DYEC Phase II Diagnostic Evaluation and Source Testing Procedures: 2016.07.12

1.0 Overview

The Abatement Plan establishes the requirement for a comprehensive system-wide equipment evaluation that include Phase I “offline” inspections and Phase II “online” observations. The Abatement Plan therefore included an initial Phase II Inspection Checklist with several areas of investigation; namely: Operational Considerations, Operating Parameter and Reagent Addition Rates, SOP Verification, Training, and Testing. The efforts proposed herein provide additional detail to the Checklist and also identifies the Phase II diagnostic evaluation procedures.

The goal of Phase II is to evaluate the performance of equipment and operating trends with a focus on parameters commonly understood to be related to Dioxin and Furan (PCDD/F) formation and control. These parameters include: combustion zone temperatures, carbon monoxide concentration (as an indicator of combustion efficiency), flue gas temperatures, differential pressure across the air pollution control (APC) system, fabric filter operating conditions and carbon injection rates.

2.0 Phase II Inspection Checklist

Unit 1 re-start will only occur after Covanta has received written approval from the MOECC. Unit 1 startup will be conducted in accordance with all Standard Operating Procedures (SOP). Following startup, the Phase II Inspection Checklist will be completed as provided in the Abatement Plan and here as Table 1.

The Phase II Inspection Checklist includes activities which are either addressed by previous SOP’s or new SOP’s developed in response to Phase I investigations. These new SOP’s include:

- Second Pass Hopper Air Cannon Operation,
- Second Pass Hopper Temperatures and Level monitoring,
- IGR Nozzle Pluggage Monitoring,
- Second Pass Hopper Blast Cleaning,
- Baghouse Operation, Start up, Shutdown, Offline Operation, and
- High Baghouse Hopper Alarm Action.

Operational Considerations identified in the checklist reflect inspections of equipment performance.

SOP verification and training identified in the checklist is intended to document the proper implementation of the new procedures.

3.0 Operating Parameter Monitoring

Key operating parameters will be monitored using trends generated by CITECT software which allows data evaluation to be conducted both onsite and offsite. Table 2 below presents monitored parameter groups. All operating parameters are recorded and available for evaluation.

