



VERIFICATION REPORT FOR THE CONVERSION OF SF₆ TO AN ALTERNATIVE COVER GAS IN MAGNESIUM PRODUCTION IN EATON RAPIDS, MICHIGAN AND STRATHROY, ONTARIO PROJECT



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Summary:

The Project consists of the replacement of sulfur hexafluoride (SF₆) by an alternative cover gas (Novec-612 or Novec) in the recycling and casting of molten magnesium at Meridian Magnesium Products of America's Eaton Rapids, Michigan facility. The substitution of a lower GWP cover gas results in a net reduction of GHG emissions.

The verification process consists of the independent third-party assessment of the implementation of the Project and emission reduction assertion against the criteria stated in the *Verified Carbon Standard (VCS) Standard Version 4*, 20 January 2022, v4.2; the methodology AM0065 (Version 02.1); and the validated Project Description (VCS PD). The purpose of the verification is to ensure the project was implemented and monitored in accordance with the validated Project Description and underlying methodology.

During the verification process, First Environment issued three corrective action requests and one clarification request, all of which were addressed sufficiently by 3Degrees Group, Inc. No uncertainties were identified during the verification process. The Project claims emission reductions of 89,548 metric tonnes CO₂e for the period of January 1 through December 31, 2021. First Environment is reasonably assured that the Project meets all relevant VCS program requirements and correctly applies the AM0065 methodology (Version 02.1) and the validated VCS PD.

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1 INTRODUCTION

This report is provided to 3Degrees Group, Inc. (3Degrees) as a deliverable of the Verified Carbon Standard (VCS) project verification process for the *Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON* project (the Project). This report covers the verification of greenhouse gas (GHG) emission reductions from the replacement of SF₆ by an alternative cover gas (Novec) in the recycling and casting of molten magnesium at Meridian Magnesium Products over the period from January 1 through December 31, 2021. First Environment, Inc. (First Environment) conducted the verification from the date of the kick-off meeting through June 1, 2022.

1.1 Objective

The purpose of this verification was, through review of appropriate evidence, to establish that the Project conforms to the requirements of the verification criteria discussed in Section 1.2.

1.2 Scope and Criteria

The specific scope metrics for the verification are outlined in the table below:

Geographic Boundaries	Meridian Magnesium Products of America facility in Eaton Rapids, MI
Reporting Period	January 1 through December 31, 2021
Emission Sources Verified	<i>Baseline Sources:</i> - Emissions of SF₆ from use as a cover gas <i>Project Sources:</i> - Emissions of SF₆ in cases where SF₆ is used in the project scenario during the cover gas replacement process - Emissions of Perfluoro-2-methyl-3-pentanone (Novec) from the use as an alternate cover gas - Emissions of CH₄, C₂F₆, and C₃F₈ (accounted for through the calculation of project emissions)
Definition of Materiality	- Misstatements of greater than five percent of the Project's GHG assertion; and - Qualitative non-conformities with the Standards of Verification described below

The following table outlines the guidance and protocols used to conduct this verification:

Standards of Verification	- VCS Standard: VCS Version 4, 20 January 2022, v4.2 (VCS Standard) - AM0065 – Replacement of SF₆ with alternate cover gas in the magnesium industry, Version 02.1 (AM0065) - Validated VCS Project Description (VCS PD), March 27, 2018
Verification Process	- VCS Standard - VCS Program Guide: VCS Version 4, 20 January 2022, v4.1 - ISO 14064-3: Specification with guidance for the validation and verification of greenhouse gas assertions, 2006

The Monitoring Report, dated June 1, 2022 and titled “Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON” Version 2.2, was also used to inform the verification assessment.

1.3 Level of Assurance

First Environment and 3Degrees have agreed that a reasonable level of assurance be applied for the Project.

1.4 Summary Description of the Project

The Project voluntarily replaces the use of SF₆ as a cover gas during magnesium metal recycling and casting at a Meridian Magnesium Products of America's facility in Eaton Rapids, Michigan with an alternative cover gas (Novec-612) that has a lower global warming potential. The GPS coordinates of the project activity are located in Section 1.7 of the Monitoring Report. The Project claims GHG emission reductions from the avoidance of SF₆ emissions, which otherwise would have been emitted to the atmosphere during the manufacturing process. The VCS PD provides additional details regarding the Meridian facility and the emission reduction project.

