

VALIDATION & VERIFICATION REPORT
FOR THE
SECOND CREDITING PERIOD AND
FIRST MONITORING REPORT OF VCS
PROJECT 618,

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



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Summary:

NSF International (NSF) performed a validation of the second crediting period of the “Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI, and Strathroy, ON” project (the “Project”). Concurrent with its validation activities, NSF also performed a verification of the first monitoring report in the second crediting period. In this Project alternate cover gases were deployed to substitute for sulphur hexafluoride used to prevent oxidation of molten magnesium metal upon contact with air. The project developer, Magnesium Products of America, has implemented this project in its magnesium metal recycling and die casting facilities located in Eaton Rapids, Michigan USA, and in the magnesium metal recycling and die casting facilities of Meridian Lightweight Technologies Inc. in Strathroy, Ontario Canada. For the second crediting period, however, project emission reduction crediting will be limited to the facility located in Eaton Rapids, Michigan.

The objective of the validation was to determine whether the validity of the original baseline scenario remained demonstrable, and whether the project continued to demonstrate regulatory additionality. The objective of the verification was to verify the Project’s emission reductions during the first reporting

period of the second crediting period, 1 January 2017 through 31 October 2017. NSF validated Project eligibility in accordance with crediting period renewal requirements in the Verified Carbon Standard v. 3.7. NSF verified the asserted emission reductions against criteria found in CDM Approved baseline and monitoring methodology AM0065 “Replacement of SF₆ with alternate cover gas in the magnesium industry,” version 2.1. NSF conducted its validation and verification activities in conformity with ISO 14064-3:2006 and the VCS “Validation and Verification Manual” v. 3.2.

NSF performed off-site document review and on-site validation during this engagement. NSF issued 27 validation findings, including 21 clarification requests, five nonconformities, and one recommendation. NSF received acceptable responses for all findings issued. NSF found that regulatory surplus could no longer be demonstrated for the High Street facility in Strathroy, ON. As a result, the Project decided not to continue monitoring emission reductions at the smaller Wright Street facility in Strathroy. Consequently, all second crediting period emission reductions will be associated only with the Magnesium Products of America facility in Eaton Rapids, MI.

NSF performed off-site document review and on-site verification activities during this engagement. NSF issued six clarification requests. No material uncertainties with respect to project monitoring were identified. On the basis of work performed, NSF concluded with reasonable assurance that the Project’s asserted 163,334 metric tons of carbon dioxide–equivalent vintage 2017 emission reductions were fairly stated. More detail concerning the findings that support this conclusion is provided in Section 4 of this report.

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1 INTRODUCTION

1.1 Objective

The 3Degrees Group, Inc. (3Degrees) engaged NSF International (NSF) to validate the Project Description for the second crediting period of Magnesium Products of America's project "Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI, and Strathroy, ON". In this same engagement the 3Degrees also engaged NSF to verify emission reductions achieved during the first reporting period of the second crediting period.

The objective of the validation was to determine whether the validity of the original baseline scenario remained demonstrable, and whether the project continued to demonstrate regulatory additionality. The objective of the verification was to determine whether the emission reductions achieved at the magnesium production facility in Eaton Rapids, MI USA during the reporting period 1 January 2017 through 31 October 2017 were fairly stated and in conformity with the validated Project Description and applicable VCS requirements.

The validation/verification team consisted of John C. Shideler, PhD, lead validator/verifier. An independent review of the validation/verification results was performed by Michael DeBusschere, P.E. After evaluation, NSF determined that the potential for conflict-of-interest was low for NSF, for the validation/verification team, and for the independent reviewer.

1.2 Scope and Criteria

The scope of the validation was the demonstration of continuing validity of the baseline scenario and regulatory additionality of emission reduction activities in Eaton Rapids, MI, and Strathroy, ON. The temporal scope for this validation was the Project's second ten-year crediting period which began on 1 January 2017.

The scope of the verification included magnesium metal production facilities in Eaton Rapids, MI, where magnesium scrap was recycled and die cast products were made using alternate cover gases. Sources of greenhouse gas project emissions included amounts of SF₆ used as a cover gas and Perfluoro-2-methyl-3-pentanone in substitute cover gases. The temporal scope for this verification was the Project's first reporting period in the second crediting period which began 1 January 2017 and extended through 31 October 2017.

Criteria included the Verified Carbon Standard, version 3.7 (21 June 2017), and the CDM Approved baseline and monitoring methodology AM0065 "Replacement of SF₆ with alternate cover gas in the magnesium industry," version 2.1 (28 November 2008).

1.3 Level of Assurance

This validation/verification was conducted at the reasonable level of assurance.

1.4 Summary Description of the Project

Two magnesium facilities, one in Eaton Rapids, Michigan, USA, and one in Strathroy, Ontario, Canada, produce magnesium ingots by recycling magnesium scrap in a melting process. These two facilities and a third facility, also located in Strathroy, ON, remelt the ingots in die cast machines to manufacture parts for the automotive industry. In both the metal recycling and die casting processes a cover gas is used to prevent oxidation of molten metal in the presence of air. The substitution of Novec™ 612 and dilute sulphur dioxide (SO₂) cover gases for sulphur hexafluoride (SF₆) reduce the usage of SF₆ and thereby lower the facilities' total greenhouse gas emissions.

The Project activity is located at 2001 Industrial Drive, Eaton Rapids, MI 48827 USA. The latitude is 42° 31' N and the longitude is 84° 38' W.

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

NSF developed a sampling plan for this engagement based on the AM0065 methodology, the Verified Carbon Standard, and data provided to NSF for document review. Validation and verification procedures followed ISO 14064-3, Greenhouse gases – Specification with guidance for the validation and verification of greenhouse gas assertions. The validation and verification process was also informed by the VCS Validation and Verification Manual, version 3.2 (19 October 2016). After off-site document review, validation and verification activities were conducted on-site in Eaton Rapids, MI, on 6 December 2017, and in Strathroy, ON, on 7 December 2017.

NSF developed a sampling plan for this engagement that addressed the following validation and verification elements:

- A checklist of requirements pertaining to validation of subsequent crediting periods included in the Verified Carbon Standard
- A checklist of requirements pertaining to verification of emission reduction monitoring periods included in the AM0065 methodology.
- A spreadsheet for recomputation of emission reduction calculations presented in the Monitoring Report. In this case, two instances of this spreadsheet tab were completed so that Project emission reduction calculations could be checked at disaggregated levels (i.e. for both the recycling and die casting activities in Eaton Rapids, MI).
- A spreadsheet tab to record the results of data checks.

After the reduction in scope to exclude project implementation instances in Strathroy, ON, the threshold of materiality for this verification was adjusted to five percent.

The completed sampling plan is a validation/verification engagement record retained by NSF.

2.2 Document Review

The validation/verification team conducted a document review to inform the planning process in advance of performing verification activities. In response to clarification requests, 3Degrees updated its Monitoring Report and provided additional information for review during the validation/verification process.

To assess regulatory surplus for the second crediting period, NSF reviewed applicable greenhouse gas reporting and cap-and-trade regulations from the Province of Ontario. An updated Global Warming Potential for SF₆ was applied to the Parameters Not Monitored section of the Project Design. For its verification activities, NSF cross-checked monitored project parameters against the validated parameters.

