

Monitoring Report

Project title: Conversion of SF₆ to an Alternative Cover Gas in Magnesium Production in Eaton Rapids, MI and Strathroy, ON

Report completed by: Brian Jones
Report completed on: April 21, 2011

1. Monitoring period: January 1, 2010 to December 31, 2010

Verified emission in the reporting period:

2010 U.S. (Michigan facility)

- Project emissions 50,574 t CO₂ equivalents
- Baseline emissions 232,831 t CO₂ equivalents
- Emission reductions 182,257 t CO₂ equivalents

2010 Canada (Ontario facility)

- Project emissions 9,672 t CO₂ equivalents
- Baseline emissions 27,328 t CO₂ equivalents
- Emission reductions 17,656 t CO₂ equivalents

Year	Project Emissions	Baseline Emissions	Leakage	Emission Reductions
2010 (US)	50,574	232,831	0	182,257
2010 (Canada)	9,672	27,328	0	17,656

2. Project timeline

- Starting date of the project: January 1, 2007
- Crediting period: 10 years
- Starting date of crediting period: January 1, 2010

3. Project summary

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 GWP values, such as SF₆, which typically escape to the atmosphere.¹ 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 currently uses SF₆ as a protective cover gas to prevent oxidation of its molten magnesium. The proposed project will switch over from SF₆ to Novec-612, a recently-patented gas by 3M, which has never been used commercially in the US, as well as SO₂. The SO₂ will perform the same function as the SF₆, as a cover gas to prevent the metal from reacting with the air. The SO₂ gas will be pumped from a gas mixer, in very low concentrations, 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 a cover gas that has no global warming potential, thus

¹ 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 3, Chapter 4, page 4.57)

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 will install the necessary piping and other equipment required to switch from SF₆ to Novec-612 and SO₂. Novec-612 is a recently-patented gas by 3M. The gas is a fluorinated ketone with the chemical formula C₂F₅COC₃F₇.

4. Remaining issues, including any material discrepancy, from previous validation (verification).

In DNV's second verification / certification report in September 9, 2009 included three forward action requests (FAR). The FARs identified in the second verification are listed below and Climate Change Capital and Meridian Magnesium Products' response follows:

- FAR 1 The calibration documents for all flow meters and scales need to be maintained for scales and flow meters for Novec-612™ and SO₂.
- FAR 2 DNV was unable to cross verify the invoices of Magnesium to the amount of Magnesium melted reported in the excel file *Error! Reference source not found.*. CCC and Meridian need to revise the monitoring plan to include procedures to track the Magnesium bought and its usage to record any losses.
- FAR 3 The magnesium melted is not recorded per station. DNV found it complicated to verify the total amount of magnesium melted. CCC and Meridian need to revise the monitoring technique to clarify the process.

FAR 1

For the 2009 data year verification, Meridian provided every calibration document for the flow meters, gases and metal weigh scales for both plants. All the calibration documents for both the Michigan and Ontario plants are provided for the 2010 data year verification.

Mass flow meters are installed at each cell at the Michigan and Ontario plants. The flow meters regulate the quantity of gas delivered to each cell. The meters are calibrated when purchased from the manufacturer and stored by Meridian in a vacuum seal until it is necessary to replace the flow meters in operation. The mass flow meters were changed at the Michigan plant in July of 2010. However, the calibration certificate indicates that the calibration date was in 2009. In addition, the mass flow meters were changed at the Canadian plant in September of 2010. However, the calibration certificates indicate that the calibration date was 2008.

A question arose last year from DNV regarding the timing of calibrations and

replacement of mass flow meters. Meridian contacted the mass flow meter supplier about this last year and they confirmed that if they are vacuum sealed sitting on a shelf the calibration is not affected. According to the mass flow meter supplier, calibration is effective from the date of the installation.

The calibration for the metal weigh scales for the Ontario plant were not completed in 2009 due to plant production shut down due to the economic downturn. The calibration document provided was dated May 2010. DNV reviewed the 2010 calibration document and confirmed no error in reading.

As detailed below, Meridian tracks SF₆ and alternative gas usage (Novec and SO₂) at the plant level. The flow meter settings are then utilized by Meridian to assign the plant level quantity of SF₆ and alternative cover gas (Novec and SO₂) utilized per cell. SF₆ and the alternative cover gases are delivered to the cells through individual centralized gas cabinet locations at each plant. The gas cabinet systems installed at each plant for the alternative cover gases (Novec and SO₂) record alternative cover gas usage at the point that it leaves the centralized gas cabinet.

