Malfunction Abatement Plan
for
Fabric Filter Baghouses and SNCR

St. Marys Cement U.S. LLC
Charlevoix, Michigan

Project No. 180985
November 2018




Fishbeck, Thompson, Carr & Huber, Inc.
engineers | scientists | architects | constructors

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Prepared For:
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List of Abbreviations/Acronyms

CEMS	continuous emissions monitoring system
°F	degrees Fahrenheit
FTCH	Fishbeck, Thompson, Carr & Huber, Inc.
HAP	hazardous air pollutant
MAP	Malfunction Abatement Plan
MDEQ	Michigan Department of Environmental Quality
N_2	nitrogen
NO_X	nitrogen oxides
PM	Preventive Maintenance
PTI	Permit to Install
ROP	Renewable Operating Permit
SMC	St Marys Cement U.S. LLC
SNCR	selective non-catalytical reduction
SO_2	sulfur dioxide

1.0 Introduction

This MAP, has been prepared to comply with the requirements of PTI 115-15, PTI 140-15, ROP MI-ROP-B1559-2014, as well as Michigan Air Pollution Control Rules 910 and 911. The purpose of this Plan is to define actions that will be taken by St Marys Cement U.S. LLC (SMC) in the event of a malfunction or equipment breakdown which could result in an exceedance of emission limitations.

Michigan Rule 910 requires the proper installation, maintenance, and operation of air pollution control systems. The Rule reads:

> *An air-cleaning device shall be installed, maintained, and operated in a satisfactory manner and in accordance with these rules and existing law.*

Michigan Rule 911 specifies that, upon request of the MDEQ, a facility must prepare a MAP to prevent, detect, and correct malfunctions or equipment failures resulting in emissions exceeding any applicable emission limitation. Rule 911 states:

> *(1) Upon request of the department, a person responsible for the operation of a source of an air contaminant shall prepare a malfunction abatement plan to prevent, detect, and correct malfunctions or equipment failures resulting in emissions exceeding any applicable emission limitation.*
>
> *(2) A malfunction abatement plan required by subrule (1) of this rule shall be in writing and shall, at a minimum, specify all of the following:*
>
> *(a) A complete preventative maintenance program, including identification of the supervisory personnel responsible for overseeing the inspection, maintenance, and repair of air cleaning devices, a description of the items or conditions that shall be inspected, the frequency of the inspections or repairs, and an identification of the major replacement parts that shall be maintained in inventory for quick replacement.*
>
> *(b) An identification of the source and air cleaning device operating variables that shall be monitored to detect a malfunction or failure, the normal operating range of these variables, and a description of the method of monitoring or surveillance procedures.*
>
> *(c) A description of the corrective procedures or operational changes that shall be taken in the event of a malfunction or failure to achieve compliance with the applicable emission limits.*
>
> *(3) A malfunction abatement plan required by subrule (1) of this rule shall be submitted to the department and shall be subject to review and approval by the department. If, in the opinion of the commission, the plan does not adequately carry out the objectives as set forth in subrules (1) and (2) of this rule, then the department may disapprove the plan, state its reasons for disapproval, and order the preparation of an amended plan within the time period specified in the order. If, within the time period specified in the order, an amended plan is submitted which, in the opinion of the department, fails to meet the objective, then the department, on its own initiative, may amend the plan to cause it to meet the objective.*
>
> *(4) Within 180 days after the department approves a malfunction abatement plan, a person responsible for the preparation of a malfunction abatement plan shall implement the malfunction abatement plan required by subrule (1) of this rule.*

2.0 Defining Malfunctions

Rule 113(a) defines a **malfunction** as:

> *Malfunction means any sudden, infrequent and not reasonably preventable failure of a source, process, process equipment, or air pollution control equipment to operate in a normal or usual manner. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.*

A true malfunction must have a reasonable potential to cause:

- An operating parameter to stray from an acceptable range or value that has been established to indicate compliance with an emission limit
  or
- An exceedance in emissions or operating parameter

Most malfunctions of the control equipment will not result in emissions exceedances. However, the systems must be returned to service as soon as possible to maintain maximum emission control. If a malfunction or failure occurs that cannot be corrected by an operator, then a Work Order will be issued to repair the system.

Following is a list of malfunction events covered by this Plan.

- Failure of emission control system components (e.g., monitoring and data acquisition equipment)
- Bag failure (e.g., due to rips/tears, bag blinding due to moisture in gas, timer failure, magnahelic failure, manometer failure)
- Power failure
- Plugging of conveyors
- Sudden and unavoidable failure of control or process equipment, not due to poor operation or maintenance procedures

3.0 Source Description

SMC is a Portland Cement manufacturing facility that consists of quarry operations, crushing systems, raw feed receiving and storage areas, raw mill systems, fuel receiving and storage areas, a calciner, a kiln system, clinker cooler, clinker storage systems, finish mill systems, and a cement storage and shipping facility. The manufacture of Portland cement primarily involves crushing, grinding, and blending of limestone and other raw materials into a chemically proportioned mixture which is then heated by an inline calciner followed by a rotary kiln at extremely high temperatures (2,800°F) to produce pellets that are approximately 0.5 to 2 inches in diameter. The pellets, known as clinker, are cooled and ground in ball mills together with 5% to 10% gypsum to produce the final product, Portland cement. The plant utilizes more than 45 air-cleaning devices to limit the emissions of dust from process equipment and operations.

Table 1 Identifies the Emission Units that are subject to the requirements of this MAP and the applicable emission limits.

In addition, SMC is subject to 40 CFR Part 63 Subpart LLL National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry.

4.0 Emission Control Devices

SMC utilizes SNCR systems and baghouses to control NO_X and particulate emissions, which are generated by the Portland cement manufacturing processes.

4.1 Fabric Filters and Dust Collectors

The fabric filters currently in operation at SMC are described in Table 2. The fabric filters remove dust from the exhaust gases by a mechanical filtering mechanism. As dust builds up on the collecting fabric, the filtering efficiency improves, to the point where the dust builds up too high and the fan has trouble drawing air through the filter, which increases the pressure drop across the fabric filter. A majority of the accumulated dust is removed from the fabric at regular intervals by using a shaking, reverse air, or jet pulse mechanism. The dust that is shaken or blown off the bags drops into a hopper, from which it is periodically removed and, when practical, returned to the process.

The critical criteria for the operation of the fabric filters in general depends on the source they are controlling. They may include 1) high differential pressure, 2) high fabric filter inlet temperature, 3) low fabric filter outlet temperature, 4) opacity, 5) low compartment pressure, and 6) broken bag detectors. For the SMC collectors that operate at or near ambient temperature conditions, the only three critical factors are high differential pressure, low compartment pressure, and opacity. High differential pressure can indicate plugging of the fabric; low compartment pressure and alarming broken bag detectors can indicate a leak in a bag; and high opacity will generally indicate leak(s) in one or more bags. For the baghouses that were installed to control dust emissions from the main kiln exhaust and the bypass exhaust; the inlet and outlet temperature are also important. The fabric is designed to withstand a certain maximum temperature; if the temperature at the inlet is higher than the bags operating temperature, then the fabric can be destroyed. If the outlet temperature is too low, then condensation and subsequent plugging of the fabric could occur.

