

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

Project Title	Conversion of SF ₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON
Version	Version 6
Report ID	2012
Date of Issue	March 9, 2013
Project ID	618
Monitoring Period	1-January-2012 to 31-December-2012
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1 PROJECT DETAILS

1.1 Summary Description of Project

Because molten magnesium burns in the presence of oxygen, production and casting of magnesium metal requires a protection system to prevent this oxidation. Among the various protection systems commonly used are those that use gaseous components with high global warming potential (GWP) values, such as SF₆, which typically escape to the atmosphere. SF₆, because it is such a non-reactive gas, is ideally suited for this kind of protection as a “covering” for molten magnesium (hence the term “cover gas”).

Meridian Magnesium Products historically used SF₆ as a protective cover gas to prevent oxidation of its molten magnesium. The ongoing project switched over the cover gas from SF₆ to Novec-612, a gas patented by 3M, which has heretofore never been used commercially in the U.S., as well as SO₂. The Novec-612 and SO₂ performs the same functions as the SF₆, as cover gases to prevent the molten magnesium from reacting with the air. The Novec-612 and SO₂ gases are pumped from a gas mixer to the point-of-use and inserted over the melt surface. The purpose of the project activity is to stop using the SF₆ and instead use cover gases that have smaller or no global warming potential, thus reducing GHG emissions to the atmosphere.

The baseline scenario is the continued use of SF₆. The project scenario is the use of alternative cover gases. This project installed the necessary piping and other equipment required to switch from SF₆ to Novec-612 and SO₂. Novec-612 is a fluorinated ketone with the chemical formula C₂F₅COC₃F₇. While the GWP for SO₂ is zero, the GWP for Novec-612 is 2,830.

1.2 Sectoral Scope and Project Type

4. Manufacturing industries

1.3 Project Proponent

Project developer: Climate Change Capital

Address: 3 More London Riverside, London, SE1 2AQ

Responsible person: Kevin James

Tel: 202-340-1112

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Project host : Meridian Magnesium Products of America

Address: 2001 Industrial Drive, Eaton Rapids, Michigan, U.S.A. 48827

Responsible person : Charles Woodburn

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1.4 Other Entities Involved in the Project

Project consultant: M.J. Bradley & Associates, LLC

Address: 47 Junction Square Drive, Concord, MA 01742

Responsible person: Brian Jones
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E-mail: bjones@mjbroadley.com

1.5 Project Start Date

The project start date is January 1, 2007.

1.6 Project Crediting Period

The crediting period is 10 years starting from January 1, 2007.

This monitoring report is for the 1-January-2012 to 31-December-2012 crediting period.

1.7 Project Location

Site 1 – U.S.

Meridian Magnesium Products of America
2001 Industrial Drive
Eaton Rapids, Michigan
U.S.A. 48827

Longitude Latitude 42° 31' N 84° 38'W

Site 2 - Canada

Magnesium Products Division (MPD)
155 High St. East
Strathroy, Ontario N7G 1H4
Canada

Longitude Latitude 42° 59' N 81° 62'W

1.8 Title and Reference of Methodology

This project uses an approved CDM Methodology, AM0065 – Replacement of SF₆ for Use as a Cover Gas in Magnesium Production, Version 1.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

In 2012, Meridian continued to utilize the Novec and SO₂ cover gas alternatives to SF₆ in its magnesium recycling and die cast operations in the U.S. and Canada. Meridian produces magnesium ingots by recycling magnesium scrap in its recycling operations. The magnesium ingots are then melted in the die cast operations to make Meridian products, which are primarily for the automobile manufacturing industry.

Total emission reductions in 2012 are the largest achieved by Meridian to date due to the fact that Meridian melted a larger quantity of metal than in previous years and used a smaller amount of SF₆ in its Michigan recycling process. In 2012, Meridian melted over 5 million pounds more metal in its recycling operation and approximately 4 million pounds more in its die cast operation than it did in 2011. Meridian has become more experienced at utilizing the alternative cover gases resulting in greater emission reductions. Meridian was particularly successful reducing its use of SF₆ in its Michigan recycling operation in 2012 with the use of Novec and SO₂.

