	MORTON SALT MANISTEE FACILITY	K+S Experience growth.	MA 300 CM **Issue Date: 2-14-18** **Page 1 of 17**
Environmental, Health, Safety & Sustainable Development Procedure			
MALFUNCTION ABATEMENT PLAN			

COVER PAGE

	NAME/TITLE	SIGNATURE	DATE
Revised By:	Donald E. Kuk EHS Manager		04 JAN 2019
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Reviewed By:	Mike Hull Production Supervisor		1/4/2019
Approved By:	David J. Slivka General Manager		04 JAN 2019

REVISION LOG

Revision No.	Reason for Change(s)	Date
	Original Issue	6-2003
1	Inserted "quarterly" inspection in Section 4.3.1. Added "Tipping Gate and Spare I.D. Fan to Parts Inventory, Section 4.4 and "tipping gates" to Section 4.3.2., Additional Inspections.	7-2004
2	Defined "as needed" in Section 6.3	2-2006
3	Language addition to Section 4.0, Eu#6Boiler, Continuous monitoring noted in Section 4.3.2., and Additions noted in Parts Inventory, Section 4.4.	8-27-07
4	Plan modified to include soot blowing on an as-needed basis.	11-29-07
5	Update Facility Management/Eliminate Elastomag and Magnesia Sections/Update Appendix A	8-12-09
6	Added Equip. No. for each of the Dust Collectors in Appendix	2-9-10

	A\Eliminated Rotary Dryer Scrubber – System No Longer in Use\Changed Name of "Rotary Dryer Transfer Scrubber" to "Filter Building Transfer Scrubber"\Added K+S Logo	
7	Added Annual Replacement of all Filter Bags in the EUPELLETPROD (MAC) Dust Collector to Section 2.3	5-17-10
8	Scheduled Update\Added Section 5 "Corrective Action Procedure" and Eliminated Sections 2.5, 3.5 and 4.5\Various Small Language Changes\Equipment No. Changes in Appendix A.	11-20-12
9	Appendix A, EUTM/BLOCK Differential Pressure Change	4-22-13
10	Added EUPRETZELSALT description, quarterly visible emissions observation, one time stack test and building method 9 and update Appendix A	6-26-14
11	Added J. Logan and R. Kinney and Replaced D. Slivka with J. Bialik to Review Team\Language Changes to Sections 2.4, 2.5, 3.4, 4,3.2\Added Section 4.6\Updated Appendix A Adding Boiler Baghouse Dust Collector.	12-15-15
12	Added New Section 4.2.2 and Renumbered Following Sections. Added New Section 4.6. Original Section 4.6	1-26-16
13	New Language in Section 2.4 Regarding Inspection and Replacement of Filter Bags in the FGPELLPRETZEL (MAC) Dust Collector\Section 4.5 Language Change to show Soot Blowing Performed Once Per "Day"	6-23-16
14	Added D. Slivka as Facility Manager and Eliminated J. Bialik\ Added M. Ganger to Review Team\Changed Water Flow Range for EUPELLETCOOLING as a New Scrubber was Installed During Annual Plant Shutdown.	10-20-16
15	Changed Differential Press Range and Water Flow Range Numbers for EUPELLETCOOLING in Appendix A	11-15-16
16	Removed EUFILTERTRANSFER from MAP and Appendix A. Added D. Daberkoe to review team. Modified dP and water flow range for EUPELLETCOOLING in Appendix A.	2-13-18

TABLE OF CONTENTS

1.0 INTRODUCTION

This Malfunction Abatement Plan (MAP) for the Morton Facility in Manistee, Michigan was prepared as part of the facility's Renewable Operating Permit.

This MAP has been prepared in accordance with MDEQ Rule 911, "Malfunction Abatement Plans."

2.0 MILL DEPARTMENT DUST COLLECTION

The Mill Department operates dust collection devices associated with the following emission sources:

- **EUMILLTRANSFER** – Salt transfer system consisting of mill conveyors, bucket elevators, screens vented to two wet scrubbers (Grandfathered).
- **EUPELLETPRODUCTION** – Water softener pellet production including pellet briquetting machines, a vibratory screen, belt conveyors, bucket elevators vented to a baghouse (555-89A).
- **EUPELLETCOOLING** – Salt product cooling system vented to a wet scrubber (744-85).
- **EUTM/BLOCK** – Salt and Trace Mineral processing machinery vented to a Baghouse (46-77).
- **EUPRETZELSALT** – Totally enclosed pretzel salt production system which includes a main crusher, a pellet press, an enclosed screw conveyor, a recycle crusher, a bucket elevator, and a sizing screener. Controlled by a 33,000 cfm baghouse known as the MAC dust collector (PERMIT # 54-14). Along with EUPELLPROD comprises the flexible group FGPELLPRETZEL

2.1 Supervisory Personnel

The Mill and Loading Department Superintendent is responsible for inspection, maintenance and repair of the Mill Department dust collection devices.