4.2 Selective Non-Catalytic Reduction System

NO_X emissions from the kiln are controlled by an SNCR system. SNCR is based on the chemical reduction of NO_X to N_2 and water. Ammonia is used as the reducing agent and is injected into the inline kiln at the point in the system with the proper temperature profile. The ideal temperature for NO_X conversion using SNCR is approximately 1800°F. The amount of ammonia injected is based on the NO_X concentrations, which are determined by the CEMS.

5.0 Responsible Personnel

The Responsible Personnel for this MAP is the Environmental Manager. Maintenance Department technicians and Shift Supervisors perform preventive maintenance tasks. Appendix 1 includes the current organizational chart for SMC. Appendix 1 will be updated as needed; a copy of the most recent updated organizational chart will be maintained at the plant. Changes to applicable personnel will be submitted to the MDEQ upon request.

6.0 PMP, Operational Variables, and Corrective Procedures

Preventative maintenance will include equipment inspections, scheduled replacement of parts, and maintaining an inventory of critical spare parts. The facility will track and maintain records of each preventative maintenance action completed. As part of the normal operations at SMC, equipment is monitored to ensure proper functioning of the process and control equipment. If plant personnel notice an equipment malfunction or variation in the normal operating variables, they are instructed to inform the Maintenance Manager or Area Supervisor. Fluctuation in the normal operating variables can signify equipment, system(s), or control(s) issues, which may lead to an environmental excursion. Table 3 lists the general preventative maintenance schedule for the fabric filters.

6.1 Equipment Inspections and Operational Variables

The facility is required to monitor the opacity and differential pressure of the fabric filter baghouses and the ammonia flow of the SNCR to ensure proper operation of the control equipment. Maintenance of these systems is handled through the Electronic Maintenance Management Route Order system or by a contractor, if necessary. The plant's electronic maintenance planning and record keeping system tracks and maintains records of each PM action and/or repair completed and will track maintenance and repairs performed. Table 4 summarizes the operating variables and frequency for common inspections of the fabric filters.

The frequency and scope of PM inspections depend on the manufacturer recommendations and operator experience. When conducting PM activities, technicians use checklists from the plant's electronic maintenance planning and record keeping system that lists PM tasks, steps, and instructions. The technician finishes the PM checklist and returns the form to Maintenance, who verifies that the tasks on the checklist have been finalized and logs the completed checklist into the plant's electronic maintenance planning and record keeping system. Electronic verification of the completed checklist is maintained for a minimum of five years following completion of the PM items or inspections.

6.2 Fabric Filters and Dust Collectors

The SMC Shift Supervisors make daily opacity observations of the equipment that is operational (not a formal reading); upon these observations, they create maintenance work notifications as needed. A change in the opacity may indicate broken bags. It is recommended to observe opacity during the cleaning cycle when possible. When a compartment is being cleaned, it does not participate in the particulate removal. If opacity is noticeably lower during part of the cleaning cycle, the compartment being cleaned likely has broken bags.

In addition to the routine inspections, damage to the filter cloth must be located at the earliest possible time and the defective bag replaced. There are two basic inspection techniques:

- First, visual inspection of all bags. The first indication of a bag failure is often an accumulation of dust in the bottom of the failed bag. This is particularly true if the bag failure occurs near the bottom; however, those failures near the top of the bags are unlikely to provide any tell-tale dust accumulation; in this case, it will be necessary to inspect the full length and circumference of each bag looking for the failures. Dust patterns can be of assistance in at least locating the general area of the failed bag.
- A second technique is the use of a tracer power and ultraviolet light (Visolite®). In this instance, a black-light sensitive powder is fed into the compartment while the system is on line. The compartment is then brought off line and is scanned with an ultraviolet light. The light-sensitive material will glow and immediately identify the location of leaks. It will probably be necessary to search the full area of each bag.

A record of all inspections and maintenance work will be maintained via the routine management system and can be located with the maintenance department.

6.3 SNCR System

NO_X emissions are measured by a CEMS system, which plant operators can monitor for a change in emissions. A change in the NO_X emissions may indicate plugging of the spray nozzles. SMC will maintain the preventative maintenance and inspections of the SNCR system through the electronic Maintenance Management System Route Order System. The PM of the system is designed to minimize downtime, ensure proper operation of the system, and avoid emissions exceedances.

6.4 Corrective Action

If a malfunction occurs which causes, or may cause, excess emissions during plant operations, the equipment causing the potential excess emission rate will be evaluated – as soon as practicable in accordance with safe operating procedures – to determine the proper procedure to correct the issue or determine that the malfunction will not cause excess emissions.

If a malfunction occurs, the Plant Manager (or designee) and if necessary with the assistance of the Environmental Manager, will determine whether affected equipment can continue to operate consistent with the requirements of the ROP. If not, appropriate plant personnel will follow the procedure outlined below:

- Define and correct the issue, which may include investigating the following conditions:
  - Bag failure (e.g., due to rips/tears, bag blinding due to moisture in gas, timer failure, magnahelic failure, and manometer failure)
  - Power failure
  - Plugging of conveyers
  - Failure of emission control system components (e.g. dust collectors and associated water sprays)
- Determine if equipment can continue to operate within compliance of the limitations specified in the facility's PTI and/or ROP. If not, action shall be taken to correct the issue in accordance with safe operating procedures.
- Notify the appropriate staff of any issues that occur and/or if there are any questions regarding compliance or action(s) which should be taken to correct the issue.
- If the issue is one that calls for immediate corrective action, contact the Plant Manager and/or the Environmental Manager.

Excess emissions can be prevented by following the proper procedures for operating all equipment.

Records of any malfunctions are prepared immediately to ensure all required notifications and reports are completed; Appendix 2 contains an example *Abnormal Conditions/Malfunction Follow-Up Report Form*. The Environmental Department will review each incident to determine if emissions exceeded permit limits for more than two hours for criteria pollutants or more than one hour for TACs (if applicable). If so, a malfunction will be reported to the MDEQ Air Quality Division in accordance with Rule 912.

All corrective actions will be documented in the electronic Maintenance Management System.

6.5 Preventative Maintenance Records

SMC uses Route Orders issued via an electronic Maintenance Management System, for scheduling and recording routine maintenance tasks. Upon completion of the Route Order, the paperwork is returned to the maintenance clerk and the work order is closed out as part of the maintenance process. An example of a *Route Order* is attached as Appendix 3.

6.6 Common Control System Malfunctions

Table 5 summarizes common symptoms associated with fabric filter baghouse control system malfunctions, their potential causes, and typical solutions.

Table 6 summarizes common symptoms associated with SNCR systems, their potential causes, and typical solutions.

7.0 Reporting Malfunctions and Abnormal Conditions

Michigan Rules 912(2)-(5) require facilities to report of certain abnormal conditions, start-up, shutdown, or malfunctions associated with process and/or emission control systems subject to air quality requirements.

