

**AIR PERMIT – STARTUP, SHUTDOWN,
AND MALFUNCTION PLAN**

Procedure No. 05-05-01

Revision 6

REVIEW / APPROVAL:

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I. Record of Reviews and Revisions

Revision/Reviewed	Revision By/Reviewed By	Date of Revision/Review
Rev 1 added phase 2 info	Brian Roth/George Keefe	3/27/03
Rev 2 updated procedure numbers and added lessons learned	Brian Roth/George Keefe	5/25/05
Revision limited to change in ownership name	T. Shepard/George Keefe	3/19/2008
Rev 4—Added changes to incorporate revisions to Renewable Operating Permit (ROP)	Brian Roth/Tom Shepard	10/19/09
Rev 5—Revisions for new ammonia delivery system and Attachment A.	Gregg Baustian/Homer Manning/Cory Anderson	08/01/2013
Rev 6—Added a reference to the Combined Cycle Aqueous Ammonia System Procedure and made other minor updates. Changed DAHS PLC to DAHS PLC/Data Logger.	Jason Prentice/J. Homer Manning/Gregg Baustian	5/27/2014

II. Overview

A. Purpose/Function

1. To present to the Michigan Department of Environmental Quality (MDEQ), Air Quality Division (AQD) the Zeeland Generating Station plan to minimize emissions during conditions of startup(s), shutdown(s), and malfunction(s) in accordance with the Zeeland Generating Station's air permit. As of May 27, 2014, the current air permit is identified as Renewable Operating Permit (ROP) MI-ROP-N6521-2009a, and any references to "air permit" or "ROP" within this plan refer to the preceding air permit and any subsequent modifications or renewals of this ROP.

Note:

Remember: Stop, Think, Act, Review – STAR!

B. Precautions/Limitations

1. The procedure steps in Section III do not list all permit requirements. They are intended to highlight and clarify specific sections of the permit.
2. This procedure applies to the simple and combined cycle operation of the Zeeland Generating Station facility.

III. Procedure

Note: Except during periods of startup, shutdown, malfunction or other circumstances as identified within this plan, the plant shall not be operated at emissions levels exceeding the applicable numerical emission limits for more than 2 hours.

A. Emission Limits and Operating Restrictions

1. A summary of the emission limits and operating restrictions of this permit must be posted in the control room and must be plainly visible (without obstructions) to the operator of the facility (Attachment A).
 - a. Instances where Units 2A or 2B are operated without ammonia injection into the associated SCR for purposes of ammonia injection grid (AIG)

tuning, consistent with Section III.E.2. of the Combined Cycle Aqueous Ammonia System Procedure, are NOT considered deviations of the ROP (i.e., Condition FGCOMBINEDCYCLE, III.1 of ROP MI-ROP-N6521-2009a). NOTE: All emissions occurring during such periods shall be accounted for when assessing compliance with the daily average and 12-month rolling time period emission limits.

2. Records shall be maintained of the occurrence and duration of any startup, shutdown or malfunction in the operation of the facility plus any malfunction of the air pollution control equipment or any periods during which the CEMS is inoperative. Records shall also be maintained for any instances where ammonia injection to the SCR is halted for purposes of AIG tuning, consistent with Section III.E.2. of the Combined Cycle Aqueous Ammonia System Procedure. In addition to the normal plant logs, a special logbook for CEMS operation and maintenance activities shall be maintained in Unit 1A, Unit 1B, Unit 2A, and Unit 2B CEMS shelters respectively.

B. Plant Startup and Shutdown

1. NOX, PM-10, CO and VOC emissions rates shall be minimized during startup and shutdown by verbatim compliance with plant startup and shutdown procedure number 03-10-01 for phase 1 and IOI-1 and IOI-2 for phase 2. These procedures have incorporated all manufacturers' recommendations for safe and proper operations of the plant gas turbine units in accordance with the ROP.
2. The ROP requires compliance with short term emission limits (i.e., those based upon the average of all operating hours within a calendar day) at all times with the exception of periods of startup, shutdown, and malfunction. Compliance with all other emission limits is based upon all periods of unit operation.
3. Compliance with the short term NO_x, CO, and NH₃ slip emissions limits shall be demonstrated on a daily average basis in accordance with the ROP. The plant's certified CEMS shall provide the necessary measurements to demonstrate compliance with these emissions limits.
4. Compliance with the PM₁₀, VOC, and Formaldehyde emissions limits shall be demonstrated on a daily average basis in accordance with the ROP. This will be done through emissions factors determined during compliance testing and fuel usage. The actual daily average emissions calculations will be performed within the Data Acquisition and Handling System (DAHS) or via spreadsheet.