NSF reviewed calibration records for installed monitoring equipment at the Michigan facility and reviewed previously issued verification reports. Magnesium Products of America (MPA), which is also known as Meridian Magnesium Products of America, provided NSF with extensive records related to project activities, a portion of which are listed in the following table:

#	Title
1	Project Description for “Conversion of SF ₆ to an alternative cover gas in magnesium production in Eaton Rapids, MI and Strathroy, ON,” version 2.6, (27 March 2018), by Julie Kelleher of 3Degrees Group, Inc.
2	Clean Development Mechanism, Approved Methodology AM0065, v. 2.1, “Replacement of SF ₆ with alternate cover gas in the magnesium industry” (28 November 2008)
3	Clean Development Mechanism “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period,” v. 3.0.1 (2 March 2012)
4	Ontario Regulation 143/16, “Quantification, reporting and verification of greenhouse gas emissions,” published on e-Laws 19 May 2016 and subsequently amended
5	Ontario Regulation 144/16, “The cap-and-trade program,” published on e-Laws 19 May 2016 and subsequently amended
6	Ontario “Guideline for Greenhouse Gas Reporting,” December 2015, ON.290-295, Magnesium Production, pp. 118-121
7	“VCS Monitoring Report: Conversion of SF ₆ to an alternative cover gas in magnesium production in Eaton Rapids, MI and Strathroy, ON,” for the period 1 January 2017 through 31 October 2017, version 2.1, (6 March 2018), by Julie Kelleher of 3Degrees Group, Inc.
8	“VCS Verification Report: Conversion of SF ₆ to an alternative cover gas in magnesium production in Eaton Rapids, MI and Strathroy, ON, Seventh Monitoring Period (1 January 2016 through 31 December 2016)” revision 1.0 (27 June 2017), by NSF International
9	“B- Meridian 2017 Monitoring Data 11-7-2017_v2.1.xlsx”
10	Calibration records for scales located at the MPA plant in Eaton Rapids, MI

2.3 Interviews

The lead validator/verifier interviewed key personnel at the Magnesium Products of America project host site in Eaton Rapids, MI, and at Meridian Lightweight Technologies in Strathroy, ON. A list of personnel interviewed follows.

Person	Title	Organization
Chuck Woodburn	Facilities Manager	Magnesium Products of America (MI)
Pahouha Thao	Accounts Receivable	Magnesium Products of America (MI)
Brent Wagar	Deputy Plant Manager	Meridian Lightweight Technologies Inc. (ON)
Doug O'Neill	Facility Coordinator	Meridian Lightweight Technologies Inc. (ON)
Don Lyons	HSE Specialist	Meridian Lightweight Technologies Inc. (ON)
Julie Kelleher	Project consultant	3Degrees Group, Inc.

2.4 Site Inspections

NSF Lead Validator/Verifier John Shideler visited the Magnesium Products of America facility in Eaton Rapids, MI, on 6 December 2017 and the Meridian Lightweight Technologies Inc. facilities in Strathroy, ON, on 7 December 2017. The validation objective was to determine ongoing validity of the project's baseline and its continued regulatory additionality. The objective of the verification site visit was to confirm that the monitoring, distribution and accounting systems for cover gas continued to meet the requirements of the CDM methodology and that calculated emission reductions for the monitoring period were fairly stated. During site visits at both locations the lead validator/verifier reassessed Project management controls and inspected die cast and magnesium recycling equipment.

Facility personnel identified no significant changes or additions to the installed set of die cast machines at either the Eaton Rapids or Strathroy facilities since the last visit of the NSF verifier earlier in 2017. The installed production equipment at Eaton Rapids included 15 die cast cells and 3 recycling cells. Each cell was equipped with piping that provided cover gases to prevent contact of molten magnesium to air which would provoke immediate oxidation. Cells were provided with either dilute SO₂ or Novec cover gases and with SF₆ as a backup cover gas. The necessary control and backup equipment required by AM0065 was installed in all cases.

2.5 Resolution of Findings

NSF issued clarification requests, nonconformities, and recommendations during the course of this validation/verification engagement. MPA and 3Degrees provided satisfactory responses and information to close out findings.

For the validation NSF issued 21 clarification requests, 5 nonconformities, and 1 recommendation. For the verification NSR issued 6 clarification requests. A complete table of validation findings and verification findings and their resolution is included in this report in Appendix A.

2.5.1 Forward Action Requests

No forward action requests were raised during this engagement.

3 VALIDATION FINDINGS

3.1 Project Details

The Project substituted dilute SO₂ and Novec™ 612 cover gases for SF₆ in the Magnesium Products of America plant in Eaton Rapids, MI. MPA recycled magnesium to make magnesium ingots and used those ingots to feed die cast cells to manufacture magnesium parts, largely for the automotive industry. Magnesium scrap from the die cast process was also recycled to make new ingots.

Project Type and Eligibility. The CDM AM0065 methodology, “Replacement of SF₆ with alternate cover gas in the magnesium industry”, version 2.1, applied to the Project because the methodology specifically mentioned die cast and recycling operations as eligible operations. Further details about the Project’s adherence to the requirements of the methodology are provided below in Section 3.3.1.

Project Proponent and Other Entities. The project proponent was Magnesium Products of America, a company located in Eaton Rapids, Michigan. They contracted with 3Degrees Group, Inc., of San Francisco, California, to provide consulting support and to monetize the emission reduction credits derived from the project. 3Degrees was the account holder in the VCS Registry for the credits from this project. MPA was also known as “Meridian Magnesium Products.”

Project Start Date. The project start date was January 1, 2007. This was the date that trials of the new cover gas system ended in the sister High Street plant of Meridian Lightweight Technologies in Strathroy, Ontario. Both the High Street and the Wright Street plants in Strathroy implemented the project along with Magnesium Products of America in the first crediting period.

Crediting Period. This validation applies to the second crediting period of the Project. The second crediting period began on January 1, 2017, and will extend to December 31, 2026.

Project Scale and Estimated GHG Emission Reductions. The Project, which has limited its scope to only the Eaton Rapids plant of Magnesium Products of America, anticipates reducing GHG emissions by approximately 196,000 metric tons of CO₂-e per year during the second crediting period.

Project Location and Conditions Prior to Project Initiation. The Magnesium Products of America plant in Eaton Rapids was constructed in 1999. It installed die cast and recycling equipment with a projected useful life of approximately 40 years. During the first crediting period the plant’s equipment changed only marginally. Some new or used equipment was installed to increase production capacity or to accommodate changed product designs, but these additions

were incremental and marginal and did not affect the validity of the initial baseline determination that the Project was financially feasible only with the assistance of marketable carbon credits.

Regulatory Additionality. The Project complied with all applicable laws and regulations in the United States. The Eaton Rapids facility was not required to have a Clean Air Act (CAA) Title V permit, and neither the provisions of the CAA's New Source Review or Prevention of Significant Deterioration were triggered by changes in equipment at the plant. After the U.S. Environmental Protection Agency issued its "endangerment finding" that greenhouse gases constituted air pollutants that were subject to regulation, the agency's "Tailoring Rule" in 2010 established emissions thresholds that the Eaton Rapids plant did not exceed. Consequently, the Project implemented at Eaton Rapids maintained the regulatory additionality that it had demonstrated during the validation of the initial crediting period.

In 2016, the last year of the first crediting period, the Province of Ontario finalized regulations for a cap-and-trade program. This program included facilities that performed specified activities, including magnesium production. Each of the two facilities in Strathroy was considered separately, as they had different addresses and facility identification numbers with the Ministry of Environment. Because of its emissions of SF₆, the High Street facility exceeded the 10,000 metric tonne of CO₂-e per year threshold and was required to begin GHG reporting and to register for the cap-and-trade program. The Wright Street facility fell below the reporting threshold and was therefore exempt from the cap-and-trade program. Based on this information, MPA decided not to continue reporting emission reductions from the Wright Street facility during the second crediting period.

Project Ownership. The plant and equipment in Eaton Rapids that comprised the Project for the second crediting period were owned by Magnesium Products of America, a corporation established under Michigan law.

Other Forms of Environmental Credit. MPA has not sought other types of environmental credit under any program for its emission reductions in Eaton Rapids, MI.