Michigan Rule 912(2) addresses reporting requirements for sources releasing emissions of HAPs and/or TACs in excess of applicable limitations for one hour or more. The requirement reads:

> *The owner or operator of a source, process, or process equipment shall provide notice of an abnormal condition, start-up, shutdown, or a malfunction that results in emissions of a hazardous air pollutant which continue for more than 1 hour in excess of any applicable standard or limitation established by the clean air act or the emissions of a toxic air contaminant which continue for more than 1 hour in excess of an emission standard established by a rule promulgated under the air pollution act or an emission limitation specified in a permit issued or order entered under the air pollution act.*

Michigan Rule 912(3) addresses reporting requirements for sources releasing emissions of any air contaminant in excess of allowable emission rates for two hours or more. The rule reads:

> *The owner or operator of a source, process, or process equipment shall provide notice and a written report of an abnormal condition, start-up, shutdown, or a malfunction that results in emissions of any air contaminant continuing for more than 2 hours in excess of a standard or limitation established by any applicable requirement.*

Rule 912(4) establishes the reporting timelines. The rule reads:

> *The notices required by this rule shall be provided to the department as soon as reasonably possible, but not later than 2 business days after the start-up or shutdown or after discovery of the abnormal conditions or malfunction. Notice shall be by any reasonable means, including electronic, telephonic, or oral communication.*

The content requirements for reports submitted under Rule 912 are specified in Rule 912(5). The Rule reads:

> *The written reports required under this rule shall be submitted within 10 days after the start-up or shutdown occurred, within 10 days after the abnormal conditions or malfunction has been corrected, or within 30 days of discovery of the abnormal conditions or malfunction, whichever is first. The written reports shall include all of the following information:*
> *(a) The time and date, the probable causes or reasons for, and the duration of the abnormal conditions, start-up, shutdown, or malfunction.*
> *(b) An identification of the source, process, or process equipment that experienced abnormal conditions, was started up or shut down, or which malfunctioned and all other affected process or process equipment that have emissions in excess of an applicable requirement, including a description of the type and, where known or where it is reasonably possible to estimate, the quantity or magnitude of emissions in excess of applicable requirements.*
> *(c) Information describing the measures taken and air pollution control practices followed to minimize emissions.*

(d) For abnormal conditions and malfunctions, the report shall also include a summary of the actions taken to correct and to prevent a reoccurrence of the abnormal conditions or malfunction and the time taken to correct the malfunction.

SMC will report abnormal conditions or malfunctions associated with process and/or emission control systems in accordance with the requirements of Rule 912. An example form is included as Appendix 2.

8.0 Replacement Parts Inventory

Lists of spare parts for the various fabric filters and SNCR are stored in the maintenance system software and can be retrieved by the Maintenance Clerk or from various local vendors during normal business hours. Additional spray nozzles for the SNCR are kept onsite.

Tables

Table 1 – Emission Units and Emission Limits
Malfunction Abatement Plan
St. Marys Cement, Charlevoix, Michigan

Emission Unit/Flexible Group	Controls	Pollutant	Emission Limit	Monitoring
EUSOLIDFUELSYSTEM	Fabric filter baghouse	Opacity PM PM10 PM2.5	10% 0.010 gr/dscf 3.93 pph 1.86 pph	BLDS
EUINLINEKILN	conditioning towers prior to downstream equipment (for modulating temperatures), SNCR, the main stack baghouse, bypass stack baghouse and other smaller baghouses	Opacity PM PM10 PM2.5 NOX SO2 Hg	10% 0.25 lb/1000 lb exhaust gas 57.5 pph 57.5 pph 700 pph 2.8 lb/ton clinker (30-day) 2.4 lb/ton clinker (annual) 1,175 pph 106 lb/yr	CPMS, COMs, NOX CEMS, SO2 CEMS, Hg CEMS
EUCLINKERCOOL	Fabric filter baghouse	Opacity PM PM10 PM2.5	10% 0.02 lb/ton clinker 5.0 pph 5.0 pph	CPMS, VE
FGFINISHMILLS (1-3)	Fabric filter baghouses	Opacity	10%	VE
EUFINISHMILL4	Fabric filter baghouse	Opacity PM PM10 PM2.5	10% 0.25 lb/1000 lb exhaust gas 6.24 pph 6.24 pph	VE
FGNONKILNFACILITY	Fabric filter baghouses	Opacity PM PM10/PM2.5	10% 0.15 lb/1000 lb exhaust gas Baghouse dependant	VE

Table 2 – Fabric Filters

Malfunction Abatement Plan

St. Marys Cement, Charlevoix, Michigan

Site Plan ID	Emission Point
1	Secondary Crusher (Screen House)
2	North Steel Raw Mat Tank BV
3	Cartridge Air slide Post RM
4	Raw Meal Elev DC
5	Cartridge Air slide Pre Homo Elev
6	Homo Silo DC (Top)
7	Blend Silo DC (bottom)
8	Lower Raw Feed Bucket Elev DC
9	Upper Raw Feed Bucket Elev DC
10	Cartridge Air Slide Feed to New Side
11	FF Coal Mill Bin Vent
12	IDF Coal Mill Bin Vent
13	Clinker Cooler DC
14	Clinker Apron Conv DC
15	Clinker Transport DC
16	Clinker Location Selector DC
17	Clinker Dome #1 DC
18	Clinker Dome #2 DC
19	Old M3 DC (north)
20	New M3 DC (south)
21	Main Stack
22	Bypass Stack
23	CKD truck loadout (pug system)
24	No. 1 Finish Mill
25	No. 2 Finish Mill
26	No. 3 Finish Mill
27	No. 4 Finish Mill
28	No. 4 Finish Mill Elev DC
29	Clinker Silos (M-855B) - E
30	Clinker Silos (M-855C) - W
31	Clinker Silos (M-855D) - N
32	#1 Finish Mill Clinker Feeder #1 & #2 (M161B & M163B)
33	#2 Finish Mill Clinker Feeder #1 (M194B)
34	#2 Finish Mill Clinker Feeder #2 (M196B)
35	#3 Finish Mill Clinker Feeder #1 (M063B)
36	#3 Finish Mill Clinker Feeder #2 (M067B)
37	Cement Silo No. 1
38	Cement Silo No. 2
39	Cement Silo No. 3
40	Bucket Elevator New Silos (M-1105)
41	Cement Silo 4 Pack DC

Site Plan ID	Emission Point
42	Cement Dome (old)
43	Cement Dome (New)
44	Ship Loading (Internal Vent under 12 pack)
45	Truck loading (Internal Vent under 12 pack)

Table 3 – Fabric Filter Preventative Maintenance Schedule
Malfunction Abatement Plan
St. Marys Cement, Charlevoix, Michigan

