CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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SECTION A. General description of project activity

A.1 Title of the project activity:

Title of the project activity: "Conversion of SF_6 to the alternative cover gas SO_2 at RIMA magnesium production"

PDD version number: 06

Date (DD/MM/YYYY): 03/03/2009.

A.2. Description of the project activity:

The project "Conversion of SF_6 to the alternative cover gas SO_2 at RIMA magnesium production" (hereafter referred to as "RIMA Project") consists in substituting sulphur hexafluoride (SF_6), a high global warming potential (GWP) gas[1], 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 as 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 green house gas, this gas has health impacts, therefore new latest environmental/safety high control technology will be 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 project will bring to RIMA the latest SO_2 control technology. In the past, there have been problems with SO_2 use as a cover gas related to low metal quality and health impacts.
Actually, plants in Europe are still using SO_2 and recently the US Environmental Protection Agency indicated that SO_2 is an attractive alternative to SF_6 as a cover gas for the magnesium industry if used in proper concentrations, and with modern control technology, protecting the metal and the surrounding plant facilities from damage.

[1] SF_6 global warming potential is 22,200 in a time horizon of 100 years. Then, 1 molecule of SF_6 is 22,200 more aggressive - regarding GHG effects - than carbon dioxide (CO_2). Available at: <http://www.grida.no/climate/ipcc_tar/wg1/248.htm#tab67>. Accessed in 10 March 2008.

Nowadays, the technology for protection of workers and preservation of the quality of metal has improved, thus making SO_2 a more viable option. If proper training procedures are adopted to protect workers, there should also be no public health effects, and because SO_2 is used in very small concentrations (with a good portion of the gas destroyed in the Mg production process), emissions to the atmosphere are generally minimal.

As a result of this CDM project activity, these latest techniques will be transferred to Brazil.

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 parts.

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"[2]. They join companies committed to eliminate SF_6 emissions from magnesium production and casting processes by year-end 2010.

RIMA is the world's 4th largest producer of Silicon Metal, the 2nd largest Magnesium Die Caster, as well as the only magnesium producer in South America. RIMA is also the only one integrated plant in the world. Manufacturing magnesium from the raw material (dolomite), induction/melting, 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 states. Vicintin Foundation also support other institutions as Associação de Pais e Amigos dos Excepcionais (Special Needs Children Parents and Friends Association), Núcleo de Internação do Menor and Casa Lar Cristã.

[2] For more information see: <http://www.epa.gov/magnesium-sf6/index.html>.
[3] For more information see: <http://www.fundacaovicintin.org.br/website/?secao=fundacao>.

A.3. Project participants:

Table 1 – Party(ies) and private/public entities involved in the project activity

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved whishes to be considered as project participant (Yes/No)
Brazil (host)	RIMA Industrial S/A	No
Netherland	33 Asset Management. (private entity)	
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Detailed contact information on party(ies) and private/public entities involved in the project activity listed in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil.

A.4.1.2. Region/State/Province etc.:

Minas Gerais state.

A.4.1.3. City/Town/Community etc:

Bocaiúva city.

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):



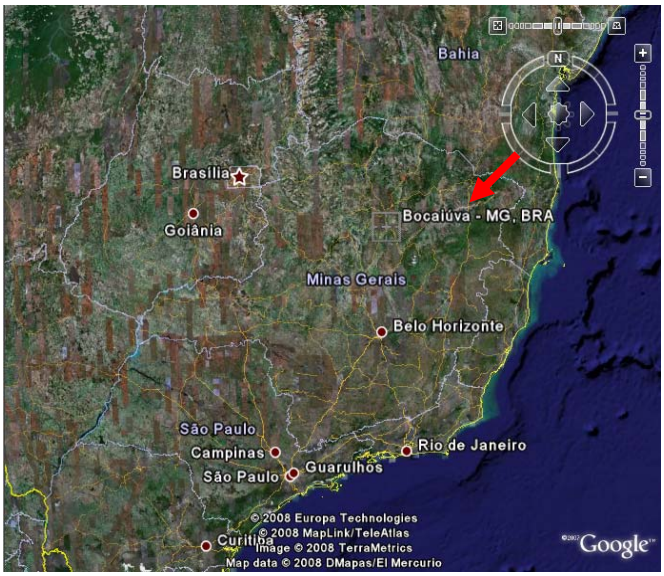


Figure 1 – Political division of Brazil showing Minas Gerais state and Bocaiúva city. (Source: City Brazil[4], 2008 and Google Earth[5], 2008)

The project activity is located in Bocaiúva city, Minas Gerais state, Midwest region of Brazil. Bocaiúva has 44,657 inhabitants, 3,233 km^2 and is 370 km of Belo Horizonte, the capital of the state (IBGE, 2008).

The project geographic coordinates is latitude 17° 36’ 07” South and longitude 43º 48' 28" West.

A.4.2. Category(ies) of project activity:

Sectoral Scope 04: Manufacturing
Sectoral Scope 09: Metal Production

Sectoral scope: 11 - Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride.

A.4.3. Technology to be employed by the project activity:

Cover gas substitution project description

[4] Available at: <www.citybrazil.com.br>. Accessed on March 10th, 2008.
[5] Available at: <www.googleearth.com>. Accessed on March 10th, 2008.

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

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

RIMA project will install the necessary piping, equipments and procedures (including staff safety equipments and training) required to switch from SF_6 to SO_2. Details of the SO_2 project is available in the document: "Resumo Projeto SO_2.doc", and "layout pipeline SO_2.jpg"

The project itself will consist 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 will remove the current piping and pumping equipments used to the actual protective cover gas SF_6. Removed equipments will be 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;
- Perform staff technical training for proper handling procedures, to reduce dangerous accidental exposure to SO_2;
- Develop and train 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;
- Provide personal safety equipment: protective wear and gears, respirator, dosimeter, monitors; when operating in an environment under SO_2.;
- Develop and perform Maintenance Plan for equipment and gas distribution system to assure safe and consistent operation.

Magnesium Products Production

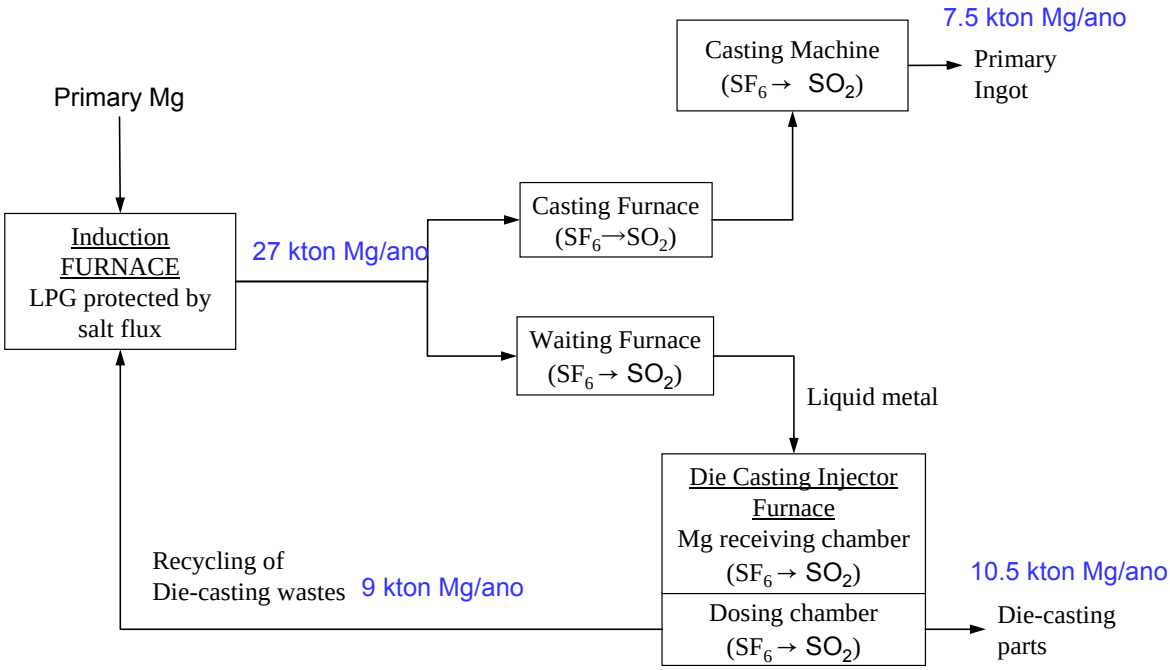


Figure 1 – Simplified RIMA magnesium process Flow Diagram (amounts are installed capacity)

The induction furnace is where the magnesium crystals are melted with a salt protection, no SF_6 is used to protect the surface. Any additives to produce alloys are injected in the induction furnace. The melted magnesium is transferred to the next furnaces.