Though the scope of the offset project also includes Meridian Magnesium Products' facility in Strathroy, Ontario, in the current reporting period emission reductions are only claimed for the Eaton Rapids, Michigan facility.

2 VERIFICATION PROCESS

The verification process consisted of an assessment of the Project's implementation, as described in the Monitoring Report, against the verification criteria described above, as well as an assessment of the GHG emission reduction assertion. Discrepancies between project documentation and the verification criteria were considered material and identified for corrective action.

2.1 Method and Criteria

To review the Project's GHG information, the following verification process was used:

- conflict of interest review;
- selection of Audit Team;
- kick-off meeting with 3Degrees;
- review of the validated VCS PD;
- development of the verification plan and sampling plan;
- site visit;
- desktop review and evaluation of raw data, calculations, and supporting documentation for the period under review;
- follow-up interaction with 3Degrees for corrective action or supplemental data as needed; and
- final statement and report development.

The verification process was utilized to gain an understanding of the Project's GHG emission sources and reductions and to evaluate and verify the collection and handling of data, the calculations that lead to the results, and the means for reporting the associated data and results.

Conflict of Interest Review

Prior to beginning any verification project, First Environment conducts an evaluation to identify any potential conflicts of interest associated with the project. No potential conflicts were found for this project.

Audit Team

First Environment's Audit Team consisted of the following individuals who were selected based on their verification experience, as well as familiarity with industrial gases.

Michael Carim – Lead Verifier
Jeff Daley – Verifier
Logan Simpson - Verifier
James Wintergreen – Independent Reviewe

Audit Kick-off

The verification audit was initiated with a kick-off conference call on April 14, 2022 between First Environment and client contacts, Ms. Julie Kelleher and Ms. Teresa Fukuda. The communication focused on confirming the verification scope, objectives, criteria, schedule, and the data required for the verification.

Project Description Review

The Audit Team reviewed the validated VCS PD as a basis for developing the verification plan.

Development of the Verification and Sampling Plans

The Audit Team formally documented its verification plan as well as determined the data-sampling plan. The verification plan was developed based on discussion of key elements of the verification process during the kick-off meeting. 3Degrees was afforded the opportunity to comment on key elements of the plan for verification. Based on items discussed and agreed upon with 3Degrees, the plan identified the First Environment team members, project level of assurance, materiality threshold, and standards of evaluation and reporting for the verification. It also provided an outline of the verification process and established project deliverables. A separate sampling plan was designed to review all project elements in areas of high risk of inaccuracy or non-conformance.

Site Visit

First Environment performed a site visit during the verification process for the reporting period from November 1, 2017 to December 31, 2018. The site visit, which occurred on May 22, 2019, included interviews with relevant facility personnel, a review of data collection procedures and information management systems, and assessments of the Project's controls for sources of potential errors and omissions. The site inspection included a tour of the project facility, as well as a review of the magnesium production process and all associated monitoring equipment (i.e., data collection and recording systems). Because First Environment issued a positive verification opinion for the reporting periods from January 1 to December 31, 2019 and January 1 to December 31, 2020, and no material changes to data management systems occurred during 2021, a streamlined verification was conducted for the current reporting period and no site visit was performed.

Desktop Review

The Audit Team performed a desktop review of the Monitoring Report, GHG emission reduction assertion, and supporting documentation, as further described in Section 2.2 below.

Corrective Actions and Supplemental Information

The Audit Team issued requests for corrective action and clarification during the verification process. The corrective action requests and the responses provided by 3Degrees are summarized below in Section 2.5 and an appendix to this report.

Verification Reporting

Verification reporting documents the verification process and identifies its findings and results. Verification reporting consists of this report and a separate Deed of Representation to be submitted to Verra.

2.2 Document Review

During the verification process, First Environment reviewed the Project's Monitoring Report, GHG emission reduction assertion, and supporting documentation for the current reporting period to ensure consistency with the validated VCS PD and AM0065. Discrepancies between Project documentation and the verification criteria were considered material and identified for corrective action. Additionally, First Environment assessed the GHG emission reduction assertion and underlying monitoring data to determine if either contained material or immaterial misstatements. The results of these reviews are discussed in greater detail below.

2.3 Interviews

Through the course of verification activities, First Environment interviewed the following project personnel to inform the verification process.