Item	Activity	Equipment Status	Frequency
Discharge Vent	10-minute opacity readings using Method 22	On line	Monthly, or alternate schedule allowed under PC MACT
	30-minute opactiy readings using Method 9	On line	Within 1 hour of Method 22 reading showing visible emissions.
Hopper Heaters	1. Check for proper operation.	On or off line	Quarterly
	2. Check with ammeter.	On or off line	Quarterly
	3. Calibrate thermostat.	Off line	Annually
Fabric Filter Outlet Bypass Damper	1. Inspect bearings and stuffing boxes	Off line	Annually
	2. Inspect damper blade(s) for abrasion	Off line	Annually
	3. Check operation of damper and actuator	Off line	Annually
	4. Check for leakage	Off line	Annually
	5. Tighten bolts	Off line	Annually
Inlet Butterfly Isolation Dampers	1. Inspect damper bearings	Off line	Annually
	2. Inspect blades and seals for abrasion	Off line	Annually
	3. Check operation of damper and actuator	Off line	Annually
	4. Tighten bolts	Off line	Annually
Hopper Vibrators (if installed)	1. Inspect Integrity	Off line	Annually
	2. Ensure proper operation	On or off line	Annually
Instrumentation	1. Check hopper level switches for proper operation	Off line	Annually
	2. Adjust cleaning cycle (if necessary)	On line	As required
	3. Calibrate all instruments	Off line	As required
Spare Parts	1. Inventory spares and check against recommendations	Off line/Cycle count	Annually
Expansion Joints	1. Check for holes	On line	Annually
	2. Tighten bolts	Off line	Annually
	3. Internal inspection for wear	Off line	Annually
Filter Medium	1. Inspect bags	Off line	Annually
	2. Inspect manifolds for dust buildup	Off line	Annually
	3. Replace defective bags	Off line	As needed
	4. Check bag suspension	Off line	Annually
	5. Isolate each module and check opacity	On line	As needed
Casing, Ducts and Hoppers	1. Inspect for cracks, leaks, cracked welds, or presence of foreign material	Off line	Annually
	2. Inspect support structure	Off line	Annually
	3. Check for defective gaskets	Off line	Annually
	4. Inspect elbows and turning vanes for abrasion	Off line	Annually
	5. Mechanically remove all deposits from hoppers	Off line	Annually
Insulation	1. Inspect for presence of moisture, loose lagging, loose connections	On or off line	As Needed
Doors and Gaskets	1. Check for blown or loose gaskets	On line	As needed
	2. Inspect for leaks (Openings can be detected by listening for hissing sounds, which would indicate that air is being drawn into the unit.)	On line	As needed

Table 4 – Operating Variables
Malfunction Abatement Plan
St. Marys Cement, Charlevoix, MI

Process	Device Description	Operating Variable	Monitoring Method	Frequency	Normal Operating Range	Corrective Procedure or Operational Change in the Event of a Malfunction	Responsible Supervisor
Secondary Crusher (Screen House)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
New Flyash Tanks	FF-BV	Opacity	Visible Emissions Check	Daily	0-5%	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
Cartridge Air Slide Post RM	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Raw Meal Elevator DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Cartridge Air Slide Pre Homo Elev	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Homo Silo DC (top)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Blending Silo-DC (Bottom)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Lower Raw Meal Bucket Elev DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Upper Raw Meal Bucket Elev DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		

Process	Device Description	Operating Variable	Monitoring Method	Frequency	Normal Operating Range	Corrective Procedure or Operational Change in the Event of a Malfunction	Responsible Supervisor
Cartridge Air Slide Meal to new side	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Flash Furnace Bin Vent	FF-BV	Opacity	Visible Emissions Check	Daily	0-5%	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
Kiln End Coal Bin Vent	FF-BV	Opacity	Visible Emissions Check	Daily	0-5%	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
Clinker Cooler DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Apron Conv. DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Transport DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	4 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Location Selector DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	5 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Dome #1 (West)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Dome #2 (East)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Reclaim M-3 (North)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		

Process	Device Description	Operating Variable	Monitoring Method	Frequency	Normal Operating Range	Corrective Procedure or Operational Change in the Event of a Malfunction	Responsible Supervisor
Clinker Reclaim M-3 (South)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Main	FF	Pressure Drop	Magnehelic gage or manometer	Continuous	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Continuous	0-20%		
Main - Raw Mill Operating		Temp Inlet	Thermocouple	Continuous	> 210 ° F	No emissions impact.	Production Supervisor
Main - Raw Mill Not Operating		Temp Inlet	Thermocouple	Continuous	< 400 ° F (actual temperature be established every 30 months per the PCMACT)	Reduce temperature to protect equipment by altering fans, water sprays and fuel and feed rate alternations.	
Bypass	FF	Pressure Drop	Magnehelic gage or manometer	Continuous	2 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system.	Production Supervisor
		Opacity	Visible Emissions Check	Continuous	0-20%		
Bypass - Raw Mill Operating		Temp Inlet	Thermocouple	Continuous	> 210 ° F	No emissions impact.	Production Supervisor
Bypass - Raw Mill Not Operating		Temp Inlet	Thermocouple	Continuous	< 400 ° F (actual temperature be established every 30 months per the PCMACT)	Reduce temperature to protect equipment by altering fans, water sprays and fuel and feed rate alternations.	
CKD Truck Loadout (Pug System)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
No. 1 Finish Mill	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
No. 2 Finish Mill	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
No. 3 Finish Mill	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
No. 4 Finish Mill	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	4 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		

Process	Device Description	Operating Variable	Monitoring Method	Frequency	Normal Operating Range	Corrective Procedure or Operational Change in the Event of a Malfunction	Responsible Supervisor
No. 4 Finish Mill Elev DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	5 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Silos (M-855B)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Silos (M-855C)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Clinker Silos (M-855D)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
#1 Finish Mill Clinker Feeder #1 & #2 (M161B & M163B)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
#2 Finish Mill Clinker Feeder #1 (M194B)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
#2 Finish Mill Clinker Feeder #2 (M196B)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
#3 Finish Mill Clinker Feeder #1 (M063B)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
#3 Finish Mill Clinker Feeder #2 (M067B)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Cement Silo No. 1	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		

Process	Device Description	Operating Variable	Monitoring Method	Frequency	Normal Operating Range	Corrective Procedure or Operational Change in the Event of a Malfunction	Responsible Supervisor
Cement Silo No. 2	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Cement Silo No. 3	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Bucket Elevator New Silos (M-1105)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Cement Silo 4 Pack DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Cement Dome Old	FF-BV	Opacity	Visible Emissions Check	Daily	0-5%	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
Cement Dome New	FF-BV	Opacity	Visible Emissions Check	Daily	0-5%	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
Ship Loading	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Truck loading	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		

Table 4 – Operating Variables
Malfunction Abatement Plan
St. Marys Cement, Charlevoix, Michigan

Process	Device Description	Operating Variable	Monitoring Method	Frequency	Normal Operating Range	Corrective Procedure or Operational Change in the Event of a Malfunction	Responsible Supervisor
Bucket Elevator New Silos (M-1105)	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Cement Silo 4 Pack DC	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Cement Dome Old	FF-BV	Opacity	Visible Emissions Check	Daily	0-5%	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
Cement Dome New	FF-BV	Opacity	Visible Emissions Check	Daily	0-5%	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
Ship Loading	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		
Truck loading	FF	Pressure Drop	Magnehelic gage or manometer	As Needed	3 to 7 inches	Prepare work order for repair of dust collector. Track work order in computerized maintenance system. Examples of corrective actions shown in Table 5.	Production Supervisor
		Opacity	Visible Emissions Check	Daily	0-5%		

Table 5 – Fabric Filter Malfunction Abatement Summary
Malfunction Abatement Plan
St. Marys Cement, Charlevoix, MI

