Technical Memo

Date:	Wednesday, June 15, 2016
Project:	Durham York Energy Centre (DYEC)
To:	Mirka Januszkiewicz, PEng, Regional Municipality of Durham Laura McDowell, PEng, Regional Municipality of York
From:	Bruce Howie, PE, HDR Corporation (HDR) John Clark, PE (HDR)
Subject:	**Covanta Phase 1 Completion and Recommendation for Boiler #1 Restart**

During the period between May 2nd to May 11th, the DYEC underwent Emissions Compliance Testing that was mandated by The Regional Municipalities of Durham and York (the "Regions"). During the testing, the DYEC emissions of dioxin/furans (D&F) from boiler #1 were reported to be an average of 818 pg-TEQ/Rm^3 compared to the Environmental Compliance Approval (ECA) limit of 60 pg-TEQ/Rm^3. Based on this exceedance, Covanta shut down and secured boiler #1 on May 26th to allow for inspections and cleaning of the entire system, and developed an Abatement Plan at the request of the MOECC. The Abatement Plan was accepted by the Regions and HDR on June 10th, and accepted by the MOECC on June 15, 2016.

As part of the accepted Abatement Plan, Covanta prepared a checklist of items to be inspected, cleaned or repaired and to be analyzed during the boiler #1 shutdown to identify the probable causes of the D&F exceedance. In addition, a second checklist was submitted that included a list of operational items that will be checked and monitored after startup of boiler #1 and during operations.

Based on the inspections and reviews performed while boiler #1 was offline, Covanta provided the following initial assessment: "To date, Phase I inspections did identify several preliminary indications of equipment and/or operating conditions that could be related to D&F formation and control." Covanta found the following:

- "Buildup of residue in superheater hopper and/or the blasting of residue in the superheater." Covanta is of the opinion that "this material could be related to downstream gas phase reactions that form D&F."
- "Buildup of residue between bags in the baghouse". Covanta removed and replaced 93 bags to address potential bag failures or degraded baghouse performance and to ensure all ash was cleared from the baghouse compartments. Only one small hole in one bag (out of 1,560 bags) was found and replaced during this period, and the remaining 92 bags were replaced as a precaution. Covanta's inspections identified an excessive accumulation of fly ash in the Unit 1 baghouse that could have adversely affected abatement of D&F.

- Covanta noted that Unit 1 was used to evaluate alternative baghouse pulsing frequencies prior to the stack test and that changes to the normal pulsing frequency could have contributed to baghouse pluggage. HDR agrees that the pulsing frequency trials could have been a contributing factor to the baghouse plugging. Once the initial plugging occurred in the baghouse, it could have continued to buildup and further impact baghouse performance. HDR recommends that Covanta closely monitor the baghouse differential pressure (dP) and the pulsing frequency. HDR will monitor these parameters closely through Phase 2.

It is HDR's opinion that these observations made by Covanta may have contributed to reduced D&F removal efficiency across the boiler #1 air pollution control (APC) system.

HDR Assessment of Boiler #1 Exceedance:

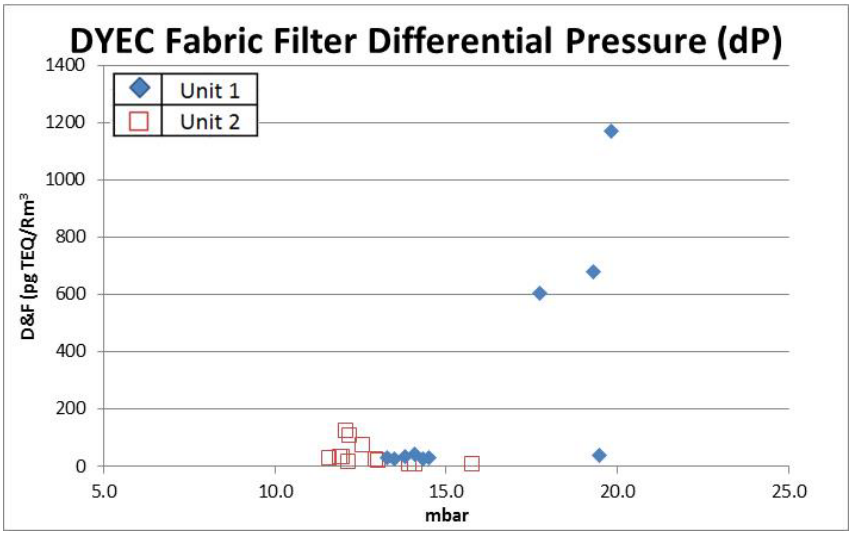
Dioxin Furan emissions from Energy from Waste (EfW) facilities can be in solid (particulate) form or in a gaseous phase and can be "typically" traced to one of four main factors:

1. Incomplete D&F destruction in the furnace;
2. Reformation of D&F (also know as "De Novo Synthesis"), which can occur as the flue gases cool from 400°C to 250°C;
3. Inadequate adsorption of the chlorinated compounds, including D&F on Powdered Activated Carbon (PAC) in the APC system; and,
4. Breakthrough of D&F laden particulate through the baghouse.

Based on HDR's observations of the operation of the DYEC and other similar EfW facilities, it would appear that the DYEC boiler design is adequate for the destruction of D&F, and that the cause of the high D&F Emissions is likely related to items 2-4 identified in the above list.

HDR is also in agreement that the high fly ash buildup in the 2nd/3rd pass hopper and the baghouse issues are two of the most probable causes of the high emissions of D&F. A graph of the fabric filter differential pressure (dP) data from all D&F testing to date is shown in Figure 1. As seen in the graph, the higher D&F results were measured when the fabric filter dP was at the highest. There are many factors associated with this variable and this graph alone is not intended to show a direct correlation.

Figure 1



There are many other factors that could be contributing to D&F reformation or to ineffective capture of the D&F within the fabric filter. During the diagnostic dioxin testing performed by Covanta in April 2016, it was observed that the D&F removal efficiency across boiler #1 was 97.1% while boiler #2 was 99.6%. Literature references[*1] and testing at other EfW facilities indicate that removal efficiencies of greater than 95% are typical for EfW facilities with a scrubber and baghouse without PAC, and removal efficiencies of over 99.5% are expected for an APC system that includes a combination of an acid gas scrubber, baghouse and PAC injection, similar to that of the DYEC. It is possible that there was some bridging of ash in the baghouse system during the April testing that may have contributed to a reduction in D&F removal efficiency in boiler #1 at that time. Bridging and plugging may have continued to progress and become more significant and problematic during the May 2016 tests.

Other potential causes for the high D&F include the PAC distribution within the baghouse, flue gas residence time in the 250°C to 400°C range, certain NOx Reduction System operating parameters such as VLN system nozzle condition and recirculated gas flow, SNCR system ammonia consumption, fly ash recirculation rates and moisture addition in the conditioning mixers, ash extractor level control, and combustion control among other parameters.