2.2 **Device Monitoring**

2.2.1 Pressure Drop

The dust collection devices will be monitored for pressure drop through the use of magnehelic gauges or equivalent devices. Pressure differential ranges for each dust collection device are listed in Appendix A.

2.2.2 Water Flow Rate

Scrubber dust collection devices will be monitored for water flow rate through the use of a water flow meter. Water flow rate ranges for each scrubber are listed in Appendix A.

2.3 **Inspection Schedule**

Daily Inspections (when the process is operating)

- Pressure Drop
- Water Flow Rate (for scrubbers)

Additional Inspections

- Filter bags-Annual Inspection
- Filter cages-Annual Inspection
- Spray nozzle inspection-Annual Inspection
- System diaphragms and solenoids-Annual Inspection
- Collector blower/belts-Annual Inspection
- Inspect collector housing, inlet and outlet lines-Annual Inspection
- Preventive maintenance of dust collection system-Quarterly Inspection
- Inspection of pellet production dust collector filter bags – Quarterly Inspection

2.4 **Testing, Observation, and Maintenance**

- Visual opacity readings of the pellet production dust collector exhaust
- Annual replacement of all filter bags in the EUPELLETPROD (MAC) dust collector

- Non-certified 30 minute visible emissions inspections (documented) on a quarterly basis from the fabric filter (MAC) stack when FGPELLPRETZEL is operating
- One time method 9 evaluation of visible emissions from the building housing EUPRETZELSALT
- Initial verification and quantification of PM emission rates from the PELLPRETZEL Stack (with 180 days of initial start-up which was 6-20-14)

2.5 **Parts Inventory**

An inventory of spare parts for immediate repair of these devices is maintained in the plant stockroom and includes:

- Fan Belts
- Motors
- Filter Bags

3.0 PANHOUSE/FILTER DEPARTMENT DUST COLLECTION

The Panhouse/Filter Department operates a dust collection devices associated with the following emission source:

- **EUBIN TRANSFER** - Material handling system used to transfer salt from the Filter building to the Mill and vented to a wet scrubber (296-81A).

3.1 **Supervisory Personnel**

The Production Superintendent is responsible for inspection, maintenance and repair of the Panhouse/Filter Department scrubber.

3.2 **Device Monitoring**

The scrubber will be monitored for pressure drop through the use of magnehelic gauges or equivalent devices. The scrubber will be monitored for water flow rate through the use of water flow meters.

Pressure differential ranges and water flow rate ranges for this dust collection device is listed in Appendix A.

3.3 **Inspection Schedule**

Daily Inspections (when the process is operating)

- Pressure Drop
- Water Flow Rate

Additional Inspections

- Semi-annual preventive maintenance of the dust collector system and motor
  NOTE: PM will occur at scheduled boil outs and annual outages

These preventive maintenance inspections will visually inspect the water flow system, nozzle condition, ductwork, system housing and drive components.

3.4 **Parts Inventory**

An inventory of spare parts for immediate repair of this device is maintained in the plant stock room and includes:

- Fan Belts
- Motor

4.0 POWERHOUSE DEPARTMENT DUST COLLECTION

The Powerhouse Department operates dust collection devices associated with the following emission sources:

- **EUCOAL CRUSHER**– Coal crushing and conveying vented to a wet scrubber (362-83).
- **EUGASBOILER** – 16,000,000 BTU per hour natural gas fired boiler. No dust collection device needed for this equipment (460-82).
- **EU#6BOILER** – 180,000 pounds steam per hour Wickes spreader stoker coal and natural gas co-fired boiler used to generate electricity and steam for both sections of the stationary source. The collection device for this equipment is a four module baghouse. Each module contains 289 high temperature resistant filter bags. Bag cleaning is by high pressure compressed air reverse pulse.

4.1 **Supervisory Personnel**

The Powerhouse Superintendent is responsible for inspection, maintenance and repair of the Powerhouse Department dust collection devices.