Conclusion. NSF has evaluated the information provided in the Project Description and found that it is accurate, complete, and provides a faithful representation of the nature of the project. NSF has further concluded that the Project was implemented at Eaton Rapids as described in the Project Description.

3.2 Participation under Other GHG Programs

The Project has not sought registration under any other GHG program.

3.3 Application of Methodology

3.3.1 Title and Reference

The Project applied the CDM approved methodology AM0065 "Replacement of SF₆ with alternate cover gas in the magnesium industry" (v. 2.1, 28 November 2008). For the second crediting period, the only applicable methodological tool was the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period," v.

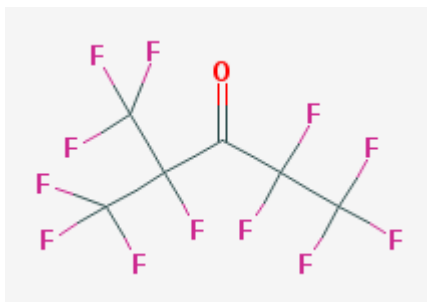
3.0.1 (2 March 2012). This tool was used to assess the continuing validity of the baseline conditions and calculations. The result was a determination that the baseline remained valid. The only change made by the Project was to update the Global Warming Potential from that of the IPCC's Second Assessment Report to that of the IPCC's Assessment Report 4.

3.3.2 Applicability

Segments of the Magnesium Industry. To be eligible, a project had to be implemented in segments of the magnesium industry as defined in the methodology. The definition included “die casting” and “production of secondary magnesium through recycling of magnesium or its alloys.” The MPA plant in Eaton Rapids, MI, was engaged in those two segments of the magnesium metal casting industry and therefore was eligible by definition to implement an emission reduction project based on replacement of SF₆ as a cover gas.

AM0065 applied to projects in existing facilities in the magnesium metal casting industry that replaced SF₆ as a cover gas in full or in part by another cover gas, HFC134a, perfluoro-2-methyl-3-pentatone, or dilute SO₂. MPA used two of the three permitted replacement gases, perfluoro-2-methyl-3-pentatone and dilute SO₂.

MPA has implemented the project using a trademarked product from 3M called Novec™ 612. The product data sheet for this product identifies it as dedecafluoro-2-methyl-3-pentanone with the chemical formula of CF₃CF₂(O)CF(CF₃)₂. This product was shipped in totes as a liquid and became a gas when pressurized. The molecular formula also may be expressed as C₆F₁₂O, with the following structure:



Molecular formula of perfluoro-2-methyl-3-pentatone

(source: National Center for Biotechnology Information. PubChem Compound Database; CID=2782408, <https://pubchem.ncbi.nlm.nih.gov/compound/2782408> (accessed 27 February 2018).

According to the National Center for Biotechnology Information, PubChem Compound Database, C₆F₁₂O is a synonym for perfluoro-2-methyl-3-pentatone. It is also a synonym for Novec™ 1230, a product chemically similar to Novec™ 612 sold by 3M for use as a low-GWP fire suppressant.

NSF Finding. On the basis of the evidence reviewed, NSF has concluded that Novec™ 612 is chemically identical to the perfluoro-2-methyl-3-pentatone cover gas specified in AM0065.

Dilute SO₂ Technology. Only “dilute SO₂ technology” met the requirements of AM0065. The definition required that the following conditions be met:

- “Well controlled SO₂ concentration and flow rates with concentration typically one percent or less. An associated SO₂ exhausting and abatement system to ensure SO₂ emissions are in compliance with the local environmental regulations. Emissions from the facility to the ambient air should comply with the local standards of the country. If no local standards exist, the following value should be taken into account as a cap limit for SO₂ concentration in the exhausting system – “1470 mg/m³ (dry basis, 273 K, 101,325 kPa at an oxygen concentration of 6 %(v/v);”

NSF Finding. According to an engineering analysis performed at the MPA plant in Eaton Rapids, the calculated amount of SO₂ in air exhausted by the plant was 2.23 mg/m³, well below the default maximum concentration. The Eaton Rapids plant circulated 3,751,912 m³ of outside air per day in the plant, and used 8,362,274 mg of SO₂ per day. This rate of recirculation of outside air made exceeding the limit of 1470 mg/m³ nearly impossible under any imaginable circumstance.

- “Precise gas mixing and delivery system using mass flow controllers (MFC) or similarly accurate device and heated gas lines to SO₂,”

NSF Finding. The Eaton Rapids plant used Brooks 5850S mass flow controllers to pipe cover gas to die cast cells and recycle cells.

- “Gas cabinet or cylinder storage area with leak monitors and emergency ventilation system;”

NSF Finding. Cover gases at the Eaton Rapids plant were contained in storage cabinets with leak monitors and emergency ventilation systems.

- “Redundant/back-up melt protection technology in case SO₂ leak requires system shut-down and repair;”

NSF Finding. MPA maintained piping to provide all die cast and recycling cells with SF₆ cover gas in case of a power outage or a production issue that required use of SF₆ instead of the alternate cover gas.

- “Emergency response plan, training, and personal safety equipment;”

NSF Finding. The Eaton Rapids plant was certified to ISO 14001, and it maintained emergency response procedures, provided training, and equipped personnel with safety equipment.

- “Back-up power / generator for gas mixing system and necessary controls, compressors, etc. – capable of running independently for 12 hours;”

NSF Finding. A Generec Power Systems generator, fuelled by propane, provided back up power for the SF₆ cover gas system and emergency lights.

- “Maintenance plan for equipment and gas distribution system to assure safe and consistent operation.”

NSF Finding. MPA implemented and maintained maintenance plans for both equipment and its gas distribution system at Eaton Rapids. These procedures were incorporated in the plant’s ISO 14001 management system.

Local SO₂ Regulations. There were no applicable local indoor air regulations that specified a cap limit of SO₂ concentration in the air exhaust system. As a result, the project evaluated its concentration in accordance with the limit imposed in the Applicability section of the AM0065 methodology. As stated above, the calculated concentration at the Eaton Rapids plant was substantially below the limit defined in AM0065 and also met OSHA short-term exposure limits of 5 ppmv and 2 ppmv on a time-weighted average basis.

Application of Tools. AM0065 referred to the latest version of the CDM “Combined tool to identify the baseline scenario and demonstrate additionality.” The application of this tool was assessed during the initial validation of the project performed for the first crediting period. According to the Verified Carbon Standard 3.7, section 3.8.5 (Renewal of Project Crediting Period), a full reassessment of additionality is not required when renewing the project crediting period. Instead, where the original baseline scenario remains valid, regulatory surplus shall be demonstrated and the Project Description updated accordingly.

NSF Finding. The validity of the baseline scenario has been demonstrated (see 3.3.4 below). In this case, the correct methodological tool to apply, per VCS 3.7, section 3.8.5.1b, is the current version of the CDM Tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period,” v. 3.0.1 (2 March 2012). The Project has applied this tool and reassessed regulatory additionality. Accordingly, the Project has limited the project boundary in the second crediting period to the sole manufacturing site in Eaton Rapids, MI.

Overall Conclusion. On the basis of the evidence reviewed, NSF has concluded that MPA’s Eaton Rapids plant met all the applicability requirements of the AM0065 methodology.

3.3.3 Project Boundary

At the beginning of the second crediting period, the project continued to be implemented with the same spatial extent as in the first crediting period: die cast and recycling cells at the MPA plant in Eaton Rapids, MI, and die cast and recycling cells at two plants in Strathroy, ON. However, due to the change in regulatory additionality in Strathroy, the Project has limited its quantification of emission reductions in the second crediting period to the sole Eaton Rapids site.