It is HDR's opinion that the following chain of events and factors may have contributed to the high D&F emissions during the testing in the week of May 9th:

- Prior to May 5th, the hopper that collects ash at the bottom of the 2nd and 3rd pass of the boiler hopper became bridged with fly ash, either within the hopper or at the discharge valve. This resulted in a high ash levels in the hopper.
- The boiler was shut down on May 5th due to a plugged feed chute caused by overloading waste into the feed chute. As a result of the plugged feed chute, Covanta elected to secure boiler #1. During the May 5th boiler #1 shutdown, Covanta elected to clean out the ash in the plugged 2nd/3rd pass hopper.
- The 2nd/3rd pass hopper was cleared by using explosive charges in the early morning of May 6th. During this process, some of the fly ash from the plugged hopper may have been entrained in the flue gas stream and carried to the backend of the boiler and into the air pollution control (APC) system. It is also likely that the percussion from the explosive charges cleared other boiler tube deposits that were also carried to the APC. The extra fly ash loading with potentially higher D&F concentrations may have overburdened the APC system contributing to the exceedance.
- The baghouse on boiler #1 had been operating at a higher dP than boiler #2 with all other operating conditions being similar. A higher dP may be an indication of fouling in the ducting or on the filter bags. Local readings of baghouse compartment dPs also showed higher dP on boiler #1 than boiler #2. During the subsequent outage and inspection, it was discovered:
    a. There were numerous bags that were bridged and plugged and may have contributed to degraded baghouse performance. (See Photos 19 through 26 in Attachment 3) Approximately 93 filter bags were replaced by Covanta during the outage (out of a total of 1560 bags). Only one bag was found to have a small hole, and the remaining 92 bags were replaced as a precautionary measure. A Visolite test (a tracer method that uses a fluorescent powder and a blacklight to detect bag leaks) was performed to verify that no other bag leaks were present.

b. Inspection of the on-line boiler #2 revealed some similar baghouse bag plugging, but to a significantly lesser degree. (See Photo 45 in Attachment 3)
c. The dispersion plates (screened plates) in the inlet duct to the baghouse had become heavily fouled and plugged, altering the distribution of flue gas and flyash concentrations to the various baghouse compartments. (See Photos 37, 38 and 39 in Attachment 3)

Based on these conditions, HDR is of the opinion that it is possible the following occurred:

- A portion of the ash within the $2^{nd}/3^{rd}$ pass hopper was in the temperature range conducive to the De Novo Synthesis potentially resulting in D&F being reformed;
- The D&F may have been in either the gaseous or solid phases;
- Ash on the boiler tubes in other boiler sections may have also reformed small amounts of dioxin;
- The shutdown and explosive blasting re-entrained a portion of the contaminated fly ash;
- The baghouse was exposed to a higher loading of particulate than is typically experienced during normal operations;
- Given the compromised condition of the baghouse inlet duct and bags, the baghouse did not efficiently control the D&F emissions; and,
- It is possible that the fouled inlet duct and baghouse contributed to a reduction in the distribution of the PAC that contributes to D&F reduction.

HDR Observations of Abatement Plan Phase 1 Activities:

The Abatement Plan prepared by Covanta addresses measures to monitor and control the plugged $2^{nd}/3^{rd}$ pass hopper and to improve baghouse operations. As part of the Plan, Covanta has developed revised Standard Operating Procedures (SOPs) for the following:

- 2^{nd} Pass Hopper Air Cannon Operation;
- 2^{nd} Pass Hopper Temperatures and Level Monitoring;
- IGR Nozzle Pluggage Monitoring;
- 2^{nd} Pass Hopper Blast Cleaning;
- Baghouse Operation, Startup, Shutdown, offline Operation; and,
- High Baghouse Hopper Alarm Action.

HDR has reviewed the SOPs and has provided some comments on these SOPs to Covanta for their consideration. The SOPs should continue to be reviewed by DYEC operations and maintenance personnel as the procedures are implemented. It is HDR's opinion that there is sufficient detail in the current SOPs to train operating personnel to safely restart boiler #1 and are reflective of good operating standards. The SOPs will help mitigate future similar 2nd pass hopper and baghouse plugs. The SOPs must be modified based on recommendations provided to Covanta by HDR, as well as by field observations made by operators within the first 2 weeks of Phase 2. HDR will also monitor and verify that SOPs are being followed after boiler #1 is restarted and as part of our monthly inspections of the DYEC.

Covanta has provided training to a majority of the Shift Supervisors, Control Room Operators and Auxiliary Operators on the new SOPs, and has provided HDR with a sign off sheet indicating the training has been completed and attested to by the Facility Chief. Training will continue to capture all pertinent operators and should be revisited as operations progress or if procedures are modified. A listing of all active employees and the status of training is included in Attachment 1. The implementation of these SOPs and completion of staff training, combined with the work performed during boiler #1 shutdown, significantly reduces the potential for re-occurrences of the 2nd pass hopper plug and baghouse bag issues that were potential contributors to the D&F exceedance in this unit. Further investigation of other settings for existing operating equipment or new equipment is included in Phase 2. HDR is not in a position to state affirmatively that all future hopper plugs and baghouse issues will be mitigated. Even with the SOPs in place, hopper plugging and baghouse filter issues are typical operational issues that occur in EfW facilities. However, the implementation of the SOPs, training and diligent operation and maintenance of the equipment, will reduce the potential for a re-occurrence and will minimize the impact of hopper plugs and baghouse issues if they do reoccur. The SOP for hopper explosive blasting will reduce the potential for D&F emissions in the event the hopper does become plugged.

HDR has been monitoring some of the work and inspections performed by Covanta on boiler #1 during the shutdown and has reviewed Covanta's detailed Phase 1 check list. A copy of the checklist with comments based on HDR's observations is attached as Attachment 1 to this technical memorandum. Some of HDR's major observations and comments regarding the checklist include:

- Air cannons have been installed on the sloped wall of the 2nd pass hopper on boiler #1 and boiler #2. The air cannons are designed to release a large pulse of air into a strategically placed nozzle in the hopper to disturb any buildup an aid in emptying the hopper. The air cannons on the 2nd pass are currently operational on boiler #2 and will be operational on boiler #1 when the unit restarts. Covanta has a plan for the initial settings for the air cannon and will monitor the performance and adjust the settings as deemed necessary. This will assist in eliminating plugs in the 2nd pass hopper. During Phase 2 Covanta will be investigating the need for additional air cannons or relocating the current air cannon to be more effective.
- The ash discharger collects ash from the grates and quenches the ash in water. The level of water in the ash discharger is controlled to provide a water seal in the extractor. This stops any air from being drawn into the boiler through the extractor. During the boiler #1 shutdown, the inspections and data review revealed that the level probe had been installed incorrectly and the water level was several inches lower than necessary. As a result, there is a possibility that uncontrolled air was being drawn into the boiler. This adversely impacts boiler draft, and combustion control. The level control was adjusted to the proper setting during boiler shutdown. Boiler #2 was inspected and found to be in the correct position.
- The Plattco valve used to isolate the last superheater hopper from the ash conveying system was found to be cracked. Air in-leakage can cause localized zones in the undesirable 250°C to 400°C temperature range. The Plattco valve was repaired during the outage.
- There is a damaged sootblower drive on Sootblower 129. The damaged sootblower is one of the two sootblowers in the lowest bundle in the economizer. The temperature in this area is in the 170-200 °C range, and typical economizer tube fouling in this location is minimal. Extended operation without the sootblower could result in localized fouling of the tubes and some slight

tube erosion. If the economizer outlet temperature cannot be controlled to the desired outlet temperature it may warrant temporarily swapping the drive with one of the drives from another sootblower. HDR feels these issues are minor operational matters, not related to emissions, and are of minimal concern, particularly at this elevation.

