



VALIDATION REPORT



VOLUNTARY CARBON STANDARD 2007.1

CONVERSION OF SF₆ TO AN ALTERNATIVE
COVER GAS IN MAGNESIUM PRODUCTION
IN EATON RAPIDS, MI AND STRATHROY,
ON

PROJECT NO: 70001721

REVISION NO. 01

DET NORSKE VERITAS



VALIDATION REPORT

Validation Report:

Name of Verification company:	Date of the issue:
Det Norske Veritas Certification AS	04-01-2008
Report Title:	Approved by:
VCS 2007.1 Validation Report for "Conversion of SF ₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON" project	Michael Lehmann
Client:	Project Title:
Climate Change Capital	Emission Reduction Protocol for Conversion of SF ₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON
Summary:	
Det Norske Veritas Certification AS (DNV) has performed validation of the project "Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON" at two locations, namely Eaton Rapids, Michigan, United States of America, and Strathroy, Ontario, Canada, applying the Voluntary Carbon Standard, 2007.1, as well as criteria given to provide for consistent project operations, monitoring and reporting. The validation consisted of the following three phases: • Phase I: a desk review of the project description document • Phase II: follow-up interviews with project stakeholders and site visits. • Phase III: the resolution of outstanding issues and the issuance of the final validation report and opinion. In summary, it is DNV's opinion that the "Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON" as described in the revised and resubmitted VCS PD of 9 March 2009 meets all relevant VCS requirements and correctly applies the CDM baseline and monitoring methodology AM0065 (version 1).	
Work carried out by:	Number of pages:
Shruthi Poonacha Barbara Toole O'Neil Weidong Yang Chandrashekara Kumaraswamy	15



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APPENDIX A VALIDATION AND VERIFICATION PROTOCOL



Abbreviations

CAR	Corrective Action Request
CL	Clarification request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DNV	Det Norske Veritas
EIA	Environmental Impact Assessment
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Mg	Magnesium
NGO	Non-governmental Organization
SF ₆	Sulfur hexafluoride
VCS	Voluntary Carbon Standard
VCS PD	VCS Project Description Project
VCU	Voluntary Carbon Unit



1. Introduction

Climate Change Capital has commissioned Det Norske Veritas Certification AS (DNV) to perform a validation of the “Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON” project (“the project”) at two locations, namely Eaton Rapids, Michigan, United States of America, and Strathroy, Ontario, Canada. The validation was based on the Voluntary Carbon Standard, 2007.1, as well as criteria given to provide for consistent project operations, monitoring and reporting.

This report provides a summary of the findings by DNV during the various stages of validation in addition to the description of the project, and steps involved in conducting the validation.

The validation team consists of the following personnel:

<i>Role/Qualification</i>	<i>Last Name</i>	<i>First Name</i>	<i>Country</i>
Team Leader	Toole O’Neil	Barbara	USA
GHG Auditor	Poonacha	Shruthi	USA
Technical reviewer (applicant)	Yang	Weidong	USA
Technical reviewer	Chandrashekara	Kumaraswamy	India

The validation team can not provide consulting services. However, clarifying questions may provide insight into the VCS requirements and be used to make improvements in the project in the future.

1.1 Objective

Validation is a requirement for all Voluntary Carbon Standard (VCS) projects and is necessary to provide assurance to stakeholders of the quality of the project and its intended generation of verified Voluntary Carbon Units (VCU). The purpose of a validation is to have an independent third party assess the project design. In particular, the project’s baseline, monitoring plan, and the project’s compliance with relevant VCS criteria are validated in order to confirm that the project design is sound and reasonable and meets the identified criteria.

1.2 Scope and Criteria

The validation scope is defined as an independent and objective review of the VCS project design (VCS PD). The VCS PD is reviewed against:

- the Voluntary Carbon Standard 2007.1 specifications for the project-level quantification, monitoring and reporting as well as validation and verification of greenhouse gas emission reductions or removals,,
- the CDM baseline and monitoring methodology AM0065 - Replacement of SF₆ with alternate cover gas in the magnesium industry (Version 01), and
- International Emission Trading Association (IETA) & the World Bank’s Prototype Carbon Fund (PCF), Validation and Verification Manual



Based on the recommendations in the Validation and Verification Manual

/23/	International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF), Validation and Verification Manual http://www.ieta.org/ieta/www/pages/index.php?IdSitePage=200
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A risk-based approach was employed. The approach focuses on the identification of significant risks for project implementation and the generation of VCUs.

1.3 VCS project Description

Meridian Magnesium Products is the owner and operator of two magnesium die casting facilities, located in Eaton Rapids, Michigan, USA, and Strathroy, Ontario, Canada. These two locations are the sites of the VCS project.

Meridian Magnesium Products primary business is the production and casting of magnesium alloys into automotive parts using an injection molding process. This process requires a protection system to prevent the ignition of molten magnesium in the presence of air. The protection system in the Eaton Rapids and Strathroy facilities is sulfur hexafluoride (SF₆) gas. It replaced salt and other gases that were previously used. The density and low reactivity of the gas makes it ideal for use in the casting of reactive metals and is widely used in the magnesium casting industry in the US and Canada. Some of the gas escapes to the atmosphere during the casting process. However, the SF₆ gas has a high global warming potential (GWP) once it has been released to the atmosphere.

In this project activity Meridian Magnesium Products has replaced SF₆ with a new cover gas called "Novec-612TM" (C₂F₅COC₃F₇). This is a recently patented gas by 3M and has never been used in USA or Canada for this purpose. Novec-612TM in combination with sulfur dioxide (SO₂) eliminates the use of SF₆ as a cover gas at both projects sites. Based upon historical SF₆ use at the plants and assuming a GWP of 22,200 tCO₂e for SF₆, the proposed project will prevent the release of 3,335,835 tCO₂e during a fixed 10 year crediting period starting 1 January 2007.

1.4 Level of assurance

DNV provides reasonable level of assurance that the "Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON" meets VCS 2007.1 criteria. To ensure complete transparency, DNV included a validation protocol in Appendix A. The validation protocol addresses all the criteria that are required to be met by for the VCS standard. Any clarification or corrective actions raised have been included in the validation protocol, along with the changes implemented and responses.

2 Methodology

The validation consists of the following three phases:

- Phase I: A desk review of the project description document
- Phase II: Follow-up interviews with project stakeholders and site visits.



- Phase III: The resolution of outstanding issues and the issuance of the final validation report and opinion.

In order to ensure transparency, a validation protocol was customized for the project. The protocol shows in transparent manner, the criteria against which the project was validated, means of verification and the results from validating the identified criteria.

The validation protocol serves the following purposes:

- It organizes, details and clarifies the requirements that a VCS project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been met and the result of the validation.

The VCS validation standard has been converted into two tables. Explanations of the requirements are described in Figure 1. The complete validation protocol is enclosed in Appendix A to this report. The validation protocol can result in a request of corrective actions (CAR) or clarifications (CL).

Corrective action requests are issued, where:

- Mistakes have been made with a direct influence on project results;
- Validation protocol requirements have not been met; or
- There is a risk that the project would not be accepted as a VCS project or that emission reductions will not be certified.

A clarification request may occur where additional information is needed to fully clarify an issue.