Table 1

Phase II: Unit #1 Inspection Checklist

TASK	RESPONSIBLE	STATUS	START DATE	DUE DATE	% COMPLETE	DONE?	NOTES
PHASE 2 - Post-Start Up Checks							
OPERATING PARAMETERS AND REAGENT ADDITION RATES							
Review selective non-catalytic reduction system and ammonia injection rate	Technical	In Progress	May 30, 2016		25%		
Review fresh lime rate addition rates and controls	Technical	In Progress	May 30, 2016		50%		
Review fresh carbon rate addition rates and controls	Technical	Complete	May 30, 2016	June 13, 2016	100%	✓	run at 5.1 kg/hr; diagnostic test at 7.5 kg/hr
Review fly ash recirculation system rate and amount of recirculated residue	Technical	In Progress	May 30, 2016		50%		
Review baghouse differential pressure and pulsing system settings	Technical	In Progress	May 30, 2016		75%		
Review and verify sootblower operating schedule to optimize boiler cleanliness	Technical	In Progress	May 30, 2016		25%		
TESTING							
Outlet sample filters will be examined for particulate loading during the diagnostic testing to ensure	Technical	Not Started			0%		on start up
A sample of powdered activated carbon will be tested to ensure that it exhibits properties consistent with purchase specification	Env. Spec	Complete	May 30, 2016	June 15, 2016	100%	✓	results received. Carbon condition is good per PAC test suite.
Samples of APC residual ash will tested once per shift during the seasoning phase of the boiler re-start	Shift Supervisor	Not Started			0%		on start up
Samples of raw carbon, hydrated lime, quench tower spray water, wetting mixer water and APC residual ash will be collected during both the diagnostic and source testing periods	Shift Supervisor	Not Started			0%		on start up
OPERATIONAL CONSIDERATIONS					0%		
Sootblowers in good working order, no steam leakage into boiler;	Shift Supervisor	Not Started			0%		on start up
verify blower steam pressure (once unit re-started)	Shift Supervisor	Not Started			0%		on start-up
Combustion appearance good – proper UFA flow & distribution, no evidence of fuel piling, appropriate bed depth	Shift Supervisor	Not Started			0%		on start up
Ash discharger running at appropriate speed; good seal and level control; ensure good transition chute door seal	Shift Supervisor	Not Started			0%		on start up
Proper furnace draft – minimal setting to avoid going positive and minimize in leakage	Shift Supervisor	Not Started			0%		on start up
No excessive slag in furnace	Shift Supervisor	Not Started			0%		on start up
Stable operation – consistent crane operations, consistent bed depth, good fuel mix	Shift Supervisor	Not Started			0%		on start up
Proper bed thickness	Shift Supervisor	Not Started			0%		on start up
Low and stable CO means (low products of incomplete combustion)	Shift Supervisor	Not Started			0%		on start up
All ash hoppers flowing properly	Shift Supervisor	Not Started			0%		on start up
All Plattco flop gates and rotary valves operating correctly	Shift Supervisor	Not Started			0%		on start up
Ensure fuel is well mixed and pit management SOP is adhered to	Shift Supervisor	Not Started			0%		on start up
Confirm sootblowing schedule	Shift Supervisor	Not Started			0%		on start up
Ensure good communication within Shift personnel	Shift Supervisor	Not Started			0%		on start up
Track boiler ash hopper temperatures (as measured at the Plattco valves) as a predictive measure for plugging	Shift Supervisor	Not Started			0%		on start up
SOP VERIFICATION AND TRAINING SIGN-OFF					0%		
2nd pass hopper Air Cannon - Train Operators on SOP	Shift Supervisor	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
2nd pass hopper Air Cannon - Verify SOP and Training	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
2nd Pass Hopper Level - Train Operators on SOP	Shift Supervisor	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
2nd pass hopper Level - Verify SOP and Training	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Hopper Plattco Temp - Train Operators on SOP	Shift Supervisor	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Hopper Platcco Temp - Verify SOP and Training	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
IGR Air Nozzle Pluggage Monitoring - Train Operators on SOP	Shift Supervisor	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
IGR Air Nozzle Pluggage Monitoring - Verify SOP and Training	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Plugged Nozzles in Evaporator Tower - Verify PM & Schedule	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Hopper Cleaning - Train Operators on SOP	Shift Supervisor	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Hopper Cleaning - Verify SOP and Training	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Baghouse Operation - Train Operators on SOP	Shift Supervisor	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Baghouse Operation - Verify SOP and Training	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Baghouse High Hopper Alarm Response - Train Operators on SOP	Shift Supervisor	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
Baghouse High Hopper Alarm Response - Verify SOP and Training	Owners Engineer	Complete	June 7, 2016	June 15, 2016	100%	✓	Complete
TRAINING CONSIDERATIONS							
Train 3 Auxiliary Operators to the point where they can relieve for CRO vacancies	Chief Engineer	In Progress	June 7, 2016	September 30, 2016	30%		Using Covanta OQP program + Specialized emissions mitigation training
Train Shift Supervisors to the point where they can relieve for CRO vacancies	Chief Engineer	In Progress	June 7, 2016	September 30, 2016	15%		Using Covanta OQP program + Specialized emissions mitigation training

Phase II: Unit #1 Inspection Checklist

TASK	RESPONSIBLE	STATUS	START DATE	DUE DATE	% COMPLETE	DONE?	NOTES
PHASE 2 - Post-Start Up Checks							
Implement and complete Operator Training Program (OQP)	Chief Engineer	In Progress	May 1, 2016	December 31, 2016	15%		Continue implementation of “Operator Qualification Program” (OQP) specific for Durham York. Scope includes specific modules that address safety, environmental (with specific training on emissions mitigation), boiler and auxiliary system training. This training is highly tailored to Waste to Energy facilities, and incorporates learnings from Covanta’s fleet of 41 North American facilities. Advance individual training plan for each Operator that is tracked on a comprehensive database with oversight by the Corporate Training Group. Plan includes for both technical training modules and field experience using a pre-qualified pool of personnel. In addition to OQP, the Operators are required to study for, achieve and maintain provincially mandated Steam Engineer licenses. This is administered by the Technical Standards and Safety Authority (TSSA). **All Operators have tickets appropriate for their position**
MAINTENANCE CONSIDERATIONS							
Baghouse hoppers - evaluate best combination of hopper vibrators and level probes	Maintenance Sup	In Progress	June 1, 2016	September 1, 2016	10%		Prevent false positive high level alarms
Change out Roof and Sidewall thermocouples	Maintenance Sup	In Progress	June 1, 2016	October 15, 2016	75%		Sidewall thermocouples changed out. 2 of 3 roof thermocouples changed out. Remaining one will be done in Fall, 2016 outage.
Evaluate options for clearing IGR nozzles on the run	Maintenance Sup	In Progress	October 15, 2016	October 30, 2016	100%	✔	50% of #1 Boiler IGR nozzles now have rod out ports installed to permit on the run cleaning.
Review 2nd pass hopper platform and rod out ports	Maintenance Sup	In Progress	June 1, 2016	October 30, 2016	50%		Review current access platforms and rod out port locations (including cannon location). Determine if additional upgrades are required to be installed on next boiler outages.