- Economizer sootblowers 122 and 123 were found to have broken lances. This would render the sootblowers ineffective in this area and could cause damage to tubes. While it is possible that blowing uncontrolled steam into this section could have an impact on emissions, it would not be expected to be significant. The lances have been repaired. Currently the steam is isolated to these sootblowers (see Photo 18 in Attachment 3). HDR will monitor the full sootblowing sequence with Covanta during startup of boiler #1.
- Two (2) of the ten (10) NOx Reduction System Internal Gas Recirculation (IGR) nozzles on the right side of boiler #1 were plugged (see Photos 4, 5 and 6 in Attachment 3). These nozzles are alternating sizes of 40 mm and 55 mm. Boiler #2 nozzles are 40 mm and 70 mm. There may be some slight impact of the plugged nozzles on carbon monoxide (CO) or combustion control with the two (2) configurations. Covanta's Corporate engineers are planning to monitor composition of the IGR gases during Phase 2. HDR will continue to review and monitor these activities.
- Buildup on the boiler #1 tubes appeared typical of other similar boilers based on the current point in the operating campaign. Therefore, this buildup does not appear to be a contributor to the D&F exceedance in boiler #1. No staging or access into the boiler was provided, so HDR performed all inspections externally. (see Photos 7 through 12 and Photos 14 through 18 in Attachment 3)
- The inlet duct to the baghouse had heavy deposits of fly ash on the distribution baffle plates. These were cleaned off with the exception of the extreme left and right sides of the second row of baffles (see Photos 37, 38, and 39 in Attachment 3). An uneven distribution of particulate and PAC to the six (6) baghouse compartments could adversely impact the baghouse removal efficiency.
- The orientation of the hopper level probes in the baghouse hoppers is important to the performance of the instrument. During the outage Covanta found several level probes with the improper orientation. All of the probes have been orientated properly and have been marked externally to facilitate inspection for proper orientation.
- During the boiler start-up and diagnostic testing phase, the continuous opacity monitors (COMS) and differential pressures need to be closely monitored to evaluate baghouse performance. Furthermore, baghouse leak detection systems are available that may be capable of providing an early warning indication that the baghouse removal efficiency is deteriorating or that a bag leak is present. If the Phase 2 observations and diagnostic testing indicate that baghouse performance was a contributing factor to the D&F exceedance, HDR recommends Covanta be required to install bag leak detection systems.
- The baghouse bags used at the Facility have Polytetrafluoroethylene (PTFE) coated fibers. Two part bags, with a PTFE membrane rather than coated fibers have shown some benefits associated with fine particulate removal. While the testing for particulate matter demonstrated emissions below the ECA limit, PTFE membrane bags may provide further improvement. Based on Phase 2 testing and further investigation, PTFE membrane bag construction may be considered.

- Based on Covanta's Abatement Plan, Phase 2 testing will include operating at higher carbon injection rates (i.e. 5 kg/hr and 7.5 kg/hr) to assess D&F removal efficiency improvements.
- D&F testing during Phase 2 should include D&F measurements at the economizer outlet in conjunction with the baghouse outlet to better quantify D&F emissions from the boiler and D&F removal efficiencies across the APC system.

Conclusions and Recommendations:

Although it is difficult to point to a single cause or causes of the D&F exceedance in boiler #1, it is HDR's opinion that the likely contributors to the exceedance, included:

- A portion of the ash within the $2^{nd}/3^{rd}$ pass hopper was in the temperature range conducive to the De Novo Synthesis potentially resulting in D&F being reformed;
- The D&F may have been "captured" within the fly ash particles;
- Ash on the boiler tubes in other boiler sections may have also reformed small amounts of dioxin;
- The shutdown and explosive blasting re-entrained a portion of the contaminated flyash;
- The baghouse was exposed to a higher loading of particulate;
- Given the compromised condition of the baghouse inlet duct and bags, the baghouse did not efficiently control the dioxin emissions; and,
- That it is possible that the fouled inlet duct and baghouse contributed to a reduction in the distribution of the PAC that contributes to D&F reduction.

HDR is of the opinion that the Phase 1 checklist as presented in the Abatement Plan has been developed and completed by Covanta as a means to determine the main causes of the exceedance and to best mitigate the impact of the above potential contributors to the exceedance.

As demonstrated by the completion of the Phase 1 checklist, the APC system has been adequately cleaned, the bags have been inspected and replaced as necessary, the baghouse inlet ducting has been sufficiently cleaned, and the boiler hoppers, including the 2^{nd} pass hopper have been cleared. Covanta has also developed new SOPs to train operating personnel, made the commitment to closely monitor the $2^{nd}/3^{rd}$ pass hopper and baghouse conditions during boiler operating campaigns, and to make modifications to equipment as determined necessary. Covanta has completed the inspections, cleanings, and repairs identified in the Phase 1 checklist, made a determination of the potential causes of the dioxin emissions, put remedies in place to minimize the potential for a re-occurrence during the restart of boiler #1, developed and implemented new SOPs, has completed and documented training of plant operating staff in the new SOPs, and has committed to review, update and train personnel in these SOPs on an on-going basis.

HDR has performed the following activities:

- Confirmed the inspections were completed;
- Confirmed ash was cleared from hoppers and collection points;
- Performed independent observations and took independent photographs,
- Confirmed that the corrective actions taken were appropriate;

- Reviewed and commented on Covanta's new SOPs and verified that the SOPs have been implemented;
- Reviewed training logs and verified that the TSSA licensed Chief Operator attested to the training; and
- Reviewed Covanta's photographs documenting as-found and as-left equipment conditions.

Based on our assessment, HDR can state that Covanta has completed the Phase 1 tasks listed in Appendix B to the Abatement Plan (as verified by HDR in Attachment 2 to this memo). This Technical Memo should be forwarded by the Regions to the MOECC for their review and determination with respect to the startup of Boiler #1. HDR will prepare a follow-up technical memo on behalf of the Regions that will summarize our observations of operations and review of results from the Phase 2 diagnostic and compliance testing.

