Factor of SF_6 that reacts with the magnesium in the production process assumed as 0.5.
Source of data	According to AM0065, version 02.1.
Value(s) applied	0.5

[12] 2006 IPCC Guidelines for NGGI PA. 4.68.
[13] 2006 IPCC Guidelines for NGGI PA. 4.68.

Choice of data or measurement methods and procedures	The Board after due consideration of available literature and structural design of the magnesium production facilities arrived at the conclusion that in absence of a proper system to collect the covers gases and exhaust, the uncertainties in current procedures to estimate the SF_6 destruction are very high. Therefore, a conservative default has been provided to ensure that emission reductions credited are real. Project proponents are encouraged to submit new procedures for undertaking measurement on project site to estimate the destruction efficiency. Procedures should be sufficiently robust, based as much as possible in International Standards and properly documented to ensure reliable estimates. The procedures should be based on experimentation of sufficient duration taking into account the variability in equipment used in different segments, variations in operating conditions/practices, different type of alloys manufactured and similar other real-time production issues.
Purpose of data/parameter	Baseline emission
Additional comments	Prior to the renewal of a crediting period it should be assessed if the Degradation Factor default should be changed.

D.2. Data and parameters monitored

Data/Parameter	**1 - $P_{Mg,PJ,k,j,y}$**
Unit	tMg/yr
Description	Production output: annual amount of Mg or Mg products manufactured in project scenario in each equipment *"k"* in each segment *"j"* per year.
Measured/calculated/ default	Measure and/or Calculated depending on the type of product. See section C – Description of Monitoring System for details
Source of data	Industrial Facility
Value(s) of monitored parameter	See table below

Period	**Total Net Production (t)**	
	Primary Ingot+ Liquid metal	**Die casting pieces**
January/2019	2,205.862	24.374
February/2019	2,169.868	124.110
March/2019	2,275.780	86.012
April/2019	2,268.530	121.894
May/2019	2,218.239	157.869
June/2019	2,264.511	133.814
July/2019	2,248.282	128.563
August/2019	2,215.510	148.301
September/2019	2,226.918	122.161
October/2019	2,217.326	143.929
November/2019	2,284.400	58.745
December/2019	2,249.900	48.842
TOTAL	**26,845.126**	**1,298.614**

The data presented in the table above are related to the monitored data, for more details see "Additional comments" below.

Monitoring equipment	**<u>Produced amount</u>** of Ingots, Liquid metal and Mg Die casting pieces are measured by calibrated scales in various points of the plant. These values are used to calculate emission reductions. See section C – Description of Monitoring System, Description of data processing procedures and Table 2 - Scales for details.
Measuring/reading/recording frequency	Continuously
Calculation method (if applicable)	Ingots, Liquid metal and Mg Die casting pieces are measured by calibrated scales in various points of the plant. See section C – Description of Monitoring System, Description of data processing procedures for details.
QA/QC procedures	Measurement data to be cross-checked with internal sales and stock reports. The scales are calibrated annually in according with the PDD and monitoring plan of the second crediting period. See section C – Description of Monitoring System for details, Description of data processing procedures for details.
Purpose of data/parameter	Baseline emission
Additional comments	We are presenting in this monitoring report the data during the period of 01/01/2019 until 31/12/2019. During the verification RIMA will present to DOE the data that will go permit conciliate this data.