Table 2 – Monitored Parameters for Trending

GROUP/PARAMETER
FABRIC FILTER PERFORMANCE
FABRIC FILTER CLEANING PULSE FREQUENCY
FILTER DIFFERENTIAL PRESSURE
FABRIC FILTER PULSE AIR PRESSURE
COMBUSTION AIR FLOW
WETTING MIXER ROTARY VALVE SPEED
CEMS FLOW OUTLET DRY
STEAM FLOW
ACID GAS CONTROL
WETTING MIXER PROCESS WATER FLOW
LIME FEED RATE
CEMS SO_2 INLET
CEMS O_2 OUTLET
CEMS HCl OUTLET
CEMS SO_2 OUTLET
CARBON FEEDRATE
FLUE GAS TEMPERATURE CONTROL
QUENCH WATER FLOW CONTROLLER OUTPUT
QUENCH WATER FLOW CONTROLLER PRESSURE
QUENCH WATER FLOW CONTROLLER SET POINT
QUENCH CHAMBER WTR FLOW
ECONOMIZER OUT TEMPERATURE
ECON BYPASS TEMP CONTROLLER SET POINT
ECON BYPASS TEMP CONTROLLER OUTPUT
COMBUSTION
STEAM FLOW SET POINT
CEMS CO OUTLET
CEMS O_2 INLET
MARTIN IR PYROMETER TEMPERATURE
IR TEMPERATURE SETPOINT
FEEDER STROKE LENGTH SCALER
O_2 CONTROLLER AUTO SETPOINT FEEDBACK
IGR PRESS/FLOW/TEMP
IGR-FAN FLUE GAS INLET POSITION
IGR FAN INLET FLUE GAS RECIRCULATION TEMPERATURE
IGR FAN TEMP CONTROLLER SETPOINT
IGR FAN INLET DAMPER POSITION
IGR FAN OUTLET TEMPERATURE
IGR DISCHARGE FLOW
IR CAMERA TEMPERATURE

4.0 Testing Matrix

In addition to the Phase II Inspection Checklist and comprehensive monitoring and reporting on facility performance as noted above, the Diagnostic Phase II Testing Matrix Evaluation Methodology, presented as Table 3, has been prepared to provide additional detail on how each of the two units will be evaluated during Phase II operations. Several activities identified in this test matrix (items 1, 4 and 5, evaluation of combustion air flows, standard operating procedures, laboratory investigation) will be initiated within the first several weeks to establish the operating conditions which will be subsequently utilized during the Diagnostic Source Test Program.

Laboratory issues have been added as a separate effort because of the persistent presence of diphenyl ether interference and the need for removing it to obtain a true and accurate assessment of actual PCDD/F emission rates. Lastly, a proximate schedule is added to illustrate the general schedule of known activities, however, the scope of activities and schedule is subject to adjustment to reflect lessons learned as Phase II activities progress.

Items 1 through 3 inclusive of the test matrix on Table 3 apply to both units. The following information is provided to explain those activities.

4.1 Combustion Air and IGR

Combustion air rates will be parametrically evaluated and adjusted as necessary to achieve stable and steady state operating conditions. Combustion air flow conditions will be monitored and evaluated within each boiler and for a comparison between the two units. Parameters will include total air flow, internal gas recirculation air flow, oxygen content and air temperature (ambient and preheated air).

Covanta will use CEMS data to observe changes to oxygen (O_2), carbon monoxide (CO), total hydrocarbons (THC) and flue gas temperature in the combustion zone. That data will ensure that we are complying with relevant ECA limitations while also enabling a comparison of Unit 1 and Unit 2. Sampling and analysis of PCDD/F at the economizer may be implemented to enable a comparison of these scenarios, however, the scope of this testing will depend on initial CEMS results and other observations and considerations.

4.2 Carbon Feed Rate and Carbon in Recirculated Residue

The dry recirculation APC includes three major components; 1) evaporative tower, 2) reagent system and recirculation system and 3) baghouse. The evaporative tower has been effectively maintaining the flue gas temperature set point of 144^{o}C +/- 1 C which is below the temperature of 200^{o}C recommended for control of gas phase PCDD/F. Further control of gas phase PCDD/F occurs from adsorption onto carbon, therefore, Covanta plans to optimize the amount of carbon in the filter cake for adsorption. The total amount of carbon is due to both the fresh dosage rate and the recirculation rate of residue. The plan is to test two rates of fresh carbon dosage and to measure the amount of carbon in the recirculated residue. Carbon content of the recirculated residue will confirm the impact of adding additional fresh carbon.