Attachment 1 – Status of Operator Training on New SOPs

Attachment 2 – HDR review of Phase 1 checklist

Attachment 3 – HDR Photographic Documentation of Phase 1 Activities

*1 Hartenstein, H.U, Licata, Anthony, Modern Technologies to Reduce Emissions of Dioxins and Furans from Waste Incineration, Northa American Waste To Energy Conference 8 , May 2000

McKay, Gordon, Dioxin characterization, formation and minimization during municipal solid waste (MSW) incineration;review, Chemical Engineering Journal 86 (2002) 243-368

Attachment 1 – Status of Operator Training on New SOPs

SOP Training Schedule

EMPLOYEE NAME		JOB TITLE	Department						
Last	First			DYEC-APC-018	DYEC-APC-019	DYEC-BLR-037	DYEC-BLR-034	DYEC-BLR-035	DYEC-BLR-036
Mike	Koevoet	Chief Operating Engineer	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Ken	Coatham	Assistant Chief Operating Engineer	Operations	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16
Art	Sobolevsky	Shift Supervisor	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Francis	Trottier	Shift Supervisor	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Gerry	Cowley	Shift Supervisor	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Laporte	Mike	Shift Supervisor	Operations	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16
Vacant		Auxilliary Operator	Operations	Upon Hire	Upon Hire	Upon Hire	Upon Hire	Upon Hire	Upon Hire
McDonell	Logan	Auxilliary Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Purcell	Josh	Auxilliary Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Murphy	Brandon	Auxilliary Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Naugle	Eric	Auxilliary Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Grendel	Justin	Auxilliary Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Bastien	Austin	Auxilliary Operator	Operations	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16
Kwan	Lydia	Auxilliary Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Guthrie	Eric	Auxilliary Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Hanlon	Timothy	Control Room Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Nesbitt	Jeffrey	Control Room Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Shafer	Colin	Control Room Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Fron	Breanne	Control Room Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Arseneault	Jennifer	Utility Operator	Operations	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16
Latinovski	Zhive (Zack)	Utility Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Murphy	Brock	Utility Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Higdon	Derek	Utility Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Winters	Shane	Equipment Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Challice	James	Equipment Operator	Operations	Complete	Complete	Complete	Complete	Complete	Complete
Vyas	Jigar	Maintenance Supervisor	Maintenance	Complete	Complete	Complete	Complete	Complete	Complete
McComb	Randy	Leadhand - E/I	Maintenance	Complete	Complete	Complete	Complete	Complete	Complete
Vacant		Mechanic	Maintenance	Upon Hire	Upon Hire	Upon Hire	Upon Hire	Upon Hire	Upon Hire
MacLeod	Joseph	Leadhand - Mechanic	Maintenance	Complete	Complete	Complete	Complete	Complete	Complete
Huson	Doug	E/I Technician	Maintenance	Complete	Complete	Complete	Complete	Complete	Complete
Skora	Pete	Mechanic	Maintenance	Complete	Complete	Complete	Complete	Complete	Complete
Badada	Amanuel	E/I Technician	Maintenance	Complete	Complete	Complete	Complete	Complete	Complete
Matt	Neild	Facility Manager	Administration	NA	NA	NA	NA	NA	NA
Baron	Jennifer	Business Manager	Administration	NA	NA	NA	NA	NA	NA
Ma	Angel	Facility Controller	Administration	NA	NA	NA	NA	NA	NA
Beleskey	Nicole	Admin Assistant	Administration	NA	NA	NA	NA	NA	NA
Pickett	Dawn	Facility Safety Coordinator	Administration	NA	NA	NA	NA	NA	NA
Huxster	Amanda	Facility Environmental Specialist	Administration	NA	NA	NA	NA	NA	NA
Dunk	Calvin	Facility Buyer/Storekeeper	Administration	NA	NA	NA	NA	NA	NA

DYEC-APC-018	Baghouse Operation_StartUp_Shutdown_Offline_Operation
DYEC-APC-019	High Baghouse Hopper Alarm
DYEC-BLR-037	2nd Pass Hopper Blast Cleaning
DYEC-BLR-034	2nd Pass Hopper Air Cannon Operation
DYEC-BLR-035	Checking 2nd Pass Hopper Level and Temperature
DYEC-BLR-036	IGR Nozzle Pluggage Monitoring

Attachment 2 – HDR review of Phase 1 checklist

Phase I: Unit #1
Inspection Checklist

	TASK	NOTES	HDR NOTES
	PHASE 1 - Pre-Start Checks		
	GRATE AND FURNACE		
	Ash discharger		
1	Clean and inspect ash discharger	cleared (including back side of ram)	Appropriate Actions taken, will need to monitor level control during Phase 2 to see if there is any impact of water level on air infiltration
2	Stroke ash discharger ram to ensure correct operation	complete- ok	
3	Inspect water level control mechanism	fill discharger and perform final checks; complete	
	Riddlings		
4	Riddlings system clear and functional, no stuck flaps, no evidence of excessive riddlings	Complete - good.	Minimal concerns - will monitor a riddlings cleaning cycle during operations
	Feed Chute and Feed Table		
5	Internal surfaces of feed chute, feed table, and sidewalls in feeder area - no loose wear strips, missing bricks, or any other issues which may impede waste flow	No issues; complete	No internal inspections made - only from exterior - but all appeared clear
6	No water leakage from feed chute or transition piece	complete	
7	Verify feed rams and brake plates are in good condition	complete	
8	Feed ram speeds consistent between rams and within Martin specs	complete	to monitor during operations
	Grate		
9	Visually inspect that all grate bars in good condition (i.e., no broken or missing grate bars)	complete	HDR did not observe operation during outage, not expected to be a concern
10	All grate runs making complete strokes	complete	
11	Grate speeds consistent between runs and within Martin specs	complete	
	Over Fire Air		
12	Inspect over fire air system (secondary air) for leakage	complete	Continue to monitor during Phase 2 Nozzle inspection required boiler entry
13	Inspect and verify proper damper operation/orientation	complete	
14	visually inspect nozzles for evidence of pluggage	complete	
15	Clean combustion air intake screen from tipping haul	complete	