4.2 **Device Monitoring**

4.2.1 The scrubber associated with the coal crusher and conveying system (EUCOALCRUSHING) will be monitored for pressure drop and water flow rate in the following manner:

- ***Pressure Drop*** – Through use of a magnehelic gauge or similar device.

4.2.2 The baghouse dust collector associated with #6 boiler will be monitored for pressure drop through the use of magnehelic gauges or similar devices. The pressure differential range for the baghouse dust collection system is listed in Appendix A.

4.3 **Inspection Schedule**

4.3.1 Scrubber for coal crusher and conveying system:

Daily Inspections (when the process is operating)

- Pressure Drop
- Water Flow Rate

Additional Inspections

- Quarterly preventive maintenance to include inspection of water flow system, spray nozzles, ductwork and collector housing.

4.3.2 Baghouse for #6 Boiler

Continuous monitoring and recording via computer control system

- Pressure Drop
- Continuous Opacity Monitoring and Recording
- Continuous Temperature Monitoring and Recording

Additional Inspections

- ID fan motor-Annual Inspection
- Calibration of Opacity Monitor-Annual Inspection

4.4 **Parts Inventory**

An inventory of spare parts for immediate repair of these devices is maintained in the plant stockroom and include:

- Installed spare I.D. fan VFD
- Dust Collector Bags
- Dust Collector Cages

4.5 **Soot Blowing of #6 Boiler**

Soot blowing is conducted on an as-needed basis for the safe and efficient operation of the boiler system. Typically soot blowing is performed once per shift.

4.6 **Method to Measure Coal and Lime Usage Rates During Periods of Maintenance or Repair of the Monitoring Equipment**

4.6.1 Lime Usage Rate Calculation- the hydrated lime is injected into the #6 boiler emission stream as needed at a constant rate of 1 pound/minute, or 2 pounds/minute, or 3pounds/minute, or 4 poounds/minute based upon the level of chlorine in the coal and the amount of coal being burned. Should the Delta V monitoring system fail or the monitoring system be taken off-line for maintenance, lime will continue to be added at the same calculated required rate. The usage rate will be calculated to be the lime set point rate at the time of the monitoring system failure or maintenance repair. This rate will be used as the rate of addition per minute. The total lime usage rate during the period of monitoring equipment failure/maintenance will be calculated as follows:

Lime set point rate X Total time in minutes the monitoring equipment was not available

(At time of failure or maintenance of monitoring equipment in #/minute)

It should be noted that the control for lime addition will continue to be operating during these times noted above and if the boiler load were to go up or down the lime addition would adjust with it. However, when adding

lime in 1 pound increments the likelihood that lime would need to be adjusted is very unlikely being that the control parameters allow for very large changes in ppm of chlorine.

4.6.2 Coal Usage Rate Calculation- Coal is weighed on two individual weigh feeders prior to being fed into the #6 boiler for fuel. The amount of coal being fed into the boiler will vary depending on the amount of steam and pressure being produced by the boiler. Should either one or both of the monitoring systems for the weigh feeders fail or require maintenance, Morton will calculate the amount of coal used during that period of monitor down-time. The correlation of the amount of steam produced at the given heating value of the coal (BTU/pound) will be used to calculate the amount of coal being fed to the boiler in tones per hour.

(Example) 84,000 pounds of steam per hour requires a coal feed rate of **X tons/hour** at a heating value of 12,500 BTU/pound. The total tons of coal utilized during the monitoring or weigh feeder down time will be calculated using the tons coal/hour (determined above) X total time, in hours, the monitoring equipment or feeder was not available.

4.7 Methodology for Determination of Lime Injection Rates and Daily HCL Emission Totals

No Lime Addition

Based on the HCL emission rate of 0.934#/hr. HCL during the October 1, 2015 compliance stack test and using a worst case of the boiler operating every hour of the year for a total of 8760 hours and using the highest steam production rate achievable, 108,350#/hr. during the stack test (normal steam production is about 85,000#/hr) the following amount of HCL would be emitted per year(0.934# HCL/hrX8760 hr/yr)/ 2000 #/ton=**4.09 tons HCL/yr@100 ppm chlorine in coal.**

Next a determination of the maximum concentration of chlorine in coal to generate less than 9.9 tons per year HCL: without adding hydrated lime must be made as follows:

((9.9 tons HCL/X2000#/ton)/8760 hr/yr))/0.934 #HCL/hr X (100 ppm chlorine)= **242 ppm chlorine in coal** maximum to emit less than 9.9 tons/yr HCL.