Validation Protocol Table 1: Requirement Checklist				
Checklist Question	Reference	Means of verification (MoV)	Comment	Draft and/or Final Conclusion
<i>The checklist is organised in seven different sections. Each section is then further sub-divided. The lowest level constitutes a checklist question.</i>	<i>Documents where the answer to the checklist question or item is found.</i>	<i>Explains how conformance with the checklist question is investigated. Examples of means of verification include document review (DR) or interview (I). N/A means not applicable.</i>	<i>The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.</i>	<i>This is either acceptable based on evidence provided (OK), or a Corrective Action Request (CAR) due to non-compliance with the checklist question (See below). A request for Clarification (CL) is used when the validation team has identified a need for further clarification.</i>
Validation Protocol Table 2: Resolution of Corrective Action Requests and Requests for Clarification				
Draft report corrective action requests and requests for clarifications	Summary of project participants' response	Final conclusion		
<i>If the conclusions from the draft Validation are either a Corrective Action Request or a Clarification Request, these should be listed in this section.</i>	<i>The responses given by the project participants during the communications with the validation team should be summarised in this section.</i>	<i>This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion".</i>		

Figure 1: Validation Protocol Tables

2.1 Review of Document

Documents provided that relate directly to the project:

/1/	Climate Change Capital, VCS PD of Conversion of SF ₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON, 5 May 2008.
/2/	Climate Change Capital, VCS PD of Conversion of SF ₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON, 9 March 2008.
/3/	Financial Analysis worksheet with carbon credits
/4/	Financial Analysis worksheet without carbon credits
/5/	Environmental Protection Agency, Meridian Magnesium Memo – SF ₆ usage, 1 October 2008.
/6/	Meridian Magnesium, Project Management, 30 April 2008
/7/	Meridian Magnesium, Presentation on emergency response plan, training, and personal safety equipment 30 April 2008
/8/	Ministry of the Environment , Application for approval (Air and Noise), Ontario, 14 May 2002.



/9/	Ministry of Environment, Amended Certificate of Approval (Air), 5 May 2008, Ontario
/10/	Taniguchi, N; Wallington, T. J; Hurley, M. D; Guschin, A. G; Molina, L. T; Molina, M. J (2003) “ <i>Atmospheric Chemistry of C₂F₅C(O)CF(CF₃)₂: Photolysis and Reaction with Cl Atoms, OH Radicals, and Ozone</i> ”, J. Phys. Chem. 107, 2674-2679
/11/	Emission reduction calculation worksheet
/12/	EPA, Characterization of Cover Gas Emissions from U.S. Magnesium Die Casting, Washington D.C., May 2004
/13/	Kurt T. Werner, Environmental Affairs Manager, 3M, email on Magnesium Meridian as market leaders for use of Novec-612™, 12 March 2009,
/14/	US EPA, Enforcement and Compliance History Online (ECHO), http://www.epa-echo.gov/echo/index.html
/15/	Meridian Magnesium, SO ₂ concentration charts, December 2008, Ontario, Canada
/16/	Meridian Magnesium, Strathroy Emissions Report, December 2008, Ontario, Canada
/17/	3M Canada, Invoice, 25 November 2008, Canada
/18/	California targets phase-out of HFC-134a in MAC, By R744.com, January 4, 2008, http://www.r744.com/article.view.php?Id=390
/19/	Meridian Magnesium, Expected Novec use from Strathroy tests, excel file
/20/	Meridian Magnesium, Invoice for gas mixing cabinet, Eaton Rapids, December 2007
/21/	E-mail from Scott Bartos, International Climate Policy Advisor, U.S. Environmental Protection Agency, Climate Change Division, Washington, DC, April 21 2009.
/22/	Meridian Magnesium, Quality Tonnes/Meridian Magnesium Agreement, January, 2007

Background documents related to the design and/or methodologies employed in the design or other reference documents:

/23/	International Emission Trading Association (IETA) & the World Bank’s Prototype Carbon Fund (PCF), Validation and Verification Manual http://www.ieta.org/ieta/www/pages/index.php?IdSitePage=200
/24/	Voluntary Carbon Standard, Voluntary Carbon Standard 2007.1, 18 November 2008
/25/	CDM Executive Board, AM0065 - Replacement of SF ₆ with alternate cover gas in the magnesium industry, Version1.

2.2 Follow-up Interviews

As per the requirements of the VCS, DNV conducted a site visit at the Meridian Magnesium facility located in Eaton Rapids, Michigan, USA on 1 May 2008 and the facility located in Strathroy, Ontario, Canada on 20 February 2009.

The site visits included a facility tour, interviews with the project developers to confirm selected information and to resolve issues identified in the document review. The main topics of the interviews are summarized in Table 1.

**Table 1: Interview topic**

Interviewed organisation	Interview topics
Seth Baruch <i>Carbon Markets, US</i> <i>Climate Change Capital Limited</i>	• Environmental permits • Site tour • Resources, training, procedures of management structure • Verification of findings of the desk review • Details of spreadsheet calculation and baseline development
Chuck Woodburn <i>Facilities Engineer</i> <i>Meridian Magnesium</i>	• Demonstration of additionality • Details on project technology • Details on the monitoring plan • Details on the monitoring technology used • Financial Assessment • Capital Invested and cost of raw materials • First time use of Novec-612™ • SO₂ usage as per methodology requirements • Safety requirements • Emergency system

2.3 Resolution of any material discrepancy

To ensure complete transparency, DNV included a validation protocol document in Appendix A. The validation protocol addresses all the criteria that are required to meet for the VCS standard. The following needs to be included in the validation

- The validation protocol and an explanation of how the project developers meet the standard
- The list of clarifications and corrective actions
- The responses to the same from the project developer

The objective of this phase of the validation was to resolve any outstanding issues which needed to be clarified for the project to meet the standard. The project participants provided their response to the CARs and CLs listed in Table 2 of the Validation Protocol document in Appendix A to this report. The project developers provided more information to resolve the CAR's. The CL's were resolved through further communications between the client and DNV.

3. Validation Findings

The findings of the validation for the project are provided in the following sections. The validation criteria, the means of verification and the results from validating the identified criteria are documented in more detail in Appendix A.

The initial validation findings relate to the project design as documented and described in the revised and resubmitted project design documentation.

3.1 Project Design



In the magnesium casting industry the production and casting of magnesium alloy parts requires a protection system to prevent the ignition of molten magnesium in the presence of air. The protection system that has been used in the Eaton Rapids and Strathroy facility is SF₆. The gas is commonly used as a cover gas in the magnesium casting industry because of its physical properties. However, this gas has a high global warming potential.

In this project, Meridian Magnesium replaced SF₆ with a new cover gas Novec-612™ (C₂F₅COC₃F₇) and sulfur dioxide (SO₂). Novec-612™ is a recently patented gas by 3M Corporation and has never been used in the USA. The project is expected to reduce 3,335,835 tCO₂e during a fixed 10year crediting period starting from the year 2007.

3.2 *Baseline*

The baseline determination was prepared using the baseline methodology AM0065, “Replacement of SF₆ with alternate cover gas in the magnesium industry” approved by the CDM Executive Board. The baseline determination includes an evaluation of alternative projects (Step 1), a barrier analysis of each alternative project listed (Step 2), a financial investment analysis (Step 3) and a common practice analysis (Step 4), using the “Combined tool to identify the baseline scenario and demonstrate additionality.

Step 1: The alternatives to the project activity are listed below:

- (a) Advanced “dilute SO₂” melt protection technology, i.e. project activity without carbon credits
- (b) SF₆- continuation of current practice;
- (c) HFC134a without the use of carbon credits.
- (d) Perfluoro-2-methyl-3-pentanone (Novec-612™ 612), i.e. project activity without the use of carbon credits.
- (e) SF₆ capture and reuse;
- (f) Process modifications / optimizations to minimize SF₆ consumption.