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Inspection Checklist

	TASK	NOTES	HDR NOTES
	Under Fire Air		
16	Inspect under fire air hoppers for pluggage	inspected and verified clear; complete	Review will continue after Start up with focus on flows to various zones
17	stroke zone dampers and ensure correct operation;	zone 4 damper operation confirmed ok.	
18	ensure correct orifice plates installed in all compartments;	Complete	
19	all pressure lines clear and transmitters correctly calibrated;	complete	
20	Verify opening between zone 4 and 5 is clear	verified clear	
21	Clean under fire steam heating coils	Washed out; complete	
	Internal Gas Recirculation System (IGR) & SNCR		
22	Inspect mechanical condition of fan and ducting;	complete	2 Nozzles (#2 and #) on boiler right (west) found plugged Reviewed photos and had discussions with Staff. Boiler 1 - Nozzles 40 mm and 55 mm - Boiler 2 40 and full port (70 mm?)
23	stroke dampers to ensure correct operation;	complete	
24	remove IGR nozzle elbows and ensure nozzles are clear;	2 blocked nozzles found on west side (#2 and #3); both were unplugged	
25	verify correct IGR orifice plates are installed	40mm/55mm alternating and interlaced; verified correct	
26	Vacuum ash out of ductwork	complete. Significant amount of dust removed.	
27	Inspect ammonia lances and ensure tip in good mechanical condition and lance properly oriented	Check tip and heat shield; confirm proper lance orientation	
	Furnace Walls and Water Wall Tube		
28	Visually inspect furnace walls and screen tubes for excessive slagging	small clinker in 1st pass was removed; complete	typical slagging for this time in campaign
	Furnace Auxilliary Systems		
29	Perform burner PM's	cleaned scanner; complete	Witnessed burner operation PMs to be logged and validated through PM Program
30	Perform furnace purge and test fire burner	Complete	
31	Perform MICC camera system PM's	camera removed while blasting; re-installed - ok; complete	
32	Perform furnace compliance IR thermometer PM's	complete	
	BOILER		
	Hoppers		
33	Inspect 2nd/3rd (convection) hopper is clear	Front wall hard build-up noted; blasting completed June 1	Observed to be clear
34	Inspect Super Heater #1 (SH-1) hopper/chute is clear	cleared hopper, drop chutes and conveyor	Observed to be clear on June 2
35	Inspect Super Heater #2 (SH-2) hopper / chute is clear	cleared hopper, drop chutes and conveyor	Observed to be clear on June 3
36	Inspect Super Heater #3 (SH-3) hopper /chute is clear	cleared hopper, drop chutes and conveyor	Observed to be clear on June 4
37	Inspect Economizer hopper is clear	cleared hopper	Cleared on June 5
	Plattco (Ash) Flap Valves		
38	Inspect 2nd/3rd (convection) Plattco	door removed; confirmed sealing.	Robust valves - no issues anticipated at this stage of life cycle
39	Inspect Super Heater #1 (SH-1) Plattco	door removed; confirmed sealing.	
40	Inspect Super Heater #2 (SH-2) Plattco	door removed; confirmed sealing.	
41	Inspect Super Heater #3 (SH-3) Plattco	tightened loose seat; door removed; confirmed sealing.	
42	Inspect Back Draft Plattco on Collection Conveyor	door removed; confirmed sealing.	
43	Inspect Economizer Plattco A1	door removed; confirmed sealing.	
44	Inspect Economizer Plattco A2	door removed; confirmed sealing.	

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	TASK	NOTES	HDR NOTES
	Boiler Ash Conveyors		
45	Inspect boiler ash collection conveyors for proper operation - covers in place and sealed		
46	Boiler Collection Conveyor AH-CV-101	hanger bearing connector to flight bolt replaced; removed inspection ports and confirmed conveyor clear	Routine PM - no impact on emissions
47	Boiler Collection Conveyor AH-CV-102	Removed inspection ports and confirmed conveyor clear	
48	Economizer Collection Conveyor AH-CV-103	Removed inspection ports and confirmed conveyor clear	
49	Transfer Conveyor AH-CV-104	Removed inspection ports and confirmed conveyor clear	
	Sootblowers		
50	run in retractable blowers and verify proper alignment	complete	
51	run rotary blowers and verify alignment	repaired broken lances on economizer SB's 122 and 123; SB 129 broken drive; parts expected 2 wks (SB129 will have no effect on facility operations or emissions	SB 122 and 123 broken shafts - reviewed latest SB rounds Inspections -
	General		
52	Confirm that there are no known tube leaks	Confirmed tight	none anticipated
53	All lower furnace doors closed and sealed - ignition ports, rear doors	closed and sealed	Should be reverified at startup
54	Furnace observation viewports closed & sealed, glass in good condition	closed and sealed	
55	Furnace access doors closed and sealed; ensure door refractory in convection and SH hoppers is secure	confirmed that SH hopper door refractory secure (prevent falling into Plattco); complete	
	AIR POLLUTION CONTROL PLANT (APC)		
56	Inspect carbon silo (loss in weight feeders, gate valves, eductor, blowers) to ensure accurate flow of carbon reagent to #1 Boiler air pollution control plant	timed weight samples taken (10 min and 15 min samples); correct feed confirmed.	Discussed sampling with Steve DeDuck - weights recorded were higher than typically recorded by DCS., May perform additional calibrations.
57	Test carbon delivery piping with clean air to ensure free flow of carbon from the feeder to the addition point; the addition point on the flue gas duckwork will be inspected for pluggage	Confirmed clear	Easily monitored at last foot of clear flexible piping at injection point. To be monitored
58	Remove Quench tower spray lance; inspect and clean nozzles	2 of 5 nozzles found plugged; swapped with spare spray lance assembly; complete	Need to implement better PM program on nozzles
59	Open upper Quench tower hatch and inspect diffuser baffle plate	observed through alternate door; confirmed clear	Some buildup based on photos- not significant
60	Open new Quench tower hatch (elevation 5.6) and inspect above and below lower diffuser plate; remove any accumulated material	confirmed clear	minor buildup on vanes
61	Open door to Quench tower crusher; inspect diffuser plate from below; clean crusher; Inspect and clean ducting from bottom of Quench tower to the conditioner	deposits cleaned; confirmed clear	Photos showed some build up - cleared
62	Recycle surge bin hopper – verify no bridges or build-ups exist	deposits cleaned; confirmed clear	Buildup occurred during outage - cleared - to be checked prior to start up