Julie Kelleher – 3Degrees Group, Inc.

Teresa Fukuda – 3Degrees Group, Inc.

Colin Chapman - Meridian Magnesium Products of America

2.4 Site Inspections

As described above, no site visit was performed for the current verification process.

2.5 Resolution of Findings

The Audit Team issued three requests for corrective action and one request for clarification during the verification process. 3Degree's responses were sufficient to resolve the requests. The corrective action and clarification requests and the responses provided are summarized in an appendix to this report.

2.5.1 Forward Action Requests

No forward action requests were issued during the verification process.

2.6 Eligibility for Validation Activities

First Environment is accredited to perform validation activities in Sectoral Scopes 4, 9, and 11, which are the applicable scopes for the approved methodology AM0065.

3 VALIDATION FINDINGS

The validation process consisted of an assessment of any deviations or other discrepancies from information presented in the validated VCS PD. One project description deviation was presented for review during the current verification period. The Audit Team reviewed justification for the deviation, including supporting documentation, as applicable, in order to confirm that it was consistent with the underlying methodology and did not negatively impact the conservativeness or accuracy of the emission reductions.

3.1 Participation under Other GHG Programs

During the current verification process, First Environment reviewed an attestation from 3Degrees confirming that GHG emission reduction credits from the Project have not been registered under another GHG programme.

First Environment concluded that the project is eligible to participate under the VCS programme.

3.2 Methodology Deviations

Not Applicable – No methodology deviations were applied during the current reporting period.

3.3 Project Description Deviations

The following project description deviation was identified in the Monitoring Report and approved for the Project during the current reporting period:

- The global warming potential (GWP) for sulfur hexafluoride (SF₆) has been updated to the value reported in the IPCC's Fifth Assessment Report. This reflects policies allowed in accordance with the most recent version of the VCS Standard (v4.2). First Environment approved this deviation because it is consistent with the most recent VCS Standard guidance.

The deviation described above did not impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario, and the Project remained in conformance with all AM0065 and VCS requirements. 3Degrees provided an appropriate description and justification for the applied deviation. The applied project description deviation was deemed to be valid. The same project description previously was applied and approved for the 2020 reporting period.

3.4 Grouped Project

Not Applicable – The Project Activity is not a Grouped Project.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The Project was implemented according to the approach documented in the validated VCS PD. The replacement of SF₆ commenced in 2008 at the Eaton Rapids, Michigan facility. Alternate cover gas use was implemented in the diecasting process on February 1, 2008 and in the magnesium recycling process on April 1, 2008. This is the fifth reporting period of the Project's second crediting period, which began January 1, 2017 and ends December 31, 2026.

The Audit Team confirmed that no data and/or variables presented in the Monitoring Report differ materially from those stated in the validated VCS PD, except as identified in Section 3.3 above. Similarly, the data collection and recordkeeping procedures were found to be consistent with those outlined in the monitoring plan described by the VCS PD and met the requirements of AM0065. 3Degrees has adequate management and operational systems in place with respect to monitoring and reporting (i.e., the process and schedule for obtaining, recording, compiling, and analysing the monitored data and parameters), as determined through observations made during the previous verification site visit and the desktop review of project documentation conducted during the current verification process.

Through communications with 3Degrees, the Audit Team confirmed that the Project is neither participating in any other GHG programmes or emissions trading programmes, nor has it attempted to

register with any such programmes. As indicated in the validated VCS PD, no other environmental credits are generated by the Project. Further, the Project has not participated or been rejected under any other GHG programmes since validation or previous verification.

The Project contributes to sustainable development objectives by replacing a high global warming potential cover gas with an alternate cover gas of lower global warming potential, thus reducing GHG emissions during the production of magnesium products.

No methodology deviations have been previously validated for the Project.

Overall, the Project is implemented according to the description provided in the VCS PD, and the monitoring system implemented was found appropriate to the task of obtaining, recording, and compiling the monitored data and parameters required for emission reduction quantification.

4.2 Safeguards

4.2.1 No Net Harm

The Project creates no negative environmental or socio-economic impacts.

4.2.2 Local Stakeholder Consultation

Not Applicable.