Table 3 – Diagnostic Phase II Testing Matrix Evaluation Methodology

Item	Parameter	Activity	Evaluation Methodology
1	Combustion air	Evaluate air and IGR flows in both units	1. Total air flow 2 .Oxygen, CO and THC CEMS results 3. Combustion zone temperature 4. IGR Temperature 5. Optional APC inlet sampling of PCDD/F[(a)]
2	Carbon rate	Adjust carbon rate from 5 to 7.5 kg/hr per unit.	Measure carbon in recirculated residue at 5 kg/hr and 7.5 kg/hr injection rate in both Unit 1 and Unit 2.
3	Baghouse cleaning frequency	Evaluate frequency along with other parameters	1. Adjust Unit 1 to have same baghouse pulsing frequency as Unit 2 2. Evaluate along with recirculation rate and differential pressure
	APC Residue recirculation rate	Verify recirculation rate to design	Verify set points and equipment operating conditions at full load, measure carbon in recirculated residue.
4	Standard Operating Procedures (SOP)	Implement new SOPs and record findings	Compare findings with expected result.
5	Laboratory interference	Initiate review of interference and options going forward	Evaluate existing procedures and compare with alternatives used by other laboratories, Analyze duplicate samples, use alternative procedures to minimize laboratory interference

Notes:

(a) Sampling duration and number of test runs to be determined during parametric evaluation.

4.3 Baghouse Cleaning Frequency and Differential Pressure Drop

The total amount of carbon available for adsorption is a function of the carbon in the recirculated residue and the amount on the bags. Pressure drop is a surrogate for the amount of filter cake on the bags. Therefore, pressure drop combined with carbon in the residue indicates the total amount of carbon for adsorption.

The pulse frequency is defined as the amount of time between pulsing of the same row of filter bags. Less frequent pulsing is considered optimum because it maintains a steady state condition in the filter bag with fewer events for solid particulate to break through the filter bag. Covanta believes that the current method of operation in Unit 2 is optimum as demonstrated by achieving the lowest PCDD/F results to date, but will monitor and evaluate both Unit 1 and Unit 2.

5.0 Laboratory Issues

Test results from at least two Ontario certified laboratories, ALS and Maxaam and one U.S. certified laboratory, SGS, have documented interference from other organic compounds that prevents an accurate measurement of the actual emission factor for PCDD/F. That interference warrants investigation in principle but also because the PCDD/F stack limit of 60 pg TEQ/RM^3 is very low relative to the quantification and detection limits of the sample train and laboratory analysis. A collaborative effort will be initiated with a Maxxam, the Regions consultants and a specialist.

6.0 Diagnostic Source Test Program

Once all Phase II parametric evaluations have been completed and inlet APC dioxin test results have been received, the scope of a singular Diagnostic Source Test Program will be established. The conduct of this Diagnostic Source Test Program will include simultaneous sampling at both the inlet and outlet of the APC system. The duration of the test program will be dependent on several factors: namely the number of process conditions which will be evaluated, (up to four), the number of replicate test runs for each selected operating condition (2-3), the time period to establish stable operations between switching between the selected operating conditions and the availability of the source test team and general flexibility. Each diagnostic source test run will be conducted using the methodology of EPS 23 with a 240 minute sampling duration.

7.0 Schedule

The general schedule for implementation of the Testing Matrix Evaluation and Diagnostic Source Test Program is;

- Startup and initial review of combustion parameters: Weeks 1-3
- Conduct parametric evaluation (Items 1, 2 and 3) of operating conditions and inlet APC source testing: Weeks 2-6
- Conduct diagnostic test program including 2 to 3 test runs at up to four selected operating conditions: Weeks 7-8 (and week 9 if required)
- Submit all diagnostic test samples as a single source test program to Maxxam for analysis
- SOP verification and review: Immediately upon startup of Unit 1. Already in effect for Unit 2.
- Laboratory interference: Ongoing

- Facility prepared to conduct full compliance test in conformance with ECA requirements on both Unit 1 and Unit 2: One month following the conclusion of the diagnostic testing program

8.0 Contingency Plan

In the event that any diagnostic test results are outside the ECA limitation for PCDD/F, the Diagnostic Testing Contingency Plan, as attached, will be utilized to consult with the MOECC.