Phase I: Unit #1
Inspection Checklist

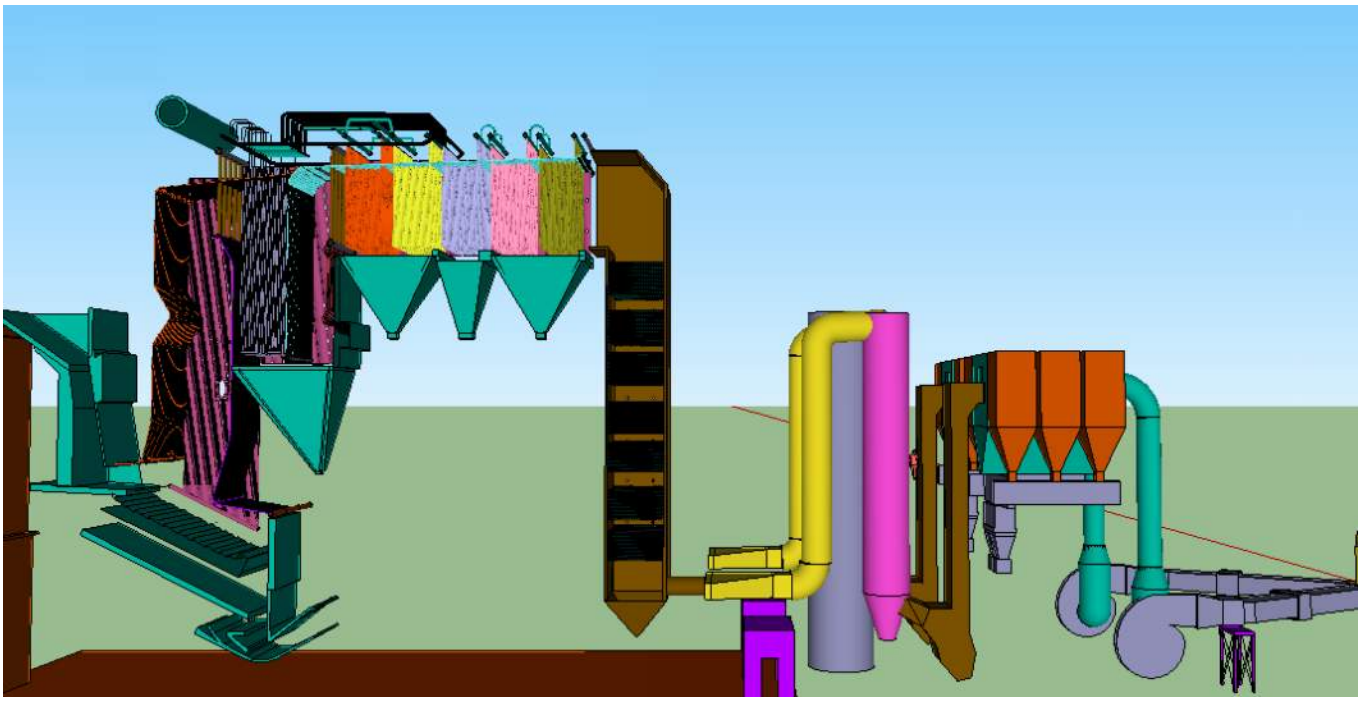
	TASK	NOTES	HDR NOTES
63	Verify all heat tracing is operational	complete	will continue to monitor once on line
64	Open conditioner and clean surface of reactor barrel; observe condition of reactor balls and remove any internal build-up	complete	Observed from above - appeared clear
65	Verify position and integrity of Reactor bypass damper	verified OK. Picture taken	Inspected damper - open approximately 5-10% - clear
66	Double Shaft Mixers – Inspect water nozzles for damage/pluggage	cleaned; complete	May be some issues with the orientation of the paddles - Covanta completed follow up check on June 11 and confirmed paddle orienttion is as designed.
67	Visolite baghouse to ensure bags are tight and sealed	baghouse confirmed tight	Observed Visolite after bag replacement - Covanta should purchase better blacklight and improve SOP for Visolite testing (removal of pulse pipes for better inspection Suggest Visolite prior to Compliance Test
68	Recirc hoppers and rotary valve vanes-open up and clean	complete	Same as item 62 - some pluggage during outage after bag replacement - cleared
69	Clear baghouse hoppers; clear inlet dampers	final verifcation; level indicators confirmed functional; reduce hopper vibrator throw; complete	Hoppers verified clear after bags replaced
70	Inspect fabric filter bags and change out as required	93 bags changed and 15 cages; Kuttner rep on site June 1 to assess baghouse; observed some pluggage in bags; see map.	93 Bags replaced - one small hole identified - ptfe coated fibers versus ptfe membrane - membrane may provide superior filtration and may provide operational benefits
71	Continuous emissions monitoring system (CEMS) will be inspected	change inlet/outlet filters; cleared ash build-up in inlet sampling nozzle. Complete	No comment
72	2nd pass hopper Air Cannon - Develop SOP for Usage	Complete - DYEC-BLR-034 "2nd Pass Hopper Air Cannon Operation" developed. Current setting is: 100 psi, timer set at 2 min. An operator initiates the cycle, which will continue at 2 min intervals until the operator shuts off cannon. The cannons are run once per 12 hr shift, or as necessary to assist clearing blockage. Air cannon usage will be logged on a checksheet. Future cycle time settings will be based on operational experience	Monitored operation on unit 2 -More appropriate timing maybe hourly pulses - to be discussed and monitored Reviewed SOP and provided comments - SOP sufficient to commence operations Suggest revised SOP based on HDR comments and operational findings by week 2 of Phase 2
73	2nd Pass Hopper Level- Develop SOP to Monitor levels	Complete - DYEC-BLR-035 "Checking 2nd Pass Hopper Level and Temperature" developed. Monitor the hopper level via observation of an ash flow/embers noted through the collection conveyor inspection port. Draft through the plattco and up into the hopper will also be observed by opening the conveyor inspection port and observing draft when the plattco valve cycles. This will be done twice per 12 hour shift. The measurement will be logged on a checksheet. Timing/Frequency of measurements will be adjusted as required.	SOP reviewed - provided comments - suggest magnehelic on conveyor for monitoring Reviewed SOP and provided comments - SOP sufficient to commence operations Suggest revised SOP based on HDR comments and operational findings by week 2 of Phase 2

Phase I: Unit #1
Inspection Checklist

	TASK	NOTES	HDR NOTES
74	Hopper Plattco Temp - Develop SOP for measurement	Complete - DYEC-BLR-035 "Checking 2nd Pass Hopper Level and Temperature" developed. The plattco ash valves on the second pass hoppers will be monitored with an infra-red temperature gun twice per 12 hour shift. The measurement will be logged on a checksheet. Timing/Frequency of measurements will be adjusted as required. Examine moving to an on-line thermocouple based measurement once appropriate measurement locations are finalized.	Reviewed SOP and provided comments - SOP sufficient to commence operations Suggest revised SOP based on HDR comments and operational findings by week 2 of Phase 2
75	IGR Air Nozzle Pluggage Monitoring - Develop SOP	Complete - DYEC-BLR-036 "IGR Nozzle Pluggage Monitoring" developed. The flex hoses immediately before the IGR port elbows will be monitored with an infra-red temperature gun once per day. The measurement will be logged on a checksheet. Timing/Frequency of measurements will be adjusted as required.	Reviewed SOP and provided comments - SOP sufficient to commence operations Suggest revised SOP based on HDR comments and operational findings by week 2 of Phase 2
76	Plugged Nozzles in Evaporator Tower - Develop PM	A weekly preventative Maintenance job was developed in the Facilities Computerized Maintenance Management System to inspect and check that the spray nozzles on each boilers quench tower are unplugged (ref PM ID 475 and 476); Complete	PM work Order is in system for weekly check
77	Hopper Cleaning - Develop SOP for Blast Cleaning	Complete - DYEC-BLR-037 "2nd Pass Hopper Blast Cleaning" developed. This procedure will minimize downstream carryover of ash.	Reviewed SOP and provided comments - SOP sufficient to commence operations Suggest revised SOP based on HDR comments and operational findings by week 2 of Phase 2
78	Baghouse Operation - Develop Enhanced SOPS for Start-Up/Shutdown and Offline Operation	Complete - DYEC-APC-018 "Baghouse Startup Shutdown and Offline Operation" developed. SOP will result in the avoidance of build-up in hoppers and between bags; SOP will include more frequent visual inspections and enhanced monitoring of baghouse differential pressure.	SOP reviewed and comments provided - SOP sufficient to start Phase 2 Should incorporate full cleaning of all components during outages Require update by week 2 of Phase 2
79	Baghouse High Hopper Alarm Response - Develop SOP	Complete - DYEC-APC-019 "High Baghouse Hopper Alarm" developed. Immediately inspect hopper for pluggage and clear if necessary. High level stops baghouse pulsing which can lead to plugging	SOP reviewed and comments provided - SOP sufficient to start Phase 2 Require update by week 2 of Phase 2