The casting furnaces, waiting furnaces, production of ingots and production of liquid magnesium are located in the FUSION AREA of the RIMA plant. Liquid magnesium is then transported in containers by folk-lifts to the Die-casting area, called as FSP (Fundição Sob Pressão) in RIMA.

In the Fusion Area, there are 11 furnaces alternating the use between induction, casting and waiting furnaces where is necessary the use of cover gas; and 2 casting machines. Commonly 3 furnaces operate as induction furnace, 6 as casting furnace and 2 as waiting furnace. Actually only 1 casting machine is meeting the market demand. Total capacity of the furnaces is 26,000 ton/year of ingots and liquid metal.

In the FSP, there are 12 units of die-casting. Die-casting unit receives the liquid metal container that is coupled at the unit. The liquid metal in injected into the first chamber, and then injected to the part model.

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

It is expected an increase in the market demand for magnesium products of 5% per year. Actual Fusion Area has enough capacity to meet this increase demand, however, the FSP will require adding new units.

Liquid Magnesium transport

In its start, RIMA was only a primary ingot manufacture. Later, the die-casting area was constructed. The die-casting area was supplied/fed by the solid ingot produced in the Fusion/Ingot 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 Primary Fusion Furnaces 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/melting, and die-casting.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 1 - (2009)	241,685
Year 2 - (2010)	253,769
Year 3 - (2011)	266,458
Year 4 - (2012)	279,781
Year 5 - (2013)	293,770
Year 6 - (2014)	293,770
Year 7 - (2015)	293,770
Total estimated reductions (tonnes of CO_2e)	**1,923,003**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**274,715**

A.4.5. Public funding of the project activity:

This project does not receive any public funding and it is not a diversion of ODA.
RIMA is paying from his own capitals and bank loan, the cover gas changing project.
33 Asset Management is paying for the CDM registration process.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

AM0065 - "Replacement of SF_6 with alternate cover gas in the magnesium industry", version 01.

The project activity also utilizes the *combined tool to identify the baseline scenario and demonstrate additionality*, version 2.2 as referred in the AM0065 methodology.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Eligibility

This methodology is applicable to the proposed CDM project activity because satisfy the following conditions:

- *Replaces the use of cover gas SF_6 in (full or in part) by SO_2 technology, in existing facilities;*

RIMA project will replace full SF_6 by SO_2.

- *The facility has an operating history of at least three years prior to validation.*

RIMA Industrial S/A has more than 3 years operation history and all data is archived and available.

Applicability

The methodology is applicable under the following conditions:

• All segments of the magnesium industry where SF_6 is replaced;

*The **magnesium metal casting industry**, for the purposes of this methodology, is defined as being included in one or more of the following industry segments:*

- *Primary ingot casting (includes alloying furnaces, does not refer to primary magnesium production from metallic magnesium such as electrolysis or thermal reduction processes);*
- *Die casting;*
- *Gravity casting;*
- *Production of secondary magnesium through recycling of magnesium or its alloys;*

RIMA has both Primary ingot casting (~7,500 ton/year) and Die casting processes (~10,500 ton/year), as well as recycle the waste from the die-casting into the process again (~9,000 ton/year). Detailed actual installed capacity is described in Section A.4.3.

• If SO_2 is used as cover gas, only "dilute SO_2" technology is used which meets the definition provided in the Definitions as per the methodology;

Advanced "dilute SO_2" melt protection technology is technology that meets the following specifications:

• Well controlled SO_2 concentration and flow rates with concentration typically 1 percent or less. An associated SO_2 exhausting and abatement system to ensure SO_2 emissions are in compliance with the local environmental regulations. Emissions from the facility to the ambient air should comply with the local standards of the country. If no local standards exist, the following value should be taken into account as a cap limit for SO_2 concentration in the exhausting system – 1470 mg/m_3 (dry basis, 273 K, 101,325 kPa at an oxygen concentration of 6 %(v/v);
• Precise gas mixing and delivery system using mass flow controllers (MFC) or similarly accurate device and heated gas lines to SO_2;
• Gas cabinet or cylinder storage area with leak monitors and emergency ventilation system.
• Redundant / back-up melt protection technology in case SO_2 leak requires system shut-down and repair;
• Emergency response plan, training, and personal safety equipment;
• Back-up power / generator for gas mixing system and necessary controls, compressors, etc. – capable of running independently for 12 hours;
• Maintenance plan for equipment and gas distribution system to assure safe and consistent operation.

All requirements will be met by RIMA project. The project will start implementation after or during validation process if the first evaluation seems to be positive for CDM registration. Basic design of the SO_2 technology could be verified in the document: "Resumo Projeto SO_2" and "layout pipeline SO_2.jpg"

• Local regulations in the host country regarding SO_2 emissions in the exhausting system should be complied with. If such regulations are not in place, the following value should be taken into account as a cap limit of SO_2 concentration in the exhausting system – 1470 mg/m3 (dry basis, 273 K, 101,325 kPa at an oxygen concentration of 6 %(v/v).

The Minas Gerais States Environmental Policies Council (COPAM - Conselho Estadual de Política Ambiental), establishes through the Regulation number 11 of 1986, and revised by Deliberation number 01 of 24 February 1992, the SO2 emission limit for a fixed of non-listed source is 2500mg/Nm^3 (ref:[6]).

According to CONAMA-National Environmental Policies Council, which establishes overall frame fro environmental policies, the limit concentration is dry basis; 273 K; 101.325 kPa.
RIMA project will monitor the emissions during all project lifetime to ensure compliance.

The methodology is only applicable if the baseline scenario is the continuation of current practice of using SF_6 as a cover gas.

As will be proven below in the section B.4-Baseline scenario identification, the baseline is the continuation of current practice of using SF6 as cover gas.

[6] SEMAD-Secretaria de Estado de Meio Ambiente e Desenvolvimento Sustentável (Environment and Sustainable Development State Secretariat).
Regulation 11/1986 :Available on http://www.siam.mg.gov.br/sla/download.pdf?idNorma=92
Deliberation 1/1992: Available on http://www.siam.mg.gov.br/sla/download.pdf?idNorma=396

The methodology is not applicable to the following:

· *Sectors other than magnesium that use SF_6;* Only magnesium sector consumes SF6 in RIMA

· *Project activities that replace the use of SF_6 with salt fluxes, or sulfur powder;* SF6 will be replaced by dilute SO2.

· *New facilities*. Since its start RIMA produces primary magnesium ingots, and since May 2001, has 12 injectors in die-casting segment with installed capacity of 10,500 tonnes of Mg parts per year.

B.3. Description of the sources and gases included in the project boundary

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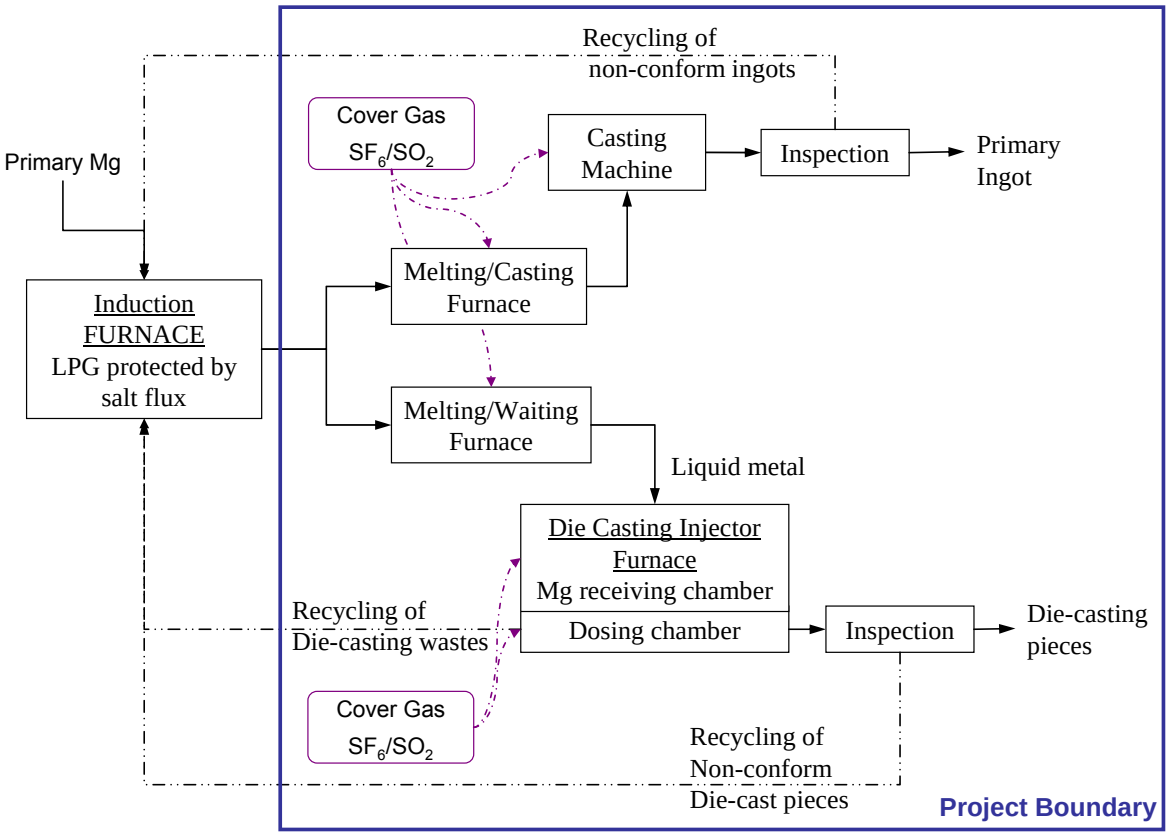