Data/Parameter	**2 - $C_{SF6,CON,PJ,k,j,y}$**
Unit	tSF_6/yr
Description	The total consumption of SF_6 in the industrial facility in the project scenario in each equipment *"k"* in each segment *"j"*, per year.
Measured/calculated/ default	Measured (in fact, observed, as there is no SF_6 supplying system)
Source of data	Industrial Facility
Value(s) of monitored parameter	0 There was no SF_6 consumption in the project activity. All SF_6 system was substituted to the SO_2 system.
Monitoring equipment	As recommended by IPCC direct reporting of SF_6 consumption can be measured in the following ways: • Recording delivered purchases and inventory changes (accounting method); • Measuring the difference in cylinder weight for gas used/returned (weight difference method); and • Measuring flow rates and integrating over time (flow measurement method). If more than one method is used for measurement, use the highest value for calculation of project emission.
Measuring/reading/recording frequency	Once at first verification
Calculation method (if applicable)	Not applicable, as there is no SF_6 usage.
QA/QC procedures	Not Applicable, as there is no SF_6 usage.
Purpose of data/parameter	Project emission
Additional comments	-

Data/Parameter	**3 - $C_{ALTGAS,PJ,k,j,y}$**
Unit	t/yr
Description	Consumption of alternate gas SO_2, in project scenario for each equipment *"k"* in each segment *"j"* per year.

Measured/calculated/ default	Measured and calculated
Source of data	Industrial Facility
Value(s) of monitored parameter	**Period (month/year)** / **SO_2 Total Consumption (t)**: January/2019: 0.891; February/2019: 0.896; March/2019: 0.895; April/2019: 0.891; May/2019: 0.892; June/2019: 1.783; July/2019: 1.780; August/2019: 0.890; September/2019: 0.919; October/2019: 0.891; November/2019: 0.888; December/2019: 0.894; **TOTAL**: **12.510** Refer to Excel spreadsheet “RIMA_ SO_2 consumption 2019-Jan to 2019-Dec” for consumption per equipment. See ANNEX, SO_2 consumption, for details.
Monitoring equipment	Flow meters. See section C – Description of Monitoring System, SO_2 consumption monitoring and Table 5 – Flow meters for details.
Measuring/reading/recording frequency	The weight difference method is used to calculate the monthly consumption, once the cylinder is replaced and combined with the consumption of gas mixture by equipment, this combination is used to make the distribution of So2 consumption by equipment.
Calculation method (if applicable)	The same procedures recommended by IPCC for direct reporting of SF_6 consumption, used in the baseline scenario will be used for SO_2: RIMA measurement and calculate method is a combined from 2 methods recommended by IPCC: • Recording delivered purchases and inventory changes (accounting method); and • Measuring the difference in cylinder weight for gas used/returned (weight difference method). The used cylinders are weighted to ensure that they are empty, if not, the cylinder is returned to the process to use its full content. See Section C – Description of Monitoring system for details
QA/QC procedures	See Section C – Description of Monitoring system for details
Purpose of data/parameter	Other (parameter not used for emissions calculation, but for reference)
Additional comments	-

Value(s) of monitored parameter (detail):

Period (month/year)	SO_2 Total Consumption (t)
January/2019	0.891
February/2019	0.896
March/2019	0.895
April/2019	0.891
May/2019	0.892
June/2019	1.783
July/2019	1.780
August/2019	0.890
September/2019	0.919
October/2019	0.891
November/2019	0.888
December/2019	0.894
TOTAL	**12.510**

Data/Parameter	**4 - SO_2 emissions**
Unit	mg/m^3
Description	SO_2 emissions
Measured/calculated/ default	Measured
Source of data	External Laboratory Analysis

Value(s) of monitored parameter

	2019			
Chimneys	**Mar**	**Jun**	**Sep**	**Dec**
Chimney 1	10.84	10.72	10.94	11.21
Chimney 2	10.91	9.99	9.08	10.74
Chimney 3	10.26	11.64	10.38	11.80
Chimney 4	11.08	10.11	11.85	9.27
Chimney 5	10.18	11.29	11.37	10.36
Chimney 6	9.77	10.20	9.61	9.47

Ambient Air Quality (µg/m^3) External:

		2019			
	Location	**Mar**	**Jun**	**Sep**	**Dec**
Point 1	Industrial Park, near RIMA office building	21	17	23	16
Point 2	Bonfim District - Casa Paroquial	<25	<25	<25	<25
Point 3	Magnesium Mill	16	8	12	14
Point 4	UMM Gate	11	15	9	12
Point 5	Military Police	<25	<25	<25	<25