Attachment 3 – HDR Photographic Documentation of Phase 1 Activities

FACILITY OVERVIEW



BOILER FIRST PASS

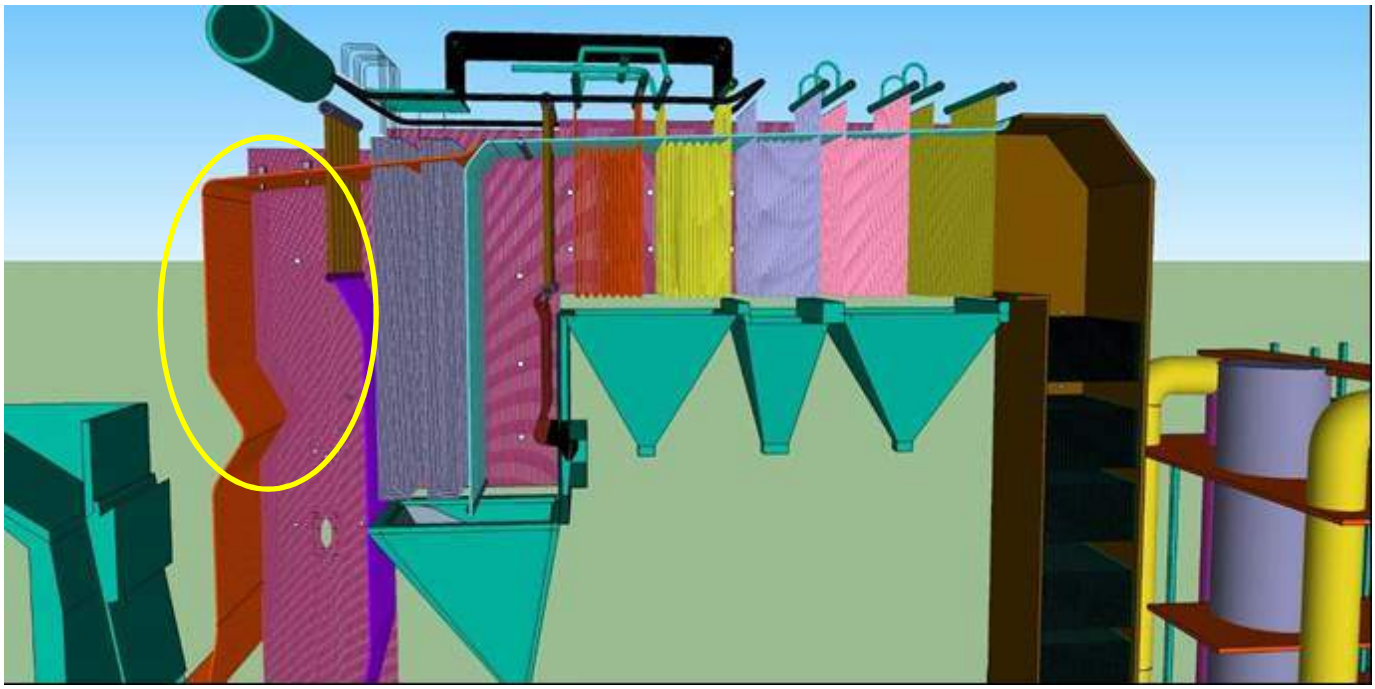


Photo 1 - Boiler First Pass- Looking Down from Top

Photo 2 – Boiler 1st Pass – IGR Nozzles

Photo 3 – 1st Pass Small Build Up on Bullnose

Photo 4 - IGR Nozzles – Boiler Sidewalls

Photo 5 - Plugged IGR Nozzle

Photo 6 - Clear IGR Nozzle

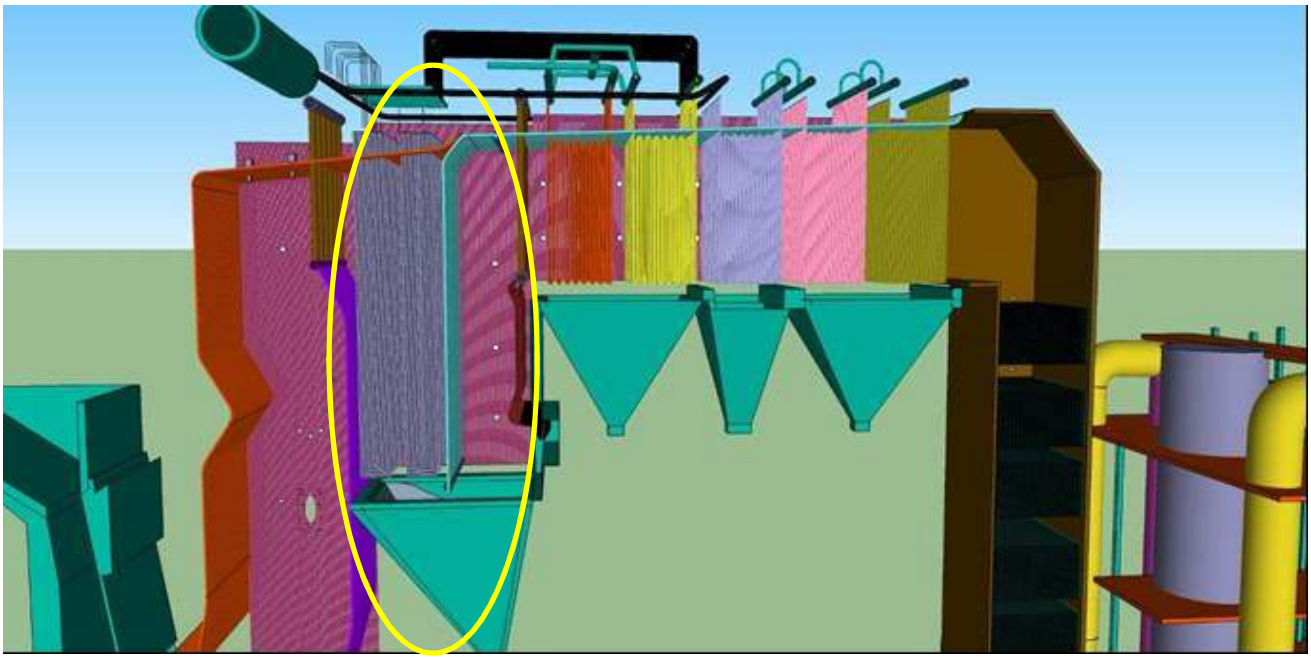


Photo 7 - 2nd Pass Superheater Platens.