Figure 2 – Project Boundary Scheme

Source		Gas	Included?	Justification/Explanation
Baseline	Cover gas mix to protect molten magnesium	CO_2	No	Used in some cases as diluent to SF_6 in the cover gas mix. Since it is used both in baseline and project scenarios, for the sake of simplicity it is excluded from both calculations. When CO_2 is used only in the baseline activity, it will not be included as a conservative assumption.
		SF_6	Yes	Major source of emissions in the baseline.

		CH_4	No	CH_4 is excluded from the baseline calculations. Exclusion of this gas is conservative.
		N_2O	No	N_2O is excluded from the baseline calculations. Exclusion of this gas is conservative.

There will be no project emissions as the alternative cover gas is not using HFC-134a nor which could produce CH_4, N_2O, C_2F_6, C_3F_8 as by-product of reaction between cover gas and molten magnesium.

Additionally the diluent gas will be used nitrogen (N_2) and not dioxide carbon (CO_2), and all SF_6 will be replaced by the alternative cover gas SO_2.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The baseline scenario is identified applying the latest version of the *"Combined tool to identify the baseline scenario and demonstrate additionality"*, taken into account the guidance described in the AM0065.

Step 1. Identification of alternative scenario

Sub-step 1a. Define alternative scenarios to the proposed CDM project activity

For RIMA, possible alternatives include the use of:
(1) Advanced "dilute SO_2" melt protection technology without CDM registration;
(2) SF_6- continuation of current practice;
(3) HFC134a;
(4) Perfluoro-2-methyl-3-pentanone;
(5) SF_6 capture and reuse;
(6) Process modifications / optimizations to minimize SF_6 consumption.

Sub-step 1b. Consistency with mandatory applicable laws and regulations

All alternatives are in compliance with related applicable laws and regulations.

Step 2. Barrier analysis

Sub-step 2a. Identify barriers that would prevent the implementation of alternative scenarios

First of its kind Barrier

In a seminar on climate change held during the 63rd Annual World Magnesium Conference[7] in Beijing, China on May 21, 2006 **no non-Annex I** participants reported using HFC134a, Perfluoro-2-methyl-3-

[7] Proceedings of the 63rd Annual World Magnesium Conference. Pages 107, 114. Also personal hearing.

pentanone (PMP) or "dilute SO2". Only a small number of European die-casters reported using HFC or PMP, and many non-Annex I still rely on sulfur powder or SO_2.

63rd Annual World Magnesium Conference was also where the alternatives to SF6 for Magnesium Melt Protection brochure, published in three languages, **was first** introduced to the industry and public [8]. EPA collaborated with the International Magnesium Association (IMA), China Magnesium Association (CMA), and Japan Magnesium Association (JMA) to write and publish this technical brochure discussing climate-friendly magnesium melt protection technologies.

Prevailing Practice Barrier

SF_6 has been widely used by the magnesium industry for more than 25 years[9]. Magnesium producers, casters, and recycling companies commonly use a cover gas of dilute SF_6 in dry air and/or carbon dioxide (CO_2) to protect the molten metal from oxidation and potentially violent burning.

RIMA Industrial SA is the only magnesium producer in Latin America region and there are no regulatory mandates or governmental incentives to substitute the gas.

Alternatives (3), HFC 134a and (4) Perfluoro-2-methyl-3-pentanone, are gases that were never used as cover gas in magnesium industry, as well as the use of "dilute SO_2" technology is the first of its kind.

The type of gas used in alternative (1), SO_2, was used in the past, but discontinued because of highly toxicity for the users. The handle of advanced "dilute SO_2" technology requires a new company mentality and culture to be developed, arising additional institutional barrier. There is a high resistance from the operators, and even from production managers to introduce this new harmful and corrosive gas.

Technological Barrier

The use of advanced "dilute SO_2" melt protection technology (scenario 1), HFC 134a (scenario 3), Perfluoro-2-methyl-3-pentanone (scenario 4) for melt protection is an entirely new technique that is being introduced to the magnesium sector due to the sectors growing awareness concerning climate change.

For all these alternatives gases, installation of new not commonly known state-of-the art safety equipments and implementation of new handle and safety procedures are required.

In order to provide melt protection, the cover gas, whether it is SF_6, SO_2 or another cover gas, must be mixed with CO_2, dry air or nitrogen. Each cover gas performs differently depending on the carrier gas or combination of carrier gases used. In addition, it is crucial that the proportions of this mixture be exact, and that the final blended product be applied to the molten magnesium at the right flow rate.
There are three important elements to have the best **performance operation: carrier gas, concentration, and flow rate**. If these elements are not combined properly, the magnesium will oxidize and ignite, which will ruin the ingot and require its disposal.
The appropriate formula varies greatly from plant to plant, therefore, in switching to an alternate cover gas, the plant will have to **undergo a significant period of trial and error** in order to identify the proper carrier gas, concentration, and flow rates which provide optimal performance of the gas.
During the period of trial, RIMA will likely lose an increased percentage of magnesium ingots due to substandard quality.

[8] USEPA: http://www.epa.gov/magnesium-sf6/resources.html

[9] US-EPA – SF6 emission reduction partnership for the Magnesium Industry . http://www.epa.gov/magnesium-sf6/basic.html

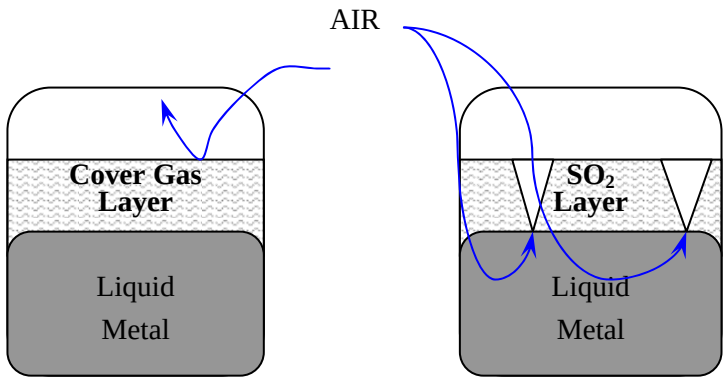
RIMA specific Technological Barriers

SF6 has more stable characteristics as cover gas.

SO2 also have good protective characteristics, IF possible to utilize higher concentration.

The difficulty is to find the ideal balance between best operation and safety, i.e., low concentration to ensure health & safety conditions, and enough high concentration to ensure the protection.

Cover gas has to create a layer on the liquid magnesium surface. SF6 creates a more homogeneous layer then dilute SO2. The contact of liquid magnesium with air, oxides the surface and produces very little solid magnesium oxide (MgO) inside the liquid Mg.



Problem in the die-casting injection machine

Pumping and Dosing System

The dosing system is designed to operate by volume of liquid magnesium. When there is oxide formation, there is a 67% increase in the volume, changing the real amount in weight of magnesium required to the part being molded.

Moreover, the solid oxide incrusts the pump and pipelines, blocking the smooth flow of the liquid Mg, leading to higher production stop time to cleaning procedures.

These 2 factors contributes to a low precision in the dosing system, leading to a decrease up to half amount of liquid Mg dosed, compared to that of real amount required to manufacture the part. This leads to a partial fulfillment of the part-mold and thus producing non-conform part, increasing scraps, decreasing the productivity.

As demonstrated above, during the first testing phase, there were huge decrease in productivity, with large amount of products (ingots and die-casting parts) being returned to be re-melted.