Meridian operates weigh scales at the Michigan and Ontario plants to weigh the SF₆ cylinders. Separate weigh scales are utilized at both plants to weigh metal as well. All weigh scales are calibrated according to manufacturer's specifications annually. Novec, SO₂ and SF₆ are weighed when the tanks/bottles are filled by the supplier. The invoice provided by the supplier to Meridian contains the purchased gas weights.

Meridian utilizes cylinder weigh scales to track the quantity of SF₆ gas used by the plant and records usage amounts on internal company tracking sheets. Meridian weighs each cylinder of SF₆ as it is installed and each cylinder as it is removed. The Meridian SF₆ usage tracking sheets includes the heel returned to the supplier. SF₆ usage has always been determined through the mass balance method, rather thru flow meters, which is a widely accepted methodology for this gas.

FAR 2

For the 2009 data year verification, Meridian provided every metal invoice for the Michigan and Ontario plant to DNV. For the 2010 data year verification, Meridian is providing internal metal tracking and forecasting excel spreadsheets for both plants. In addition, as detailed in our response to FAR 3 below, Meridian is implementing a new electronic metal tracking tool (Plex-Dross) to track magnesium purchases from the time they enter the facility to the time they leave the facility as a customer part. This system will aide DNV to cross verify the amount of magnesium melted.

The magnesium die cast and recycling plant operations are somewhat complex. However, the vast majority of metal that enters the plant is used in a customer part one way or another. During the magnesium part manufacturing process, metal is melted to a molten state and poured into a mold and then stamped into a customer part.

Meridian purchases magnesium ingots and recycled material from multiple sources throughout the year, and sometimes transfers metal between its Mexican, United Kingdom and Canadian plants as needs arise. As part of its planning efforts, Meridian forecasts its metal needs based on customer part orders several months in advance including the contracts in place to fill those projected needs.

FAR 3

While the system was introduced in the fourth quarter of 2010 in Michigan, it was not introduced in Ontario until the beginning of 2011. A screen shot of the Plex Online system is provided below. Reports from the system are also provided.

5

Now, in the Michigan die cast cells, each pallet of magnesium ingots is electronically scanned prior to its use by the cell operator. Along with the time, shift number, operator id and cell id, the scan captures the weight, origin and type of metal prior to it being melted in the cell and stamped into a customer part. This data capture will provide for the quantity of metal melted on a per cell basis.

The data capture for the recycling cells remains unchanged. The recycling operation relies on the weights off of the Meridian scale located at the facility. This weight is then automatically captured by Meridian's internal system.

Update on Ontario Plant Recycling Production Line

Recall that in March 2009 the magnesium recycling production line of the Ontario Meridian facility was shut down due to a lack of market demand. In 2010, the increase in market demand was sufficient to run the recycling all year. However, the recycling line of the Ontario Meridian plant continue to run the MRI metal all year and Meridian was not successful in using SO₂ on it. This is the same magnesium recycling process, which DNV and CCC mutually agreed last year falls outside the guidelines of the project activities. As a result, the volumes of magnesium produced and SF₆ gas utilized have been removed from the baseline scenario. We view it as appropriate and conservative to exclude the recycling activity from 2010.

Overall Emission Reduction Performance

2010 emissions reductions (across both sites) as a percentage of baseline emissions have increased to approximately 75% in 2010 from 66% in 2009 and 40% in 2008 as the Meridian facilities have become more experienced at utilizing the Novec and SO₂ alternatives to SF₆ use and have demonstrated increased switchover across their production lines. However, there remain periodic SF₆ usage spikes, due to inferior metal quality.

5. Methodology and Monitoring

- Methodology used
- Monitoring processes
- Data sources other than those monitored
- Calculation processes for baseline and project emissions respectively

The methodology used is AM0065.

The monitoring process requires the production of magnesium to be calculated using weighing methods and multiplying those numbers by the TSF₆/TMg ratio calculated in the baseline. In other words, we are determining how much SF₆ would have been used with the metal production numbers in the crediting year. Those are the baseline emissions. Project emissions are calculated by determining the amount of SF₆ that was used in the project year and the amount of alternative gas used. Using flow

meter readings and the weighing of bottles, we can determine the amounts of gas used. In the case of Novec, we multiply the amount of Novec used by a default GWP of 2,830 TCO₂eq/Ton of Novec used. This is deducted from the baseline emissions to obtain a figure for emission reductions.