However, periodic SF₆ usage spikes sometimes occur during a given month due to inferior metal quality, power outage, or some other operational problem with the alternative cover gas. Poor quality scrap metal creates a negative operating condition which makes it problematic to use the Novec and SO₂ alternatives thus requiring higher levels of SF₆ use than normal. A power outage results in the inability to use the Novec system, due to the fact that electricity is required to operate the air compressors and mixing cabinet. When there is a power outage, the backup SF₆ system kicks in to protect the molten metal on the die cast floor at the time of the power outage. Similarly, if there is an operational issue with the Novec or SO₂ alternative cover gas system, the backup SF₆ system is used to keep the molten metal protect and to continue the manufacturing process.

In January 2012, Meridian experienced a 20 hour power outage at its Michigan facility resulting in 222 pounds of SF₆ consumption to protect the molten metal on the die cast floor at the time of the power outage. In addition, in December 2012, Meridian experienced a 45 minute power outage at its Michigan facility resulting in 7 pounds of SF₆ consumption. The two power outages were the only SF₆ cover gas usage in the Michigan die cast operation in 2012.

Meridian operates an internal metal tracking system (called "Plex") to track the quantity of magnesium metal melted in its operations. The Plex system has been implemented fully at the Eaton Rapids, Michigan site and is planned for the site in Canada. In Michigan, magnesium ingots are stacked on pallets and weighed on a batch basis. The weight is electronically recorded into the Plex system and a bar code is adhered to the stack. Every time a pallet of ingots is delivered to a die cast cell, the bar code on the stack is scanned, and the weight is electronically recorded into the Plex system. Prior to the use of this system, weight was manually recorded in centralized Excel spreadsheets.

Update on Ontario Plant Recycling Production Line

In 2010 and 2011, the recycling line of the Ontario Meridian plant ran a different metal than was melted in the project baseline (MRI metal). The use of the MRI metal was necessary in order to produce several key contracted parts for automobile companies. Meridian was not successful in using SO₂ on it. During the 2010 verification of the project, CCC and the third party verifier mutually agreed that the MRI metal falls outside the guidelines of the project activities. As a result, the volumes of magnesium melted and SF₆ gas utilized were removed from the baseline scenario.

In 2012, the Ontario recycling operations ended its use of the MRI metal in the beginning of the second quarter and transitioned to use normal metal that was part of the original project design. The transition to the normal metal began during the second quarter of 2012 but Meridian experienced operational challenges with the SO₂ alternative cover gas system that delayed the full transition until the third quarter. Meridian pulled the SO₂ alternative cover gas cabinet out and sent it to the manufacturer for repairs in May thus requiring the recycling operations to run exclusively on SF₆. During June and July the SO₂ alternative cover gas system continued to malfunction, requiring the manufacturer to send crews to the Meridian facility to troubleshoot. The SO₂ alternative cover gas system was finally repaired and began normal operation in August and continued through the end of the year. As a result of the transition from the MRI metal to the normal metal and operational issues associated with the SO₂ alternative cover gas system experienced during the transition, the volumes of magnesium melted and SF₆ utilized from January – July 2012 were removed from the baseline scenario.

2.2 Deviations from the Monitoring Plan

At validation, the mass flow controllers were identified as the primary monitoring devices for the quantity of cover gas used at the Meridian sites. However, Meridian relies on the mass balance weight method rather than the flow controllers to determine the quantity of cover gas used. The mass flow meters are utilized to control the amount (mixture or ratio) of all of the cover gas delivered to each cell. Meridian views the mass balance weight method as more accurate and aligned with their internal operations.