During the first testing period in June 2008, the waste amount increase from 2-4% to 25-28% and productivity decreases from 34-35 parts per working hour to 13-19 parts/hour. During first days of second testing in August 2008, the waste amount increase from 2-4% to 15-16%, and productivity decreases from 34-38 parts/hour to 16-18 parts/hour, showing that the waste amount is starting to be

better controlled. Details of these numbers are delivered to the DOE, as attached document: "Waste increase during SO2 test.xls"

For scenario 5, capturing SF_6, is extremely difficult given the temperatures and other environmental conditions involved in the pots themselves. The gas can also be contaminated by some by products, such as HF. The cost of recycling and the required treatment of the gas in order to reuse it would be much higher than the savings from reduced SF_6 purchases.
US-EPA has conducted economic analyses on key sources of high global warming potential gases (high GWP gases).[10]. Air Liquide developed an SF6 capture/recycle system that could reduce SF6 emissions by up to 95 percent from current levels. This patented process uses semi-permeable hollow membrane fibers to separate SF6 from CO2 and air in the spent cover gas. The captured SF6 can be re-used by the industry onsite. Capital costs for replacing SF6 with SO2 in 2000 are estimated to be USD 15.887 million. This includes retrofitting expenses as well as the purchase of SO_2-compatible equipment (CHEMinfo, 1998). Cost for a worker safety training program for all firms is also included in the capital costs. The capital cost is almost 10 times higher than implementing SF6 (USD1.6 million)

For scenario 6,
This may have been a viable option, but the RIMA plant has already been optimized, and there is virtually no room left for optimization. Therefore, the current baseline emissions figure represents these already implemented improvements. As is possible to observe from the RIMA operation data, SF_6 consumption in 2007 was very constant in an average 1.08 kgSF_6 per ton of magnesium product (0.18 to 0.30%), a very low state-of-the-art consumption level.

Quality / Productivity Decrease Barrier

The increase on demand for Magnesium metal is from automotive industries, seeking for reducing the vehicle weight, and consequently decreasing fuel consumption, turning the product more attractive to the client. A 10% decrease in the weight result in 5% decrease in the fuel consumption and proportional decrease in pollutant emissions. RIMA main client as well is in the automotive sector (ex.: Volkswagen, Fiat). Weight comparison: Steel>Al>Mg. Mg = 2/3 Al weigth.

Automotive industries/segment is known as one of the most restrictive and high quality requirements.
The low level of SO2 protection, causes production of small magnesium oxides (MgO), that are imperceptible as are located inside the products.
This non-metallic incrustation is critical for the quality and performance of the final product. Besides that would cause breakage problems in the equipments/tools during the machining process of the part at the final client, due to its high hardness, could lead to sparks caused by the friction between the machining tools and hard MgO particle that in extreme cases could lead to fire.

[10] U.S. High GWP Gas Emissions 1990–2010: Inventories, Projections, and Opportunities for Reductions June 2001. Chapter 4 - COST AND EMISSION REDUCTION ANALYSIS OF SF_6 EMISSIONS FROM MAGNESIUM PRODUCTION AND PARTS CASTING IN THE UNITED STATES.
http://www.epa.gov/highgwp/pdfs/chap4_mag.pdf

As the non-metallic incrustation inside the parts are not possible to be detected in quality inspection procedures, parts with MgO can cause leakage and increase in the scrapped parts, causing increase in costs and loss of competitiveness for the supplier.

Even the CERs sale revenues could turn the project financially attractive, if the quality problem is not solved, RIMA will not implement the project, considering that the client will not buy the product, in case of quality loss of the actual supply.

Operational Culture Barrier

The use of SO2 as cover gas, even in dilute concentration (1% or less), rises additional safety and health procedures to the operator. The strong and characteristic odour rises concern in the operator, if will not cause carcinogenic problems. Operators are afraid in working with a new, dangerous product.

The alternatives to change to HFC134a or Perfluoro-2-methyl-3-pentanone were not considered by RIMA, as these gases also have global warming potential. SO2 have no GWP under Kyoto Protocol.

Sub-step 2b. Eliminate alternative scenarios which are prevented by the identified barriers:

Alternatives	Barriers					Result
	First of its kind	Prevailing Practice	Technological	Quality/ Productivity	Operational Culture	
(1) Dilute SO_2 without CDM registration	Very High	Very High	Very High	Very High	Very High	Highly Prevented
(2) Continuation of current practice	None	None	None	None	None	Not prevented
(3) HFC134a	Very High	Very High	Very High	Should Have	Shoudl have	Prevented
(4) Perfluoro-2-methyl-3-pentanone	Very High	Very High	Very High	Should Have	Should have	Prevented
(5) SF_6 capture and reuse	High	Very High	Very High	None	None	Prevented
(6) Optimization of SF_6 consumption	alternative not possible RIMA plant is already in its limit of efficiency					Prevented

Outcome of Step 2: The only alternative not prevented by the barriers is the scenario (2) Continuation of the current practice, and identified as the most plausible baseline scenario.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

Steps 1 and 2 of the Combined tool to identify the baseline and demonstrate additionality was developed in Section B.4 – and identified as the baseline scenario the alternative (2): continuation of the current practice utilizing SF6.

The Combined tool states that:
If there is only one alternative scenario that is not prevented by any barrier, and if this alternative is not the proposed project activity undertaken without being registered as a CDM project activity, then this alternative scenario is identified as the baseline scenario. Explain – using qualitative or quantitative arguments – how thee registration of the CDM project activity will alleviate the barriers that prevent the proposed project activity from occurring in the absence of the CDM. If the CDM alleviates the identified barriers that prevent the proposed project activity from occurring, proceed to Step 4, otherwise the project activity is not additional.

To demonstrate **how the CDM project activity will alleviate the barriers** that prevent the proposed project activity from occurring in the absence of the CDM, a simplified Investment Analysis is performed.

There is **no new income** generated by the project activity, but a certain decrease in the cost of the alternative cover gas, as SO_2 is cheaper than SF_6, thus a completely financial analysis is not performed.

The simplified investment analysis here is made to demonstrate that the decrease in the cost do not worth the large efforts to transpose the barriers shown above and the extra investment in new equipments, personal training, stopping production to test the new cover gas, etc..

At first moment, in 2007 the estimated investment was USD1,200,040 (BRL 2,095,270 exchange rate 1.746 at the time) and there was around 8% of Internal Rate Return, below the benchmark.

After the first equipments renting and purchase to start testing with “dilute SO2”, total investment forecasted increased to USD 1,604,290 (BRL 3,033,714 exchange rate: 1.891 in 29 Sep 08), and the SO2 amount required per quantity of magnesium produced had to be increased to the limit of 1% to lead with the quality and productivity barrier.

With this new figure, IRR of the project dropped into a negative return. The local bank (Nossa Caixa) loan interest to RIMA is CDI CETIP (a Brazilian bond: 13.6% annum in 26 Sep08 http://www.cetip.com.br/) with a sobreposition rate of 0.31% per month (3.78% per year), which gives 17.90% p.a.

The negative IRR reinforces the fact that the initial investment and personal and company efforts to transpose the prevailing practice barriers: change/train the mind of workers to operate with a more dangerous gas, with more safety procedures, in a new technology; do not worth.

With the CDM additional revenues from 2009 until 2012, from the estimated around 270,000 tCO_2/year of emission reductions, considering a carbon credit of around 10 euros (~BRL 25), the IRR increases to 195%, what was an important additional income to the Board of RIMA decide in proceeding with the plan of implementing the project activity.

Table 1 – Simplified investment analysis resume

IRR without CERs	-15.233%
Benchmark	17.90%
IRR with CERs	195%

Moreover, this project activity is coupled with the emission reductions purchase by 33 Asset Management, who is financing the CDM process. The decision to start cover gas switch testing investment was made after the ERPA between RIMA and 33 Asset Management was closed.

For the simplified investment analysis, were included:
• Cost of adaptation of magnesium production equipments to work on alternate cover gas;
• Cost of installing new equipments to work on alternate cover gas;
• Additional maintenance and training costs due to the SF_6 switch;
• Cost of raw material (difference between SF_6 and SO_2);
• Cost of new safety measures (in the case of advanced "dilute SO_2" melt protection technology), including the abatement system;

The additional costs, involving financial, equipments shutdown time, scraps increase, etc., for the tests, analyzes and technology development to use the new cover gas, until is guaranteed the same level of quality and productivity of SF6 operation, only is justified considering the extra incentives from the revenues through GHG emissions reductions.

For the details of investment analysis, please refer to the annexed document spreadsheet: "Rima Investment Analysis". For the investment analysis, it was considered the real production level estimated in the future for RIMA plant, and not the one used in the CERs estimation, as this is the real financial situation RIMA will face.

Even though the CERs revenues could turn the project financially attractive, if the quality problem is not solved, RIMA will not implement the project, as the client will not buy the product.

Undertaking the project activity without CDM revenue does not justify surmounting the technological, prevailing practice, and institutional barriers posed by the project activity. As demonstrated above, the CDM revenues alleviates and gives incentives to RIMA work on overcoming the identified barriers that prevent the proposed project activity from occurring.