Therefore **coal that has a chlorine content of less than 242 ppm chlorine** may be used in the boiler without the addition of the hydrated lime neutralizing agent and will result in generating less than 9.9 tons per year of HCL emissions.

Lime Additions of Approximately 1 Pound per Minute

Based on this HCL emissions rate of 0.094#/hr HCL during the October 6, 2015 compliance stack test and using a worst case of the boiler operating every hour of the year for a total of 8760 hours and using this highest steam production rate achievable 108,967#/hr during the stack test the following amount of HCL would be emitted per year:
(0.094#HCL/hr X 8760 hr/yr) /2000#/ton=0.**411 tons HCL/yr @ 100 ppm chlorine in coal and a hydrated lime injection rate of 0.933#/min.**

Next a determination of the maximum concentration of chlorine in coal and still generate less than 9.9 tons per year HCL with the addition of hydrated lime at a rate of 0.933#/min must be made as follows:
((9.9 tons HCL/yr X 2000#/ton)/8760 hr/yr))/0.094#HCL/hr X (100 ppm chlorine)= **2404 ppm chlorine in** coal maximum to emit less than 9.9 tons/yr HCL.

Therefore coal that has a chlorine content of more than 243 ppm chlorine and less than 2404 ppm chlorine may be used in the boiler with an addition rate of 0.933# hydrated lime/min neutralizing agent and will result in generating less than 9.9 tons per year of HCL emissions. Since the actual addition rate of lime was 0.933#/min rather than 1.0#/min rate can be made as follows: 1.0/.933=1.0718 multiplier to convert to 1.0#/min lime. Therefore: **2404ppm chlorine X 1.0718=2576 ppm chlorine in coal maximum when adding 1.0#/min of hydrated lime.** Further analyses of the data when injecting lime at 2.0#/min into the exhaust stream and resulting HCL levels seems superfluous since the chlorine content of coal used at the Manistee facility is not expected to exceed 2000 ppm (o.20%). However for completeness and due to the fact that the air quality permit allows the use of coal with a maximum of 1.9 % chlorine the data analysis continues.

Lime Addition of Approximately 2 Pounds per Minute

Based on the HCL emissions rate of 0.020#/hour during the October 7, 2015 compliance stack test and using a worst case of the boiler operating every hour of the year for a total of 8760 hours and using the highest steam production rate achievable, 110,100#/hour during the stack test the following amount of HCL would be emitted per year: (0.020#HCL/hr X 8760 hr/yr)/2000#/ton=**0.088 tons HCL/yr @ 100 ppm chlorine in coal and a hydrated lime injection rate of 2.55 #/min.**

Next a determination of the maximum concentration of chlorine in coal and still generate less than 9.9 tons per year HCL with the addition of hydrated lime at a rate of 2.55#/min must be made as follows: ((9.9 tons HCL/yr X 2000#/ton)/8760 hr/yr))/0.020 #HCL/hr X (100 ppm chlorine)+ **11,301 ppm chlorine in coal** maximum to emit less than 9.9 tons/yr HCL.

Therefore coal that has a chlorine content of more than 2404 ppm chlorine and less than 11,301 ppm chlorine may be used in the boiler with an addition rate of 2.55# hydrated lime/ min neutralizing agent and will result in generating less than 9.9 tons per year of HCL emissions. Since the actual addition rate of lime was 2.55#/min rather than 2.0#/min as intended a conversion to a 2.0#/min rate can be made as follows: 2.0/2,55=0.7843 multiplier to convert to 2.0#/min lime. Therefore: **11,301 ppm chlorine X 0.7843=8,863 ppm chlorine in coal maximum when adding 2.0#/min of hydrated lime.**

Lime Addition of Approximately 4 Pounds Per Minute

Based on the HCL emission rate of 0.0084#HCL/hour during the October 8, 2015 compliance stack test and using a worst case of the boiler operation every hour of the year for a total of 8760 hours and using this highest steam production rate achievable, 110,933#/hour during the stack test the following amount of HCL would be emitted per year: (0.0084#HCL/hr X 8760 hr/yr)/2000#/ton=**0.0368 tons HCL/yr @ 100 ppm chlorine in coal and a hydrated lime injection rate of 4.1 #/min.**

Next a determination of the maximum concentration of chlorine in coal and still generate less than 9.9 tons per year HCL with the addition of hydrated lime at a rate of 4.1#/min must be made as follows; ((9.9 tons HCL/yr X 2000#/ton)/8760 hr/yr))/0.0084#HCL/hr

X (100 ppm chlorine)=**26,908 ppm chlorine in coal** maximum to emit less than 9.9 tons/yr HCL.