4.3 AFOLU-Specific Safeguards

Not Applicable.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

Emission reductions are calculated ex-post using the approach indicated in AM0065 and the validated VCS PD. Emission reduction calculations for the reporting period were reviewed to ensure accuracy in the formulas used and the raw data used as inputs. The formulas were tested and found to be consistent with the calculations described in AM0065 and the validated VCS PD.

Baseline emissions are estimated using monitored data for the amount of magnesium metal melted in recycling and diecast operations ($P_{Mg,PJ,k,j,y} / P_{Mg,PJ,y}$) at the Meridian facility. Magnesium melted in the recycling plant ($P_{Mg,recycle,y}$) is determined from the weight of ingots produced plus any dross and scrap. Quantities produced are weighed on a calibrated scale and recorded by plant supervisors in a summary spreadsheet. The weight of ingots and dross produced are also recorded by the facility's Enterprise Resource Planning (ERP) system. The amount of magnesium ingots melted in diecasting operations ($P_{Mg,diecast,y}$) is determined from raw material input data recorded by the facility's ERP system for each batch of cast products manufactured. An output from the ERP system summarizes all magnesium used for diecasting during the reporting period.

Baseline emissions are quantified by the product of $P_{Mg,recycle,y}$ and $P_{Mg,diecast,y}$ by a baseline emission factor ($EF_{SF_6,Mg,k,j}$) and the global warming potential of SF_6 (GWP_{SF_6}). The baseline emission factors for SF_6 emitted in the recycling and diecasting operations were determined at the Project's initial crediting period from historical facility data and reassessed at the crediting period renewal; the verification process confirmed that the values applied in calculations were consistent with the values in the VCS PD approved at validation of the Project's second crediting period.

The total reported quantities for $P_{Mg,recycle,y}$ and $P_{Mg,diecast,y}$ were compared to the weight of magnesium products sold as recorded by the ERP system to assess whether 70 percent of total magnesium produced was sold. This review showed that total magnesium sales did not achieve the threshold of 70 percent of production in 2021. However, Meridian was able to provide justification that a decline in demand occurred in 2021—specifically the impacts of the COVID-19 pandemic and supply chain constraints on the automotive manufacturing sector—that allowed First Environment to conclude that the requirements of AM0065 were satisfied.

Project emissions sources consist of emissions of Novec and SF_6 from their use as cover gases for molten magnesium in the recycling and diecasting processes. Consumption from inventory is tracked by weighing gas cylinders (SF_6) or totes (Novec) before and after each material disbursement to operations. The difference in cylinder/tote weight is recorded and represents consumption; activity data is recorded on paper records and transcribed to Microsoft Excel summary spreadsheets.

Project emissions of Novec ($PE_{ALTGAS,y}$) are quantified by multiplying the quantity of Novec consumed by the GWP of the alternate gas and the Conservative Factor (CF) specified by AM0065.

Project emissions of SF_6 ($PE_{SF6,y}$) are quantified by multiplying the quantity of SF_6 consumed by a Degradation Factor ($DF_{SF6,k,j}$), a data integrity factor ($DI_{SF6,CON,PJ,k,j,y}$), and the GWP of SF_6 (GWP_{SF6}). The values applied for $DF_{SF6,k,j}$ and $DI_{SF6,CON,PJ,k,j,y}$ were determined at the Project's initial crediting period from historical facility data and reassessed at the crediting period renewal; the verification process confirmed that the values applied in calculations were consistent with the values in the VCS PD approved at validation of the Project's second crediting period.

Project emissions from the consumption of CO_2 are excluded because the facility uses CO_2 in its production processes in both the project and baseline scenarios.

Project emissions from consumption of SF_6 and Novec are summed to determine total project emissions. Total emission reductions are quantified as the difference between total baseline and total project emissions.

No SO_2 consumption was identified for the current reporting period. First Environment therefore concluded that the requirements of AM0065 were satisfied.

The verification process focused on the assessment of calculation spreadsheets to ensure that they were consistent with the formulas and equations described in AM0065 and the validated VCS PD. Copies of the raw data used in the calculations, including the quantities of magnesium melted and SF_6 and Novec consumed, were compared with the values used in the final calculations and tested for transcription or mathematical errors. The calculations for the entire period were reviewed as well to determine whether they were free of material misstatement. All calculation methods and emission factors used for quantifying baseline and project emissions were consistent with those outlined in the validated VCS PD. Leakage emissions do not apply. No default values were applied in the Monitoring Report, except as specified by the validated VCS PD and/or AM0065.