→ Proceed to Step 4 of Combined Tool.

Step 4 – Common Practice

As explained before, SF_6 has been widely used by the magnesium industry for more than 25 years[11]. Magnesium producers, casters, and recycling companies commonly use a cover gas of dilute SF_6 in dry air and/or carbon dioxide (CO_2) to protect the molten metal from oxidation and potentially violent burning. RIMA Industrial SA is the only magnesium producer in Latin America region among 88 producers member of the International Magnesium Association.

In addition, in a seminar on climate change held during the 63rd Annual World Magnesium Conference

[11] US-EPA – SF6 emission reduction partnership for the Magnesium Industry . http://www.epa.gov/magnesium-sf6/basic.html, accessed in April 2008.

in Beijing, China on May 21, 2006 **no non-Annex I** participants reported using HFC134a, Perfluoro-2-methyl-3-pentanone (PMP) or "dilute SO2". Only a small number of European die-casters reported using HFC or PMP, and many non-Annex I still rely on sulfur powder or SO_2.

Therefore, the RIMA project, substitution of SF_6 by SO_2 is not common practice in the region, i.e. similar activities cannot be observed in the region, thus the proposed **project activity is additional**.

Implementation timelines

After the registration of the first CDM project developed by RIMA in 10 March 2007, the company Board started to think and discuss about a second CDM project. The registered project is a fuel switching project (http://cdm.unfccc.int/Projects/DB/SGS-UKL1169640574.53/view)

During the month of March, the possibility to switch the cover gas SF_6 to a non-green house gas started to be discussed.

On 09 April 2007, there was a Board Meeting discussing among others, the importance of foreign currence income from the sale of carbon credits generated by the cover gas switch project activity, to mitigate the risks associated with the project, and so decided to start the CDM process and allow some investments to perform preliminary studies. At this time, only a draft estimative of main investments and CDM registration costs and incomes were made. No details at this moment were discussed.

In January 2008, RIMA closed the ERPA (Emission Reduction Purchase Agreement) with 33 Asset Management.

1 February 2008, CDM methodology AM0065, was approved and publicized by EB.

In February 2008, consultants to develop CDM process were contacted.

In February 2008, RIMA started construction of the room to install the SO_2 gas supplier.

From 18 June to 08 July 2008, a testing with SO2 cover gas was held in some equipments in melting furnaces and die-casting injectors. The results were not good. The initial plan for the test period was 5 days, however as did not give conclusive results, the testing was extended for more 5 days, in a total of 10 days. This testing was made with rented safety equipments and small SO2 cylinders.

During the same period, safety equipments were rented for personal training.

After the PDD was published to Global Stakeholders Comments and received the argue of validation DOE on 08 August 2008, RIMA started new testing on 3 die-casting injector with SO_2, in order to verify SO_2 concentration and safety issues as well as improve quality and productivity.

It was demonstrated during first test, that few days for testing is not enough to ensure homogeneous/stable operation conditions with the new gas. As well as to keep product quality in the same level as when using SF6. The second testing is being held during longer period, to ensure the stability of the operation conditions, as well as to find the ideal concentration of SO2.

The second test is giving better results in terms of productivity and quality, using 1% SO2 diluted in Nitrogen. The quality still did not achieve the best level, however the problems with incrustation of pumping and dosing system shows significant improvement. The tests will be continued, however RIMA is optimistic with the results, and will soon after the confirmation of stabilization of the process using

dilute SO2, start to change the cover gas in all injectors and furnaces, and will take around 3 months to completely change all SF_6 by SO_2 in all plant.

The final decision in implementing the switching of cover gas to SO2 in all plant will be done only after finalizing the tests and obtaining a positive result. If the second test results negative, the project will not be continued. Therefore, the start date of the project is not yet defined.

Detailed chronogram is available on site and was delivered to validation DOE.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions

There are two ways to calculate Baseline emissions:

Case 1: In case historical annual consumption for SF_6 **per equipment *k* in each segment *j*** is available; or

Case 2: In case **only** the historical annual consumption for SF_6 for the **total** facility is available.

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

$$BEy = \sum_j \sum_k P_{Mg,PJ,j,k,y} \times GWP_{SF6} \times EF_{SF6,Mg} \quad \textbf{Equation 1}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2e/yr)

$EF_{SF6,Mg}$ = Baseline emission factor for the facility (tSF_6/ tMg)

$P_{Mg,PJ,k,j,y}$ = Annual amount of Mg products manufactured in project scenario in each equipment *k* in each segment *j* per year *y*.

GWP_{SF6} = Global Warming Potential of SF_6 (tCO_2e/ tSF_6)

$$EF_{SF6,Mg} = \frac{C_{SF6,EM,BL}}{P_{Mg.BL,TOTAL}} \quad \textbf{Equation 2}$$

Where:

$P_{Mg,BL,TOTAL}$ = Total Amount of Mg products manufactured in baseline scenario in the facility (tMg/ yr).

$C_{SF6,EM,BL}$ = Total SF_6 actually emitted in the baseline in the facility. (tSF_6/ yr)

$$C_{SF6,EM,BL} = C_{SF6,CON,BL} \times DF_{SF6} \times DI_{SF6,CON,BL} \quad \textbf{Equation 3}$$

$C_{SF6,CON,BL}$ = 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.

$DI_{SF6,CON,BL}$ = A conservative factor portraying the Data Integrity of $C_{SF6,CON,BL}$ (Fraction), estimated as per information in Data and Parameters not monitored section.

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. $P_{Mg,PJ,j,k,y} = P_{Mg,Bl,,TOTAL}$.

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) (CSF_6,TOT,BL);
• Total consumption of SF_6 in the facility, per year as per the 2006 IPCC Guidelines (CSF_6,IPCC,BL) as per following equation:

$$C_{SF6,IPCC,BL} = C_{SF6,SPIPCC} \times P_{Mg,BL,TOTAL} \quad \textbf{Equation 4}$$

Where:

$C_{SF6,SPIPCC}$ = Specific consumption of SF_6 in each equipment *k* of each segment *j* as per 2006 IPCC Guidelines (0.001t SF_6/t Mg casting)

Project emissions

Project emissions should include:
• Emissions from the cover gas used; HFC-134a or Perfluoro-2-methyl-3-pentanone;
• Emissions from the use of SF_6, if any;
• Emissions from the consumption of CO_2 in case it is only used in the project scenario and not in the baseline.

In the RIMA project activity, none of the gases above will be used during crediting period.

Leakage

No leakage is expected from the project activity.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(15)}$$

Where:
ER_y = Emission reductions in year *y* (tCO_2e/yr)
BE_y = Baseline emissions in year *y* (tCO_2e/yr)
PE_y = Project emissions in year *y* (tCO_2/yr)

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**GWP of SF_6**
Data unit:	tCO_2eq/tSF_6
Description:	Global Warming Potential of SF_6
Source of data used:	IPCC 2006
Value applied:	23,900
Justification of the choice of data or description of measurement methods and procedures actually applied :	Provided by the IPCC to calculate the global warming potential of SF_6.
Any comment:	Prior to the renewal of a crediting period it should be assessed if GWP values have changed.

Data / Parameter:	**$C_{SF6, CON, BL}$**
Data unit:	tSF_6
xDescription:	Total consumption of SF_6 as measured in each baseline year
Source of data used:	Project sponsor data
Value applied:	Year: 2005, 2006, 2007 — tSF_6: 19.050, 21.550, 25.950
Justification of the choice of data or description of measurement methods and procedures actually applied :	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.
Any comment:	-

Data / Parameter:	**$P_{Mg,,BL, total}$**
Data unit:	tMg
Description:	Ton of produced Mg per year in each of the baseline years
Source of data used:	Project sponsor data.
Value applied:	Year: 2005, 2006, 2007 — tMg: 19,744, 21,964, 24,334
Justification of the choice of data or description of measurement methods and procedures actually	Production data is based on Sale Amount, and not gross production. All non-conformance products are excluded.

applied :	
Any comment:	-

Data / Parameter:	**Weighting of alternative gas by-products**
Data unit:	GWP number
Description:	The average weighting of greenhouse gas by-products generated when some alternative cover gases are used.
Source of data used:	Project sponsor data.
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	SO_2 will be used as an alternative cover gas, thus generating no by-products which are greenhouse gases.
Any comment:	-

Data / Parameter:	**$DI_{SF6,CON,BL,k,j}$ /$DI_{SF6,CON,BL}$**
Data unit:	Fraction
Description:	A conservative factor portraying the Data Integrity of $C_{SF6,CON,BL,k,j,y}$/$C_{SF6,CON,BL}$ in each equipment k in each segment.
Source of data used:	*IPCC guidelines 2006.*
Value applied:	*Default= 0.95.*
Justification of the choice of data or description of measurement methods and procedures actually applied :	Following the IPCC recommendation, is used conservatively the lowest 0.95 uncertainty level.
Any comment:	*This value shall account for the uncertainty in SF_6 consumption. IPCC guidelines state that direct reporting has a 5% uncertainty level. 0.95 shall be used as the default factor unless the project proponent can demonstrate to the DOE that their estimates of $C_{SF6,CON,BL,k,j}$/$C_{SF6,CON,BL}$ are more than 95% accurate. Project proponents will utilize the default 0.95.* Prior to the renewal of a crediting period it should be assessed if the Conservative Factor default should be changed.

