<table>
<tr><td></td><td colspan="3">New Covert Generating Company, LLC
Covert Generating Facility</td></tr>
<tr><td>Number:
OPS-903
(Formerly CGC 6.3.3)</td><td colspan="3">Subject:
SCR & CMCO Operations & Maintenance</td></tr>
<tr><td>Approved by: FDGoble</td><td>Current Issue:
Revision 2</td><td>Issue Date:
February 14, 2013</td><td>Last Review Date:
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RECORD OF CHANGES

Rev	Date	Description of Changes
0	11/30/02	Original Document
1	7/29/03	Added CO Catalyst Information *(Note: Approved by MDEQ on 8/19/03.)*
2	2/14/13	Complete rewrite based on Carbon Monoxide Catalytic Oxidation (CMCO) & Selective Catalytic Reduction (SCR) Sampling Reports provided by Cormetech following Spring 2012 sampling of all Unit CMCO & SCR catalysts. Update to recommended sample interval and basis.

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1.0 PURPOSE

The purpose of this document is to describe how Covert operates and maintains the SCR (Selective Catalytic Reduction) and CMCO (Carbon Monoxide Catalytic Oxidation) modules for the three heat recovery steam generators (HRSG's).

This document utilizes the information from Cormetech's SCR O&M manual, Engelhard's Carbon Monoxide Converter System Manual, our local operating experience, and actual SCR & CMCO inspection results to explain how all of this information is used to properly operate and maintain our SCR & CMCO components to ensure compliance with our air permit.

2.0 REFERENCES

2.1 SCR Catalyst Operations and Maintenance Manual, Issued by Cormetech, Inc. to Deltak LLC for Covert, MI; Job # G01001-6830-680, Issue 2.1, 3/23/01

2.2 Catalyst Handling and Maintenance Procedures for an Engelhard Carbon Monoxide Converter System, Issued by Engelhard to Deltak LLC for Covert, MI; Job # 1203141, Rev 0, 8/22/01

2.3 Unit Start-Up and Shutdown Emissions Reduction Procedure & Guidelines, OPS-902 *(Formerly Procedure Number CGC 6.3.2)*

2.4 Unit Start Up / Shutdown, OPS-616

2.5 Unit 1 SCR Catalyst Performance Test Report, Submitted by Cormetech, Inc. to TPF Holdings Covert, 8/23/12

2.6 Unit 2 SCR Catalyst Performance Test Report, Submitted by Cormetech, Inc. to TPF Holdings Covert, 8/23/12

2.7 Unit 3 SCR Catalyst Performance Test Report, Submitted by Cormetech, Inc. to TPF Holdings Covert, 8/23/12

3.0 SCOPE

This procedure is applicable to the SCR and CMCO modules at the Covert Generating Facility.

4.0 RESPONSIBILITIES

4.1 The **Plant Manager** is responsible for procedure approval and implementation.

4.2 The **Maintenance Manager** has the responsibility of ensuring that the maintenance aspects of this procedure are complied with and that this procedure is fully utilized and followed by appropriate employees of Covert Generating Facility and any third parties engaged in the maintenance and/or handling of the CMCO & SCR modules.

4.3 The **Operations Manager** has the responsibilities of ensuring that the CMCO & SCR modules at the station are operated in accordance with this manual and other referenced documents. Additionally, the Operations Manager is responsible for ensuring that proper notifications are made to the State & relevant authorities in accordance with air permit directions AND for reporting any variances involving the handling and/or disposal of CMCO/SCR module materials to the proper authorities.

4.4 The **Plant Engineer** is responsible for procedure review and revision per direction from component OEM's, Test Reports, and Operations & Maintenance Managers.

5.0 OVERVIEW

a. Carbon Monoxide Catalytic Oxidation (CMCO) occurs when carbon monoxide is converted to carbon dioxide at high temperature in the presence of a catalyst. This reaction is passive and occurs above 500 °F.

$$2CO + O_2 \rightarrow 2CO_2$$

b. Selective Catalytic Reduction (SCR) of combustion flue gases reduces nitrogen oxides (NO_x) into nitrogen (N_2) and water (H_2O). NO_x breaks down when it reacts with a reducing agent, usually ammonia (NH_3), in the presence of a catalyst.

Ammonia is mixed thoroughly with the flue gas prior to the catalyst. The mixing assures even distribution of the temperature and reaction components. The catalyst, by providing active sites, allows the reaction to occur at temperatures between 300 °F – 1,050 °F. By design and procedure, Covert limits the low-end reaction temperature to > 550 °F to prevent formation of salts.