Step 2: Barrier Analysis for the above mentioned alternatives

(a) Advanced “dilute SO₂” melt protection technology, i.e. project activity without carbon credits

The cost of SO₂ is about 40% of the cost of SF₆ and the amount of SO₂ required per kg of Magnesium produced is 1/3 of the amount of SF₆ used. However, switching to SO₂ incurs high capital cost in terms of re-piping and equipment replacement /17/. SO₂ is a harmful gas and requires additional safety requirements (masks, monitoring equipment, etc) and training of personnel. The costs of SO₂, ratio of SO₂ to SF₆, capital investment and maintenance have been taken into account in the financial analysis /3/.

(b) SF₆- continuation of current practice;

No barriers are present for the continuation of the use of SF₆ as a cover gas in magnesium production.



(c) HFC134a without the use of carbon credits;

Switching from the use of SF₆ as a cover gas to HFC-134a requires additional costs and has no other benefit. Additionally, there is a discussion of banning the use of HFC-134a in the US and Europe /18/. Hence, Meridian Magnesium does not want to make additional investment in switching to a cover gas, which holds a potential of being banned.

(d) Novec-612™ use i.e. project activity without the use of carbon credits.

Novec-612™ has never been used commercially in USA before. DNV was able to confirm with 3M that Magnesium Meridian were their first clients in the US and second in Canada. The amount of Novec-612™ purchased by the company that did the first purchase of Novec-612™ in Canada is very small and hence can not be compared with Meridian Magnesium. Meridian Magnesium had to conduct many trials under various operating conditions prior to choosing this as a cover gas. Novec-612™ is also 1.5 times more expensive than SF₆ /17/. The higher cost of Novec-612™, capital cost of switching and additional cost of trials makes this an unlikely option as a baseline scenario.

(e) SF₆ capture and reuse;

SF₆ capture and use faces technological barriers /21/. SF₆ is difficult to capture given the temperatures and other environmental conditions in the pots themselves. Evaluation of the technical feasibility associated with installing either SF₆ capture/recycle systems is currently under progress.

(f) Process modifications / optimizations to minimize SF₆ consumption.

Meridian Magnesium has already implemented SF₆ optimization methods. The SF₆ usage in the US plant has been reduced by 80%, i.e. from 28 bottles to 8 bottles per month. The US EPA has submitted a memo that reflects the SF₆ usage rate in Meridian Magnesium compared to other magnesium industries /5/. This memo not only reflects the constant decrease in the SF₆ usage in Meridian Magnesium from 1999, but also reflects the kg SF₆ usage per tonne of Magnesium compared to other magnesium industries in the US.

Based on the barrier analysis presented in the VCS PD, DNV was able to conclude that the continuation of the use of SF₆ as cover gas is the most plausible of all the above given alternatives.

Step 3: Meridian Magnesium has further conducted an investment analysis for the below given alternatives:

- (a) Advanced “dilute SO₂” melt protection technology without the use of carbon credits.
- (b) SF₆- continuation of current practice;
- (d) Perfluoro-2-methyl-3-pentanone (Novec-612™) without the use of carbon credits.

The alternatives (a) and (d) combined are part of the project activity without carbon incentives. The investment analysis reflected the following costs as provided in AM0065.

- Cost of installing new equipment to work on alternate cover gas;



- Additional maintenance and training costs due to the SF₆ switch;
- Cost of raw material;
- Cost of new safety measures (in the case of advanced “dilute SO₂” melt protection technology), including the abatement system;

An ex-ante estimation of the project emission and quantity of cover gas (Novec-612™ and SO₂) was carried out by Meridian Magnesium through trials in the US and Canadian plants. From the trials, the ratio of the use of SF₆: SO₂ was estimated as 1:1 and the ratio of the use of SF₆: Novec-612™ was 1: 0.75. The per ton cost of SO₂ is 40% lesser than per ton cost of SF₆. However, the operation maintenance cost of SO₂ is much higher than SF₆, due to the high safety requirements for SO₂. Per ton of Novec-612™ is 1.5 times the cost of SF₆ /17/. The capital costs of switching from SF₆ to Novec-612™ and SO₂ used for the investment analysis was verified to be a total of \$1,378,000 /3/.

The revenue from VCU's for this project activity have been evaluated by Magnesium Meridian /3/. Switching from SF₆ to Novec-612™ and SO₂ does not fetch any revenue. The revenue earned from the emission reductions can help cover the capital investment and maintenance cost for this project activity.

The project was implemented in the Ontario facility as a pilot project in 2007. January 2007 Meridian Magnesium signed a contract with QualityTonnes , LLC in Jan 2007 (which later was acquired by Climate Change Capital) to provide all services related to monetizing the potential carbon credits from SF₆ replacement projects /22/. This provides evidence that carbon credits were considered prior to the investment decision for this project activity

Step 4: Common practice analysis

This project used the “*Combined tool to identify the baseline scenario and demonstrate additionality*” for the common practice analysis and the information from the three steps above.

Novec-612™ has not been used anywhere else in the US on a commercial basis. In Canada Novec-612™ has been used in one other Magnesium industry. However, the quantity is very small and the use of Novec-612™ at this other Magnesium plan is thus not comparable in scale with the use of Novec-612™ in this project activity. DNV was able to confirm the same through a telephone interview with 3M. SO₂ has been used but on a limited basis only. According to US EPA, Meridian Magnesium will be the first to switch away from SF₆ in the magnesium industry /5/.

3.3 Monitoring Plan

Methodology and applicability

The project applies AM0065, version 1 as the monitoring methodology correctly. It meets all applicability requirements of AM0065, version 1 as detailed in the following:

- SF₆ is replaced in die casting and production of secondary magnesium
- SO₂ is one of the cover gases that are used, only “dilute SO₂” technology is used which meets the safety specifications given in the methodology. The requirement by the



methodology and the procedure by which it has been verified by DNV is provided in the Table 2 below.

Table 2: SO₂ safety requirement specified in AM0065

Requirement	Method of Verification
Well controlled SO ₂ concentration and flow rates with concentration typically 1% or less.	SO ₂ concentration charts were verified to confirm that the SO ₂ concentration was below 1%
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.	The Meridian facility in USA emits a very small amount of SO ₂ and is not regulated. This was verified against the environment and compliance history online (ECHO) The Canadian facility has submitted Amended Certificate of approval from the Ministry of Environment, Ontario
If no local standards exist, the following value should be taken into account as a emission limit for SO ₂ concentration in the exhaust system 1470 mg/m ³ (dry basis, 273 K, 101,325 kPa at an oxygen concentration of 6 %(v/v))•	The SO ₂ concentration in the exhaust system was further verified by the emissions report.
Precise gas mixing and delivery system using mass flow controllers (MFC) or similarly accurate device and heated gas lines to SO ₂	Verified during visit to US and Canadian plant
Gas cabinet or cylinder storage area with leak monitors and emergency ventilation system.	Verified Gas Cabinet with leak monitors at both facilities
Redundant / back-up melt protection technology in case SO ₂ leak requires system shut-down and repair	SF ₆ system is in place and can be used in the event of emergency. Both facilities also have premixed bank of gas ready for use. Monitors in place shut system down if they detect concentration of 1 PPM SO ₂ and auto switch to SF ₆ system.
Emergency response plan, training, and personal safety equipment;	The training manual and presentation for emergency response, training and safety was reviewed during the site visit./7/
Back-up power / generator for gas mixing system and necessary controls, compressors, etc.	12 kW backup generator is in place and has an auto start facility in the event of power outage.