The cover gas mix used in the baseline scenario at Eaton Rapids consisted of SF₆ and CO₂ as a carrier gas. Given its high GWP, SF₆ was the major source of emissions in the baseline. In the Project activity, the use of SF₆ was minimized to the maximum practical extent. Project emissions included any application of SF₆ needed during special operational circumstances as well as emissions associated with the use of the Novec™ 612 replacement gas. CO₂ use was not quantified as a project emission because it was already used in the baseline. By-product emissions of CH₄, N₂O, C₂F₆, and C₃F₈ that can occur after the degradation of the alternate gas

were included in the project boundary and were accounted for by the application of a “Conservative Factor” during the quantification of project emissions.

Overall Conclusion. On the basis of the evidence reviewed, NSF has concluded that the Project has included all applicable emissions sources in the project boundary.

3.3.4 Baseline Scenario

In accordance with VCS requirements for validation of credit period renewals, the Project had to demonstrate the continued validity of the baseline scenario using the CDM Tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.” Step 1.1 of the assessment criteria included an evaluation of the impact of new relevant national and/or sectoral policies and circumstances on the validity of the baseline scenario. This assessment resulted in limiting the Project scope to magnesium production operations in Eaton Rapids, MI.

Step 1.2 of the assessment considered the impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions without reassessing the baseline scenario. The Project Description described the operational characteristics of magnesium production at the Eaton Rapids plant, including the use of technology, the age and expected useful life of equipment, load capacities, and level of service provided. It compared the relative cost of SF₆ and Novec™ 612. NSF found very little change had occurred since Project inception and that no new circumstances rendered implausible the validity of the baseline scenario.

Step 1.3 was not applicable to this Project. The baseline scenario selected at project implementation included financial investment in the necessary hardware to pipe low-GWP cover gases to existing cells and to pay for the necessary metering, backup electricity generation, and safety alarm equipment. Plant equipment had an expected useful life greater than two crediting periods.

Step 1.4 assessed the validity of data and parameters. The result of this assessment was to update the GWP of SF₆ from the Second Assessment Report value (23,900) to the Assessment Report 4 value (22,800). Baseline emission factors were not updated, as they relied upon historical information gathered during three years of operation prior to project implementation where SF₆ was the only cover gas used at the plant.

NSF Conclusion. NSF agrees with the project proponent that the current baseline, data and parameters, with the exception of the updated GWP for SF₆, remain valid and can be used during the second crediting period.

3.3.5 Additionality

As this project validation is performed at the renewal of a crediting period, the analysis of additionality is limited to adherence to regulatory surplus requirements. As described above in 3.3.1, the main change affecting the Project was institution by the Province of Ontario's Ministry

of Environment of a cap-and-trade program in 2016. The Project was implemented in Strathroy, ON, at two locations, each separately permitted by regulatory authorities. The High Street facility's SF₆ emissions were sufficiently high to trigger inclusion in the cap-and-trade program while the Wright Street facility's SF₆ emissions fell below the threshold. While Wright Street would have met regulatory additionality criteria had it remained within the project scope, the Project elected to limit second crediting period emission reduction quantification to the Michigan plant only.

NSF Conclusion. The Project, at its Eaton Rapids, Michigan plant, met VCS regulatory surplus requirements.

3.3.6 Quantification of GHG Emission Reductions and Removals

Baseline SF₆ Emission Factors. In preparation for the first crediting period, the Project determined the amount of SF₆ used by the Eaton Rapids plant in three prior years: 2005, 2006, and 2007. The following tables provide the results from this monitoring and demonstrate that the Project adopted the minimum annual SF₆ emission factor as required by Equation 6 of AM0065.

Michigan		Original Baseline		
Die Casting		2005	2006	2007
	US Die casting SF ₆ (lbs)	14,740	10,788	10,981
	US Die casting Metal (lbs)	62,672,227	56,085,588	56,696,032
P_{Mg,BL}	Total Mg Production (short tons)	31,336	28,043	28,348
SF₆con	Total SF₆ Use (short tons)	7.37	5.39	5.49
DF_{SF6}	50% discount	3.69	2.70	2.75
DISF₆,CON	5% discount	3.50	2.56	2.61
EF,SF₆	EF	0.000112	0.0000914	0.0000920
GWP of SF₆		22,800	22,800	22,800

Recycling		2005	2006	2007
	US Die casting SF ₆ (lbs)	34,234	34,923	44,222
	US Die casting Metal (lbs)	42,236,980	40,996,103	40,683,251
P _{Mg,BL}	Total Mg Production (tons)	21,118	20,498	20,342
SF ₆ con	Total SF₆ Use (tons)	17.12	17.46	22.11
DF _{SF6}	50% discount	8.56	8.73	11.06
DISF ₆ ,CON	5% discount	8.13	8.29	10.50
EF,SF ₆	EF	0.000385	0.000405	0.000516
GWP of SF₆		22,800	22,800	22,800

Emission Reductions. Based on the final Equation 15 of $ER_y = BE_y - PE_y$, the Project had estimated annual emission reductions during the ten-year crediting period. The forecast amounts for each year are as follows:

BE_y	PE_y	Secondary Effects (Leakage)	ER_y
234,260	38,260	0	196,000

Over a ten-year crediting period from 2017 through 2026, the total estimated emission reductions are 1,960,000 metric tonnes of CO₂-e.

Baseline Emissions. Estimated second crediting period baseline emissions were calculated by extrapolating verified results of the mass of metal melted, project emissions, and achieved emission reductions for the first ten months of 2017, and normalizing them to a twelve-month period. The level of production from the verified ten-month period was projected to continue throughout the remainder of the second crediting period. The same baseline emissions factors developed for the recycling and die cast operations in Eaton Rapids that were used in the first crediting period were applied to the second crediting period. These emissions factors are provided in the “parameters not monitored” section of the Monitoring Report. They give the following results:

Eaton Rapids, Recycling: $(20,185,267.77 \text{ kg}) \times (0.001 \text{ tonne/kg}) \times (0.0003850 \text{ tSF}_6/\text{tMg}) \times (22,800 \text{ tCO}_2\text{e}/\text{tSF}_6) = 177,186 \text{ tCO}_2\text{-e}$

Eaton Rapids, Die casting: $(27,388,135.34 \text{ kgMg}) \times (0.001 \text{ tonne/kg}) \times (0.0000914 \text{ tSF}_6/\text{tMg}) \times \text{WP} (22,800 \text{ tCO}_2\text{e}/\text{tSF}_6) = 57,074 \text{ tCO}_2\text{-e}$

Project Emissions. Project emissions were calculated by multiplying separately the amounts of Novec™ and SF₆ used as alternate cover gases. Usage of dilute SO₂ was also tracked, but since this gas does not have a GWP, it is not included here. The formulae for project emissions for SF₆ and for Novec™ are provided separately as their calculations differ. The formula for calculating project emissions from Novec™ is: $\sum C_{\text{ALTGAS},\text{PJ},\text{k},\text{j},\text{y}} * \text{GWP}_{\text{ALTGAS}} * \text{CF}$. Fractional amounts of the sum of Novec™ and SF₆ are rounded up to the next nearest tonne.

Novec 612™

Eaton Rapids: $(6,669.93 \text{ kgNovec}) \times (0.001 \text{ tonne/kg}) \times 1(\text{GWP}) \times 2830 (\text{CF}) = 18,876 \text{ tCO}_2\text{-e}$

Project emissions from the use of SF₆ are calculated using the following formula: $PE_{\text{SF}_6,\text{y}} = \sum C_{\text{SF}_6,\text{EM},\text{PJ},\text{k},\text{j},\text{y}} * \text{GWP}_{\text{SF}_6}$. Per the methodology SF₆ emitted is reduced by a degradation factor of 50% and adjusted by a conservative factor of 105% to account for uncertainty of measurement.