Data / Parameter:	**$DI_{SF6,CON,PJ,k,j,y}$**
Data unit:	%
Description:	A conservative factor portraying the Data Integrity of $C_{SF6,CON,PJ,k,j,y}$ in each segment, per year.
Source of data used:	*IPCC guidelines 2006.*
Value applied:	*Default= 1.05.*
Justification of the choice of data or description of	Following the IPCC recommendation, is used conservatively the highest 1.05 uncertainty level.

measurement methods and procedures actually applied :	
Any comment:	*This value shall account for the uncertainty in SF_6 consumption. IPCC guidelines state that direct reporting has a 5% uncertainty level. 1.05 shall be used as the default factor unless the project proponent can demonstrate to the DOE that their estimates of CSF_6,CON,PJ,k,j,y are more than 95% accurate Project proponent will not claim for lower value, and will use the default factor.* Prior to the renewal of a crediting period it should be assessed if the Conservative Factor default should be changed.

Data / Parameter:	**DF_{SF6}**
Data unit:	No unit
Description:	Degradation Factor of SF_6 that reacts with the magnesium in the production process
Source of data used:	According to AM0068, version 01.
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Executive 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.
Any comment:	Prior to the renewal of a crediting period it should be assessed if the Degradation Factor default should be changed.

B.6.3 Ex-ante calculation of emission reductions:

>>

Baseline Emission Factor for the facility ($EF_{SF6,Mg}$)

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) (CSF_6,TOT,BL);
• Total consumption of SF_6 in the facility, per year as per the 2006 IPCC Guidelines (CSF_6,IPCC,BL) as per following equation:

$$C_{SF6,IPCC,BL} = C_{SF6,SPIPCC} \times P_{Mg,BL,TOTAL}$$

Where:
$C_{SF6,SPIPCC}$ = Specific consumption of SF_6 in each equipment *k* of each segment *j* as per 2006 IPCC Guidelines (0.001t SF_6/t Mg casting)

Annual Consumption of SF_6:

Historical consumption	IPCC Guidelines Equation		
$C_{SF6,TOT,BL}$ tonSF6/year	$C_{SF6,IPCC}$ (0.001t SF6/	$P_{Mg,BL,total}$ (tonMg/year)	$C_{SF6,IPCC,BL}$ ton SF6/year

		t Mg casting)		
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			19.744

Minimal amount of SF_6 consumption is delivered from the historical consumption, thus:
$C_{SF6,CON,BL}$ = 19.050 tonSF_6/year

Applying this value in $C_{SF6,EM,BL} = C_{SF6,CON,BL} \times DF_{SF6} \times DI_{SF6,CON,BL}$ Equation 3

$$C_{SF6,EM,BL} = 19.050 \times 0.5 \times 0.95 = 9.049 \qquad tSF6/year$$

Applying in $EF_{SF6,Mg} = \frac{C_{SF6,EM,BL}}{P_{Mg.BL,TOTAL}}$ Equation 2

$$EF_{SF6,Mg} = \frac{9.049}{19,744} = 0.000458 \qquad tSF6/tonMg$$

Detailed calculation is available in the spreadsheet "RIMA_SF_6_CER.xls"

B.6.4 Summary of the ex-ante estimation of emission reductions:

RIMA production plant is operating under its total capacity, and is expected an increase in the market demand for magnesium products. For 2008 is expected an increase of 7% and for the next 2009 to 2013, a 5% increase per year. Part of the expected production increase will be met by the existing installed capacity of 12 injectors (up to 10,500 tonnes/year with injectors tag number 1 to 12), and part will be necessary an expansion with new equipments. Part of the expansion was implemented in March 2008 installing 3 new injectors in the FSP area. The production increase rates are considered in the ex-ante estimation of emissions reductions.

Years	**Estimation of project activity emissions** (tonnes of CO_2e)	**Estimation of baseline emissions** (tonnes of CO_2e)	**Estimation of leakage** (tonnes of CO_2e)	**Estimation of overall emission reductions** (tonnes of CO_2e)
Year 1 - (2009)	0	241,685	0	241,685
Year 2 - (2010)	0	253,769	0	253,769
Year 3 - (2011)	0	266,458	0	266,458
Year 4 - (2012)	0	279,781	0	279,781
Year 5 - (2013)	0	293,770	0	293,770
Year 6 - (2014)	0	293,770	0	293,770
Year 7 - (2015)	0	293,770	0	293,770
Total (tonnes of CO_2e)	0	**1,923,003**	0	**1,923,003**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$\mathbf{P_{Mg,PJ,k,j,y}}$
Data 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.
Source of data to be used:	Project sponsor internal control and sales receipt.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Year / tMg 2009 / 22,079 2010 / 23183 2011 / 24,343 2012 / 25,560 2013 / 26,838 2014 / 26,838 2015 / 26,838 Estimated for total plant, not by equipment.
Description of measurement methods and procedures to be applied:	Measured by calibrated truck scales at the outgate of the company, according to on-site working procedures.
QA/QC procedures to be applied:	Measurement data to be crosschecked with internal sales and stock reports. QA/QC procedures are explained in Annex 4. Scales are calibrated each 6 months. Upon site experience, was determined that 6 months period was necessary instead of annual calibration.
Any comment:	Data will be archived in paper and electronic format.

Data / Parameter:	$\mathbf{C_{SF6,CON,PJ,k,y}}$
Data unit:	tSF_6 /yr
Description:	The total consumption of SF_6 in the industrial facility in the project scenario in each equipment in each segment, per year.
Source of data to be used:	Project sponsor internal control.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0. There will be no SF_6 consumption in the project activity. All SF_6 system will be substituted to the SO_2 system. There will be no possibility of SF_6 use.
Description of measurement methods and procedures to be applied:	*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) *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.* *Accounting Method- once purchase is made* *Weight difference method – once cylinder is replaced* *Flow measurement method - continuously*
QA/QC procedures to be applied:	QA/QC procedures are explained in Annex 4.
Any comment:	-

Data / Parameter:	**$C_{ALTGAS,PJ,k,j,y}$**
Data unit:	tSO_2/ yr
Description:	Consumption of alternate gas SO_2, in project scenario for each equipment *k* in each segment *j* per year.
Source of data to be used:	RIMA internal control.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Year / $tonSO_2$ 2009 / 66.2 2010 / 69.6 2011 / 73.0 2012 / 76.7 2013 / 80.5 2014 / 80.5 2015 / 80.5
Description of measurement methods and procedures to be applied:	*The same procedures recommended by IPCC for direct reporting of SF6 consumption, used in the baseline scenario will be used for SO_2:* 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. Accounting Method- once purchase is made Weight difference method – once cylinder is replaced
QA/QC procedures to be applied:	QA/QC procedures are explained in Annex 4.Cross-checked with gas cylinders purchase receipts.
Any comment:	-

Data / Parameter:	**SO_2 emissions**
Data unit:	mg/Nm^3
Description:	SO_2 emissions from the facility to the ambient air

Source of data to be used:	CONAMA – National Environmental Council and COPAM – Minas Gerais State Environmental Policy Council.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	365 microgram/m3 for internal atmosphere 2,500. Is the limit for SO_2 emissions from the plant to external atmosphere.
Description of measurement methods and procedures to be applied:	On-site periodically sampling, outsourced by a specialized laboratory. Details are described in Annex 4 – Monitoring Information, SO2 Environment Monitoring; and separated document RIMA-79-08-SO2Safety.ppt sent to DOE:
QA/QC procedures to be applied:	Analysis equipment is calibrated by the manufacture.
Any comment:	*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, 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.*

Data / Parameter:	*Magnesium sales reports*
Data 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.*
Source of data to be used:	*Project sponsor data.*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*Not applicalbe*
Description of measurement methods and procedures to be applied:	*Annual Magnesium sales shall be compared to $P_{Mg,PJ,j,y}$, annual magnesium produced.*
QA/QC procedures to be applied:	*QA/QC procedures are explained in Annex 4. Magnesium sales reports shall be verified by DOE as part of the verification process.*
Any comment:	*If less than 70% of total magnesium produced is 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 has 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.*

B.7.2 Description of the monitoring plan:

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Responsible: Roberval Pereira Brito, Production Manager – Magnesium Division

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

• Amount of Mg manufactured in project scenario

• 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, engineering best practices, ISO9000 certification.