The key methods to determine how much SF₆ or SO₂ cover gas is actually consumed is based on (1) the accounting method (recording and putting into an inventory database the recorded amount of cover gas in the cylinder, as provided by the SO₂ and SF₆ manufacturer); and (2) the weight method. Using the weight method, the weight of the SO₂ and SF₆ cylinder is weighed when the bottle is full, at regular monthly intervals, and when the bottle is sent back to the manufacturer. The difference is the amount of SO₂ and SF₆ used.

The key method to determine how much Novec is actually consumed is based on recording the weight of the Novec tote as received by the manufacturer and weighing the tote each time it is used to fill the Novec delivery system. The difference is the quantity of Novec consumed.

3 DATA AND PARAMETERS**3.1 Data and Parameters Available at Validation**

Data Unit / Parameter:	GWP of SF ₆
Data unit:	tCO ₂ eq/tSF ₆
Description:	Global Warming Potential of SF ₆
Source of data:	IPCC

Value applied:	23,900
Purpose of the data:	Baseline and project emissions
Any comment:	

Data Unit / Parameter:	PMg,BL,TOTAL
Data unit:	tMg per year
Description:	Amount of MG melted in baseline scenario in the facility (tMg/yr).
Source of data:	Meridian Magnesium Products
Value applied:	28,348 total for die casting for U.S. 20,342 total for recycling for U.S. 26,950 total for die casting for Canada 6,262 total for recycling for Canada
Purpose of the data:	Baseline emissions
Any comment:	

Data Unit / Parameter:	CSF ₆ ,TOT,BL
Data unit:	tSF ₆
Description:	Minimum of annual TOTAL consumption of SF ₆ in the facility for the last three years prior to validation.
Source of data:	Meridian Magnesium Products
Value applied:	5.7057 for die casting 12.4625 for recycling
Purpose of the data:	Baseline emissions and project emissions
Any comment:	

Data Unit / Parameter:	DFSF ₆
Data unit:	Fraction
Description:	Default percentage of SF ₆ assumed to be destroyed in the magnesium process and thus not emitted, thereby reducing baseline emissions.
Source of data:	According to AM0065
Value applied:	0.5
Purpose of the data:	Baseline and project emissions
Any comment:	

Data Unit / Parameter:	GWP _{Novec}
Data unit:	TCO ₂ eq/TNovec used

Description:	Global Warming Potential of Novec
Source of data:	According to AM0065
Value applied:	1
Purpose of the data:	Project emissions
Any comment:	

Data Unit / Parameter:	CF
Data unit:	
Description:	To compensate for the uncertainty in the global warming potential of the byproducts emitted after the degradation of Novec.
Source of data:	According to AM0065
Value applied:	2,830
Purpose of the data:	Project emissions
Any comment:	

Data Unit / Parameter:	DI (DISF ₆ ,CON,BL)
Data unit:	Fraction
Description:	To account for the data integrity of SF ₆ consumption.
Source of data:	According to AM0065
Value applied:	0.95
Purpose of the data:	Baseline emissions
Any comment:	

Data Unit / Parameter:	DI (DISF ₆ ,CON,PJ,k,j,y)
Data unit:	Fraction
Description:	Uncertainty factor of SF ₆ consumption
Source of data:	According to AM0065
Value applied:	1.05
Purpose of the data:	Project emissions
Any comment:	

Data Unit / Parameter:	Lowest baseline emissions factor for US Die Casting
Data unit:	tSF ₆ /tMg
Description:	t SF ₆ per t of MG metal melted
Source of data:	Baseline assessment

Value applied:	0.0000914
Purpose of the data:	Baseline emissions
Any comment:	

Data Unit / Parameter:	Lowest baseline emissions factor for US Recycling
Data unit:	tSF ₆ /tMg
Description:	t SF ₆ per t of MG metal melted
Source of data:	Baseline assessment
Value applied:	0.000385
Purpose of the data:	Baseline emissions
Any comment:	