- From the baseline scenario determination it has been established that the baseline scenario is the continuation of current practice of using SF₆ as a cover gas.
- Magnesium Meridian USA plant started operation in 1993 and the Canadian plant started operation in 1981. They have been operating for more than three years and have provided three years data prior to the implementation of the project for ex-ante emission reduction estimation.



The monitoring plan provides information related to collection and archiving of relevant data needed to estimate, measure and determine project emissions, baseline emissions.

1) *Project emissions:*

Project emissions include emissions from the cover gas consumed; Novec-612™ or SO₂, and emissions from the use of SF₆, if any.

2) *Baseline emissions:*

Baseline emissions include:

- Ex-ante: Emissions from the use SF₆ in the magnesium industry. The lowest amount of emissions from the past three years historical data will be used.
- Ex-post estimation: The amount of SF₆ replaced on the basis of the actual amount of Magnesium produced annually.



Parameter	Location		Unit	Measuring Equipment	Recording Frequency	Calibration Frequency
	USA	Canada				
Consumption of Novec-612™ gas in project scenario for each equipment <i>k</i> in each segment <i>j</i> per year	Remelt Cover gas cabinet	Main Die Cast Cover gas cabinet	(t/yr)	Flow meter	Continuous	Annually
Consumption of SO ₂ gas in project scenario for each equipment <i>k</i> in each segment <i>j</i> per year	Remelt Cover gas cabinet	Recycling Cover gas cabinet	(t/yr)	Flow meter	Continuous	Annually
Production output: Annual amount of Mg or Mg products manufactured in project scenario	Recycling & Die Casting	Recycling & Die Casting	(tMg /yr)	Scales	Daily	Annually
Consumption of SF ₆ gas in project scenario for each equipment <i>k</i> in each segment <i>j</i> per year	Each Cell	Each Cell	(t/yr)	Flow Meter	Monthly	Annually



The Magnesium sales reports are not compared to the total amount of magnesium produced annually. This is because a major portion of the magnesium is recycled.

All the monitored data will be archived for a period of two years after the crediting period.

3) Leakage:

No leakage needs to be addressed according to the AM0065 Version 1.

Magnesium Meridian (project developers) is responsible for the monitoring measurement and reporting activities. They maintain the collection system with proper equipment calibration and training of site employees and submit monitoring reports to Climate Change Capital. Chuck Woodburn, facilities engineer has the overall responsibility for all aspects of monitoring activities.

Climate Change Capital (Carbon Credit Company) will be mainly responsible for developing the annual monitoring reports and maintaining the relevant records for verification. They will hold the overall responsibility for the project activity.

3.4 Calculation of GHG Emissions

The GHG sources are identified appropriately; the formulas and factors used for calculation are correct and transparent.

1) Project Emissions

The monitoring plan provides information related to collection and archiving of relevant data needed to estimate, measure and determine project emissions, baseline emissions. The project emissions can be calculated using the following equation:

$$PE_y = PE_{ALTGAS} + PE_{SF6,y}$$

Where:

$$\begin{aligned} PE &= \text{Project emissions} \\ PE_{ALTGAS,y} &= \text{Project emissions from the use of Perfluoro-2-methyl-3-pentanone (Novec-612TM), if it is used as cover gas in project scenario -} \\ &\quad \text{summing of all segments } j \text{ in year } y \text{ (tCO}_2\text{e/yr)} \\ PE_{SF6,y} &= \text{Project emissions from the use of SF}_6 \text{ - summing of all segments } j \text{ - in} \\ &\quad \text{year } y \end{aligned}$$

Project emissions from the use of Alternate gas

$$PE_{ALTGAS,y} = \sum_j \sum_k C_{ALTGAS,PJ,k,j,y} * GWP_{ALTGAS} * CF$$

Where:

$$C_{ALTGAS,PJ,k,j,y} = \text{Consumption of alternate gas in project scenario for each equipment } k \text{ in each segment } j \text{ per year (t / yr)}$$



GWP_{ALTGAS} = Global Warming Potential of alternate gas (Perfluoro-2-methyl-3-pentanone/ Novec-612™) the value used is 1

CF = Conservative Factor. To compensate for the uncertainty in the global warming potential of the by products emitted after the degradation of the alternate gas (default value of 2,830 for Perfluoro-2-methyl-3-pentanone/Novec-612™)

The ex-ante estimation of the amount of Novec-612™ used during the crediting period is 75% percent of the amount of SF_6 used during the year prior to project implementation. The ratio of the amount of Novec-612™ required per ton of Magnesium produced to the amount of SF_6 required per ton of Magnesium is based on pilot tests that were carried out in the Canada plant in 2007 /19/.

Project emissions from the use of SF_6

$$PE_{SF_6,y} = \sum_j \sum_k C_{SF_6,EM,PJ,j,k,y} * GWP_{SF_6}$$

Where:

$C_{SF_6,EM,PJ,j,k,y}$ = SF_6 actually emitted in the project scenario in each equipment k of each segment j , per year y (tSF_6/yr) * GWP_{SF_6}

GWP_{SF_6} = Global Warming Potential of SF_6 (tCO_2e/ tSF_6) = 22,200

$$C_{SF_6,EM,PJ,j,k,y} = C_{SF\ CON\ PJ\ k\ j\ y} * DF_{SF\ k\ j} * DI_{SF\ CON\ PJ\ k\ j\ y}$$

Where:

$C_{SF\ CON\ PJ\ k\ j\ y}$ = Total consumption of SF_6 in the project scenario in each equipment k for each segment j , per year y (tSF_6/yr)

$DF_{SF\ k\ j}$ = Degradation Factor of SF_6 that reacts with the magnesium in the production process assumed as 0.5.

$DI_{SF\ CON\ PJ\ k\ j\ y}$ = A conservative factor portraying the Data Integrity of $C_{SF_6,CON,PJ,k,j,y}$ in each segment, per year. (Fraction) = 0.95

The project does not estimate any project emissions from SF_6 , as part of the ex-ante estimation. The project intends to completely replace the use of SF_6 with alternate cover gas i.e. Novec-612™ and SO_2 . However, SF_6 will still be included in the monitoring plan and will be monitored when used in case of emergency.

2) Baseline emissions

Baseline emissions include emissions from the use SF_6 in the magnesium industry. The lowest amount of emissions from the past three years historical data will be used. In case only the historical annual consumption for SF_6 for the total facility is available, baseline emissions shall be calculated using the following equations (Case 2):

$$BE_y = \sum_j \sum_k P_{Mg,PJ,k,y} GWP_{SF_6} EF_{SF_6,Mg}$$

Where:

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



$EF_{SF_6, Mg}$ = Baseline emission factor for the facility calculated as the minimum emission factor for 3 years of data (tSF₆/ tMg)
 $P_{Mg, PJ, k, j, y}$ = Annual amount of Mg products manufactured in project scenario in the facility per year y
 GWP_{SF_6} = Global Warming Potential of SF₆ (tCO₂e/ tSF₆) = 22,200 (tCO₂e/ tSF₆)

And

$$E_{SF\ Mg} = \text{Min}\{ C_{SF, EM, BL} / P_{Mg, BL, TOTAL} \}$$

Where:

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

$C_{SF_6, EM, BL}$ = Total SF₆ actually emitted in the baseline in the facility. (tSF₆/ yr)

The SF₆ replacement pilot project was implemented in the Canadian plant in the year 2007. The historical data for the years 2006, 2005 and 2004 have been submitted. In U.S., SF₆ replacement project was implemented in 2008. The historical data for the years 2007, 2006 and 2005 was submitted to DNV.