DYEC will provide weekly updates to MOECC of results and evolving plans.

9.0 Responses to MOECC Comments

The following Table 4 was prepared to be responsive to MOECC comments /questions on Phase I of the Abatement Plan as transmitted via email of June 24, 2016 from Sandra Thomas.

Table 4: Response to MOECC Questions

Question	Response
Baghouse	
1. There are concerns with regards to HDR's recommendation to switch from PTFE coated filter bags to PTFE membrane filter bags. Covanta should conduct analysis to determine that adequate mechanical wear capabilities are maintained to ensure that the properties of the proposed filter bag material actually improve the efficiency of the baghouse.	The installed filter bags are constructed of PPS felt with a glazed surface. Individual fibers are treated with PTFE to minimize abrasion and facilitate cleaning. Emission test results for particulate matter demonstrate that this bag material is functioning well under normal operating conditions with very high particulate removal efficiency. The ability to maintain differential pressure drop in a desired range is also evidence that the bags are working effectively with the bag cleaning system. Test results of filter bag integrity and particle penetration have also demonstrated that the bags are structurally sound and performing as planned. Covanta does not intend to change the bag type that is currently in use.
2. Consider the installation of a bag leak detection system to improve monitoring of baghouse performance. The hole discovered in one of the bags (reported under inspection task 70) may not have been found if not for this unplanned system review.	Covanta agrees with this proposal. A Tribo-Dynamic type dust monitoring probe (e.g. Filter Sense EM 30T or PCME Stack 990) will be installed in each unit's baghouse outlet flue duct and the output signal will be displayed in the control room to alert the operator of potential bag leaks. We expect the system to be installed by the end of Sept, 2016 on both Units. Covanta will be conducting enhanced bag house visual inspections (as noted in the response to question 4) during the period that this equipment is being procured, installed and commissioned.
3. Does Covanta record how the monitored baghouse differential pressure compares with the recommended target operating differential pressure? What are the actions taken to address deviations?	The differential pressure drop is continuously measured across the baghouse with a target range of 12 to 20 mbar as a daily average however that range is not absolute and we expect short term variations above 20 mbar. In accordance with the newly implemented Standard Operating Procedure, one compartment of each baghouse will be individually inspected on a weekly frequency for evidence of material buildup between the bags.
4. Consider increasing the baghouse inspection frequency in the Standard Operating Procedure.	One compartment on each baghouse will be inspected each week, with a complete cycle being completed every 6 weeks.

Baghouse (continued)	
5. The baghouse filter bag performance is considered a factor in the elevated dioxin and furan emission concentrations however, only field observations of the filter bags were undertaken. In future, to properly assess baghouse efficiency the replaced filter bags should be assessed for permeability, material strength, and a microscopic analysis.	Representative bags will be sent out for analysis in order to track and trend bag performance properties. Bags were removed and analysed during the August, 2015 and March 2016 outages.
Boiler	
1. Verify that the new Standard Operating Procedures will be effective in monitoring those system components that are not accessible for visual inspection during boiler operation. (eg. ash build-up in hoppers, boiler tubes etc.) The SOPs should also identify increased frequency for complete boiler system inspection and cleaning. This comment applies to Boiler #2 as well.	The new SOP's include specific to monitor IGR nozzles, boiler hoppers and baghouse condition. IGR nozzles now have periodic temperature measurements to identify plugging and Unit 1 has IGR clean out ports installed (Unit 2 to follow). Boiler hoppers are monitored for pluggage through periodic temperature and draft checks. Baghouse bags and hoppers are monitored for pluggage via pressure differential and level detectors with periodic visual inspection to verify condition of bags and hoppers. We will continue to perform semi-annual outages, during which time both boilers will be cleaned and inspected. Any additional cleaning outages will depend on our observations of key operating parameters that are out of range.
Testing	
1. Consider diagnostic testing for dioxin/furans at the economizer and baghouse outlets to assess removal efficiency.	Diagnostic testing, which includes inlet and outlet testing, will be completed as part of phase two activities as enumerated herein.
SOP and Training Records	
1. Submit the revised Standard Operating Procedures for the boiler #1 treatment train and staff training for our review.	The revised SOP's and staff training records have been included under separate cover to the MOECC.
Contingency Plan	
1. Provide a contingency plan in the event of an exceedance during the Phase 2 diagnostic testing and/or source testing.	The Contingency Plan is included as referenced in Section 8.0.

Diagnostic Testing Contingency Plan - Dioxin/Furans