SF₆ *

Eaton Rapids: $(1,619.33 \text{ kgSF}_6) \times (0.001 \text{ tonne/kg}) \times 0.5 \times (22,800 \text{ tCO}_2\text{e}/\text{tSF}_6) \times 1.05 = 19,384$

NSF validated the forecast estimates by comparing baseline emissions and project emissions achieved during the last two years of the first crediting period and the 10 months of monitored

emissions (annualized) in the first reporting period of the second crediting period. The major source of uncertainty related to forecast baseline emissions derived from economic activity in the automotive sector which directly translates into demand for the magnesium parts that MPA produces. There is additional uncertainty related to the amount of SF₆ that may need to be used in the recycling operation to take into account contamination of magnesium scrap that has been exposed to environmental conditions during ocean transport. Overall NSF found that the methods used by the project proponent to forecast emission reductions for the second crediting period were based on reasonable assumptions, taking into account the inherent uncertainty described above.

Project Description. The data relied upon for this project were primary production data for the melting of magnesium and the use of cover gases. MPA closely monitored the mass of magnesium melted in the recycle operation and in die cast machines as these were key operational and financial indicators for the company. MPA also closely monitored the amounts of cover gases purchased as these were a significant input cost for production. While full additionality analysis was not required for the renewal of a crediting period, the Project Description described current circumstances with respect to market costs for SF₆ and alternate cover gases. NSF concluded from these data that using SF₆ as a cover gas rather than Novec™ 612 remained the least expensive option for MPA.

NSF further concluded that MPA had correctly applied the AM0065 v. 2.1 methodology to this project and that the data and parameter values used in the Project Description were reasonable and that estimates of second crediting period baseline and project emissions can be reasonably derived from the operating history of the first ten months in 2017 of the first monitoring period. As stated in the project methodology, no secondary effects (leakage) can be anticipated from the implementation of the AM0065 methodology.

3.3.7 Methodology Deviations

There are no methodology deviations.

3.3.8 Monitoring Plan

MPA monitors the following parameters:

Parameter	Estimation Method	Frequency of Measurement	Unit of Measurement	Validation Conclusion
P _{Mg/yr}	Measure mass of magnesium produced each year at MPA as ingots or production parts	Each pallet of ingots; each part produced	Pounds (Note: conversion to metric units is performed annually for the Monitoring Report)	MPA tracked magnesium melted in both recycle and die cast as a key performance metric of their business. Melted metal was measured on calibrated scales and tracked through an electronic record keeping system. A complete mass balance of inputs and outputs included about 2% of dross.

Parameter	Estimation Method	Frequency of Measurement	Unit of Measurement	Validation Conclusion
PE _{Novec/yr} (= C _{Altgas})	Weight method for consumption of Novec used in MPA die cast and recycle cells	Each time a cylinder was changed	Pounds	MPA tracked alternate cover gas and SF ₆ consumption using the weight difference method, with the use of the accounting method as a cross-check. MPA recorded gas cylinder weight differences on inventory logs that were completed by plant operators. Calibrated scales were used for weighing SF ₆ and alternative cover gas cylinders and totes. Information was reviewed for accuracy by MPA and the Project consultant 3Degrees Inc.
SO ₂ (= C _{Altgas})	Weight method for consumption of SO ₂ (alternate cover gases) used in MPA die cast and recycle cells	Each time a cylinder was installed or removed from service	Pounds	
PE _{SF6}	Weight method for consumption of SF ₆ used in MPA die cast and recycle cells	Each time a cylinder was installed or removed from service	Pounds	

Parameter	Estimation Method	Frequency of Measurement	Unit of Measurement	Validation Conclusion
SO ₂ concentration in ambient air	Engineering calculations; SO ₂ monitors	Under normal operating conditions, ambient SO ₂ concentration in exhausted air is calculated to be approximately 2.2 mg/m ³ . SO ₂ monitors continually monitor SO ₂ for exceedances of 0.5 ppm.	Parts per million (by volume); converted for Monitoring Report to mg/m ³	Emissions of SO ₂ in ambient air were monitored at MPA by six leak detection monitors. One was installed in the SO ₂ cabinet, one each was installed under each cell in recycling, one was installed in the scrap crushing room, and another was installed in the hallway from the main plant to the recycling plant. Monitor alarms were triggered periodically during the changing of SO ₂ cylinders at concentrations exceeding 0.5 ppmv (1.37 mg/m ³). MPA's alarms had a range up to 10 ppmv but readings rarely exceeded 3.0 ppmv under any malfunction scenario. (3.0 ppmv equals 8.24 mg/m ³ .)
tMg/year	Sales reports of magnesium sold	Monthly, annual	Pounds	Magnesium products amounted to slightly less than half of total metal melted. About half of total metal melted was accounted for with the recycling of metal received from suppliers and from the remelting of buttons, tree and flash from the die cast process. Approximately 2% of the mass balance of metal received was accounted for as dross. MPA carried forward very little inventory from one year to the next as the plant produced parts based on customer orders and employed just-in-time delivery methods. By considering the transfer of metal from die cast back to

Parameter	Estimation Method	Frequency of Measurement	Unit of Measurement	Validation Conclusion
				recycling as an “internal sale,” MPA far exceeded the requirement of the methodology to achieve a ratio of sales to metal production of at least 70%.

NSF Conclusions. MPA met all the requirements of AM0065 for monitoring metal melted, alternative gases and SF₆ consumed, ambient SO₂ air emissions, and magnesium product sales. The primary monitoring method was weighing metal and gas cylinders on scales that were calibrated twice a year. A review of calibration records demonstrated that the scales were consistently within manufacturer’s tolerances and that therefore the weights provided met accuracy requirements and were therefore reliable. The SO₂ monitoring system ensured that ambient air SO₂ concentrations remained within OSHA and methodology limits. Monitored parameters were appropriately applied to quantification equations taken from AM0065.

3.4 Non-Permanence Risk Analysis

Not applicable to this methodology.

4 SAFEGUARDS

4.1 No Net Harm

The project proponent was not aware of any potential negative environmental and socio-economic impacts associated with this project. NSF concurs with this assessment.

4.2 Environmental Impact

No environmental impact assessment was required to be conducted with respect to this project.

4.3 Local Stakeholder Consultation

Local stakeholder consultation was not required at initial validation of this project and was therefore not required for the renewal of the crediting period.

4.4 Public Comments

The requirements for a public comment period did not apply to renewal of crediting periods.

5 VERIFICATION FINDINGS

5.1 Accuracy of GHG Emission Reduction and Removal Calculations

This project reduced emissions into the atmosphere of SF₆ by substituting lower global warming potential cover gases for SF₆. The key parameters monitored were the amount of magnesium metal melted and the amounts of cover gases actually used to prevent the oxidation of molten metal which would occur if no cover gas prevented contact of magnesium with air.

The project relied on calibrated scales to measure accurately the mass of magnesium melted and the mass of cover gases used in recycling and die cast operations. Measured results were entered into a spreadsheet that tracked production data and cover gas usage. These entries were quality controlled to ensure data integrity. Consistent with its operational reporting, melting of metal and mass of cover gases used were reported in U.S. pounds. Conversion to metric units was accomplished after data had been aggregated using valid conversion factors (pounds divided by 2.20462 to yield kilograms, then multiplied by 0.001 to convert to metric tonnes).

Baseline emissions for this project reporting period were calculated by multiplying the amount of metal melted by the specific emissions factor developed for the recycling and die cast operations in Eaton Rapids, MI. Emissions factors were provided in the “parameters not monitored” section of the Monitoring Report. Data used to establish baseline emission factors were monitored in 2005, 2006, and 2007, and represented the specific operational results for metal melted during recycling and die cast operations at the Eaton Rapids plant. Hence, a unique baseline emission factor was applied depending on the type of operation. NSF verified that the correct baseline emissions factor was used for recycling and die cast operations in Eaton Rapids.