SO_2 Concentration (mg/m^3)												
Description Sectors	**2019**											
	jan	**feb**	**mar**	**apr**	**may**	**jun**	**jul**	**aug**	**sep**	**oct**	**nov**	**dec**
Fusion of Magnesium – Ingot (Lingotamento)	0.20	0.40	0.10	0.60	0.20	0.70	0.40	0.30	0.10	0.15	0.40	0.35
Gas Room (Edicula)	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
Fusion Waiting Furnaces (F.Espera)	0.20	0.60	0.10	n/d	0.20	0.60	0.10	0.15	0.15	0.25	0.50	0.90
Liquid Metal Transfer - Cont. (Metal Liquido)	n/d	n/d	0.20	0.20	0.40	0.50	0.30	n/d	n/d	0.10	0.15	n/d
Injector #1	0.10	0.10	n/d	0.15	n/d	0.25	0.30	0.25	0.40	0.50	0.10	0.30
Injector #3	0.10	n/d	0.10	-	0.10	0.20	n/d	0.15	n/d	0.40	0.20	-
Injector #5	-	-	-	-	-	-	-	-		-	-	-
Injector #6	-	0.15	0.10	0.20	n/d	0.25	0.10	0.20	0.25	n/d	0.40	n/d
Injector #7	0.25	0.10	0.20	n/d	0.10	0.20	0.30	0.10	0.15	n/d	0.10	0.25
Injector #8	-	-	-	-	0.10	-	-	-	-	-	-	-
Injector #12	-	n/d	0.10	0.20	n/d	0.40	0.15	n/d	n/d	0.55	0.25	n/d

"N/D" means that emissions of SO_2 in the monitored sector have not reached the limit of detection;
"-" Means that the sector was not in operation at the time of monitoring, so it was not monitored;
The highest monitored point was 0.90 mg/m3 in month December//2019, where the legislation limit is 10 mg/m^3, and action level is 5 mg/m^3;
For general information see Section C – Description of Monitoring System, SO_2 environment monitoring for details.

Monitoring equipment	Not applicable, as the measurement is done by an accredited third part.
Measuring/reading/recording frequency	On-site periodically sampling (4 four times a year), outsourced by an external laboratory specialized. Details are described in Section C – Description of Monitoring System, SO_2 Environment Monitoring for details.
Calculation method (if applicable)	Not applicable
QA/QC procedures	The analysis equipment are calibrated by the manufacture. Local Regulation: - CONAMA – National Environmental Council (Air Quality Standard): 125 µg/m^3) and - COPAM – Minas Gerais State Environmental Policy Council (Exhaust Gas Emission Limit: 1,800 mg/Nm^3) Reference methods in the methodology for measuring ambient air quality: - ABNT NBR 9,546, ABNT NBR 10,562; and Reference methods in the methodology for measuring on the exhaust gas emission: - ABNT NBR 10,700, ABNT NBR 10,701, ABNT NBR 10,702, ABNT NBR 11,966/MB 3080, ABNT NBR 12,020, ABNT NBR 12,022/MB 3358 e CETESB L9.240.
Purpose of data/parameter	Other. Emissions from the facility to the ambient air should comply with the local standards of the country. If SO_2 emissions do not comply with the above, the CERs cannot be claimed for the period between the last issuance of CERs (or registration for the first verification period) and the date where non-compliance was detected.
Additional comments	Regarding SO_2 tolerance limits on external monitoring, until November 2018 the local legislation was based on Resolution number 003, of 28 June 1990 published the CONAMA – National Environmental Policies Council that established the SO_2 average concentration limit of 24 hours of 365 µg/m^3. This is the limit appointed on PDD approved to the second crediting period. On 19 November 2018 the CONAMA published the Resolution number 491 that established a new limit of SO_2 average concentration limit of 24 hours in 125 µg/m^3.