The baseline emission factors are as follows:

USA facility (EFSF₆,Mg)

Die Casting – 0.000092

Recycling - 0.000385

Canadian facility (EFSF₆,Mg)

Die Casting - 0.0000549

Recycling - 0.000684

- *Leakage*

No leakage needs to be addressed according to the AM0065 Version 1.

- *Emission reductions*

The emission reductions for the project activity for the crediting period of 2007 to 2017 have been estimated to be 3,335,835 tCO₂e and was calculated using

$$ER_y = BE_y - PE_y$$

3.5 *Environmental Impact*

All relevant permits to ensure the project's design and implementation have been carried out in compliance with all relevant local and national environmental legislations have been verified by DNV /8//9/. Novec-612™ is being used for the first time as a cover gas in Magnesium Industry in this project activity. DNV has verified literature submitted by the project proponent demonstrating that Novec-612™ has no environmental impact. The literature submitted to DNV states that Novec-612™ has an atmospheric lifetime of 1-2 weeks. After degradation, none of the degradation products at concentrations expected in the environment are considered harmful. /10



3.6 Comments by stakeholders

Not addressed in the PD. No requirement in VCS 2007.1.



4. Validation conclusion

Det Norske Veritas Certification AS (DNV) has performed a validation of the “Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON” project. The validation was performed on the basis of VCS, 2007.1 criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting. The review of the project design documentation and the subsequent follow-up interviews have provided DNV with sufficient evidence to determine the fulfilment of stated criteria.

The project correctly applies the approved CDM baseline and monitoring methodology AM0065, version 1 “Replacement of SF₆ with alternate cover gas in the magnesium industry”. By replacing SF₆ with Novec-612TM and SO₂ as a cover gas in production of magnesium in Meridian Magnesium facilities, the project avoids the emission of SF₆ into the atmosphere. SF₆ is a greenhouse gas that has a high global warming potential of 22,200. The project results in emission reductions that are real, measurable and give long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.

The total emission reductions from the project are estimated to be 3,335,835 tCO₂e for the crediting period of for the crediting period of 1 January 2007 until 31 December 2016. The emission reduction forecast has been checked and is deemed likely that the state amount is achieved given that the underlying assumptions do not change. Adequate training and monitoring procedures have been implemented. The project proponent has not submitted a letter from the designated national authority of Canada that emissions allowances equivalent to the reductions or removals generated by the project have been cancelled national cap as applicable.

In summary, it is DNV’s opinion that the “Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON” project, as described in the VCS PD of 9 March 2009, meets all relevant VCS, 2007.1 requirements and correctly applies the CDM baseline and monitoring methodology AM0065, version 1. However, confirmation by the government of Canada that the reductions generated by the project will be cancelled from the national cap has not yet been received.

The validation of the project is based on the information made available to us and the engagement conditions detailed in this report. DNV can not guarantee the accuracy or correctness of this information. Hence, DNV cannot be held liable by any party for decisions made or not made based on this report.

Appendix A

Validation Protocol

Table 1 Requirements Checklist

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
A. General Description of Project Activity <i>The project design is assessed.</i>					
A.1. Project Boundaries <i>Project Boundaries are the limits and borders defining the GHG emission reduction project.</i>					
A.1.1. Are the project's spatial (geographical) boundaries clearly defined?	/1/	DR I	Yes. The project is has two facilities, one is located in Eaton Rapids, Michigan, U.S.A. 48827 and the other is located in Strathroy, Ontario N7G. This is confirmed by DNV's site visit. The co-ordinates for the two locations are Longitude Latitude Eaton Rapids 42° 31' N 84° 38'W Strathroy 42° 59' N 81° 62'W		OK
A.1.2. Are the project's system (components and facilities used to mitigate GHGs) boundaries clearly defined?	/1/	DR I	The system boundaries include the necessary piping and other equipment required to switch from SF6 to Novec-612™ and SO2.		OK
A.2. Technology to be employed <i>Validation of project technology focuses on the project engineering, choice of technology and competence/ maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is used.</i>					
A.2.1. Does the project design engineering reflect	/1/	DR	Yes. The project design engineering reflects		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
current good practices?			current good practices. The project replaces SF6 (a greenhouse gas with high global warming potential) with Novec-612™ and SO ₂ .		
A.2.2. Does the project use state of the art technology or would the technology result in a significantly better performance than any commonly used technologies in the host country?	/1/	DR I	Yes, Novec-612™ is a recently-patented gas by 3M. It is the latest technology compared to other cover gases currently being used.		OK
A.2.3. Is the project technology likely to be substituted by other or more efficient technologies within the project period?	/1/	DR	The project technology is not expected to be substituted by other or more efficient technology within the project period.		OK
A.2.4. Does the project require extensive initial training and maintenance efforts in order to work as presumed during the project period?	/1/	DR	Yes.		OK
A.2.5. Does the project make provisions for meeting training and maintenance needs?	/1/	DR I	Relevant evidence for meeting training and maintenance needs has been provided to DNV. The training and maintenance material was evidenced during the site visit.		OK
A.3. Contribution to Sustainable Development <i>The project's contribution to sustainable development is assessed.</i>	/1/				
A.3.1. Is the project in line with relevant legislation and plans in the host country?	/1/	DR	Yes. The Michigan plant has very low amounts of SO ₂ usage and does fall under the regulation. This was verified through the EPA website /14. The Canadian facility has provided the relevant air permits /8/9		OK
A.3.2. Will the project create other environmental or social benefits than GHG emission reductions?	/1/	DR	No,		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
B. Project Baseline <i>The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.</i>					
B.1. Baseline Methodology <i>It is assessed whether the project applies an appropriate baseline methodology.</i>					
B.1.1. Is the baseline methodology previously approved by the VCS?	/1/	DR	Yes, the project uses the CDM – approved baseline methodology AM0065: “Replacement of SF ₆ with alternate cover gas in the magnesium industry”, version 1.		OK
B.1.2. Is the baseline methodology the one deemed most applicable for this project and is the appropriateness justified?	/1/ /5/ /15/ /16/ /17/	DR I	This project covers both die-casting and recycling and is thus eligible under the methodology AM0065. The US and Canadian plant has been operational for more than three years. The three years historic data has been verified during the site visit to Eaton Rapids, MI and Strathroy, Ontario. A memo from the EPA evidencing that the Eaton Rapids site has been using SF₆ from the year 2001 has been submitted to DNV/5/ The project activity uses “dilute SO₂” melt protection technology that meets the specifications listed in AM0065. This was verified during the site visit. The SO₂ usage requirements have been met		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			by the project. This has been verified during the site visit. • The SO₂ concentration and flow rate concentration is less than 1 % for Die casting and recycling /15/. The SO₂ concentration for recycling will be reduced to lesser than 1 %. • SO₂ concentration at the exhausting system for Strathroy and Eaton Rapids plants were obtained from testing - 1.93 mg/m³ (dry basis, 273 K, 101,325 kPa at an oxygen concentration of 6 %(v/v);/16/ • Precise gas mixing and delivery system using mass flow controllers (MFC) • Gas cabinet with leak monitors and emergency ventilation system. • Back-up melt protection technology in case SO₂ leak requires system shut-down and repair; • Emergency response plan, training, and personal safety equipment;/7/ • Back-up power 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		