Data Unit / Parameter:	Lowest baseline emissions factor for Canada Die Casting
Data unit:	tSF ₆ /tMg
Description:	t SF ₆ per t of MG metal melted
Source of data:	Baseline assessment
Value applied:	0.0000549
Purpose of the data:	Baseline emissions
Any comment:	

Data Unit / Parameter:	Lowest baseline emissions factor for Canada Recycling
Data unit:	tSF ₆ /tMg
Description:	t SF ₆ per t of MG metal melted
Source of data:	Baseline assessment
Value applied:	0.000684
Purpose of the data:	Baseline emissions
Any comment:	

3.2 Data and Parameters Monitored

Site 1 – U.S.

Data Unit / Parameter:	P _{Mg,recycle,y}
Data unit:	lbs Mg
Description:	Metal melted in recycling – Michigan Plant
Source of data:	Weight scales

Description of measurement methods and procedures to be applied:	Once the MG ingots are placed on a pallet, the pallet is weighed on a batch basis and the amount is electronically recorded into the Plex system and a bar code is adhered to the stack.
Frequency of monitoring/recording:	Daily
Value monitored:	46,186,808
Monitoring equipment:	Sterling scale (serial number 24098) Calibration date – January 24 and July 24, 2012
QA/QC procedures to be applied:	Calibration twice per year
Calculation method:	
Any comment:	

Data Unit / Parameter:	$P_{Mg,diecast,y}$
Data unit:	lbs Mg
Description:	Metal melted in die cast – Michigan Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	Every time a pallet of MG ingots is delivered to a die cast cell, the bar code on the stack is scanned, and the weight is electronically recorded into the Plex system.
Frequency of monitoring/recording:	Daily
Value monitored:	64,146,681
Monitoring equipment:	Sterling scale (serial number 24098) Calibration dates – January 24 and July 24, 2012
QA/QC procedures to be applied:	Calibration twice per year
Calculation method:	
Any comment:	

Data Unit / Parameter:	$PE_{Novec,y}$
Data unit:	lbs Novec
Description:	Quantity of Novec cover gas used– Michigan Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	The weight of the Novec tote is tracked using the same weight scales as the metal at the facility.
Frequency of monitoring/recording:	The Novec tote is weighed every time the Novec panel is filled and the amount is manually entered into a central excel file at that time.
Value monitored:	11,612

Monitoring equipment:	Sterling weight scale (serial number 24098) Calibration dates – January 24 and July 24, 2012
QA/QC procedures to be applied:	Calibration twice per year
Calculation method:	
Any comment:	

Data Unit / Parameter:	SO ₂ consumption
Data unit:	lbs SO ₂
Description:	SO ₂ consumed – Michigan Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	At the Eaton Rapids plant, the Sterling Scale is used to track the SO ₂ gas usage from cylinder weights.
Frequency of monitoring/recording:	Gas cylinders are weighed prior to installation and when replaced with a new cylinder and the amount is manually enter into a central excel file on a monthly basis.
Value monitored:	8,894
Monitoring equipment:	Sterling weight scale (serial number 24098) Calibration dates – January 24 and July 24, 2012
QA/QC procedures to be applied:	Calibration twice per year
Calculation method:	
Any comment:	

Data Unit / Parameter:	PE _{SF6,y}
Data unit:	lbs SF ₆
Description:	SF ₆ consumed – Michigan Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	At the Eaton Rapids plant, the Sterling Weight Scale is used to track the SF ₆ gas usage from cylinder weights.
Frequency of monitoring/recording:	Gas cylinders are weighed prior to installation and when replaced with a new cylinder and the amount is manually enter into a central excel file on a monthly basis.
Value monitored:	4,475
Monitoring equipment:	Sterling weight scale (serial number 24098) Calibration dates – January 24 and July 24, 2012
QA/QC procedures to be applied:	Calibration twice per year