Data/Parameter	**5 - Magnesium sales reports**
Unit	tMg/yr
Description	In order to dispel concerns that a company increases production levels just to gain CERs, project developers must show proof of sales of magnesium.
Measured/calculated/ default	Measured
Source of data	Industrial Facility

Value(s) of monitored parameter	<table><tr><th>Month/Year</th><th>Sales (t)</th></tr><tr><td>January/2019</td><td>2,229.255</td></tr><tr><td>February/2019</td><td>2,254.846</td></tr><tr><td>March/2019</td><td>2,407.691</td></tr><tr><td>April/2019</td><td>2,367.485</td></tr><tr><td>May/2019</td><td>2,375.038</td></tr><tr><td>June/2019</td><td>2,387.959</td></tr><tr><td>July/2019</td><td>2,404.678</td></tr><tr><td>August/2019</td><td>2,364.692</td></tr><tr><td>September/2019</td><td>2,329.292</td></tr><tr><td>October/2019</td><td>2,342.997</td></tr><tr><td>November/2019</td><td>2,365.633</td></tr><tr><td>December/2019</td><td>2,329.239</td></tr><tr><td>TOTAL</td><td>28,158.805</td></tr></table> As there are large amount of data, only the monthly aggregated data is publicized here, detail data will be supplied to the DOE during verification site visit. The data presented in the above table are related to the monitored data, for more details see "Additional comments" below.
Monitoring equipment	Mg Ingots and Mg die casting pieces in the calibrated scale (01 BAL 0005) at the gatehouse of the company. The liquid metal is an internal sale and measured in the calibrated scale (03 BAL 0001) at the buffer area. See section C – Description of Monitoring System for details, Description of data processing procedures, Table 2 for details.
Measuring/reading/recording frequency	Continuously
Calculation method (if applicable)	Sold amount of Mg ingots and Mg die casting pieces is delivered from scale at the gatehouse of the company. Liquid metal is an internal sale, therefore with no sale invoice, but only internal reports. Annual Magnesium sales shall be compared to $P_{Mg,PJ,j,y}$, annual magnesium. See section C – Description of Monitoring System for details.
QA/QC procedures	Magnesium sales reports shall be verified by DOE as part of the verification process. Scales are calibrated annually.See section C – Description of Monitoring System for details, Description of data processing procedures, Table 2 for details.
Purpose of data/parameter	Crosscheck for Baseline emission. If less than 70% of total magnesium produced was sold then the value of annual magnesium sales shall be used as the value for $P_{Mg,PJ,j,y.}$ Unless a project developer can prove to DOE that a decline in demand had occurred (due to sector price changes or other reasons) or that producing 30% more than sales is the common practice in the plant and was common practice prior to the implementation of CDM project activity.
Additional comments	-

D.3. Implementation of sampling plan

Samples of Die Casting Pieces

During the first crediting period, the procedure to obtain the production of die casting pieces was selected at random two samples per each injector for each work-shift. Each work-shift is 6 hours, thus considering that the injector produced in all 4 shifts had 8 samples per day per injector. A monthly average weight for each type of piece was calculated and multiplied by the piece type quantity to calculate the total pieces type production weight per injector.

When Rima was elaborating the PDD regarding the second crediting period of emission reduction of this project, it was necessary to do sampling plan in accordance to the latest version of the “Standard - Sampling

and surveys for CDM project activities and programmes of activities" (version 05.0) and the latest version of the "Guideline - Sampling and surveys for CDM project activities and programmes of activities" (version 04.0).

The objective of Sampling Plan is determining the mean monthly value of parameter of interest $P_{(Mg,PJ,k,j,y)}$ for the baseline in second crediting period.

The parameter $P_{(Mg,PJ,k,j,y)}$ is defined by summing the weights of net ingots, total liquid metal and net die casting pieces.