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.

Data flow for the parameters required specifically for the CDM project, is being included (September 2008) in the ISO system and the overall revision will take up to 60 days.

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 will be introduced in the spreadsheet and emissions reductions will be calculated automatically.

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

SF6 disarming timelines

Project participants commit that the verification process as well as CERs claim will start only after removing or disarming all SF_6 equipment. After the final decision in going with SO2, there will be no more SF6 purchase. The complete switch of the cover gas from SF6 to SO2 can be demonstrated by:

- no SF6 cylinders in inventory;
- no SF6 gas room. After all plant is switched to SO2, the actual SF6 gas room will be decommissioned as well as all SF6 pipelines.

Calibration & Maintenance Procedures

Weight scales and cover gas flowrate 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 the management system, and near the next calibration/maintenance day, the responsible is notified automatically by the system.

Emergency Procedures

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

Details on cover gas consumption monitoring is described in Annex 2 – baseline information, and magnesium production procedures are described in Annex 3 – monitoring information.

Renewal of the crediting period
Non-monitored parameters: GWP_{SF6} and $DI_{SF6,CON,BL}$ should be revised if changed.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

Date of completion: 06/06/2008

Responsible person: Mrs. .Jenny Sayaka Komatsu
jenny.komatsu@ecopart.com.br

Responsible Entity: Ecoinv Global Assessoria em Negócios Empresariais Ltda.
Rua Padre João Manoel, 222
CEP 01411-000
São Paulo – SP
Brazil.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/05/2009 . Estimated day of finishing the testing on the new cover gas "dilute gas" in all injectors.
The real decision on changing the cover gas in all equipments in the plant will be done only after the operation and quality of the products tests is stabilized.

Despite the fact RIMA closed ERPA with 33 Asset Management in January 2008, this Agreement does not have monetary penalties, and at that time there was no applicable approved methodology, therefore this is not considered as the start day of project activity.
As the methodology AM0065 itself describes, it is required testing "before the project is implemented" to estimate the amount of alternative cover gas; RIMA is still under testing phase, all SF6 supply equipments are maintained, and if this project is not registered as CDM project, the plant will back to operate with SF6. Details of the testing is described in Step 2 of Section B.4.

C.1.2. Expected operational lifetime of the project activity:

21 years.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/05/2009 or the date of registration at UNFCCC, whichever is later.

Additionally, PPs commits to start verification/monitoring for CERs only after all SF6 supplying system is decommissioned, and confirmed that no SF6 will be consumed in the same time.

C.2.1.2. Length of the first crediting period:

7 years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

During the first testing with "dilute SO2" in June 2008, contracted third-party environment consultant was hired to analyze the potential impacts of its use.

For the environment view, there are emissions concentration limit and air quality standards.

In the country level, CONAMA – Conselho Nacional de Meio Ambiente, establishes the emission limits and air quality. Additionally, the state level agency has autonomy to require more stringent limits.

In Minas Gerais state, where RIMA project is located, COPAM – Conselho Estadual de Política Ambiental is the legal environmental entity.

CONAMA Resolution number 3, of 28 June 1990, establishes the air quality standard of:

- annual average concentration of 80 micrograms per cubic meter of air;
- 24 hours average of 365 micrograms/m^3 air, that should not be exceeded more than once a year.

CONAMA 2/1990 establish 2 different standards (primary and secondary) according to the classification of the location of the activity. When there is no defined classification, as is the case of RIMA, article 7 of the resolution requires using the more restringing standard, the primary standard. Above values are for the Primary standard.

For emission limits, there is no requirement in the country level, however the state entity COPAM, in its Deliberation Normative number 01, of 24 February 1992, establishes for all other non-listed emission sources, a limit of 2,500 mg/Nm^3.

Additionally, procedures should attend the Brazilian Technical Standard ABNT-NR15 for insalubrious activities and operations. The standard requires ambient air (inhalation) limits for worker exposure. This is controlled by the Labor Ministry and not by Environment competence.
Annex 11 of the Standard states the "chemical agents that insalubrities is characterized by tolerance limit and inspections at work place ":
Limit concentration at work place: 4ppm or 10 mg/m^3 for 48 hours work/exposure per week
The insalubrity characteristic is eliminated or neutralized with:

a) adoption of general measures to control the concentration under the tolerance limit;
b) utilization of individual protection devices.

Regulation related to Environmental Impact Assessment/Environmental Report is under Minas Gerais State Law: Nr. 7,772 of 08 September 1980, and does not require new EIA for process changing, but only for new constructions. However, for the Operation License renewal, it is required that all regulated emissions concentrations are under the standards.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

As explained above, no additional environmental impact assessment was required for the substitution of cover gas to SO_2. However, during the project activity lifetime will be required to monitor the SO_2 concentrations for :

- operator inhalation;
- ambient air (plant internal environment) and
- atmospheric emission (plant chimney exhaust gases).

Insalubrity will be handled internally using protective gear and special training procedures for the staff. Also emergencial procedures were developed and operators are been trained.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

Brazilian Designated National Authority, "Comissão Interministerial de Mudanças Globais do Clima[12]", requests several documents and the fulfilment of some requisites in order to provide the Letter of Approval for a CDM project. One of these requisites is to invite comments from local stakeholders as described in its Resolution nr. 1, issued on September 11th 2003, amended by Resolution nr.7 issued on March 05th 2008.

The Resolution determines that copies of the invitations for comments sent by the project proponents at least to the following agents involved in and affected by project activities:

- Municipal governments and City Councils;
- State and Municipal Environmental Agencies;
- Brazilian Forum of NGOs and Social Movements for Environment and Development;
- Community associations;
- State Attorney for the Public Interest;
- Federal Attorney for the Public Interest

Invitation letters were sent to the following agents:

[12] Brazilian DNA web-page: <http://www.mct.gov.br/index.php/content/view/4016.html>.

- Prefeitura de Bocaiúva (Bocaiúva City Hall);
- Câmara Municipal de Bocaiúva (Municipal Assembly of Bocaiúva);
- Secretaria do Meio Ambiente e Serviços Urbanos de Bocaiúva (Environmental and Urban Services Agency of Bocaiúva);
- Câmara de Diretores Lojistas de Bocaiúva (CDL) (Shopowners Chamber of Bocaiúva);
- Associação Bocaiuvense de Artesãos (Bocaiúva Handcraftsman Association)
- FEAM – Fundação Estadual do Meio Ambiente de Minas Gerais (Minas Gerais Environmental Agency);
- Ministério Público de Minas Gerais (State Attorney for the Public Interest of Minas Gerais State);
- Ministério Público Federal (Federal Attorney for the Public Interest)
- Fórum Brasileiro de ONGs e Movimentos Sociais para o Desenvolvimento e Meio Ambiente (Brazilian Forum of NGOs and Social Movements for the Development and Environment).

Copies of the letters and post office confirmation of receipt communication are available upon request.

E.2. Summary of the comments received:

RIMA has received some comments about this project, as summarized below:

Stakeholder	Position	Summary of comments
Municipal Assembly of Bocaiúva	Favorable to the project	The implementation of the project will bring environmental benefits to the region. The project contributes to sustainable development, once it will reduce the emission of a greenhouse gas".
Bocaiúva City Hall	Favorable to the project	The implementation of the project will bring social and environmental benefits to the region. The project contributes to sustainable development of the municipality

State Attorney for the Public Interest of Minas Gerais State	No comments	According to the law 34/94 the State Attorney can not provide comments about projects
Environmental and Urban Services Agency of Bocaiúva	Favorable to the project	This project shows the RIMA commitment with the environment and community.
Local Community association. Associação Bocaiuvense de Artesãos	Favorable to the Project	Gives support to the project, and asks for clarification about safety procedures of SO2, and also asks for a plant visit.

E.3. Report on how due account was taken of any comments received:

All comments received up to now and they were very positive for project implementation.
The comments received do not require modifications in the project activity.

For the Local Community Association, RIMA sent an answer letter with the following content:

Explanation of the safety procedures, and clarification that these procedures were audited by TUV-SUD auditors, as well as, that the implementation and operation according to the presented procedures will be audited during the project activity life.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project does not receive any public funding and it is not a diversion of ODA.

Annex 3

BASELINE INFORMATION

Historical SF_6 consumption monitoring

RIMA plant is divided in 2 sectors:

1) Fusion Area, where is included the primary ingot casting and the alloying furnaces, and the production of liquid magnesium to the 2nd sector. There is only one supply point of SF_6 for all Area;
2) Die-casting Area, identified in RIMA as FSP (Fundição sob Pressão – Pressure Fusion), receives the liquid magnesium from the 1st sector. There is one supply point in each die-casting equipment.