Therefore coal that has a chlorine content of more than 11,301 ppm chlorine and less than 26,908 ppm chlorine may be used in the boiler with an addition rate of 4.1# hydrated lime/min neutralizing agent and will result in generating less than 9.9 tons per year of HCL emissions. Since the actual addition rate of lime was 4.1#/min rather than 4.0#/min as intended a conversion to a 4.0#/min rate can be made as follows: 4.0/4.1=0.9756 multiplier to convert to 4.0#/min lime.
Therefore: **26.908 ppm chlorine X 0.9756=26,251 ppm chlorine in coal miximum when adding 4.0#/min of hydrated lime.** The ROP allows a coal with a mixiumum amount of 1.9% chlorine (19,000 ppm) to be used for fuel. Therefore we have determined that HCL emissions may be controlled at this level of chlorine by the addition of approximately 4#/min of hydrated lime.

This data was used to develop the Excel calculations to determine the amount of HCL being emitted daily under two scenarios; utilizing coal with chlorine less that 242 ppm thus not adding lime and utilizing coal with chlorine of 243 ppm and up to 2576 ppm by injecting hydrated lime at 1.0#/minute. The emission factors developed during the compliance stack test, the chlorine in the coal being used, the hours of operation of the boiler and the lime injection rate(when applicable) were used to develop the daily calculations of HCL emitted. As stated above steam production at maximum levels achieved during the stack tests are used in the calculations.

5.0 CORRECTIVE ACTION PROCEDURE

If a malfunction in the operation of a dust collection device occurs such as an abnormal condition, or start up or shut down, Morton will immediately initiate corrective action. The corrective action procedures are as follows:

- Repair malfunctioning dust collection equipment.
- If repair cannot be completed in a reasonable period of time, shut down processes being serviced by the dust collection system.

- If malfunction results in emission excursion in excess of permitted limits of opacity or other limits for more than two hours, notify MDEQ of the malfunction as follows:

  - Call, fax, or report face to face to a MDEQ Air Quality Representative (Cadillac District) within two (2) business days from the time the excursion is discovered and provide the following information:

    Name of Person Calling in Excursion
    Date and Time of Excursion
    Date and Time Excursion was Discovered
    Date and Time Corrective Action was Taken
    Type of Corrective Action Taken
    Cause of Excursion

  - Provide written notification of the excursion to the District Supervisor of the Cadillac District Air Quality Division within ten (10) days from the time the start up or shut down occurs, within ten days after abnormal condition or malfunction is corrected, or within 30 days of discovery of abnormal condition or malfunction. The report shall be certified by a responsible official.

APPENDIX A

SOURCE	SOURCE NAME	REQUIREMENTS	
		DIFFERENTIAL PRESS RANGE (Inches H_2O)	WATER FLOW RANGE (GPM)
Coal Crusher Scrubber Equip. #2017-03-01-0217-001	EUCOALCRUSHER	7 - 13	25 Minimum
Boiler Baghouse Dust Collector Equip. #2017-03-01-0124	EU#6BOILER	0.1 - 9.5 Per Module	N/A
Mill Roof – NE Scrubber Equip #2017-40-05-0217-001	EUMILLTRANSFER	1 - 8	5 Minimum
Mill Roof – NW Scrubber Equip. #2017-40-05-0217-002	EUMILLTRANSFER	1 - 8	5 Minimum
Pellet Production Dust Collector Equip #2017-64-05-0214-001	EUPELLPROD	1 - 5	N/A
Pellet Cooling Scrubber Equip. #2017-64-05-0217-001	EUPELLETCOOLING	3.6 – 6.8	20 - 45
TM/Block Dust Collector Equip. #2017-40-05-0214-003	EUTM/BLOCK	0.5 - 10	N/A
Bin Building Top Floor Scrubber Equip. #2017-34-03-0217-0	EUBINTRANSFER	3 - 10	5 Minimum
Pretzel Salt and Pellet Production Dust Collector (MAC) Equip. #2017-64-05-0214-001	EUPRETZEL SALT	1 - 5	N/A
Boiler Baghouse Dust Collector Equip. #2017-03—01-0124	EU#6 BOILER	Minimum O2 at Discharge of baghouse 7.3%based on a 30 day rolling average	