Condition	Possible Cause	Means of Detection	Remedial Action
High differential pressure	Unusual rate of filter cake buildup due to high grain loading. Blockage of flow into compartment due to high dust in hoppers. Blockage of ductwork due to dust buildup. Blinding of bags or operation at temperature close to dewpoint. Loss of cleaning function due to cleaning sequence failure. Failure of compartment outlet dampers in fully or partially closed position. Plugging of differential pressure sensor lines.	Fabric filter differential pressure indication on control panel. Fabric filter differential pressure alarm. Automatic bypass.	Manually initiate the cleaning mode. Purge the differential pressure lines with compressed air. If the damper position indicators on the Control Panel indicate closed inlet or outlet dampers on compartments which should be operating, attempt to open them manually. Check the level of dust in the hopper. Remove dust if required. Inspect bags for blinding.
High Fabric Filter Inlet Temperature (Kiln FF only)	High kiln outlet temperature due to unusual combustion or other operating conditions.	Fabric filter inlet temperature thermocouple, as indicated on Control Panel.	The fabric filter will automatically be put into bypass mode by the control system, if temperature exceeds 400 ºF an emergency air damper will open.
Low Fabric Filter Outlet Temperature	Cracks in ductwork or casing, causing substantial inleakage of outside air. Failure of the fabric filter outlet thermocouple. Failure of inlet, outlet, or reverse air dampers to seat properly when a compartment is isolated for maintenance, allowing inleakage of outside air. Access doors left open or not adequately closed. Rupture of expansion joints. Failure of insulation. Substantial inleakage through failed door gaskets.	Baghouse outlet temperature thermocouple, as indicated on Control Panel.	***To avoid potential condensation, fabric filter should be put into bypass mode?*** Repair or replace thermocouples as required. Repair dampers for compartment currently off-line to achieve less leakage. Replace door gaskets. Repair or replace expansion joints. Check for hot spots around exterior of casing, hoppers, ducts, and reverse air system. Repair or replace insulation. Check for inleakage. Repair cracks.
High Opacity	Bag failures. Over cleaning the bags. Failure of bypass damper to seat properly. Leakage across bypass damper.	Visible plume from the stack. High outlet opacity alarm.	Check compartment differential pressures. An abnormally low differential pressure may indicate an inadequate filter cake or broken bag. Identify and replace broken bags. If broken bags exist in only one or two compartments, the compartment(s) can be located by monitoring the stack during a cleaning cycle. At the time that a compartment with failed bags is brought off-line, the opacity will be reduced. When it returns on-line, the opacity will increase. Check for other potential causes of leakage if there are no apparent bag failures. Welds in the wall separating the inlet and outlet manifolds, around the thimbles, or in the tube sheets can be a source of leaks. Adjust bypass damper linkage or damper actuator to seat damper in closed position.
Low compartment pressure	Bag failures Air leakage	Manometer, connected to tube sheet pressure taps. Compare each compartment tube sheet differential pressure. If one consistently lower than others, and opacity is poor, compartment with low reading likely has broken bags	Replace broken bags.

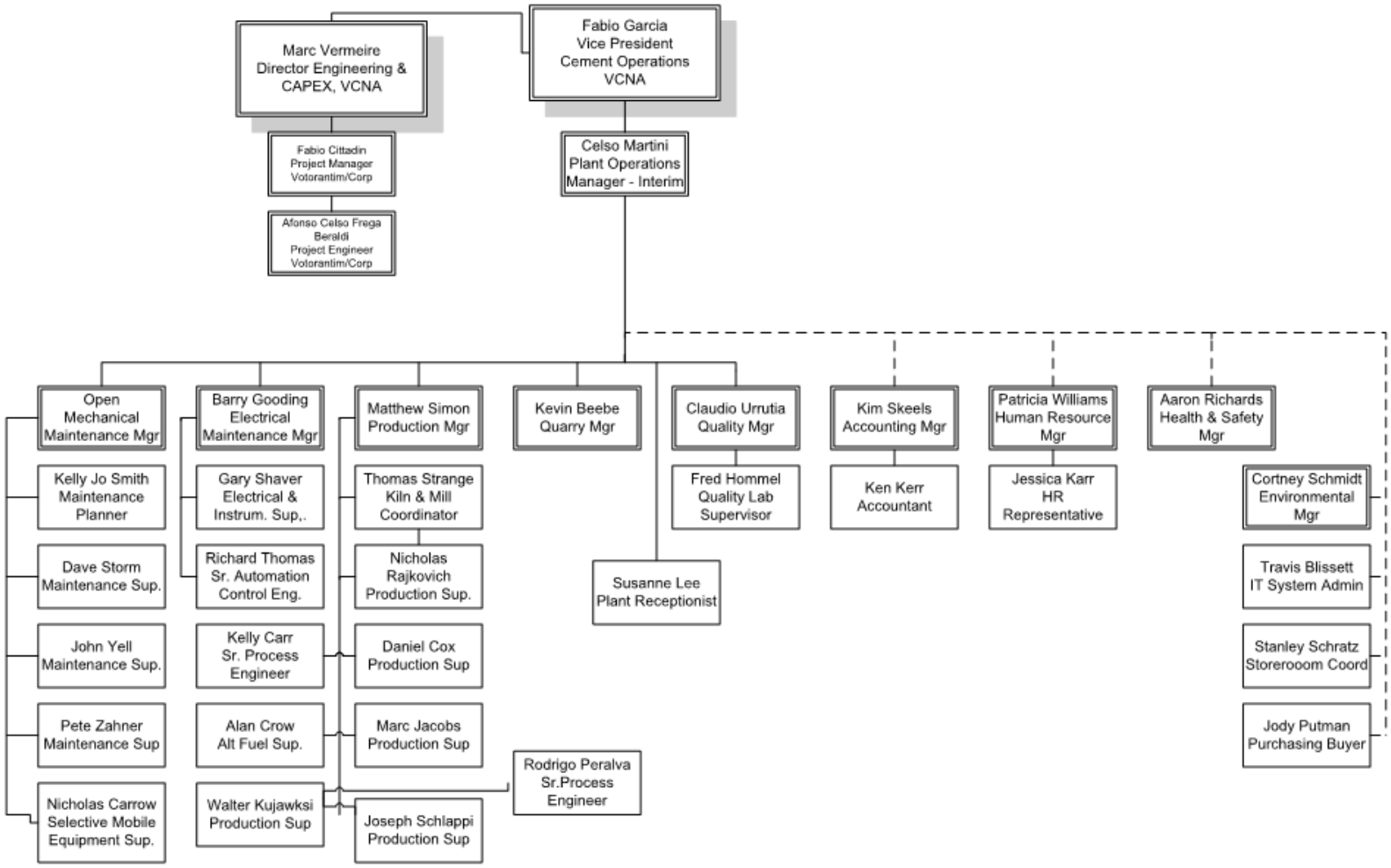
Table 6 – SNCR Malfunction Abatement Summary
Malfunction Abatement Plan
St. Marys Cement, Charlevoix, MI

Condition	Possible Cause	Means of Detection	Remedial Action
Corrosion	Localized corrosion at liquid injected SNCR facilities is a problem. Generally located in immediate vicinity of injector ports Especially problematic for fuels with high chloride and sulfur.	Visual Inspections Increased NOX emissions	Reduce liquid impingement Extended wall injectors Higher air pressure/flow Lower water flow
Detached Plume Formation	Quite common in non-scrubbed flue gas (ie raw mill down) Most often detached from the stack Caused by condensation/combination at lower temperatures. Ammonium chloride, ammonium bisulfate, etc	Visual Inspections Increased Opacity and COMs alarms	Slip reduction – keep less than 10 ppm Nozzle orientation/operation key. Get good stack and operational data.
Air Heater Pluggage	Ammonium Bisulfate is a liquid above 300F Sticky material - difficult to remove. Not a problem with low sulfur fuels	Visual Inspections Increased NOX emissions	Minimize Slip
Nozzle Failure	Plugging High Temperature Corrosion Erosions	Visual Inspections Increased NOX emissions	Preventative Maintenance and replace as needed.