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			and consistent operation.		
B.2. Baseline Determination <i>The choice of baseline will be validated with focus on whether the baseline is a likely scenario, whether the project itself is not a likely baseline scenario, and whether the baseline is complete and transparent.</i>					
B.2.1. Is the application of the methodology and the discussion and determination of the chosen baseline transparent?	/1/ /24/ /25/	DR	The baseline has to be chosen in line with the “Combined tool to identify the baseline scenario and demonstrate additionality” and Voluntary Carbon Standard, 2007.1. In Step 2: Barrier Analysis The alternatives should be eliminated based on one of the following barriers • Investment barrier • Technological barrier • Lack of prevailing practice and • Other barriers, preferably specified in the underlying methodology as examples In the VCS PD, none of barriers eliminated have been classified under the above listed barriers. Reference or evidence for the technological barriers of SF6 capture and reuse is to be submitted to DNV Back ground documents establishing the fact that the optimization process has already been implemented, are to be submitted to DNV. In Step 3: Investment Analysis The amount of Novec-612™/SO2 used per ton		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			of Mg produced in the 2007 and the amount of SF₆ used per ton of Mg produced in the year 2006 is not reflected in the financial analysis. The row for the cost of raw material has also been left blank. Step 4: Common Practice Analysis Novec-612™ has not been used anywhere else in the US on a commercial basis. SO₂ has been used but on a limited basis. A letter has been submitted by the US EPA establishing the fact that Meridian Magnesium is the first to completely switch away from SF₆. DNV has also been able to confirm with 3M that Meridian Magnesium was the first company in the US to purchase Novec-612™, which is patented by 3M. The chosen baseline scenario is the continuation of the use of SF₆ as cover gas for die casting and recycling processes.	CAR 2	
B.2.2. Has the baseline been determined using conservative assumptions where possible?	/1/ /24/ /25/	DR	See B.2.1	CAR 2, CL 2	OK
B.2.3. Has the baseline been established on a project-specific basis?	/1/ /24/ /25/	DR	See B.2.1	CAR 2, CL 2	OK
B.2.4. Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political	/1/ /24/ /25/	DR	See B.2.1	CAR 2, CL 2	OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
aspirations?					
B.2.5. Is the baseline determination compatible with the available data?	/1/ /24/ /25/	DR	See B.2.1	CAR 2, CL 2	
B.2.6. Does the selected baseline represent the most likely scenario among other possible and/or discussed scenarios?	/1/ /24/ /25/	DR	See B.2.1	CAR 2, CL 2	OK
B.2.7. Is it demonstrated/justified that the project activity itself is not a likely baseline scenario?	/1/ /24/ /25/	DR	The additionality has been chosen in line with the "Combined tool to identify the baseline scenario and demonstrate additionality" and Voluntary Carbon Standard, <i>Verification Protocol and Criteria</i> , 2007.1.	CAR 2, CL 2	OK
B.2.8. Have the major risks to the baseline been identified?	/1/ /24/ /25/	DR	Yes		OK
B.2.9. Is all literature and sources clearly referenced?	/1/ /24/ /25/	DR	Yes		OK
C. Duration of the Project/ Crediting Period <i>It is assessed whether the temporary boundaries of the project are clearly defined.</i>					
C.1.1. Are the project's starting date and operational lifetime clearly defined and reasonable?	/1/	DR I	The project starting date is to be provided in the PD.		OK
C.1.2. Is the assumed crediting time clearly defined?	/1/	DR	The crediting period needs to be described in the PD. This should include the start date of the crediting period.		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
D. Monitoring Plan <i>The monitoring plan review aims to establish whether all relevant project aspects deemed necessary to monitor and report reliable emission reductions are properly addressed ((Blue text contains requirements to be assessed for optional review of monitoring methodology prior to submission and approval by CDM EB).</i>					
D.1. Monitoring Methodology <i>It is assessed whether the project applies an appropriate baseline methodology.</i>					
D.1.1. Is the monitoring methodology previously approved by the VCS?	/24/ /25/	DR	Yes, the project uses the approved monitoring methodology AM0065: <i>Replacement of SF6 with alternate cover gas in the magnesium industry</i> , Version 01.		OK
D.1.2. Is the monitoring methodology applicable for this project and is the appropriateness justified?	/1/ /24/ /25/	DR I	The project meets all applicability requirements of AM0065, version 1 as detailed below: SF₆ is replaced in die casting and production of secondary magnesium SO₂ is one of the cover gases that are used, only “dilute SO₂” technology is used which meets the safety specifications given in the methodology A cap limit of SO₂ concentration in the exhausting system – 1470 mg/m³ (dry basis, 273 K, 101,325 kPa at an oxygen concentration of 6 % (v/v) is maintained in both the US and Canadian facilities.		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			From the baseline scenario determination it has been established that the baseline scenario is the continuation of current practice of using SF ₆ as a cover gas. Magnesium Meridian USA plant started operation in 1993 and the Canadian plant started operation in 1981. They have been operating for more than three years and have provided three years data prior to the implementation of the project for ex-ante emission reduction estimation. The Canadian and US plant have been using SF ₆ as a cover gas from the year 2001. This was verified during the site visit.		
D.1.3. Does the monitoring methodology reflect good monitoring and reporting practices?	/1/	DR	Yes.		OK
D.1.4. Is the discussion and selection of the monitoring methodology transparent?	/1/ /24/ /25/	DR	Yes.		OK
D.2. Monitoring of Project Emissions <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>					
D.2.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period?	/1/	DR	Magnesium Meridian (project developers) is responsible for the monitoring measurement and reporting activities. They maintain the collection system with proper equipment calibration and training of site employees and submit monitoring reports to Climate Change		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			Capital. Chuck Woodburn, facilities engineer has the overall responsibility for all aspects of monitoring activities. Climate Change Capital (Carbon Credit Company) will be mainly responsible for developing the annual monitoring reports and maintaining the relevant records for verification. They will hold the overall responsibility for the project activity.		
D.3. Monitoring of Leakage <i>It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.</i>					
D.3.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining leakage?	/1/ /24/ /25/	DR	Not required by AM0065, as no leakage is expected from the project activity.		OK
D.4. Monitoring of Baseline Emissions <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>					
D.4.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period?	/1/ /24/ /25/	DR	Yes, the monitoring plan provides for the collection and archiving of all data parameters as provided in AM0065. The value of the amount of Mg products manufactured in the baseline scenario ($P_{Mg, BL}$ and TOTAL) is to be updated in section 3.3 of the PD. The value of the minimum of annual TOTAL consumption of SF ₆ in the facility for the last three years prior to validation ($C_{SF6, TOT}$ and BL) is to		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			be updated in section 3.3 of the PD.		
D.4.2. Is the choice of baseline indicators, in particular for baseline emissions, reasonable?	/1/ /24/ /25/	DR	Yes		OK
D.4.3. Will it be possible to monitor / measure the specified baseline indicators?	/1/ /24/ /25/	DR	Yes		OK
D.4.4. Will the indicators give opportunity for real measurements of baseline emissions?	/1/ /24/ /25/	DR	Yes		OK
D.5. Monitoring of Sustainable Development Indicators/ Environmental Impacts <i>It is checked that choices of indicators are reasonable and complete to monitor sustainable performance over time.</i>					
D.5.1. Does the monitoring plan provide the collection and archiving of relevant data concerning environmental, social and economic impacts?	/1/ /24/ /25/	DR I	Monitoring of the environmental and social impacts of the project activity is not required by US regulations or AM0065 or Voluntary Carbon Standard, <i>Verification Protocol and Criteria, 2007.1.</i>		OK
D.6. Project Management Planning <i>It is checked that project implementation is properly prepared for and that critical arrangements are addressed.</i>					
D.6.1. Is the authority and responsibility of project management clearly described?	/1/ /24/	DR I	Yes, Facilities Engineer, Meridian Magnesium is responsible for overall project management, including all technical aspects, carrying out all		OK



Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
	/25/		monitoring and data collection.		
D.6.2. Is the authority and responsibility for registration, monitoring, measurement and reporting clearly described?	/1/ /24/ /25/	DR I	Yes, Facilities Engineer, Meridian Magnesium is responsible for overall project management, including all technical aspects, carrying out all monitoring and data collection.		OK
D.6.3. Are procedures identified for training of monitoring personnel?	/1/	DR	Yes, training of personnel have been provided and verified during the site visit.		OK
D.6.4. Are procedures identified for emergency preparedness for cases where emergencies can cause unintended emissions?	/1/	DR	Emergencies that could cause unintended emissions are to be identified and emergency preparedness to monitor these emissions is to be documented.		OK
D.6.5. Are procedures identified for calibration of monitoring equipment?	/1/	DR	Calibration records have been documented and verified during site visit.		OK
D.6.6. Are procedures identified for maintenance of monitoring equipment and installations?	/1/	DR	The procedures for maintenance of monitoring equipment and installation have been identified and documented.		OK
D.6.7. Are procedures identified for monitoring, measurements and reporting?	/1/	DR	Yes		OK
D. 6.8. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)	/1/	DR	Procedures are to be identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)		OK
D.6.9. Are procedures identified for review of reported results/data?	/1/	DR	Yes		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
E. Calculation of GHG Emissions by Source <i>It is assessed whether all material GHG emission sources are addressed and how sensitivities and data uncertainties have been addressed to arrive at conservative estimates of projected emission reductions.</i>					
E.1. Project GHG Emissions <i>The validation of ex-ante estimated project GHG emissions focuses on transparency and completeness of calculations.</i>					
E.1.1. Are all aspects related to direct and indirect GHG emissions captured in the project design?	/1/	DR I	The direct and indirect GHG emissions from the project activity have been captured in the PD. The project emissions taken into account are emissions from the use of alternate cover gas Novec-612™ and SO ₂ . The monitoring procedure for the same has been verified during the site visit.		OK
E.2. Leakage <i>It is assessed whether there leakage effects, i.e. change of emissions which occurs outside the project boundary and which are measurable and attributable to the project, have been properly assessed and estimated ex-ante.</i>					
E.2.1. Are potential leakage effects beyond the chosen project boundaries properly identified?	/1/	DR	This is not required by AM0065.		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
E.3. Baseline Emissions <i>The validation of ex-ante estimated baseline GHG emissions focuses on transparency and completeness of calculations.</i>					
E.3.1. Have the most relevant and likely operational characteristics and baseline indicators been chosen as reference for baseline emissions?	/1/	DR	The baseline emissions have been estimated in line with the methodology AM0065. The baseline emissions estimation is based on annual amount of magnesium manufactured in project scenario in equipment per year and the baseline emission factor for equipment. The emission factor is estimated based on the SF ₆ actually emitted in the baseline by the total facility and the Magnesium produced by the total facility in the last three years.		OK
E.3.2. Are the baseline boundaries clearly defined and do they sufficiently cover sources and sinks for baseline emissions?	/1/ /24/ /25/	DR	Yes.		OK
E.3.3. Are the GHG calculations documented in a complete and transparent manner?	/1/ /24/ /25/	DR	The input values have to be revised based on re-verification of source data.		OK
E.3.4. Have conservative assumptions been used when calculating baseline emissions?	/1/ /24/ /25/	DR	The baseline emission estimation is based on the emission factor. The emission factor has been estimated using the historical magnesium production and SF ₆ emissions per year. To be conservative the minimum value (magnesium produced and SF ₆ emitted) of the three years has been used. Additionally, the following conservative factors have been used:		OK

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			Degradation factor – 0.5 Data Integrity of consumption of SF ₆ – 0.95 Conservative Factor to compensate for the uncertainty of the GWP of Novec-612™ – 2,830		
E.3.5. Are uncertainties in the GHG emission estimates properly addressed in the documentation?	/1/ /24/ /25/	DR	Yes		OK
E.3.6. Have the project baseline(s) and the project emissions been determined using the same appropriate methodology and conservative assumptions?	/24/ /25/	DR	Yes, both use AM0065.		OK
E.4.Emission Reductions <i>Validation of ex-ante estimated emission reductions.</i>					
E.4.1. Will the project result in fewer GHG emissions than the baseline scenario?	/1/ /24/ /25/	DR	Yes. The emissions reductions will change based on the revised input data for the GHG emission reduction calculation.		OK

Table 2: List of Corrective actions and clarifications

[illegible]

		Meridian is lesser compared to other Magnesium plants in the US.
CAR 2 (continuation) Step 1 – This should include the alternative of Novec-612™ and SO2 as a baseline scenario – i.e.: project activity without carbon revenues. Reference or evidence for the technological barriers of SF6 capture and reuse is to be submitted to DNV – letter from EPA describing the difficulty of capture of SF6 Documented evidence to show that Meridian Magnesium was the first company to shift from SF6 to Novec-612™.		
CAR 3 Emission Reductions During the site visit, DNV identified few discrepancies with the values provided in the calculation sheet and the source documents verified. They are: • The amount of SF6 used for Die Casting in the US plant for the years 2005, 2006 and 2007. • The amount of SF6 used for recycling in the US plant for the years 2005 and 2007. • The amount of metal used for recycling in the US plant for the years 2005 and 2007. • The amount of SF6 used for Die Casting in the Canadian plant for the year 2005. • The total amount of Mg that underwent Die Casting in the Canadian plant for the years 2005 and 2006 • Total amount of Mg recycled in the Canadian plant for	The calculation worksheet revised and pending documentation submitted.	The amounts of SF6 used for recycling and die casting and the amount of Mg that underwent die casting and was recycled in the US plant was revised in the calculation sheet to match the verified amount in the data source. The pending documents from the US and Canadian plant were submitted to DNV for verification. CAR 3 closed

the years 2005 and 2006.

Data Point	Calculation Sheet	Value in Document Verified	Source Document
US, SF6 Die Casting -- 2005	14,740	14,740	Report to EPA, site visit
US, SF6 Die Casting -- 2006	12,980	10,788	Site visit
US, SF6 Die Casting -- 2007	11,000	10,981	EMF 10 form and Sf6 usage record. Site visit
US, SF6 Recycling -- 2005	34,980	34,234	Report to EPA. Site visit
US, SF6 Recycling- 2006	34,650	34,923	Report to EPA. Site visit
US, SF6 Recycling -- 2007	42,510	44,222	Report to EPA. Site visit
US, Metal, Recycling,	43,200,000	42236980	MPA - Internal