In the production of Rima process, the production of ingots and liquid metal is measured and registered by weight, therefore, the production data are in the same unit/criteria that the parameter $P_{(Mg,PJ,k,j,y)}$.

In the case of die casting pieces the registry of production is given by the quantity produced and not by its weight. Thus, it is necessary to adjust this unit/criteria to the same used by parameter $P_{(Mg,PJ,k,j,y)}$.

The first option would weigh all the die casting pieces produced, but this option is not viable due to the large number of pieces produced.

After calculations of sampling plan it was concluded that three samples per month for each type of die casting pieces meets the required specifications for reliability/precision.

Although the size of the sample established to be 3 pieces per month, in order to adapt the sampling process to the production process of the die casting pieces of magnesium and simultaneously obtaining a higher reliability/precision, will be taken a sample for each shift worked.

The samples will be performed at random 1 once every work-shift, the sampled pieces are treated in the same way as other pieces. If some kind of piece of production monthly schedule is less than three turns in this case will be guaranteed the calculated sample size of 3 samples per month.

The samples are sent to the laboratory of the Die Casting Area for inspection dimensional and its physical-chemical properties. The weighing of the sample is held in the laboratory. The samples weight is also measured (scale 03 BAL 0002) and registered electronically in the computer inside the inspection room. The scale (03 BAL 0002) used for the weighing of samples is calibrated with an annual frequency and registered in spreadsheet.

Thus, to the second crediting period the average weight of the die casting pieces will be obtained through the random selection of one sample per work-shift, per each type of pieces and per each injector.

The monthly average weight of each type of die casting piece obtained by sampling is multiplied by the output quantity of each type of die casting piece being the result of multiplying the total die casting pieces by weight produced in the month.

Thus, the total die casting pieces produced is added to the total production of ingots and liquid metal to obtain the total of parameter $P_{(Mg,PJ,k,j,y)}$.

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

According to AM0065 version 02.1 methodology there are two ways to calculate baseline emissions.

For RIMA project, there is no historical annual consumption of SF_6 per equipment, therefore is used the Case 2.

Baseline Emissions shall be calculated using the following equations:

$$BE_y = P_{Mg,PJ,y} \times GWP_{SF_6} \times EF_{SF_6,Mg} \qquad \textbf{(Equation 1)}$$

Where:

BE_y = Baseline emissions in year "*y*" (tCO_2e/yr)
$EF_{SF6,Mg}$ = Baseline emission factor for the facility calculated as the minimum emission factor for 3 years of data (tSF_6/tMg)
$P_{Mg,PJ,y}$ = Annual amount of Mg products manufactured in project scenario in the facility per year "*y*"
GWP_{SF6} = Global Warming Potential of SF_6 (tCO_2e/tSF_6)

$$EF_{SF_6,Mg} = Min\left\{\frac{C_{SF_6,EM,BL,y}}{P_{Mg,BL,Total,y}}\right\} \quad \textbf{(Equation 2)}$$

y = 1,2,3 (corresponding to the last three years before the implementation of the project activity)

Where:
$P_{Mg,BL,Total,y}$ = Total Amount of Mg products manufactured in baseline scenario in the facility in year "*y*" for each year of the 3 years prior to the project. One year may be used if 3 years of data are not available (tMg/yr)
$C_{SF6,EM,BL,y}$ = Total SF_6 actually emitted in the baseline in the facility in year "*y*" (tSF_6/yr)

$$C_{SF_6,EM,BL} = C_{SF_6,CON,BL} \times DF_{SF_6} \quad \textbf{(Equation 3)}$$

Where:
$C_{SF6,CON,BL}$ = Total annual consumption of SF_6 in the industrial facility, in the baseline (tSF_6/yr)
DF_{SF6} = Degradation Factor of SF_6 that reacts with the magnesium in the production process assumed as 0.5[14]

For the purpose of ex ante baseline calculations for reporting in the CDM-PDD, future production levels shall be assumed as the past 3-year minimum production levels i.e. $P_{Mg,PJ,y} = P_{Mg,Bl,Total}$.