Appendix 1

St Marys Cement - Charlevoix Plant

June 27, 2018



Appendix 2

Appendix 2 – Example Reporting Form

ABNORMAL CONDITIONS/MALFUNCTION FOLLOW-UP REPORT
St Marys Cement U.S. LLC

Date of Incident:_____ Time of Incident:_____ Duration of Incident:_____

Average Opacity (If applicable): _____

Emissions (if applicable): _____ Applicable Limit:_____

Explanation of Incident ***(Include Identification of the Source, Type and Quantity or Magnitude of Excess Emissions and Probable Cause):***

Immediate Actions Taken To Minimize Emissions:

Corrective Action Taken ***To Minimize or Prevent Recurrence:***

AGENCY NOTIFICATION AND REPORTING
The Environmental Manager or his delegate will notify the MDEQ-AQD within 2 days of the occurrence:

MDEQ-AQD Cadillac District Office
Phone: 231.775.3960 Fax: 231.775.1511

Date and Time Contacted:_____ **Person(s) Contacted:**_____

NOTE: ***During off hours, contact the Pollution Emergency Alert System 800.292.4706***

A written follow-up report must be completed including cause and corrective/preventive actions and submitted to the MDEQ-AQD within 10 days after the abnormal conditions or malfunction has been corrected, or within 30 days of discovery of the abnormal conditions or malfunction, whichever is first.

Appendix 3

Votorantim Cimentos

Route Order

Plant: 4606 **Risk:** C3

Order:145544695

Order Description: INSP-FM DC ROUTE-2 (CYCLE 1-TUES) **Revision Code:** **Order Type:** RT01

Priority: Normal Within 15 D **M. Plan:** 285512 **Activity Type:** Visual inspection

Inventory N°: 4606 **Downtime Required:** 4606

Equipment:

Functional Location: 4606 CHARLEVOIX CEMENT PLANT

Superior Functional Location:

Location:

CC: 2AK210 **Status:** -

Object Link Code	Linked To	Linked Object Description

Scheduled Start Date: 05/22/2018 00:00:00 **Schedule Finish Date:** 05/22/2018 **24:00:00** **Planner Group:** VC1

Work Center: MM-GEN

Activity
INSP-FM DC ROUTE-2 (CYCLE 1-TUES) DC ROUTE - WEEK 1, TUESDAY

Op.	Work Center	Person Responsible	Planned Duration

Operation	Production Resource	PRT Description	PRT Quantity	Actual Quantity

Votorantim Cimentos

Route Order

Plant: 4606 **Risk:** C3

Order:145544695

Operation: 0010 DUST COLLECTOR, 1 FM MAIN, PLENUM PULSE **ABCInd.:**

Functional Location: 4606-06-FIM1-Z1P01 DUST COLLECTOR, 1 FM MAIN

Superior Functional Location: 4606-06-FIM1 #1 FINISH MILL

Equipment:

Measuring Point	Measuring Point Description	Target Value	Lower Range Limit	Upper Range Limit	Measurement
1923591	Z1P01DUST COLLECTOR, 1 FM MAINEM-PRD-R0002-0260	0	0	0	

Item OK?	Any Action Taken?	Follow-up Notification M4 Required?	Priority
(___)OK (___)Not OK (___)Not Executed	(___)Yes (___) No	(___)Yes (___)No	(_____)

Operation	Operation Description
0010	DUST COLLECTOR, 1 FM MAIN, PLENUM PULSE

DUST COLLECTOR, 1 FM MAIN, PLENUM PULSE
DC ROUTE - WEEK 1, MONDAY
10-SAFETY - WEAR PROPER PPE
20-DISCONNECT DP TUBING FROM PRESSURE GAUGE AND BLOW OUT TUBING TO DC WITH COMPRESSED AIR
30-CHECK AIR PRESSURE, SHOULD BE BETWEEN 60 AND 90 PSIG. IF OUT OF THIS RANGE OPEN A NOTIFICATION TO REPAIR
40-CHECK DIFFERENTIAL PRESSURE: DP IN H20 - IT OPERATES BETWEEN 3-6IN W.C. FOR FABRIC FILTER BAGS AND BETWEEN 2-4 IN W.C. FOR CARTRIDGES. IF DP IS OUT OF THIS RANGE OPEN A NOTIFICATION FOR REPAIR
50-INSPECT COMPRESSED AIR PULSING SYSTEM AS FOLLOWS:
60-A. INSPECT PILOT TUBING, DIAPHRAGM VALVES, AND AIR MANIFOLD FOR LEAKS
70-B. VERIFY THAT SYSTEM CYCLES CORRECTLY AND THAT ALL PULSERS ARE FIRING
80-C. VERIFY THAT AIR IS NOT LEAKING BY DIAPHRAGM VALVES WHEN NOT PULSING
90-D. INSPECT AND DRAIN AIR WATER FILTER
100-INSPECT FAN DUCTWORK FOR CORROSION, HOLES, OR OTHER EXTERNAL DAMAGE
110-INSPECT FAN DISCHARGE FOR VISIBLE EMISSIONS
120-INSPECT FAN, FAN HOUSING, BEARINGS, DRIVE BELTS FOR DAMAGE OR ABNORMALITIES:
130-A. INSPECT FAN BASE BOLTS FOR TIGHTNESS
140-B. INSPECT FAN FOR EXCESSIVE VIBRATION
150-C. IF FAN INBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
160-D. FAN OUTBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
170-INSPECT FAN MOTOR FOR EXCESSIVE VIBRATION, NOISE OR TEMPERATURE
180-INSPECT DUST COLLECTOR HOUSING, HOPPER, AND ACCESS DOORS FOR DAMAGE, CRACKS, OR AIR LEAKS
190-INSPECT DUST DISCHARGE SYSTEM, AIRSLIDES, TIPPING VALVES, SCREWS, FEEDERS, AND COMPONENTS
200-INSPECT ALL EQUIPMENT GUARDS TO INSURE THAT THEY ARE IN PLACE AND FREE FROM DAMAGE
210-INSPECT DUST COLLECTION PICK-UP POINTS FOR PROPER FUNCTIONING
220-NOTIFY SUPERVISOR OF CONDITIONS REQUIRING A NOTIFICATION

Votorantim Cimentos

Route Order

Plant: 4606 **Risk:** C3

Order:145544695

Operation: 0020 DUST COLLECTOR, 14 FEEDER, PULSE JET **ABCInd.:**

Functional Location: 4606-06-FIM1-Z1P11 DUST COLLECTOR, 14 FEEDER

Superior Functional Location: 4606-06-FIM1 #1 FINISH MILL

Equipment:

Measuring Point	Measuring Point Description	Target Value	Lower Range Limit	Upper Range Limit	Measurement
1923714	Z1P11DUST COLLECTOR, 14 FEEDERMM-INS-R0002-0390	0	0	0	

Item OK?	Any Action Taken?	Follow-up Notification M4 Required?	Priority
(___)OK (___)Not OK (___)Not Executed	(___)Yes (___) No	(___)Yes (___)No	(_____)