Calculation method:	
Any comment:	

Site 2 - Canada

Data Unit / Parameter:	P _{Mg,recycle,y}
Data unit:	lbs Mg
Description:	Metal melted in recycling – Ontario Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	Once the MG ingots are placed on a pallet, the pallet is weighed on a batch basis and the amount is manually enter into central excel file
Frequency of monitoring/recording:	Daily
Value monitored:	4,373,954
Monitoring equipment:	Pennsylvania 7600 - Wright Street (# 00269455) Pennsylvania 7600 - High Street (#97242573) Calibration date – May 7, 2012
QA/QC procedures to be applied:	Annual calibration
Calculation method:	
Any comment:	

Data Unit / Parameter:	P _{Mg,diecast,y}
Data unit:	lbs Mg
Description:	Metal melted in die cast – Ontario Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	Once the MG ingots are placed on a pallet, the pallet is weighed on a batch basis and the amount is manually enter into central excel file.
Frequency of monitoring/recording:	Daily
Value monitored:	61,032,594
Monitoring equipment:	Pennsylvania 7600 - Wright Street (# 00269455) Pennsylvania 7600 - High Street (#97242573) Calibration date – May 7, 2012
QA/QC procedures to be applied:	Annual calibration
Calculation method:	
Any comment:	

Data Unit / Parameter:	PE _{SF6,y}
Data unit:	LBS SF ₆
Description:	SF ₆ consumed – Ontario Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	Gas cylinders are weighed prior to installation and when replaced with a new cylinder using weight scales.
Frequency of monitoring/recording:	Gas cylinders are weighed upon cylinder change out using weigh scales and the amount is manually enter into a central excel file on a monthly basis.
Value monitored:	4,269
Monitoring equipment:	Eagle (EI 2000) weight scales Calibration date – May 7, 2012
QA/QC procedures to be applied:	Annual calibration
Calculation method:	
Any comment:	

Data Unit / Parameter:	SO ₂ consumption
Data unit:	LBS SO ₂
Description:	SO ₂ consumed – Ontario Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	Gas cylinders are weighed prior to installation and when replaced with a new cylinder using weight scales.
Frequency of monitoring/recording:	Gas cylinders are weighed upon cylinder change out using weight scales and the amount is manually enter into a central excel file on a monthly basis.
Value monitored:	4,872
Monitoring equipment:	Eagle (EI 2000) weight scales Calibration date – May 7, 2012
QA/QC procedures to be applied:	Annual calibration
Calculation method:	
Any comment:	

Data Unit / Parameter:	PE _{Novec,y}
Data unit:	LBS Novec

Description:	Novec consumed – Ontario Plant
Source of data:	Weight scales
Description of measurement methods and procedures to be applied:	The weight of the Novec tote is tracked using the same weigh scales as the metal at the facilities.
Frequency of monitoring/recording:	The Novec tote is weighed every time the Novec panel is filled and the amount is manually entered into a central excel file at that time.
Value monitored:	12,715
Monitoring equipment:	Pennsylvania 7600 - Wright Street (# 00269455) Pennsylvania 7600 - High Street (#97242573) Calibration date – May 7, 2012
QA/QC procedures to be applied:	Annual calibration
Calculation method:	
Any comment:	