As stated in section II of AM0065 v. 2.1, no secondary effects (leakage) was expected to apply to this project, and NSF did not detect indications to suggest that any secondary effects were occurring.

Except for those defined in the approved methodology, the project proponent did not use any default values in the monitoring report. All values associated with calculation of emissions reductions were the result of measured mass of metal melted and cover gases utilized.

MPA has implemented quality control procedures to minimize quantification errors. Ingots of magnesium produced in recycle were weighed on pallets and the values electronically recorded. Data from production reports of “ingot moves” were copied into the project reporting spreadsheet in order to avoid the introduction of manual transposition errors. Similar precautions were applied to monthly summaries of cover gas use. These data were transferred using “paste values” to ensure that no significant decimal digits were lost in the copying process.

The quality control/quality assurance procedures implemented by the project developer provided high confidence in the underlying data that were used to quantify GHG emission reductions. In addition, these data were also reviewed by the project’s consultant who provided a further check on the application of all necessary equations associated with calculation of emission reductions in accordance with the project description and AM0065 methodology.

5.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

The project proponent maintained records for tracking the amount of magnesium metal melted for operational and quality reasons, and utilized an automated software system called Plex for tracking all movements of metal by scanning bar codes on pallets once these had been weighed. Scales were calibrated or verified annually. The use of cover gas also was tracked through an inventory accounting system with monthly weighing of cylinders and totes.

NSF made inquiries with the project proponent to assess the reliability of the system for tracking metal production and cover gas use. NSF found that the project proponent had maintained quality control procedures that were implemented in the previous reporting periods and that the risk of manual transcription errors had been reduced from moderate to low. NSF selectively checked entries for the weights of metal melted and cover gas container weights and found no errors in the project developer's spreadsheets.

Calibration records demonstrated high reliability of recorded values at scales used at the Eaton Rapids plants. These scales were calibrated semiannually, frequency that exceeded the requirements of AM0065. The mass flow meters used to distribute cover gases were also calibrated on a regular basis.

NSF checked the amount of total product sold during the period covered by the Monitoring Report. This check was performed to ensure that the plant did not produce 30% or more metal than it sold as products. NSF found that sales nearly matched the amount of metal melted. Because the MPA facilities were not primary producers of magnesium metal, the amounts of scrap metal returned to recycling from die casting for remelting were considered to be internal sales.

After performing data checks on the accuracy of the data, NSF recalculated the emissions reductions from the Eaton Rapids facility using NSF spreadsheets that reproduced equations from the AM0065 methodology. NSF arrived at the same results as the project proponent.

NSF concluded overall that the project proponent's data management and record keeping practices provided sufficient and appropriate evidence for the calculation of baseline emissions, project emissions and emission reductions during the monitoring period.

6 VALIDATION AND VERIFICATION CONCLUSION

Based upon the validation work described above, which was performed in accordance with ISO 14064-3:2006 and the requirements of the Verified Carbon Standard, NSF has concluded with reasonable assurance that:

1. The baseline scenario was appropriately re-evaluated using the CDM Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" and continued to be valid;
2. The baseline emission factor for Magnesium Products of America recycling and die cast facilities remained valid and was calculated in accordance with AM0065; and

3. The forecast emission reductions from the application of project activities at the Magnesium Products of America Eaton Rapids plant in the second crediting period were estimated based on reasonable assumptions and sound methods, and in accordance with the requirements of AM0065 version 2.1.

Actual results are likely to be different from those forecast since anticipated events frequently do not occur as expected and the variation may be material.

Based upon the verification work described above, which was performed in accordance with ISO 14064-3:2006 and the requirements of the Verified Carbon Standard, NSF has concluded with reasonable assurance and without qualification that the CO₂-e emission reductions reported by MPA and the 3Degrees Group, Inc. for the “Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI, and Strathroy, ON” project for the reporting period 1 January 2017 through 31 October 2017:

1. Are, in all material respects, fairly stated;
2. Are reported in conformity with the Verified Carbon Standard 3.7; and
3. Are reported in conformity with the CDM Approved baseline and monitoring methodology AM0065 “Replacement of SF₆ with alternate cover gas in the magnesium industry”, version 2.1.

NSF has further concluded that there were no material changes to how the project was carried out compared to the description of the project in the validated Project Description (version 2.6).

Verification period: From 1 January 2017 to 31 October 2017

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)
2017	195,217	31,883	0	163,334
Total	195,217	31,883	0	163,334

APPENDIX 1: VALIDATION AND VERIFICATION FINDINGS

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NSF SF6 Replacement Project (AM0065) Project Workbook: Validation Findings

Client Name: 3Degrees Inc. / Magnesium Products of America
 Lead VV: John Shideler
 FRS: C0289816
 Job #: J1966238
 Last Revision Date: 2018-03-15
 Reporting Year/Period: 2nd Crediting Period

Instructions to Verifiers

The Lead Verifier shall record findings of **Nonconformity (NC)** and **Clarification Requests (CR)** on this form. Findings of **Immaterial Nonconformity (INC)** may be listed (or, where a GHG program requires their reporting, shall be listed). **Forward Action Requests (FAR)** and **Recommendations (R)** may also be included as items on this form.

Finding/Clarification: State the requirement that was not met, or ask for clarification of information related to audit objectives.

Reference (Ref.): Cite a relevant requirement in a protocol, standard or procedure; or cite information provided by the Responsible Party in a monitoring plan, report or other document.

Audit Evidence: Cite evidence that supports the finding of nonconformity, or (optionally) a reason for requesting clarification.

Responsible Party Action: Summarize the response provided by the Responsible Party with respect to the Finding or Clarification Request.

Lead V/V Conclusion: State if the response has been accepted, and the disposition of the finding (closed, rewritten as a new NC, etc.).

#	Type	Finding/Clarification	Ref.	Audit Evidence	Responsible Party Action	Lead V/V Conclusion
1	CR	Please justify the use of a modified project title for the renewal of the crediting period.	Project Description (PD), title page	The project is registered and information about the project is available on the VCS registry under its original title. NOTE: The titles within and above the title page table should match exactly.	PD v. 2 title page has been revised.	Clarification accepted, issue closed.
2	NC	The project type was not described in section 1.2 of the PD.	PD, p. 3	Information to determine whether the project is a grouped project was not found in the PD.	Project is not grouped and is noted as such in PD v. 2 section 1.2.	Corrective action accepted, issue closed.

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3	CR	Please justify the absence of information about Strathroy in Section 1 of the PD.	PD, p. 4	Meridian Lightweight Technologies, Inc. is not mentioned in either section 1.3 or section 1.4	In PD v. 2, the two Strathroy facilities, Meridian Lightweight Technologies Inc. and Meridian Lightweight Technologies Inc. Plant E, have been dropped from the project. See also Findings 7 and 8.	Clarification accepted, issue closed.
4	CR	Please clarify what evidence exists for the establishment of the project start date.	PD, p. 4 VCS PD template instructions for section 1.5.	The VCS PD template asks the PP to "provide justification" for the start date in section 1.5.	The project start date of January 1, 2007 corresponds with the initial day of the trial period conducted at Strathroy Plant E - Recycling to determine which cover gas(es) would be the most effective as a replacement to SF6. PD v. 2 section 1.5 has been revised.	Clarification accepted, issue closed.
5	CR	Please clarify the nature of cells at Eaton Rapids.	PD, p. 7	The text on the first line of p. 7 states "die cast" twice. It appears that the second instance may instead refer to remelting cells.	Section 1.8 of PD v. 2 has been corrected to reflect the correct number of die cast and recycling cells at Eaton Rapids.	Clarification accepted, issue closed.