The Annual Consumption of SF_6 ($C_{SF6,CON,BL}$) shall be estimated as the minimum of the following values:

- Minimum of Annual TOTAL consumption of SF_6 in the facility for the last three years prior to validation (1 year data can be used in case 3 years data are not available) ($C_{SF6,Total,BL}$), multiplied by data integrity factor $DI_{SF6,CON,BL}$, which is a conservative factor portraying the Data Integrity of measured total SF_6 consumption, estimated as per information in Data and Parameters not monitored section; and

- Total consumption of SF_6 in the facility, per year as per the 2006 IPCC Guidelines ($C_{SF6,IPCC,BL}$) as per following equation;

$$C_{SF_6,IPCC,BL} = C_{SF_6,SPIPCC} \times P_{Mg,BL,Total} \quad \textbf{(Equation 4)}$$

Where:
$C_{SF6,SPIPCC}$ = Specific consumption of SF_6 in the facility as per 2006 IPCC Guidelines (0.001t SF_6/tMg casting)

[14] The Board after due consideration of available literature and structural design of the magnesium production facilities arrived at the conclusion that in absence of a proper system to collect the covers gases and exhaust, the uncertainties in current procedures to estimate the SF6 destruction are very high. Therefore, a conservative default has been provided to ensure that emission reductions credited are real. Project Proponents are encouraged to submit to the Board request for revision of the methodology describing new procedures for undertaking measurement on project site to estimate the destruction efficiency. Procedures should be sufficiently robust, based as much as possible in International Standards and properly documented to ensure reliable estimates. The procedures should be based on experimentation of sufficient duration taking into account the variability in equipment used in different segments, variations in operating conditions/practices, different type of alloys manufactured and similar other real-time production issues.

Annual Consumption of SF_6:

Historical consumption			IPCC Guidelines Equation		
Year	$C_{SF6,TOTAL,BL}$ (tSF_6/yr)		$C_{SF6,IPCC}$ (0.001 tSF_6/ tMg casting)	$P_{Mg,Bl,TOTAL}$ (tMg/yr)	$C_{SF6,IPCC,BL}$ (tSF_6/yr)
2005	19.050		0.001	19,744	19.744
2006	21.550		0.001	21,964	21.964
2007	25.950		0.001	24,334	24.334
Minimum	19.050		Minimum	19,744	19.744

Minimal amount of SF_6 consumption is delivered from the historical consumption, thus:

$C_{SF6,CON,BL}$ = 19.050 x $DI_{SF6,CON,BL}$

$C_{SF6,CON,BL}$ = 19.050 x 0.95

$C_{SF6,CON,BL}$ = 18.098 tSF_6/yr

Applying this value in:

$$C_{SF_6,EM,BL} = C_{SF_6,CON,BL} \times DF_{SF_6}$$ **(Equation 3)**

$C_{SF6,EM,BL}$ = 18.098 x 0.5 = 9.049 tSF_6/yr

Applying this value in:

$$EF_{SF_6,Mg} = Min\left\{\frac{C_{SF_6,EM,BL,y}}{P_{Mg,BL,Total,y}}\right\}$$ **(Equation 2)**

$$EF_{SF_6,Mg} = Min\frac{9.049}{19,744} = 0.000458 \quad tSF_6/tMg$$

Therefore **Equation 1** will be:

$$BE_y = P_{Mg,PJ,y} \times 22,800 \times 0.000458$$ (**Equation 1)**

Table 6 – Baseline Emissions Data

Period Month/Year	Total Net Production (t) $P_{Mg.PJ,j,k,y}$		Total	GWP SF_6 $EF_{SF6,Mg}$	$EF_{SF6,Mg}$ t SF_6/tMg	BE tCO_2/year
	Primary Ingot Molten metal	Die Casting parts				
January/2019	2,205.862	24.374	2,230.236	22,800	0.000458	23,289.016
February/2019	2,169.868	124.110	2,293.978			23,954.636
March/2019	2,275.780	86.012	2,361.792			24,662.777
April/2019	2,268.530	121.894	2,390.424			24,961.764