3.3 Description of the Monitoring Plan

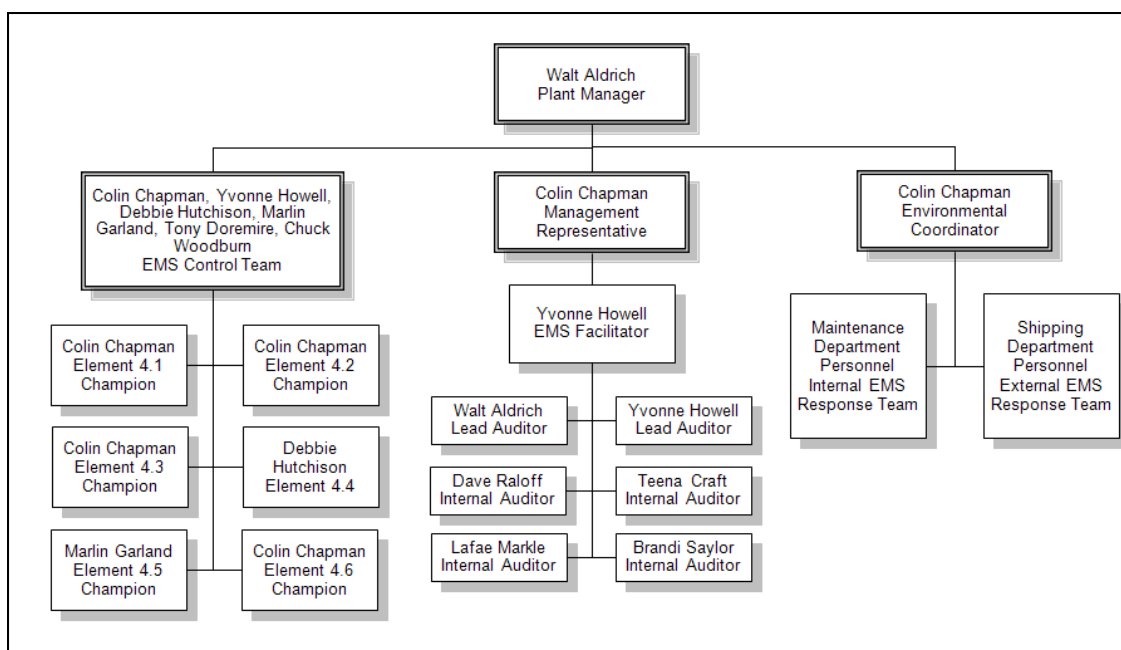
The monitoring plan requires the magnesium melted to be calculated using weighing methods and multiplying those numbers by the TSF_6/TMg ratio calculated in the baseline. In other words, the baseline emissions are determined by how much SF_6 would have been used with the metal production numbers in the crediting year. Project emissions are calculated by determining the amount of SF_6 that was used in the project year and the amount of alternative gas used. Using flow meter readings, the weighing of bottles (SF_6 and SO_2), and the weighing of the Novec tote, we can determine the amounts of SF_6 and alternative cover gases used. In the case of Novec, we multiply the amount of Novec used by a default GWP of 2,830. Project emissions are deducted from the baseline emissions to obtain annual emission reductions for the crediting year.

Data sources that are therefore monitored are: magnesium metal melted, SF_6 used, and Novec used. In addition, we monitor the amount of SO_2 because while SO_2 is not a GHG, we need to determine that the use and handling of SO_2 is in compliance both with local regulations and with AM0065. Data sources other than those monitored are primarily the baseline, which primarily includes the use of SF_6 and metal melted for each segment of the facility for up to three years.

Below is the organizational chart for the management of this project. Charles Woodburn has overall responsibility for all aspects of monitoring this project, including:

- Metal melted. Compiling all magnesium metal melt numbers, so we can accurately know the quantity of metal melted, the key factor for determining baseline emissions in each project year. This task includes calibrating the scales to ensure they are accurate. In addition, Meridian is implementing an internal metal tracking system (Plex) to accurately track the metal melted. The Plex system has been implemented fully at the U.S. site and is planned for the site in Canada.