The NH_3 diffuses into the catalyst pore structure and is adsorbed onto an active catalyst site. The NO_x then reacts with the adsorbed NH_3, completing the reaction. The reaction depends primarily on available active sites (a function of geometric surface area, pore volume and concentration of active catalyst component), flue gas temperature, and reagent concentration. A well-balanced process will maintain appropriate output levels of residual NO_x and NH_3. The reactions are listed below:

1) $4NO + O_2 + 4NH_3 \rightarrow 4N_2 + 6H_2O$

2) $NO + NO_2 + 2NH_3 \rightarrow 2N_2 + 3H_2O$

3) $6NO + 4NH_3 \rightarrow 5N_2 + 6H_2O$

6.0 OPERATION

6.1 CMCO General Operating Guidelines:

The operation of the CMCO is a chemical reaction dependent only on temperature and requires no control instrumentation. The operators can validate catalyst performance by emissions control equipment. The catalyst maximum temperature is 1100 °F and temperature does not exceed this value based on the HRSG design. See Reference 2.2 for additional information about the CMCO catalyst.

6.2 SCR General Operating Guidelines:

a. The operating temperature should not exceed 750 °F. Exposure of the SCR above this temperature risks permanent loss of catalyst activity. ***(Review of Covert operating history on TI's, XGTE-TI514 & XGTE-TI514B shows that the highest temperature recorded in the SCR Bay was 696 °F on Unit 1 – Units 2 & 3 were lower.)***

b. Ammonia injection must be terminated if the reactor temperature drops below 550 °F to prevent the sulfate and nitrate compound deposits on the catalyst surface. ***(SCR Temps remain > 550 °F for a sufficient duration of time following "flame out" on the GT. Ammonia injection stops upon "flame out" on the GT. Covert's permissive for allowing ammonia injection is 550 °F.)***

c. Process parameters should be monitored during SCR operations. At a minimum, the pressure drop across the catalyst, and the NH3 injection rate should be monitored daily. Trend analysis of this data is vital to monitoring catalyst performance. ***(As a matter of routine, ammonia flow and SCR D/P are monitored during normal operation by the CRO. Continuous monitoring and alarm of NO_x aids in the monitoring of these parameters.)***

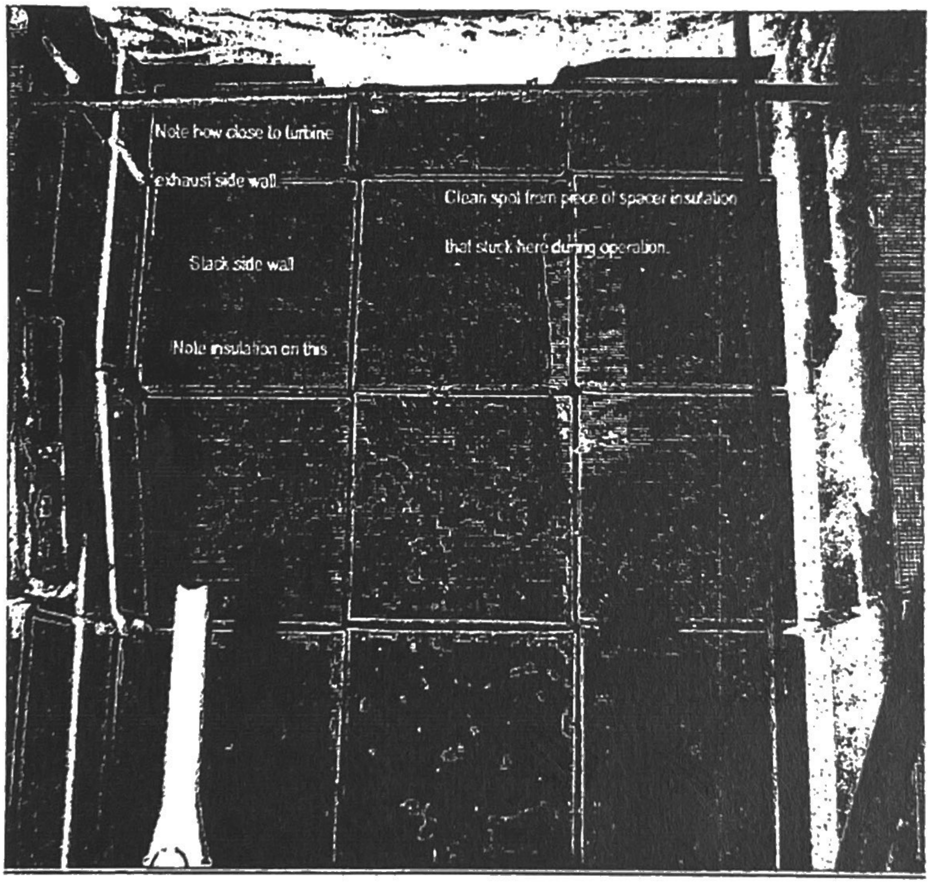
d. Start-up of the SCR should take place in accordance with Reference 2.4, OPS-616, Unit Start Up/Shut Down.

e. Refer to Reference 2.3, Unit Start-Up and Shutdown Emissions Reduction Procedure & Guidelines (OPS-902), for additional start-up and operating guidance to minimize emissions; and refer to Reference 2.1, Cormetech's SCR Catalyst Operations and Maintenance Manual, for additional detailed operating guidance & instruction for the SCR.