May/2019	2,218.239	157.869	2,376.108			24,812.270
June/2019	2,264.511	133.814	2,398.325			25,044.269
July/2019	2,248.282	128.563	2,376.845			24,819.966
August/2019	2,215.510	148.301	2,363.811			24,683.860
September/2019	2,226.918	122.161	2,349.079			24,530.023
October/2019	2,217.326	143.929	2,361.255			24,657.169
November/2019	2,284.400	58.745	2,343.145			24,468.057
December/2019	2,249.900	48.842	2,298.742			24,004.383
TOTAL	**26,845.126**	**1,298.614**	**28,143.740**			**293,888.000**

Magnesium sales reports

According to the methodology AM0065, which states, "in order to dispel concerns that a company increases production levels just to gain CERs, project developers must show proof of sales of magnesium", the Magnesium sales must be compared with the total Magnesium produced, so the emission reduction calculations can be based on the plant's production data. Sale and production amount should not have more than 30% difference. It is important to notice that to make this comparison, the liquid metal production is an internal sale from the fusion area to the die casting area with no sale receipt.

Table 7 – Comparison Among Magnesium Production and Sales Amount

Table 7.1 – Comparison Among the Summary of Magnesium Production and Sales

Month/Year	Production (t)	Sales (t)	Sales/Production
January/2019	2,230.236	2,229.255	99.96%
February/2019	2,293.978	2,254.846	98.29%
March/2019	2,361.792	2,407.691	101.94%
April/2019	2,390.424	2,367.485	99.04%
May/2019	2,376.108	2,375.038	99.95%
June/2019	2,398.325	2,387.959	99.57%
July/2019	2,376.845	2,404.678	101.17%
August/2019	2,363.811	2,364.692	100.04%
September/2019	2,349.079	2,329.292	99.16%
October/2019	2,361.255	2,342.997	99.23%
November/2019	2,343.145	2,365.633	100.96%
December/2019	2,298.742	2,329.239	101.33%
Total	**28,143.740**	**28,158.805**	**100.05%**

Table 7.2 – Comparison Among the Summary of Ingots Production and Sales

Month/Year	Production (t)	Sales (t)	Sales/Production
January/2019	2,136.947	2,141.000	100.19%
February/2019	1,902.498	1,911.000	100.45%
March/2019	2,064.045	2,079.000	100.72%
April/2019	2,014.620	2,004.000	99.47%
May/2019	1,870.674	1,872.000	100.07%
June/2019	1,926.701	1,902.000	98.72%
July/2019	1,949.212	1,972.000	101.17%
August/2019	1,869.185	1,870.000	100.04%
September/2019	1,975.268	1,957.000	99.08%
October/2019	1,947.676	1,955.000	100.38%
November/2019	2,166.560	2,154.000	99.42%
December/2019	2,129.150	2,163.000	101.59%
Total	**23,952.536**	**23,980.000**	**100.11%**

Table 7.3 – Comparison Among the Summary of Die Casting Pieces Production and Sales

Month/Year	Production (t)	Sales (t)	Sales/Production
January/2019	24.374	19.340	79.35%
February/2019	124.110	76.476	61.62%
March/2019	86.012	116.956	135.98%
April/2019	121.894	109.575	89.89%
May/2019	157.869	155.473	98.48%
June/2019	133.814	148.149	110.71%
July/2019	128.563	133.608	103.92%
August/2019	148.301	148.367	100.04%
September/2019	122.161	120.642	98.76%
October/2019	143.929	118.347	82.23%
November/2019	58.745	93.793	159.66%
December/2019	48.842	45.489	93.14%
Total	**1,298.614**	**1,286.215**	**99.05%**