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6	CR	Please clarify how the narrative in section 1.8 meets VCS requirements.	PD, p. 7 VCS PD template instructions for section 1.8.	Information provided lacks descriptions about the age and average lifetime of the equipment; and forecast capacities, load factors and efficiencies. The description of the project does not explain "how the same types and levels of services provided by the project would have been provided in the baseline scenario" or why that information is not relevant, if applicable.	PD v. 2 section 1.8 has been corrected with further explanation about the lifetime of equipment in baseline and project scenario and an explanation of the updated equipment for the project and its effects on the capacity and level of service of the project as compared to the baseline.	Clarification accepted, issue closed.
7	CR	Please clarify why Ontario mandatory GHG reporting and cap-and-trade regulations do not apply to the Strathroy facility, and provide clarity about the scope of federal and state GHG reporting requirements in Michigan.	PD, p. 8, section 1.11	The information in this section addresses only SO ₂ and not emissions of other GHGs, particularly SF ₆ .	PD v. 2 section 1.11 has been revised. Due to the regulatory thresholds in Ontario, the High Street location became a regulated entity under the cap-and-trade program and therefore is unable to receive voluntary offset credits. The Wright Street location would have still qualified for voluntary offsets, however due to the small volume of credits, we will not be seeking to include either of the Ontario locations in the project for this crediting period. The PD now includes a fuller analysis of US regulatory provisions relating to the application of the Clean Air Act.	Clarification accepted, issue closed.

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8	CR	Please clarify what evidence supports the claim of Meridian Magnesium Products of America to rights of ownership of emission reductions generated by Meridian Lightweight Technologies, Inc.	PD, p. 8, section 1.12.1; VCS 3.18.2	The PD does not explain how the ownership of emission reductions generated in Strathroy, ON, are conveyed to Meridian MPA in Michigan.	This issue is moot due to the dropping of the Strathroy plants from the project's second crediting period.	Clarification accepted, issue closed.
9	CR	Please clarify why two different reporting thresholds are cited in the last paragraph of the Sustainable Development section 1.13 (p. 10)	PD, p. 10, section 1.13	The general reporting threshold under Part 98 is 25,000 MT for a facility; please explain why the 50,000 MT figure is applicable.	This typo in section 1.13 has been corrected in PD v. 2 to 25,000 MT for the facility in both situations.	Clarification accepted, issue closed.
10	CR	Please provide the project boundary diagram referenced in the last paragraph of section 2.3.	PD, p. 12, section 2.3	No diagram was found appended to the PD.	The figure has been provided with PD v. 2.	Clarification accepted, issue closed.

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11	CR	Please justify the product equivalence of Novec (dodecafluoro-2-methyl-3-pentanone) and perfluoro-2-methyl-2-pentanone in sections 2.3 and 4.1 (GWP _{Novec}) of the PD.	PD, p. 12, sec. 2.3; AM0065 p.2; Novec Product Information sheet from 3M (Novec name.pdf)	3M identifies the chemical formulation of Novec as "dodecafluoro-2-methyl-3-pentanone," or $\text{CF}_3\text{CF}_2\text{C}(\text{O})\text{CF}(\text{CF}_3)_2$, which is not referenced in AM0065.	As explained in PD v2: Perfluoro-2-methyl-3-pentanone, as referred to in AM0065, is chemically identical to Novec 612 fluid, or dodecafluoro-2-methyl-3-pentanone, as referred to in 3M's Product Information sheet. 3M references the condensed structural formula for dodecafluoro-2-methyl-pentanone as $\text{CF}_3\text{CF}_2\text{C}(\text{O})\text{CF}(\text{CF}_3)_2$, which can also be written as the molecular formula of C6F12O. The National Institutes of Health's Open Chemistry Database cites perfluoro-2-methyl-3-pentanone as the chemical name of C6F12O (https://pubchem.ncbi.nlm.nih.gov/compound/Perfluoro_2-methyl-3-pentanone_#section=Top). The chemical structure shown on this page is the same as the condensed structural formula for dodecafluoro-2-methyl-3-	Clarification accepted, issue closed.
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12	NC	The adoption of a GWP for SF6 from IPCC AR5 was not consistent with a requirement of the VCS v. 3.7.	PD, p. 14, section 2.4, Step 1.4; VCS 3.15.3	VCS requires the use of GWPs from the IPCC's Fourth Assessment Report.	pentanone. Additionally, a reference cited 3M white paper titled "3M Novec 612 as a Substitute for SF6 in Magnesium Processing" refers to a study to determine the global warming potential of Novec, whereby perfluoro-2-methyl-3-pentanone is described with the condensed structural formula of CF3CF2C(O)CF(CF3)2, the same dodecafluoro-2-methyl-pentanone (http://pubs.acs.org/doi/pdf/10.1021/es048088u).	Clarification accepted, issue closed.
13	CR	In section 3.1 of the PD, please justify the use of Case 2 rather than case 1.	AM0065 v. 2.1, pp. 6-7	Please explain why historical annual consumption of SF₆ is only available for the total facility rather than for each piece of equipment.	The GWP for SF6 has been changed in v. 2 of the PD and in v. 2 of the Monitoring Report. Can't change history. However, the choice of case 2 in crediting period 1 will be explained.	Clarification accepted, issue closed.

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14	CR	Please explain and justify relevant methodological choices (e.g., with respect to baseline values, selection of emission factors and default values).	VCS PD template text for section 3.1	E.g., selection of the most conservative of three years of baseline data and use of default factors.	The minimum, most conservative values are used in the current baseline. Conversations with VCS helped clarify that while the values for SF6 and magnesium used in the original baseline calculations are not updated, the minimum of the 3 years should be chosen to reflect the updated requirements in AM0065 v2.1.	Clarification accepted, issue closed.
15	CR	Please expand the description of the methodology used for determining baseline emissions, such that the reader of the PD understands how the values were obtained and what the values were.	VCS PD template text for section 3.1	The methodology is described but not illustrated with values obtained.	Included in the PD v2 is an image of the baseline calculations, demonstrating how the numbers were obtained and what has been updated since the original baseline calculations.	Clarification accepted, issue closed.
16	CR	Please clarify the nature of project emissions for the Strathroy facility	VCS PD template text for section 3.1	Information is provided only for the Michigan facility.	The topic is no longer relevant, as Strathroy will not be seeking credits in this crediting period.	Clarification accepted, issue closed.

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2018-03-14

CDM SF6 Replacement
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17	CR	Please expand the narrative description of project emissions, so that the reader of the PD understands their nature.	VCS PD template text for section 3.1	The project template asks that the project proponent "Document how each equation is applied, in a manner that enables the reader to reproduce the calculation. Provide example calculations for all key equations, to allow the reader to reproduce the calculation of estimated net GHG emission reductions or removals."	See PD v2. Example calculations are added to provide further context.	Clarification accepted, issue closed.
18	CR	Please clarify whether the reference to "the crediting period of this project" refers to the first crediting period of the project.	PD, p. 31, third full sentence of bulleted item continued from p. 30.	The PD for the second crediting period is not the same as the one for the prior crediting period, and therefore references to the first ten years of the project activity need to be clearly identified.	See PD v. 2. Text corrected to reflect "initial crediting period".	Clarification accepted, issue closed.
19	NC	Serial numbers for monitoring equipment were not provided.	PD, section 4.2. Cf. VCS PD template instructions for data and para-meters monitored, "monitoring equipment".	In some cases, only weigh scale make and model numbers were provided, but not serial numbers.	The Ohaus scale in Eaton Rapids came from the manufacturer without a serial number. Other scale serial numbers are provided in the PD v2.	The corrective action is accepted, issue closed.