The overall GHG emission reductions were quantified correctly in accordance with the validated VCS PD and AM0065 and no material misstatements were detected.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

3Degrees provided adequate documentation for the emission reduction calculations as well as its management systems governing the data collection process. Specifically, First Environment was provided a Monitoring Report prepared in accordance with the VCS programme template, transparent calculation spreadsheets, third-party weigh scale calibration and QA/QC records, internal SF_6 and Novec consumption logs, and operational spreadsheets and ERP reports documenting production of

magnesium ingots and cast products. The assessments performed on this data, as described above, confirmed the reliability of the evidence and verified the accuracy of the information flow.

The evidence provided was consistent with the requirements of AM0065 and the validated VCS PD and meets generally accepted evidentiary standards for best practice in GHG accounting.

4.6 Non-Permanence Risk Analysis

Not applicable.

5 VERIFICATION CONCLUSION

First Environment was retained to provide verification services for the Project's GHG emission reductions assertion based on the following fundamentals:

- *Level of assurance:* Reasonable assurance.
- *Objectives of verification:* To assure project conformance with the VCS Standard, the CDM Methodology AM0065, and the validated VCS PD.
- *Verification criteria:* VCS Standard, the CDM methodology AM0065, and the validated VCS PD.
- *Definition of materiality:* Misstatements of more than five percent of the GHG assertion and qualitative non-conformities with the verification criteria are considered material.
- *Scope, including:*
 - *Boundaries of the assertion:* Meridian Magnesium Products of America, Eaton Rapids, MI facility operations.
 - *The physical infrastructure, facilities, and activities within the assertion:* Magnesium recycling and casting operations.
 - *GHG sources, sinks, and reservoirs included within the assertion:* Fugitive emissions of SF₆ and Novec-612 expressed as CO₂-equivalents; Process emissions of CH₄, C₂F₆, and C₃F₈ expressed as CO₂-equivalents.

Based on the assessments performed and the historical evidence collected, First Environment concludes, with a reasonable level of assurance, that the emissions reductions of the Project resulting from the replacement of SF₆ with an alternative cover gas for the period of January through December 31, 2021 are:

- consistent with the validated VCS PD of March 27, 2018;
- in conformance with the VCS Standard and the CDM methodology AM0065 (Version 02.1); and
- without material discrepancy; and meeting the minimum level of accuracy of at least 95 percent.

Verification period: From 1-January-2021 to 31-December-2021

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2021	192,917	103,369	0	89,548
Total	192,917	103,369	0	89,548

APPENDIX A: DETAILED RESOLUTION OF FINDINGS

ID	Corrective Action Request	Participant Response	Verification Conclusion
1	The monitoring report does not specifically mention the amount of time project data is electronically archived.	Section 4.3 of the Monitoring Report was revised to specify that all project data is electronically archived until at least two years after the end of the crediting period.	Response is acceptable.
2	The reported quantity of SF6 consumed at recycling operations during the month of May is inconsistent with verification evidence provided and appears to be a duplicate of June's quantity.	Activity data for the month of May was revised to be consistent with raw data provided and the emission reduction calculations were updated accordingly.	Response is acceptable.
3	Section 1.11 of the Monitoring Report does not address the following requirements from the VCS template: - Identification of which SD contributions described in Table 1 of the report contribute to achieving any nationally stated sustainable development priorities. - Documentation of the cumulative contributions over the project lifetime in the "Contributions Over the Project Lifetime" column in Table 1. Additionally, the SDG appendix specified by the Monitoring Report template is not appended to the Monitoring Report.	Section 1.11 of the Monitoring Report was revised to identify that nationally stated sustainable development priorities are not relevant. The SDG appendix detailing the Project Activity's cumulative contributions over the project lifetime was correctly appended to the revised Monitoring Report.	Response is acceptable.

ID	Clarification Request	Participant Response	Verification Conclusion
1	Please provide clarification on why recycling/remelt data was generated for "September 31st", and whether this represents valid, reportable data.	Meridian and 3Degrees clarified that an operator erroneously created the September 31st entry on the data form when attempting to enter production data for November 1st. Although the data for the factitious day was not used in emission reduction calculations, the erroneous entry was removed from the raw data summary spreadsheet for clarity.	Response is acceptable.