Operation	Operation Description
0020	DUST COLLECTOR, 14 FEEDER, PULSE JET

DUST COLLECTOR, 14 FEEDER, PULSE JET
DC ROUTE - WEEK 1, MONDAY
10-SAFETY - WEAR PROPER PPE
20-DISCONNECT DP TUBING FROM PRESSURE GAUGE AND BLOW OUT TUBING TO DC WITH COMPRESSED AIR
30-CHECK AIR PRESSURE, SHOULD BE BETWEEN 60 AND 90 PSIG. IF OUT OF THIS RANGE OPEN A NOTIFICATION TO REPAIR
40-CHECK DIFFERENTIAL PRESSURE: DP IN H20 - IT OPERATES BETWEEN 3-6IN W.C. FOR FABRIC FILTER BAGS AND BETWEEN 2-4 IN W.C. FOR CARTRIDGES. IF DP IS OUT OF THIS RANGE OPEN A NOTIFICATION FOR REPAIR
50-INSPECT COMPRESSED AIR PULSING SYSTEM AS FOLLOWS:
60-A. INSPECT PILOT TUBING, DIAPHRAGM VALVES, AND AIR MANIFOLD FOR LEAKS
70-B. VERIFY THAT SYSTEM CYCLES CORRECTLY AND THAT ALL PULSERS ARE FIRING
80-C. VERIFY THAT AIR IS NOT LEAKING BY DIAPHRAGM VALVES WHEN NOT PULSING
90-D. INSPECT AND DRAIN AIR WATER FILTER
100-INSPECT FAN DUCTWORK FOR CORROSION, HOLES, OR OTHER EXTERNAL DAMAGE
110-INSPECT FAN DISCHARGE FOR VISIBLE EMISSIONS
120-INSPECT FAN, FAN HOUSING, BEARINGS, DRIVE BELTS FOR DAMAGE OR ABNORMALITIES:
130-A. INSPECT FAN BASE BOLTS FOR TIGHTNESS
140-B. INSPECT FAN FOR EXCESSIVE VIBRATION
150-C. IF FAN INBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
160-D. FAN OUTBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
170-INSPECT FAN MOTOR FOR EXCESSIVE VIBRATION, NOISE OR TEMPERATURE
180-INSPECT DUST COLLECTOR HOUSING, HOPPER, AND ACCESS DOORS FOR DAMAGE, CRACKS, OR AIR LEAKS

Votorantim Cimentos

Route Order

Plant: 4606 **Risk:** C3

Order:145544695

190-INSPECT DUST DISCHARGE SYSTEM, AIRSLIDES, TIPPING VALVES, SCREWS, FEEDERS, AND COMPONENTS
200-INSPECT ALL EQUIPMENT GUARDS TO INSURE THAT THEY ARE IN PLACE AND FREE FROM DAMAGE
210-INSPECT DUST COLLECTION PICK-UP POINTS FOR PROPER FUNCTIONING
220-NOTIFY SUPERVISOR OF CONDITIONS REQUIRING A NOTIFICATION

Operation: 0030 UST COLLECTOR, 19 FEEDER, PULSE JET **ABCInd.:**

Functional Location: 4606-06-FIM1-Z1P21 DUST COLLECTOR, 19 FEEDER

Superior Functional Location: 4606-06-FIM1 #1 FINISH MILL

Equipment:

Measuring Point	Measuring Point Description	Target Value	Lower Range Limit	Upper Range Limit	Measurement
1923715	Z1P21DUST COLLECTOR, 19 FEEDERMM-INS-R0002-0391	0	0	0	

Item OK?	Any Action Taken?	Follow-up Notification M4 Required?	Priority
(___)OK (___)Not OK (___)Not Executed	(___)Yes (___) No	(___)Yes (___)No	(_____)

Operation	Operation Description
0030	UST COLLECTOR, 19 FEEDER, PULSE JET

UST COLLECTOR, 19 FEEDER, PULSE JET
DC ROUTE - WEEK 1, MONDAY
10-SAFETY - WEAR PROPER PPE
20-DISCONNECT DP TUBING FROM PRESSURE GAUGE AND BLOW OUT TUBING TO DC WITH COMPRESSED AIR
30-CHECK AIR PRESSURE, SHOULD BE BETWEEN 60 AND 90 PSIG. IF OUT OF THIS RANGE OPEN A NOTIFICATION TO REPAIR
40-CHECK DIFFERENTIAL PRESSURE: DP IN H20 - IT OPERATES BETWEEN 3-6IN W.C. FOR FABRIC FILTER BAGS AND BETWEEN 2-4 IN W.C. FOR CARTRIDGES. IF DP IS OUT OF THIS RANGE OPEN A NOTIFICATION FOR REPAIR
50-INSPECT COMPRESSED AIR PULSING SYSTEM AS FOLLOWS:
60-A. INSPECT PILOT TUBING, DIAPHRAGM VALVES, AND AIR MANIFOLD FOR LEAKS
70-B. VERIFY THAT SYSTEM CYCLES CORRECTLY AND THAT ALL PULSERS ARE FIRING
80-C. VERIFY THAT AIR IS NOT LEAKING BY DIAPHRAGM VALVES WHEN NOT PULSING
90-D. INSPECT AND DRAIN AIR WATER FILTER
100-INSPECT FAN DUCTWORK FOR CORROSION, HOLES, OR OTHER EXTERNAL DAMAGE
110-INSPECT FAN DISCHARGE FOR VISIBLE EMISSIONS
120-INSPECT FAN, FAN HOUSING, BEARINGS, DRIVE BELTS FOR DAMAGE OR ABNORMALITIES:
130-A. INSPECT FAN BASE BOLTS FOR TIGHTNESS
140-B. INSPECT FAN FOR EXCESSIVE VIBRATION
150-C. IF FAN INBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO

Votorantim Cimentos

Route Order

Plant: 4606 **Risk:** C3

Order:145544695

ADD AIR TO BEARING OR TO REPAIR
160-D. FAN OUTBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
170-INSPECT FAN MOTOR FOR EXCESSIVE VIBRATION, NOISE OR TEMPERATURE
180-INSPECT DUST COLLECTOR HOUSING, HOPPER, AND ACCESS DOORS FOR DAMAGE, CRACKS, OR AIR LEAKS
190-INSPECT DUST DISCHARGE SYSTEM, AIRSLIDES, TIPPING VALVES, SCREWS, FEEDERS, AND COMPONENTS
200-INSPECT ALL EQUIPMENT GUARDS TO INSURE THAT THEY ARE IN PLACE AND FREE FROM DAMAGE
210-INSPECT DUST COLLECTION PICK-UP POINTS FOR PROPER FUNCTIONING
220-NOTIFY SUPERVISOR OF CONDITIONS REQUIRING A NOTIFICATION

Operation: 0040 DUST COLLECTOR, 2 FM MAIN, PLENUM PULSE **ABCInd.:**

Functional Location: 4606-06-FIM2-Z2P01 DUST COLLECTOR, 2 FM MAIN

Superior Functional Location: 4606-06-FIM2 #2 FINISH MILL

Equipment:

Measuring Point	Measuring Point Description	Target Value	Lower Range Limit	Upper Range Limit	Measurement
1923593	Z2P01DUST COLLECTOR, 2 FM MAINEM-PRD-R0003-0262	0	0	0	

Item OK?	Any Action Taken?	Follow-up Notification M4 Required?	Priority
(___)OK (___)Not OK (___)Not Executed	(___)Yes (___) No	(___)Yes (___)No	(_____)