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CDM SF6 Replacement
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20	CR	Please clarify whether the references to scales at Eaton Rapids should cite the "Sterling Weight Scale" in addition to the Ohaus Defender scale.	PD, section 4.2, tables for SO ₂ consumption and PE _{SFR6} .	According to information from the previous project verification, the Ohaus scale replaced the Sterling scale in March 2016.	PD v2 now references only the Ohaus scale.	Clarification accepted, issue closed.
21	NC	In Strathroy, a monitoring procedure was not defined for tracking the amount of Mg manufactured in the project scenario.	AM0065 v. 2.1, p. 15, section III.	The Finance Department did not have a process for quantifying the weight of Mg in parts sold on an annual basis.	No longer relevant, as Strathroy will not be seeking credits in this crediting period.	The validator agrees the issue is moot. The issue is closed.
22	NC	The Project Plan's description of parameters monitored was incomplete.	Project Description (PD), section 4.3	The Project Description did not describe how the parameter "Magnesium sales reports" was monitored at any of the project locations.	Corrected in PD v2 to describe how Magnesium sales are tracked at Eaton Rapids. Sales are monitored by accounting, and final data is overseen by the facilities manager. Kilograms of sales from the recycling plant include ingots cast, which is about 98% of total sales and dross (waste) which is about 2% of total sales. Kilograms of sales from the die cast facility include both sales of finished parts which account for approximately half of the total and the sale of scrap sent to the recycling plant which also accounts for about half of the total. These numbers are compiled into total parts shipped and ingots moved worksheets, which are monitored and quality controlled by the facilities manager.	The corrective action is accepted, issue closed.

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23	R	The project should consider expanding the description of QA/QC processes employed in the "Data / Parameter" tables.	Project Description (PD), section 4.2	Review of three months (May-June-July) of monitored SF6 data in the "B- Meridian 2017 Monitoring Data 11-7-2017.xlsx" file revealed that data had been incompletely transferred from the "Strathroy Recycling Daily record 2017.xlsx". The error was found and corrected by 3Degrees.		
24	CR	Please clarify in the Project Description why CO2 is not accounted for as a project emission.	AM0065 Eq. 9 PD 3.2	CO2 used as a carrier case in the project scenario but not in the baseline is a project emission.	Clarified further on page 12 of the PD in version 2.2. The protocol specifies that if CO2 is used both in baseline and project scenarios, it is excluded from both calculations. CO2 was used as a carrier gas for SF6 in the baseline, and SF6 and Novec in the project scenario. It is therefore excluded from both calculations.	The clarification is accepted. The issue is closed.
25	CR	Please clarify under what name Meridian Magnesium Products of America is registered with the Michigan Secretary of State.	VCS 3.11.1	The Michigan Secretary of State's business search website did not identify a business registered under the name "Meridian Magnesium..."	The business is registered under the name: Magnesium Products of America Inc. (MPA). Meridian Magnesium Products of America is designated as such because MPA's parent company is named Meridian. The Project Description has been updated to show the correct corporate name.	The clarification is accepted. The issue is closed.

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26	CR	Please clarify how ambient air is monitored for SO ₂ levels with the MPA plant.	AM0065, III. Data and parameters monitored	SO ₂ emission levels must be monitored in order to demonstrate compliance with maximum SO ₂ concentration limits.	3Degrees has revised the PD and added monitoring parameters for ambient air SO ₂ emissions.	The clarification is accepted. The issue is closed.
27	CR	Please clarify how evidence demonstrates that the use of Novec 612 is more expensive than continuation of the use of SF ₆ .	PD Section 2.4 Step 1.2	The cost analysis provided in the PD appears to show a cost advantage for the use of Novec 612 over continued use of SF ₆ .	Upon re-reading the original PD we discovered conflicting statements about the usage ratio of SF ₆ to Novec. The validation report including a finding on this topic, but the final PD had not corrected erroneous usage statements. We have clarified what the validated usage ratio was based on the validation finding conclusion, and amended our narrative to show an SF ₆ :Novec usage ratio of 1:0.75 for equivalent oxidation protection.	The clarification is accepted. The issue is closed.

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NSF SF6 Replacement Project (AM0065) Project Workbook: Verification Findings

Client Name: 3Degrees Inc. / Meridian Magnesium
 Lead V/V: John Shideler
 FRS: C0289816
 Job #: J1966238
 Last Revision Date: 2018-03-14
 Reporting Year/Period: 2017-01-01 to 2017-10-31

Instructions to Verifiers

The Lead Verifier shall record findings of **Nonconformity (NC)** and **Clarification Requests (CR)** on this form. Findings of **Immaterial Nonconformity (INC)** may be listed (or, where a GHG program requires their reporting, shall be listed). **Forward Action Requests (FAR)** and **Recommendations (R)** may also be included as items on this form.

Finding/Clarification: State the requirement that was not met, or ask for clarification of information related to audit objectives.

Reference (Ref.): Cite a relevant requirement in a protocol, standard or procedure; or cite information provided by the Responsible Party in a monitoring plan, report or other document.

Audit Evidence: Cite evidence that supports the finding of nonconformity, or (optionally) a reason for requesting clarification.

Responsible Party Action: Summarize the response provided by the Responsible Party with respect to the Finding or Clarification Request.

Lead V/V Conclusion: State if the response has been accepted, and the disposition of the finding (closed, rewritten as a new NC, etc.).

#	Type	Finding/Clarification	Ref.	Audit Evidence	Responsible Party Action	Lead V/V Conclusion
1	CR	Please clarify why 3M's product sheet chemical description of Novec-612, $\text{CF}_3\text{CF}_2\text{C}(\text{O})\text{CF}(\text{CF}_3)_2$, should not be used instead of $\text{C}_2\text{F}_5\text{COC}_3\text{F}_7$.	Monitoring Report, p. 3, section 1.1	3M identifies the chemical formulation of Novec as "dodecafluoro-2-methyl-3-pentanone," which is not referenced in AM0065.	See v. 2	This issue is addressed in the validation findings and has been clarified to our satisfaction. The issue is closed.
2	CR	Please clarify why two different reporting thresholds are cited in the last two paragraphs of the Sustainable Development section 1.10 (p. 5)	Monitoring Report, p. 5, section 1.10	The general reporting threshold under Part 98 is 25,000 MT for a facility; please explain why the 50,000 MT figure is applicable.	See v. 2	This issue is addressed in the validation findings and has been clarified to our satisfaction. The issue is closed.

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3	CR	Please clarify the relevance of the fourth paragraph of section 2.1.	Monitoring Report, p. 6, section 2.1	There is no antecedent in the Monitoring Report to the information about ownership of MPA. The description of ownership of entities related to this project should be adequately described in the Project Description.	The paragraph was removed in v. 2 of the Monitoring Report.	The clarification is accepted, the issue is closed.
4	CR	Please clarify whether the Sterling Scale or the Ohaus Defender scale is used to weigh SO2 and SF6.	Monitoring Report, p. 15, section 3.2, tables SO2 consumption and PE _{SF6,y}	I understood that the Ohaus scale replaced the Sterling scale.	Point clarified, Ohaus replaced Sterling scale in 2016.	The clarification is accepted, the issue is closed.
5	CR	Please amend the language in the continued bullet description of monitoring to clarify which crediting period is being referenced.	Monitoring Report, p. 21, section 3.3	The language used does not separate clearly information attributed to the first crediting period from information relevant to the second crediting period.	The language of the second bullet point under 3.3 has been clarified to distinguish references to the first crediting period and continuation of first crediting period monitoring practices in the second crediting period.	The clarification is accepted, the issue is closed.
6	CR	Please clarify at what frequency the OHAUS scale is calibrated, and whether the Eaton Rapids plant's procedures meet or exceed manufacturer's recommendations.	PD sections 4.1, 4.2	The table for P _{mg} in section 4.2 states that the OHAS scale is calibrated twice yearly. I have calibration records only from 2016-06-28 and from 2017-07-24.	A calibration record from January 19, 2017, has been provided.	The clarification is accepted, the issue is closed.

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2018-03-14

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