Table 7.4 – Comparison Among the Summary of Liquid Metal Production and Sales

Month/Year	Production (t)	Sales (t)	Sales/Production
January/2019	68.915	68.915	100.00%
February/2019	267.370	267.370	100.00%
March/2019	211.735	211.735	100.00%
April/2019	253.910	253.910	100.00%
May/2019	347.565	347.565	100.00%
June/2019	337.810	337.810	100.00%
July/2019	299.070	299.070	100.00%
August/2019	346.325	346.325	100.00%
September/2019	251.650	251.650	100.00%
October/2019	269.650	269.650	100.00%
November/2019	117.840	117.840	100.00%
December/2019	120.750	120.750	100.00%
Total	**2,892.590**	**2,892.590**	**100.00%**

As can be seen, the month that presented the lowest sales/production rate (table 7.1) was February/2019 (98.29%). This rate is above the minimum rate established by the methodology (70%), therefore the production output can be considered as a baseline parameter.

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

According to the methodology, project emissions should include:

• Emissions from the cover gas used; HFC-134a or Perfluoro-2-methyl-3-pentanone;
• Emissions from the use of SF6, if any;and
• Emissions from the consumption of CO2 in case it is only used in the project scenario and not in the baseline.

None of the gases above were used in the RIMA Project during project activity

E.3. Calculation of leakage emissions

No leakage is expected from the project activity

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

Total emissions reductions which cover direct emissions of GHG and sequestration can be written as:

$$ER_y = BE_y - PE_y$$

Where:
ERy = Emission reductions in year “y” (tCO2e/yr)
BEy = Baseline emissions in year “y” (tCO2e/yr) – according to equation 1.
PEy = Project emissions in year “y” (tCO2/yr)

As there is no project emissions as explained before, emissions reductions are equal to the baseline emissions.

$$ER_y = P_{Mg,PJ,y} \times 22,800 \times 0.000458$$

	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	293,888	0 (zero)	0 (zero)	-	293,888	293,888

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

This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
293,888	302,725

Estimated Mg Production

	Primary Ingot + Liquid metal	Die casting pieces	Total
Production for 2019-Jan to 2019-Dec, based in production estimated in the PDD of second crediting period	27,318.000 t	1,672.000 t	28,990.000 t
Monthly estimated production	2,276.500 t	139.333 t	2,415.833 t
Real Production from for 2019-Jan to 2019-Dec	26,845.126 t	1,298.614 t	28,143.740 t
Real Monthly Production from 2019-Jan to 2019-Dec	2,237.094 t	108.218 t	2,345.312 t

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

The ex-ante amount was taken directly from the PDD in section B.6.4 for the year 2019.

E.6. Remarks on increase in achieved emission reductions

It is not applicable, since the emission reductions were below the estimated value.

E.7. Remarks on scale of small-scale project activity

It is not applicable, since the project is large-scale.

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

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Rima Industrial S/A
Street/P.O. Box	District Industrial of Bocaiuva
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City	Bocaiuva
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Postcode	38.390-000
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Telephone	+55 31 3329 4192
Fax	
E-mail	acr@rima.com.br
Website	www.rima.com.br
Contact person	Anderson Clayton dos Reis
Title	Administrative and Finance Director
Salutation	Mr.
Last name	Reis
Middle name	Clayton
First name	Anderson
Department	Finance
Mobile	
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Personal e-mail	acr@rima.com.br

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for completing the CDM-MR-FORM
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City	Helsinki
State/Region	
Postcode	
Country	Finland
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Contact person	Helle Lindegaard
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Salutation	Ms.
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Personal e-mail	helle.lindegaard@nefco.fi

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Electrabel NV/SA
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State/Region	
Postcode	
Country	Belgium
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Contact person	Nore, Nicolas
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Salutation	Mr.
Last name	Nore
Middle name	
First name	Nicolas
Department	
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Document information

Version	Date	Description
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
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.
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.

Version	*Date*	*Description*

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