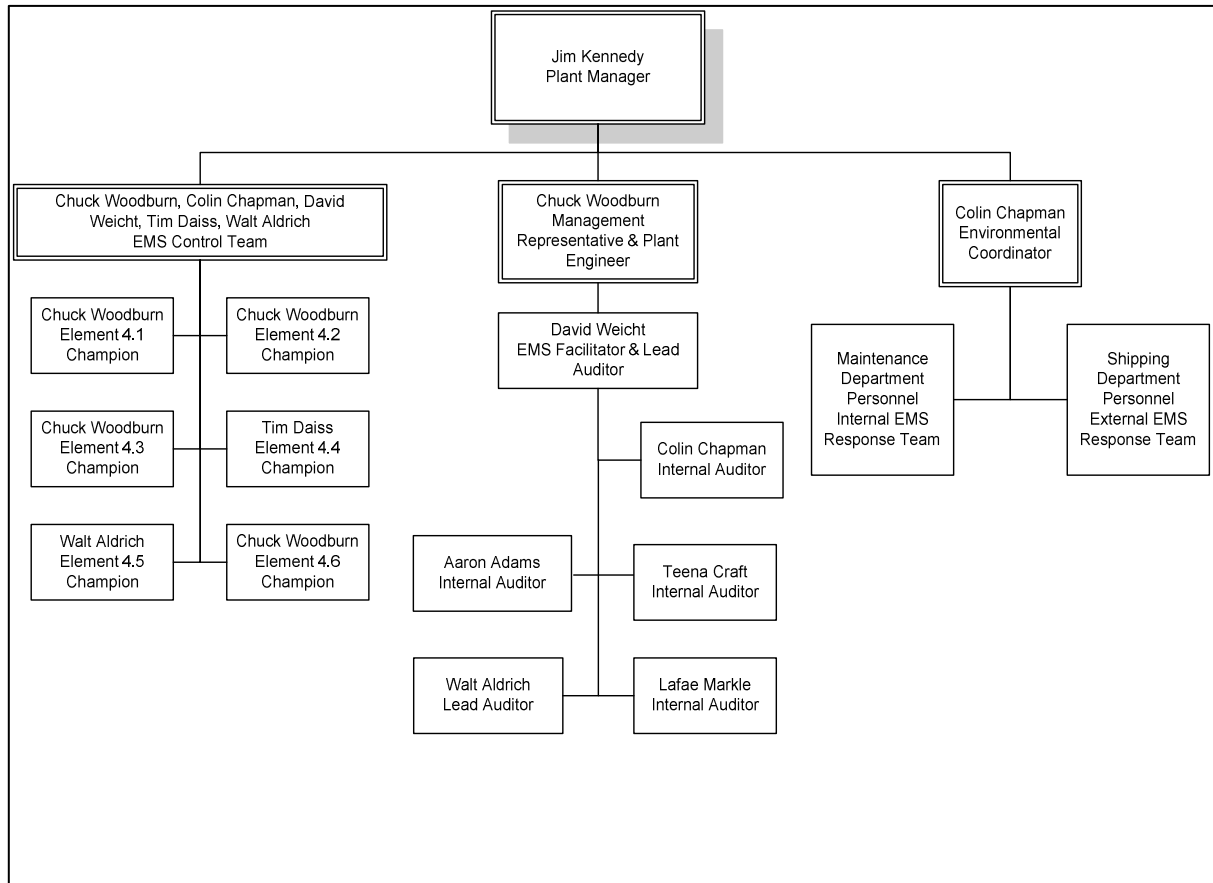
Data sources that are therefore monitored are: Metal production, SF₆ used, CO₂ used, Novec used. In addition, we monitor the amount of SO₂ because while SO₂ is not a GHG, we need to determine that the use and handling of SO₂ is in compliance both with local regulations and with AM0065. Data sources other than those monitored are primarily the baseline, which primarily includes the use of SF₆ and metal production for each segment of the facility for up to three years. This data is provided at the end of this document.

6. Management and operational system

- organisational structure
- responsibilities
- competencies
- non-conformance handling
- internal audits
- and management review

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

- Compiling all magnesium production numbers, so we can accurately know production, the key factor for determining baseline emissions in each project year. This task includes calibrating the scales to ensure they are accurate.
- Gas consumption: For every gas consumed, Novec, SO₂, CO₂ and when necessary, SF₆, Mr. Woodburn will compile all gas consumption numbers, including compilation of readings off the flow controllers, so the data can be archived. This task also involves ensuring all flow meters are periodically checked to ensure smooth operation. Meridian will also work to ensure that any situations that might require the resumption of SF₆ use are minimized as much as possible.
- 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.