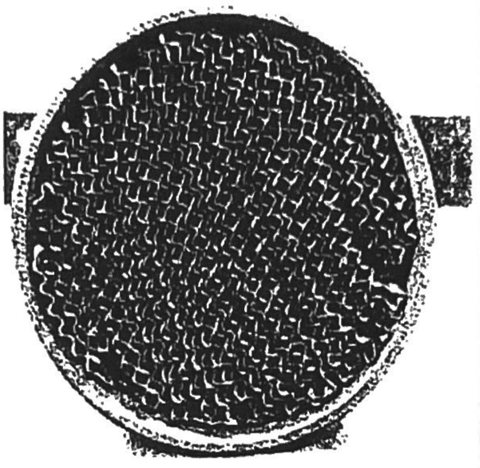
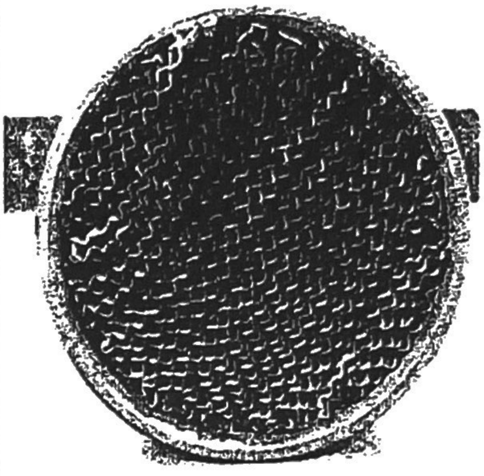
7.0 MAINTENANCE & SAMPLING

7.1 ***Inspection and Cleaning***: Both the SCR and CMCO catalysts should be inspected during outages (CMCO & SCR modules ***will be*** inspected annually at a minimum) for erosion and plugging. All debris such as dust, and other impurities should be cleaned from the catalysts using a vacuum cleaner. Vacuuming should be done with care not to damage the catalyst face. Keep the vacuum nozzle ¼" to ½" from the catalyst face.

Experience has shown that due to the two-layer design of the SCR catalyst (one full layer of blocks in front of a second layer with << 1" of space between block walls), vacuuming of the SCR grid does not have very good success because of debris that becomes entrapped in the space between the block walls. (See photo below.)



The CMCO catalyst, however, is of much simpler design and is cleaned effectively by vacuuming. Best results are achieved by blowing from the stack side and sucking from the GT side simultaneously. *(See example of CMCO catalyst "buttons" below.)*

Flow Entrance	Flow Exit
	

7.2 ***Sampling***: The CMCO and SCR catalyst performance can be verified by sampling from pre-engineered sample locations/components. In the SCR, this sample location is 2 blocks wide by 5 blocks tall (2 layers) located in the lower third near the horizontal center of the SCR Array in each of the Unit's catalysts. In the CMCO catalyst, test cores or "buttons" (3" diameter cylinders as shown in previous photo) are located in various modules. The recommended sample interval is provided in the subsequent sections based on consideration of OEM guidance, actual inspection/performance results, and operational practices.

7.3 ***Results***: All three CMCO's and SCR's were sampled during Unit outages that took place in the Spring of 2012.

SCR Sample Grid Pattern Shown below for Reference:

1	2
3	4
5	6
7	8
9	10

a. **Unit 1 Results Summary from Reference 2.5:**

Common Data:	
First Gas-In Date w/ Catalyst Installed	9/16/03
Sample Removal Date	5/20/12
Total Operating Hours on Catalyst Samples	12,513
Primary Fuel Fired	Pipeline Natural Gas
Number of Starts/Stops since Catalyst Install	365
Visual Inspection Notes – both CMCO and SCR	Element in good physical condition.
Blocked Cell Count as Received /After Cleaning	0/0
SCR Test Data:	
SCR Sample Location (Layer 1 / Layer 2)	1 / Not Sampled
Original NOx Removal Efficiency prior to First Gas-In	99.1% (at 10% ppmvdc NH3 slip)
NOx Removal Efficiency at 12,513 hours	98.1% (at 10% ppmvdc NH3 slip)
Acceptance Criteria (SCR)	95% (at 10% ppmvdc NH3 slip)
Report Sampling Recommendation (SCR Catalyst)	8,000 – 12,000 hours of operation or 3 years, whichever comes first
CMCO Test Data:	
CMCO Sample Location	East 4 Pack
CO Conversion % vs. Inlet Temp (Using BASF Std Test conditions (See Ref 2.4 for detail)	Unit 1 CO slightly deactivated when compared to new CO catalyst – shorter inspection interval given.
Report Sampling Recommendation (CO Catalyst)	12,000 – 16,000 hours of operation or 4 years, whichever comes first