5. Startup and shutdown are defined in the ROP.
 - a. **Startup** - *Startup is defined as the period of time from first ignition to when the turbine reaches "Mode 6"*
 - b. **Shutdown** - *Shutdown is defined as the period of time the turbine output is lowered below "Mode 6," with the intent to shut down, until the point at which the combustion process stops."*

6. Startup and shutdown are determined on an hourly (clock) basis. Any minute of operation that meets the definition of startup or shutdown renders the entire hour a startup or shutdown hour for the purpose of emissions compliance.

7. Selective Catalytic Reduction (SCR) Operations
 - a. The SCR will be operated in accordance with the manufacturers' guidelines and limitations.

 - b. The following permissives have to be met prior to the SCR being placed in operation (i.e. before the ammonia block valve and flow control valve can be opened):
 1. Ammonia transfer pump running
 2. Instrument air pressure > 40 psig
 3. Instrument air block valve open
 4. Vaporizer outlet temperature > 600 degrees Fahrenheit (°F)
 5. All SCR inlet duct temperature (IPSH temperatures) ≥ 600 °F (525 °F for the block valve and 600 °F for the flow control valve)
 6. NOx SCR < 30 PPM

C. Plant Malfunctions

A malfunction is not specifically defined within the ROP, but the term is defined within Michigan R 336.1113(a) as follows:

"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.

1. Steam Turbine Trip

- a. A steam turbine trip is an abnormal condition and considered to be a malfunction.
- b. The duration of the malfunction is dependent on how the control system responds and what action is required by the gas turbines to return the steam turbine to an operating condition.
- c. If it is necessary for the gas turbines to be brought out of mode 6, the duration will be as short as possible without violating the manufacturers' operating guidance.

2. Gas Turbine Trip

- a. A gas turbine trip is an abnormal condition and considered to be a malfunction.
- b. The duration of the malfunction is dependent on how the control system responds and what action is required by the operating gas turbine to return the tripped gas turbine to an operating condition.
- c. If it is necessary for the operating gas turbine to be brought out of mode 6, the duration will be as short as possible without violating the manufacturers' operating guidance.

3. Gas Turbine Runback

- a. A gas turbine runback is an abnormal condition and considered to be a malfunction.
- b. A runback is designed to prevent damage to the gas turbine, HRSG, or steam turbine by reducing load which likely will result in the gas turbine exiting mode 6. Once the abnormal condition is cleared, the gas turbine will be brought back into compliance mode as quickly as possible.

4. Continuous Emissions Monitoring System (CEMS) failure

a. Analyzer Failure

1. If the NO_x or O₂ analyzers fail, the procedures in 40 CFR 75 will be followed and a like-kind analyzer may be placed in service in accordance with the CEMS QA/QC plan to minimize the loss of data.
2. If a CO analyzer fails, a spare analyzer may be placed in service and the CO data will be flagged as bad data until the original analyzer can be repaired and returned to service.

b. PLC/Data Logger Failure

1. If the CEMS PLC/Data Logger fails, the unit will be shutdown ASAP since no operating data can be recorded without the PLC/Data Logger.

c. Data Acquisition and Handling System (DAHS) Failure.

1. If the DAHS fails, the PLC/Data Logger will store data for up to three months. Once the DAHS is restored, the PLC/Data Logger data will be sent to the DAHS for storage and processing.

5. Ammonia System Failure (Combined Cycle Only)

a. Verify the ammonia blocking valve is open, if not, determine which of the parameters caused it to shut and restore that parameter to its required value.

1. Atomizing air pressure low
2. Vaporizer outlet temperature < 250 °F
3. SCR inlet duct temperature < 525 °F
4. A reduction in dilution air flow of 10% for > 10 seconds

b. Verify ammonia transfer pump discharge pressure is between 25-70 psig.

c. Verify regulated ammonia pressure at the flow skid is >45 psig and air pressure is 120 psig.

d. If unable to get sufficient ammonia pressure to the flow skid, reduce the air pressure to match ammonia pressure.