Operation	Operation Description
0040	DUST COLLECTOR, 2 FM MAIN, PLENUM PULSE

DUST COLLECTOR, 2 FM MAIN, PLENUM PULSE
DC ROUTE - WEEK 1, MONDAY
10-SAFETY - WEAR PROPER PPE
20-DISCONNECT DP TUBING FROM PRESSURE GAUGE AND BLOW OUT TUBING TO DC WITH COMPRESSED AIR
30-CHECK AIR PRESSURE, SHOULD BE BETWEEN 60 AND 90 PSIG. IF OUT OF THIS RANGE OPEN A NOTIFICATION TO REPAIR
40-CHECK DIFFERENTIAL PRESSURE: DP IN H20 - IT OPERATES BETWEEN 3-6IN W.C. FOR FABRIC FILTER BAGS AND BETWEEN 2-4 IN W.C. FOR CARTRIDGES. IF DP IS OUT OF THIS RANGE OPEN A NOTIFICATION FOR REPAIR
50-INSPECT COMPRESSED AIR PULSING SYSTEM AS FOLLOWS:
60-A. INSPECT PILOT TUBING, DIAPHRAGM VALVES, AND AIR MANIFOLD FOR LEAKS
70-B. VERIFY THAT SYSTEM CYCLES CORRECTLY AND THAT ALL PULSERS ARE FIRING
80-C. VERIFY THAT AIR IS NOT LEAKING BY DIAPHRAGM VALVES WHEN NOT PULSING
90-D. INSPECT AND DRAIN AIR WATER FILTER
100-INSPECT FAN DUCTWORK FOR CORROSION, HOLES, OR OTHER EXTERNAL DAMAGE

110-INSPECT FAN DISCHARGE FOR VISIBLE EMISSIONS
120-INSPECT FAN, FAN HOUSING, BEARINGS, DRIVE BELTS FOR DAMAGE OR ABNORMALITIES:
130-A. INSPECT FAN BASE BOLTS FOR TIGHTNESS
140-B. INSPECT FAN FOR EXCESSIVE VIBRATION
150-C. IF FAN INBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
160-D. FAN OUTBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
170-INSPECT FAN MOTOR FOR EXCESSIVE VIBRATION, NOISE OR TEMPERATURE
180-INSPECT DUST COLLECTOR HOUSING, HOPPER, AND ACCESS DOORS FOR DAMAGE, CRACKS, OR AIR LEAKS
190-INSPECT DUST DISCHARGE SYSTEM, AIRSLIDES, TIPPING VALVES, SCREWS, FEEDERS, AND COMPONENTS
200-INSPECT ALL EQUIPMENT GUARDS TO INSURE THAT THEY ARE IN PLACE AND FREE FROM DAMAGE
210-INSPECT DUST COLLECTION PICK-UP POINTS FOR PROPER FUNCTIONING
220-NOTIFY SUPERVISOR OF CONDITIONS REQUIRING A NOTIFICATION

Operation: 0050 DUST COLLECTOR, 3 FM MAIN , PLENUM PULSE **ABCInd.:**

Functional Location: 4606-06-FIM3-Z3P01 DUST COLLECTOR, 3 FM MAIN M910

Superior Functional Location: 4606-06-FIM3 #3 FINISH MILL

Equipment:

Measuring Point	Measuring Point Description	Target Value	Lower Range Limit	Upper Range Limit	Measurement
1923595	Z3P01DUST COLLECTOR, 3 FM MAIN M910EM-PRD-R0004-0264	0	0	0	

Item OK?	Any Action Taken?	Follow-up Notification M4 Required?	Priority
(___)OK (___)Not OK (___)Not Executed	(___)Yes (___) No	(___)Yes (___)No	(_____)

Operation	Operation Description
0050	DUST COLLECTOR, 3 FM MAIN , PLENUM PULSE

DUST COLLECTOR, 3 FM MAIN , PLENUM PULSE
DC ROUTE - WEEK 1, MONDAY
10-SAFETY - WEAR PROPER PPE
20-DISCONNECT DP TUBING FROM PRESSURE GAUGE AND BLOW OUT TUBING TO DC WITH COMPRESSED AIR
30-CHECK AIR PRESSURE, SHOULD BE BETWEEN 60 AND 90 PSIG. IF OUT OF THIS RANGE OPEN A NOTIFICATION TO REPAIR
40-CHECK DIFFERENTIAL PRESSURE: DP IN H20 - IT OPERATES BETWEEN 3-6IN W.C. FOR FABRIC FILTER BAGS AND BETWEEN 2-4 IN W.C. FOR CARTRIDGES. IF DP IS OUT OF THIS RANGE OPEN A NOTIFICATION FOR REPAIR
50-INSPECT COMPRESSED AIR PULSING SYSTEM AS FOLLOWS:

60-A. INSPECT PILOT TUBING, DIAPHRAGM VALVES, AND AIR MANIFOLD FOR LEAKS
70-B. VERIFY THAT SYSTEM CYCLES CORRECTLY AND THAT ALL PULSERS ARE FIRING
80-C. VERIFY THAT AIR IS NOT LEAKING BY DIAPHRAGM VALVES WHEN NOT PULSING
90-D. INSPECT AND DRAIN AIR WATER FILTER
100-INSPECT FAN DUCTWORK FOR CORROSION, HOLES, OR OTHER EXTERNAL DAMAGE
110-INSPECT FAN DISCHARGE FOR VISIBLE EMISSIONS
120-INSPECT FAN, FAN HOUSING, BEARINGS, DRIVE BELTS FOR DAMAGE OR ABNORMALITIES:
130-A. INSPECT FAN BASE BOLTS FOR TIGHTNESS
140-B. INSPECT FAN FOR EXCESSIVE VIBRATION
150-C. IF FAN INBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
160-D. FAN OUTBOARD BEARING TEMP IS ABOVE 180F WRITE A NOTIFICATOIN TO ADD AIR TO BEARING OR TO REPAIR
170-INSPECT FAN MOTOR FOR EXCESSIVE VIBRATION, NOISE OR TEMPERATURE
180-INSPECT DUST COLLECTOR HOUSING, HOPPER, AND ACCESS DOORS FOR DAMAGE, CRACKS, OR AIR LEAKS
190-INSPECT DUST DISCHARGE SYSTEM, AIRSLIDES, TIPPING VALVES, SCREWS, FEEDERS, AND COMPONENTS
200-INSPECT ALL EQUIPMENT GUARDS TO INSURE THAT THEY ARE IN PLACE AND FREE FROM DAMAGE
210-INSPECT DUST COLLECTION PICK-UP POINTS FOR PROPER FUNCTIONING
220-NOTIFY SUPERVISOR OF CONDITIONS REQUIRING A NOTIFICATION

Votorantim Cimentos

Route Order

Plant: 4606 **Risk:** C3

Order:

Confirmation

Op.	Personnel no.	Start Date	Finish Date	Start Time	Finish Time	Activity Type

Maintenance Plan Revision Required: (___)No (___)Yes, Report on notes

Notes:

Responsible for Execution
Personnel no.:_____
Signature:_____
Date:____/_____/_____

Maintenance Approval
Personnel no.:_____
Signature:_____
Date:_____/_____/_____

Requested by Approval
Personnel no.:_____
Signature:_____
Date:_____/_____/_____