Annex 1 – Contact details

Project developer: Climate Change Capital

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Annex 2 – Summary of monitoring results

Monitored data: Michigan

ID	Variable	Unit	Value	Remark
1	Metal melted in recycling	lbs	41,726,755	Multiply by EF to get baseline emissions
2	Metal melted in die casting	lbs	59,217,813	Recycling also used some Novec
3	Novec consumed	lbs	9,515	Novec by products have a GWP default of 2830
4	SO ₂ consumed	lbs	5,917	To determine compliance with AM0065, not a GHG
5	SF ₆ Consumed	lbs	6,740	To determine project emissions

Ontario, Canada

ID	Variable	Unit	Value	Remark
1	Metal melted in recycling	lbs	0	Multiply by EF to get baseline emissions
2	Novec consumed	lbs	7,535	Novec by products have a GWP default of 2,830
3	Metal melted in die casting	lbs	45,917,329	Multiply by EF to get baseline emissions
4	SO ₂ consumed	lbs	0	To determine compliance with AM0065, not a GHG
5	SF ₆ Consumed	lbs	0	To determine project emissions

Fixed parameters

ID	Variable	Unit	Value	Remark
1	SF6 GWP	TCO ₂ eq/TSF6	23,900	
2	Novec CF (conservative factor)	TCO ₂ eq/TNovec used	2,830	According to AM0065
3	DF	Fraction	0.5	According to AM0065
4	DI (DI _{SF6,CON,BL})	Fraction	0.95	According to AM0065
5	DI (DI _{SF6,CON,PJ,k,j,y})	Fraction	1.05	According to AM0065
6	SF6 consumed in baseline years	TSF6	See Annex	
7	Mg produced in baseline years	Tons	See Annex	
8	Lowest baseline emissions factor for US Die Casting	TSF6/TMg	0.0000914	From baseline assessment
9	Lowest baseline emissions factor for US Recycling	TSF6/TMg	0.000385	From baseline assessment
10	Lowest baseline emissions factor for Canada Die Casting	TSF6/TMg	0.0000549	From baseline assessment
11	Lowest baseline emissions factor for Canada Recycling	TSF6/TMg	0.000684	From baseline assessment

Attached document - Spreadsheet for calculations of emission reductions

All monitoring data should be included in an Excel workbook. This includes:

- Project Details - This worksheet contains a brief overview of the key facts of the project.
- Calculations - Shows the calculation of emission reductions on the basis of raw data.
- Raw data - Contains the raw monitoring data
- Reference data - A list of the default values and/or values defined in the PD

Michigan

Die Casting		2005	2006	2007
	US Die casting SF6 (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
	TCO2eq assuming lowest year of P			
		2005	2006	2007
Recycling	US SF6 use in recycling facility (lbs)	34,234	34,923	44,222
	US recycling metal	42,236,980	40,996,103	40,683,251
P _{Mg, BL}	Total Mg Production (tons)	21,118	20,498	20,342

SF6con	Total SF6 Use (tons)	17.12	17.46	22.11
DF _{SF6}	50% discount	8.558500	8.730750	11.055500
DISF6,CON	5% discount	8.130575	8.294213	10.502725
EF, SF6	EF	0.000385	0.000405	0.000516
	TCO2eq			

**Baseline
Project
Emissions**

**Total (Short
Tons)**

**TOTAL VERs
2008-2012
Metric Tons**

GWP of SF6 = 23,900

Project Emissions

Novec GWP

2830

		Novec 75% of SF6	CO2e (tons)
Die Casting and Recycling	-	2.83	8,009

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Ontario

Die Casting		2004*	2005	2006
	Canada Die casting SF6 (lbs)	9,315	7,386	7,070
	Canada Die casting Metal (lbs)	71,865,712	63,956,200	59,290,000
P _{Mg, BL}	Total Mg Production (metric tons)	32,666	29,071	26,950
SF6con	Total SF6 Use (short tons)	4.66	3.69	3.54
DF _{SF6}	50% discount	2.33	1.85	1.77
DISF6,CON	5% discount	2.21	1.75	1.68
EF, SF6	EF (determined using short tons)	0.000062	0.0000549	0.0000566
	TCO2eq assuming lowest year of P	45,855	36,359	34,804
		2004	2005	2006
Recycling	Canada SF6 use in recycling facility (lbs)	21,024	25,534	NA

	Canada recycling metal (lbs)	14,596,869	14,205,400	13,776,400
$P_{Mg, BL}$	Total Mg Production (metric tons)	6,635	6,457	6,262
SF6con	Total SF6 Use (short tons)	10.51	12.77	
DF_{SF6}	50% discount	5.256000	6.383500	
DISF6,CON	5% discount	4.993200	6.064325	
EF, SF6	EF (determined in short tons)	0.000684	0.000854	
	TCO2eq		100,720	