6. DLN 2.6 System Malfunctions

a. The DLN 2.6 system is designed to keep the gas turbine operating in compliance. Variations in fuel or air flow can cause the combustion dynamics to change and affect the resulting NO_x and CO concentrations, causing a malfunction of the system that can only be fixed with the unit running and a General Electric Engineer performing remote DLN tuning of the combustion system.

b. Remote DLN tuning Procedures

1. Call Stan Peznowski (GE CPM) at 616-822-6685 and inform him of the situation. He will contact the remote tuning center.

2. If unable to reach Stan, call the GE M&D center and have them connect you to the remote tuning center. (1-800-735-2044)
3. Enable the remote tuning system by inserting and turning the key in the remote tuning box located in the DCS room.
4. If tuning is unsuccessful, troubleshoot the analyzer as follows:
 - a. Verify the bottle hasn't expired
 - b. Verify the spec on the bottle matches the DAHS and analyzer.
 - c. Verify there is sufficient pressure in the bottle (> 300 psig)
 - d. If nothing abnormal is discovered, perform a calibration with a new bottle.
 - e. If the problem still exists, contact the Plant and O&M Managers.

IV. References

- A. State of Michigan Zeeland Generating Station MI-ROP-N6521-2009a and subsequent modifications or renewals of this ROP
- B. 40 CFR 60.13
- C. Michigan Rule R 336.1915
- D. Zeeland Generating Station Procedure No. 03-21-AA, Combined Cycle Aqueous Ammonia System, Section III.E.2

V. Attachments

- A. Emission Limits and Operating Restrictions Summary

VI. Attachment A: Emission Limits and Operating Restrictions Summary

AIR EMISSION LIMITS SUMMARY

Unit	NOX		CO		PM10		VOC		Formaldehyde TPY ⁴	NH3 Slip lbs/hr ²	
	ppmv ^{1,2}	lbs/mmbtu ²	TPY ³	lbs/mmbtu ²	lbs/hr ²	TPY ³	lbs/hr ²	TPY ³			
EUGT 1A	9.0	0.04	334.6	0.021	175.6	10.8	47.3	5.8	25.4	9.4	N/A
EUGT 1B											
EUGT 2A	3.5	0.013	119.6	0.042	238	14.7	64.4	16.8	73.6	9.4	27.1
EUGT 2B											

NOTES:

- 1 Dry, corrected to 15% O₂.
- 2 Limits are on a per unit basis and do not include startup, shutdown and malfunction. Compliance is based upon the average of all operating hours within a calendar day.
- 3 Limits are on a per unit basis over a 12 month rolling time period, determined at the end of each calendar month.
- 4 The formaldehyde limit of 9.4 TPY is a combined limit for all four units over a 12 month rolling time period, determined at the end of each calendar month.

ZEELAND GENERATING STATION 05-05-01 Startup, Shutdown, and Malfunction Plan

OPERATING RESTRICTIONS SUMMARY

Unit	Startup Duration Restrictions (per unit totals per 12-month rolling time period)			Shutdown Duration Restriction (per unit totals per 12-month rolling time period)	Miscellaneous Restrictions
	Cold ¹	Warm ¹	Hot ¹		
EUGT 1A		182 ²		85 ³	1. Units shall not be operated unless an approvable SSM Plan is maintained and implemented.
EUGT 1B					
EUGT 2A	564	456	341	85 ³	1. Unit shall not be operated in combined cycle mode without the associated SCR in service, except as provided for within the SSM Plan. 2. Units shall not be operated unless an approvable SSM Plan is maintained and implemented. 3. Units shall not be operated simultaneously at 60% load or less for more than 16 continuous hours.
EUGT 2B					

NOTES:

- 1 For Units 2A and 2B only, a "hot start" is when the steam turbine first stage or reheat inner metal temperature is greater than 700 °F, a "warm start" is when this temperature is between 400 °F and 700 °F, and a "cold start" is when this temperature is less than 400 °F.
- 2 Concepts of cold, warm and hot startup do not apply to Units 1A and 1B, and "startup" is therefore defined consistent with Section III.B.5.a of the SSM Plan.
- 3 "Shutdown" is defined consistent with Section III.B.5.b of the SSM Plan.