2005			Recycling, Key performance indictor, December 2005		
US, Metal Recycling, 2007	40,668,805	40,683,251			
Canada, SF6 Die Casting -- 2005	22,523 (lbs)	7386	2005 SF6 usage/ lbs		
Canada, Mg production Die Casting – 2005	29,530 short tons	29,071 MT	Attached for ref		
Canada, Mg production Die Casting – 2006	27,528 short tons	26,950.27 MT	Attached for ref		
Canada, Mg, recycled, 2005	6,507 Short tons	6,457.37 MT	Attached for ref		
Canada, Mg, recycled, 2006	6,507 Short tons	6,262.15 MT	Attached for ref		
The documents to be submitted to DNV for the verification					

of the emission reduction calculations are as follows: • Amount of Mg used for die casting in the US plant for the years 2005, 2006 and 2007. • The amount of metal used for die casting in the Canadian plant for the years 2005, 2006 and 2007. • The amount of SF6 used for Die Casting in the Canadian plant for the year 2004 and 2006. • The total amount of Mg used for die casting in the Canadian plant for the year 2004. • The amount of SF6 used for recycling in the Canadian plant for the years 2004, 2005 and 2006.		
CL 1 The internal rate of return for the project activity is not reflected in the calculation worksheet submitted to DNV. The IRR of the alternatives should be compared and it should be established that the baseline has the lowest IRR in the VCS PD. The IRR value without carbon funds and with carbon funds should be included in the VCS PD.	Below are the following alternatives: (a) Advanced “dilute SO2” melt protection technology without the use of carbon credits. (b) SF6 capture and reuse. (c) Process modifications / optimizations to minimize SF6 consumption. (d) HFC134a without the use of carbon credits. (e) Perfluoro-2-methyl-3-pentanone (Novec-612™) without the use of carbon credits. (f) SF6- continuation of current practice. Options A and E – the project without carbon credits – has been analyzed and documents sent to DNV. These documents clearly show that the project without CDM credits has much greater costs than simply using SF6. The costs	The financial analysis has been verified for this project and has been confirmed that the project has no economic benefits from the implementation of the project activity. The project results in a negative NPV without the revenue from carbon credits. CL 1 is closed

	of doing the project are entirely negative, as there is no economic benefit to using alternative gases (while the SO₂ is cheaper than SF₆, the on-going operational costs associated with protecting workers from the gas make SO₂ operationally more expensive than SF₆). Because Options A and E are entirely cash-negative, no IRR analysis could be performed. IRR cannot be calculated because values must contain at least one positive value and one negative value to calculate the internal rate of return. However, the very negative NPV values of Option A and E have been provided to DNV. As for Options B, C and D, all possible optimization opportunities have already been implemented, as described in the PD. Thus, no additional ways to optimized can be obtained, and thus it is not possible to develop an IRR for this scenario. The same situation exists – an inability to develop an IRR analysis for the other scenarios – as recycling and reusing SF₆ is not a technically-feasible option and Meridian Magnesium could not use HFC since it could potentially be banned in Canada. If baseline scenarios are not technically possible, then no IRR analysis can be	
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	conducted. We hope this addresses this CAR.	
CL 2 The amount of Novec-612 TM /SO ₂ used per ton of Mg produced in the 2007 and the amount of SF ₆ used per ton of Mg produced in the year 2006 is not reflected in the financial analysis. The row for the cost of raw material has also been left blank.	No Novec-612 TM and very little SO ₂ was used in 2007. The Novec-612 TM is used in the Meridian Magnesium die casting operations, and those conversions took place in 2008. As for SO ₂ , some of it was used in 2007 in the Canadian recycling operation. As for the second part of the question, it is not clear to us what exactly you mean. The financial spreadsheets did have the raw materials cells filled in (they can be re-sent) and it's not clear why the SF ₆ /Mg figure for 2006 is needed in the FINANCIAL analysis, which looks at costs of the project after implementation. Perhaps this question could be clarified?	The SF ₆ to Novec-612 TM ratio was estimated to be 75% during the Canadian pilot plant tests conducted prior to the start of project activity. This data was submitted to DNV. CL 2 is closed
CL 3 Documents to evidence the capital investment and other assumptions used in the investment barrier are to be submitted to DNV.	Documents were provided	CL 3 is closed
CL 4 The project starting date is to be provided in the PD. The evidence for the starting date should be provided for each location. The VCS 2007.1 definition for project start date has been changed from the "date on which the project reached financial closure" to "the date the project activity began reducing or removing GHG emissions". This change has to be reflected in the VCS PD. The operational lifetime of the project	January 1, 2007, as shown in the contract between Meridian Magnesium and QualityTonnes, a carbon consultant that helped Meridian Magnesium develop the project	The VCS PD reflects January 1 2007. CL 4 is closed

needs to be provided.		
CL 5 The crediting period needs to be described in the PD. This should include the start date of the crediting period.	10 years, starting January 1, 2008	The crediting period is for 10years starting from 1 st January 2008. CL 5 is closed.
CL 6 Emergencies that could cause unintended emissions are to be identified and emergency preparedness to monitor these emissions are to be documented.	The only emergency emissions that could take place, which would have an a climate change impact would be SF6. SO2 is not a global warming gas and Novec-612™ has a GWP of 1. Its by-products are GHGs, but only when heated to extremely high temperatures. The simple release of Novec-612™ would have virtually no global warming impact. As for SF6, emergency emissions can be measured by weighing the cylinders. Meridian Magnesium already has an account of its inventory. If emissions do take place, Meridian Magnesium will weigh the cylinders after the unintended release of SF6, which will determine the amount emitted to the atmosphere.	The emergencies and the preparedness to monitor the project emissions due to these emissions have been described in the VCS PD. CL 6 is closed.
CL 7 The monitoring plan is to be described in section 3.4 of the VCS PD. The procedures for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation) are to be identified and detail provided in the VCS PD.	Included in the PD	The monitoring plan has been described in detail in the revised VCS PD. CL 7 is closed.
CL 8		

The weight of Mg is not measured using a scale for die – casting. The weight of the Mg manufactured for die-casting is assumed based on a check on the dimensions of the parts that are sold. This needs to be explained in section B.7.1.	Put in revised PDD, in monitoring table section	The reason for not using scales for weighing Mg has been provided in the revised VCS PD, along with the description on the accuracy of the method being used for calculating the weight of Magnesium manufactured. CL 8 is closed.
CL 9 Evidence that both plants have been using SF6 for more than 3 years has to be provided to DNV.	As shown in US EPA memo described above, it shows Meridian Magnesium has been using SF6 since 2001	The EPA memo has been verified and accepted. /5/ CL 9 is closed.
CL 10 For the parameter $C_{ALTGAS,PJ,k,j,y}$, it is not clear which of the following options is being used: • Accounting Method • Weight difference method • Flow measurement method This needs to be clearly specified in the VCS PD for both cover gases SO2 and Novec-612™.	Flow measurement method, correction made in the PD	The revised VCS PD has been verified. CL 10 is closed.
CL 11 During the site visit it was mentioned that in case of emergency there would be a possibility that SF6 would be used as cover gas. The parameter “total consumption of SF6 in the industrial facility in the project scenario in each equipment in each segment, per year ($C_{SF6,CON,PJ,k,j,y}$)” should be included in list of parameters to be monitored.	Inserted in the PD	The revised VCS PD has been verified. CL 11 is closed.
CL 12		



The SO₂ emissions from the facility to the ambient air are to be monitored. This is to ensure that a cap limit of SO₂ concentration in the exhausting system – 1470 mg/m³ (273 K, 101,325 kPa at an oxygen concentration of 6 %(v/v) is maintained.	The SO₂ level is much, much lower than the 1,470 limit – at least check, it was less than 2 mg/m³. The limit of 1,470 mg/m³ equates to about 55 ppm, and Meridian Magnesium keeps its SO₂ levels to about 1 ppm. Thus, the emissions will be only a fraction of the overall limit. Monitoring will continue and monitoring table was inserted in PD	The SO₂ emissions monitored are to verified during verification to ensure that the SO₂ levels are not above 1ppm. CL 12 is closed.
CL 13 The sections 4.1 to 4.4 are to be filled in the VCS PD. Please address other comments provided in VCS PD.	Added in VCS PD, dated March 9, 2009.	CL 13 is closed

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