b. **Unit 2 Results Summary from Reference 2.6:**

Common Data:	
First Gas-In Date w/ Catalyst Installed	9/16/03
Sample Removal Date	5/22/12
Total Operating Hours on Catalyst Samples	13,593
Primary Fuel Fired	Pipeline Natural Gas
Number of Starts/Stops since Catalyst Install	347
Visual Inspection Notes – both CMCO and SCR	Element in good physical condition.
Blocked Cell Count as Received /After Cleaning	0/0
SCR Test Data:	
SCR Sample Location (Layer 1 / Layer 2)	9 / Not Sampled
Original NOx Removal Efficiency prior to First Gas-In	99.1% (at 10% ppmvdc NH3 slip)
NOx Removal Efficiency at 13,593 hours	98.3% (at 10% ppmvdc NH3 slip)
Acceptance Criteria (SCR)	95% (at 10% ppmvdc NH3 slip)
Report Sampling Recommendation (SCR Catalyst)	8,000 – 12,000 hours of operation or 3 years, whichever comes first

CMCO Test Data:	
CMCO Sample Location	Button # 038
CO Conversion % vs. Inlet Temp (Using BASF Std Test conditions (See Ref 2.4 for detail)	Unit 2 CO nearly no deactivation when compared to new CO catalyst.
Report Sampling Recommendation (CO Catalyst)	16,000 – 20,000 hours of operation or 5 years, whichever comes first

c. **Unit 3 Results Summary from Reference 2.7:**

Common Data:	
First Gas-In Date w/ Catalyst Installed	11/14/03
Sample Removal Date	3/14/12
Total Operating Hours on Catalyst Samples	12,216
Primary Fuel Fired	Pipeline Natural Gas
Number of Starts/Stops since Catalyst Install	395
Visual Inspection Notes – both CMCO and SCR	Element in good physical condition.
Blocked Cell Count as Received /After Cleaning	0/0
SCR Test Data:	
SCR Sample Location (Layer 1 / Layer 2)	7 / Not Sampled
Original NOx Removal Efficiency prior to First Gas-In	99.1% (at 10% ppmvdc NH3 slip)
NOx Removal Efficiency at 12,216 hours	98.3% (at 10% ppmvdc NH3 slip)
Acceptance Criteria	95% (at 10% ppmvdc NH3 slip)
Report Sampling Recommendation (SCR Catalyst)	8,000 – 12,000 hours of operation or 3 years, whichever comes first
CMCO Test Data: (Unit 3 Results Summary from reference 2.6 (continued)	
CMCO Sample Location	Button # 074
CO Conversion % vs. Inlet Temp (Using BASF Std Test conditions (See Ref 2.4 for detail)	Unit 3 CO nearly no deactivation when compared to new CO catalyst.
Report Sampling Recommendation (CO Catalyst)	16,000 – 20,000 hours of operation or 5 years, whichever comes first

7.4 *Sampling Recommendations Applicable to All Units*:

a. **SCR** – Should be sampled at 11,000 +/- 1,000 operating hours OR 3 years of operation (+/- 6 months for scheduling purposes), whichever comes first.

b. **SCR** – Both layers of the SCR should be sampled during the next sample interval to allow a better evaluation of SCR performance and degradation.

c. **SCR** – Care should be taken to sample a different location than was previously sampled for the specific Unit.

d. **CMCO Catalyst** – Should be sampled at 15,000 +/- 1,000 operating hours OR 4 years of operation (+/- 6 months for scheduling purposes), whichever comes first. Upon sampling confirm that same sample location not selected.

e. In all cases, either or both of the catalysts may be sampled at an earlier interval than shown above if deemed necessary based on observed performance or for scheduling simplicity. The intervals identified above are considered to be "maximum" intervals with the start times (and dates) of the operating hours from the most recent sample (Unit 1 = 12,513 hrs; 5/20/12, Unit 2 = 13,593 hrs; 5/22/12, Unit 3 = 12,216 hrs; 3/4/12).