The consumption amount for each area is monitored by inventory control of the cylinders. In RIMA plant is used 50kg cylinders, weighting 50kg empty and comporting 50kg of SF_6 gas.

Every time the operator needs new cylinders, the empty cylinder is returned, and input in the company management system. A take-order is filled by the operator and delivered to the inventory department, describing for which area/equipment is the cylinder.

The empty cylinder is weighted to ensure all gas was used. If is not completely empty, the cylinder is returned to the process to be used to the end.

In the Fusion Area SF_6 concentration is controlled in 15 normal litters per hour of SF_6 diluted with 7,500 normal litters per hour of nitrogen.

In the FSP, cover gas is used in 2 different points:

1) injecting inside the liquid magnesium container. SF_6 concentration is 0.20% or 0.22%;
2) during injection of the liquid magnesium into the die-casting mold. SF_6 concentration is 0.18% or 0.20% .

The control of the flowrate and SF6 and nitrogen mixture rate is made by micro-valves using 0 to 10V signals. The flowrate is separated in 3 ways:

a) 250 l/h when the die-casting unit is not operating;
b) 350 l/h during operation;
c) 650 l/h each 85 seconds during the injection pulse to the mold.

Maximum concentration limit of SF_6 is 0.30%. Higher concentration causes the release of hydrofluoric acid (HF).

Annex 4

MONITORING INFORMATION

1) Magnesium Production Monitoring Procedure

Monitoring of magnesium production could be divided in 3 sectors:

a. Ingot production

Cover gas is used during all primary casting process until the ingot/alloy is solidified.

RIMA has two casting lines, therefore the production will be monitored and registered separately.

Weight of produced ingots are performed twice: first at the dispatch sector, where any ingots with quality non-conformance is returned to the melting furnace; second at the out-gate of company, on the truck scale. At the dispatch sector is possible to separate the production for each casting line. The truck scale weight is the one used in the Sale Invoice.

Sale Invoice will be used to monitor the ingot magnesium produced amount. Internal dispatch sector control will be used to cross-check.

b. Molten metal production

This is a plant internal supply, from the Fusion Area to the FSP (die-casting area).

The liquid magnesium 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 FSP. The weight difference from [fork-lift + empty container] and [fork-lift + container + liquid magnesium] is used as the liquid metal production amount. The weights are registered in paper by the operator of folk-lift.

Cover gas is used during the transfer from the melting furnace to the container. During the container transport, cover gas is not used.

c. Die-casting part production

During the production of die-casting parts, rough edges are inevitable. These edges are deburred and returned to the melting furnace.

All produced parts are inspected visually for quality, and the non-conform parts are also returned to the melting furnace.

After the visual control, 2 samples per work-shift per each injector are randomically selected. Each work shift has 6 hours, thus 8 samples per day per injector.

Samples are submitted to electro-mechanical quality inspection for physical-chemical properties. If the inspected part is out of specification, all parts of the same batch are rejected and returned to the melting furnace.

Die-casting Mg parts production monitoring by accounting

Samples **weight** is also measured and registered electronically in the computer inside the inspection room. In parallel, the quantity of parts produced is accounted per type per injector and registered.

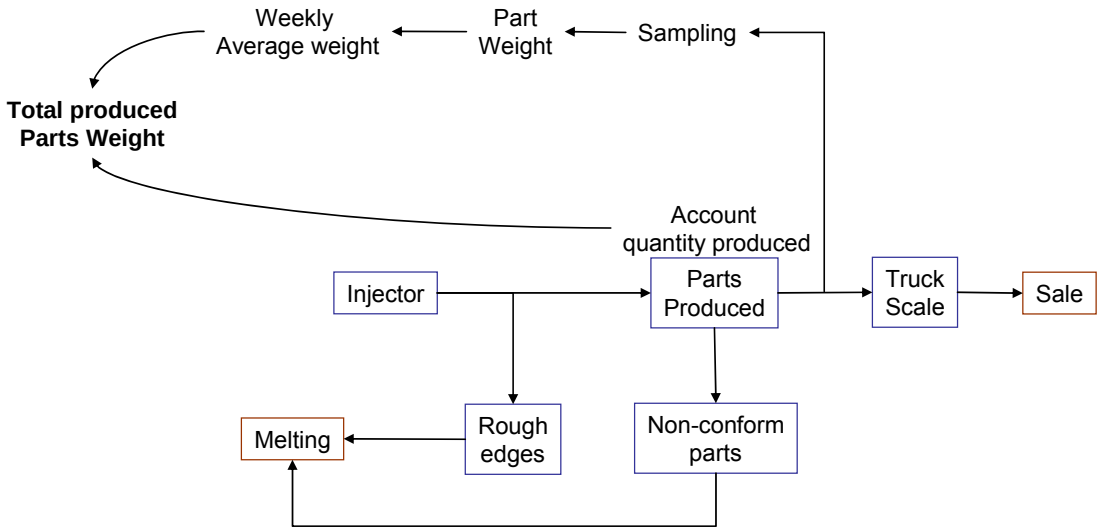
A weekly average weight for each type of part is calculated and multiplied by the part type quantity to calculate the total part type production weight per injector. The non-conform parts quantity is also registered, making possible the calculation of net parts production.

The calculated parts weight should be used only for cross-check aims.

For the emission reductions calculation is used the weight measured at the outgate of the company in the truck scale. The truck scale weight is the one used in the Sale Invoice.

Sale Invoice will be used to monitor the ingot magnesium produced and sold amount.

There are 15 injectors installed, however only 12 will be included in the emissions reductions claim; the production amount is monitored and registered per each injector. The amount of parts produced in the 3 injectors installed in the beginning of 2008, #13, #14 and #15, from the Monthly Production Report, will be excluded from the CERs calculation and claim.



2) SO2 consumption monitoring

According to the methodology AM0065, version 01, to ensure consistency between baseline and project calculations, the measurement method of alternate gas shall follow the same method conducted for SF_6.

For SF6 was used the accounting method (*Recording delivered purchases and inventory changes)*, using the weight difference method (*Measuring the difference in cylinder weight for gas used/ returned)* as auxiliary to ensure that all gas was consumed, cross-checking with sales receipt.

Therefore, the same methods will be used for SO2, recording the cylinders inventory and weight. However the monitoring methodology requires that the project monitoring should be done per equipment.

Differing from the SF6 small 50kg cylinders, that was installed one for each injector, due to the harmful characteristics of the new alternative cover gas, SO2, 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 "per equipment" consumption of SO2 will be as follows:

In each furnace and each injector it will be installed rotameters to control the flowrate of SO2. From the flowrate and total magnesium production in each casting line and injector, the SO2 consumption per equipment will be estimated per proportional calculation.

All production data, of melting, ingots, liquid magnesium and die-casting parts production are finally compiled by the control department in RIMA plant, and send to the main office.

Equipments calibration procedures

The plant management system encompasses the calibration of all magnesium weight scales and cover gas flowmeters. Calibration is done by the manufacture of each equipment.

The on-line management system issues a work order to the sector responsible to alter and call the perform the calibration, in a periodically pre-determined date. Most of the scales and flowrates have a 6 months period for new calibrations. This period is determined by on-site plant experience, which is a more stringent time-period than common.

3) SO2 Environment monitoring

All air samples collected are analysed and certified through and assay report from the Labchemical Laboratory and can be found in the annex.
The equipments are calibrated according to the technical operating to the technical operating handbooks issued by the manufacturers, which increases the reliability of the outcomes.

(Worker Safety) Occupational Monitoring
According to NIOSH – Nr. 154, air sampling during 60min collection in a flow of 1.0 liter/min
Tolerance Limit: 10 mg/m3; Level of Action: 5 mg/m3
Sampling by simple device attached in operator work cloth.

Sulphur Dioxied is monitored by collecting air through a low flow sampler of a gravimetric Gillian Type Pump

Internal Environment Monitoring
According to NBR 12797, air sampling during 720 minutes in a flow of 2.0 liter/min
Limit: based on CONAMA Resolution Nr 003, 28 June 1990. 365 microgram/m3.
Internal monitoring shed with 6 fixed points.
Sulphur dioxide is monitored by collecting air through flow sampler.

External Environment Monitoring
According to NBR-12020, air sampling during 720 minutes in a flow of 2,0 liter/min
Limit: based on CONAMA Norm Nr 001, 24 June 1992. 2,500 mg/m3
Sampling at 3 fixed points on exits of Industrial Ducts - Depletion
Sulphur dioxide is monitored by air collection by an isokinetic flow sampler. - - - -

Annex 5

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