- Gas consumption: For every cover gas consumed, Novec, SO₂, and when necessary, SF₆, Mr. Woodburn compiles all gas consumption numbers, including gas invoices, floor tracking sheets with gas consumption values based on scale weights, and compilation of readings off the mass flow controllers, so the data can be archived. This task also involves ensuring all flow meters are periodically checked and calibrated to ensure smooth operation. This task also includes calibrating the weigh scales to ensure they are accurate. Meridian will also work to ensure that any situations that might require the resumption of SF₆ use are minimized as much as possible. The gas consumption data gathering methodology has remained consistent throughout the crediting period of this project, and does not differ from previous monitoring reports. While the flow meters are used to regulate the gas flow, gas consumption is determined based on weighing the gas cylinders and Novec tote.
- SO₂ management: Meridian has an extensive training system so personnel who might be exposed to SO₂ fumes are properly prepared. This monitoring task includes the need to ensure that all SO₂ sensors are operating effectively, so if emissions do exceed certain limits, an alarm will sound and that section of the plant can be evacuated. Finally, this monitoring task involves ensuring SO₂ use and management are fully in compliance with AM0065's specifications dealing with SO₂.



4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Site 1 - U.S.

Recycling Baseline = 46,186,808 lbs metal melted in recycling//2204.6 * Emission Factor for recycling 0.0003850 (TSF₆/TMg) * SF₆ GWP of 23,900 = 192,770 t CO₂ equivalents

Die Cast Baseline = 64,146,681 lbs metal melted in die casting//2204.6 * Emission Factor for die cast 0.0000914 (TSF₆/TMg) * SF₆ GWP of 23,900 = 63,560 t CO₂ equivalents

Total Baseline Emissions for Michigan = 256,330 t CO₂ equivalents

Site 2 - Canada

Recycling Baseline = 4,373,954 lbs metal melted in recycling//2204.6 * Emission Factor for recycling 0.000684 (TSF₆/TMg) * SF₆ GWP of 23,900 = 32,433 t CO₂ equivalents

Die Cast Baseline = 60,969,179 lbs metal melted in die casting//2204.6 * Emission Factor for die cast 0.0000549 (TSF₆/TMg) * SF₆ GWP of 23,900 = 36,324 t CO₂ equivalents

Baseline emissions = 68,757 t CO₂ equivalents

4.2 Project Emissions

Site 1 - U.S.

Recycling Project Emissions = 4,246 lbs SF₆ used in recycling/2204.6 * 0.5 factor * 1.05 factor * 23,900 GWP SF₆ + 4,852 lbs Novec used in recycling/2204.6 * 1 GWP Novec * 2,830 CF Novec = 30,391 t CO₂ equivalents

Die Cast Project Emissions = 229 lbs SF₆ used in die casting/2204.6 * 0.5 factor * 1.05 factor * 23,900 GWP SF₆ + 6,760 lbs Novec used in die cast/2204.6 * 1 GWP Novec * 2,830 CF Novec = 9,981 t CO₂ equivalents

Project emissions = 40,372 t CO₂ equivalents

Site 2 - Canada

Recycling Project Emissions = 4,025 lbs SF₆ used in recycling/2204.6 * 0.5 factor * 1.05 factor * 23,900 GWP SF₆ = 22,907 t CO₂ equivalents

Die Cast Project Emissions = 244 lbs SF₆ used in die casting/2204.6 * 0.5 factor * 1.05 factor * 23,900 GWP SF₆ + 12,715 lbs Novec used in die casting/2204.6 * 1 GWP Novec * 2,830 CF Novec = 17,711 t CO₂ equivalents

Project emissions = 40,618 t CO₂ equivalents

4.3 Leakage

There is no leakage of emissions associated with this project.

4.4 Summary of GHG Emission Reductions and Removals

Site 1 - U.S.

Baseline Emissions = 256,330 t CO₂ equivalents

Project emissions = 40,372 t CO₂ equivalents

Emission reductions = 215,958 t CO₂ equivalents

Site 2 - Canada

Baseline emissions = 68,757 t CO₂ equivalents
Project emissions = 40,618 t CO₂ equivalents
Emission reductions = 28,140 t CO₂ equivalents

5 ADDITIONAL INFORMATION