Photo 8 - Second Pass Superheater Platen – Expected Fouling

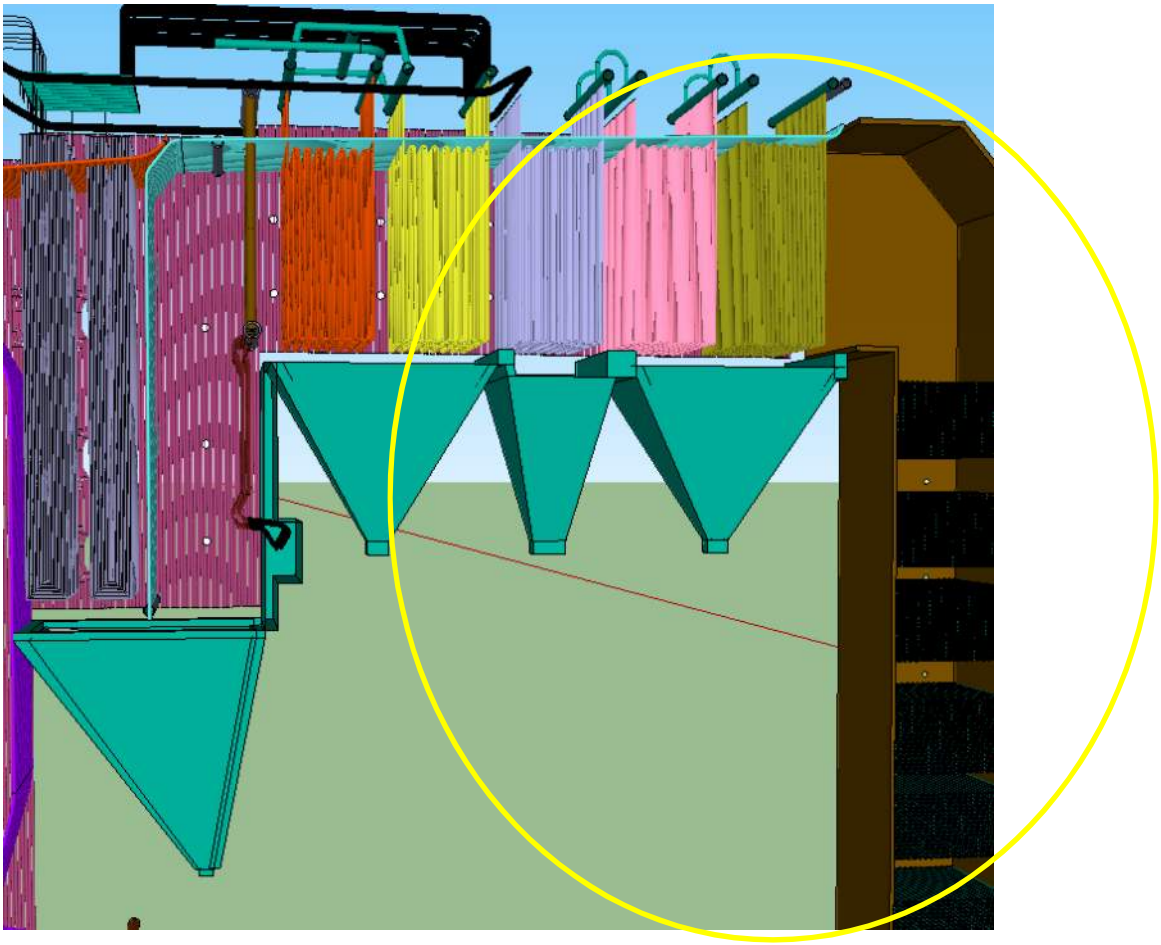
Photo 9 - 3rd Pass Rear wall – Loops from Convective Zone Removal on Rear Wall (left side of photo)
Hopper Clear (At bottom)
No Fouling on Front Wall

Photo 10 - 3rd Pass Convective Zone Bypass Loops – Looking Up

Photo 11 - Upper 3rd Pass – View Looking into Superheater – Screen Tube Fouling Heavy Near Door

Photo 12 - Top of 3rd Pass – Header at Bottom of Screen Tubes

Photo 13 - Air Cannon In Hopper Under 2nd/3rd Pass



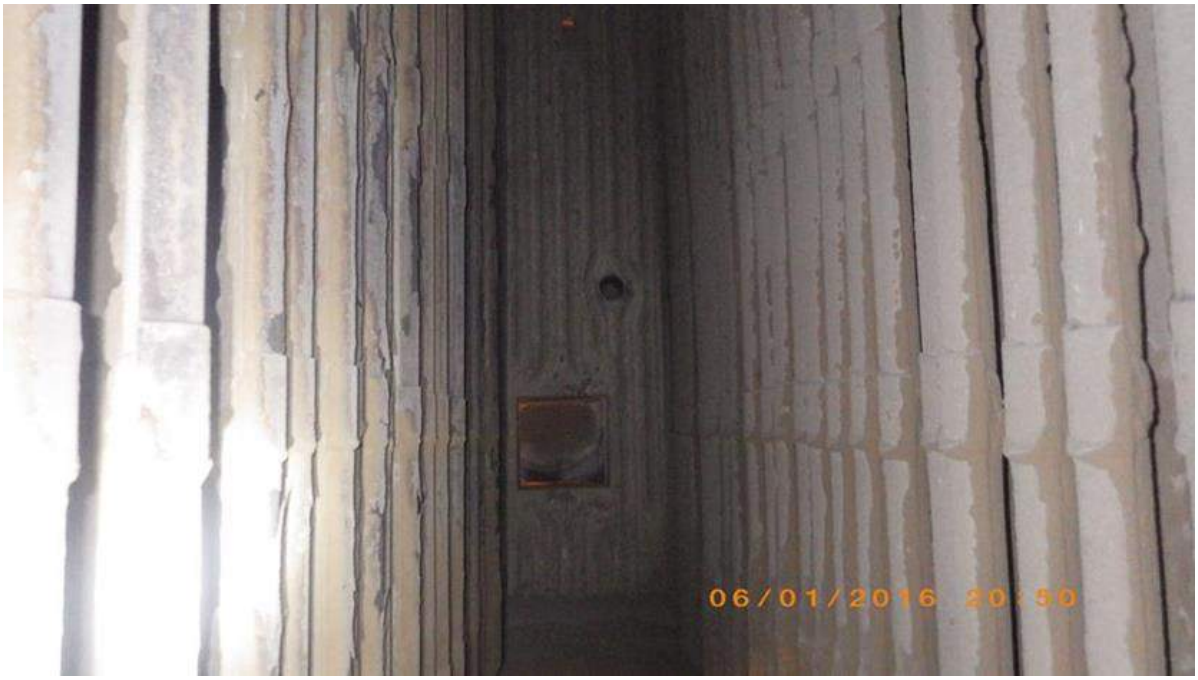


Photo 14 - View Between Superheater Sections – Fouling Typical

Photo 15 - View Up From Hopper Looking at Superheater Bottom Loops – Fouling Normal to Low

Photo 16 - Hoppers under Superheater Sections - all Clear

Photo 17 - Inlet to Economizer – No Excessive Fouling Noted from Above

Photo 18 - View Between Economizer Bundles – No Excessive Fouling Apparent

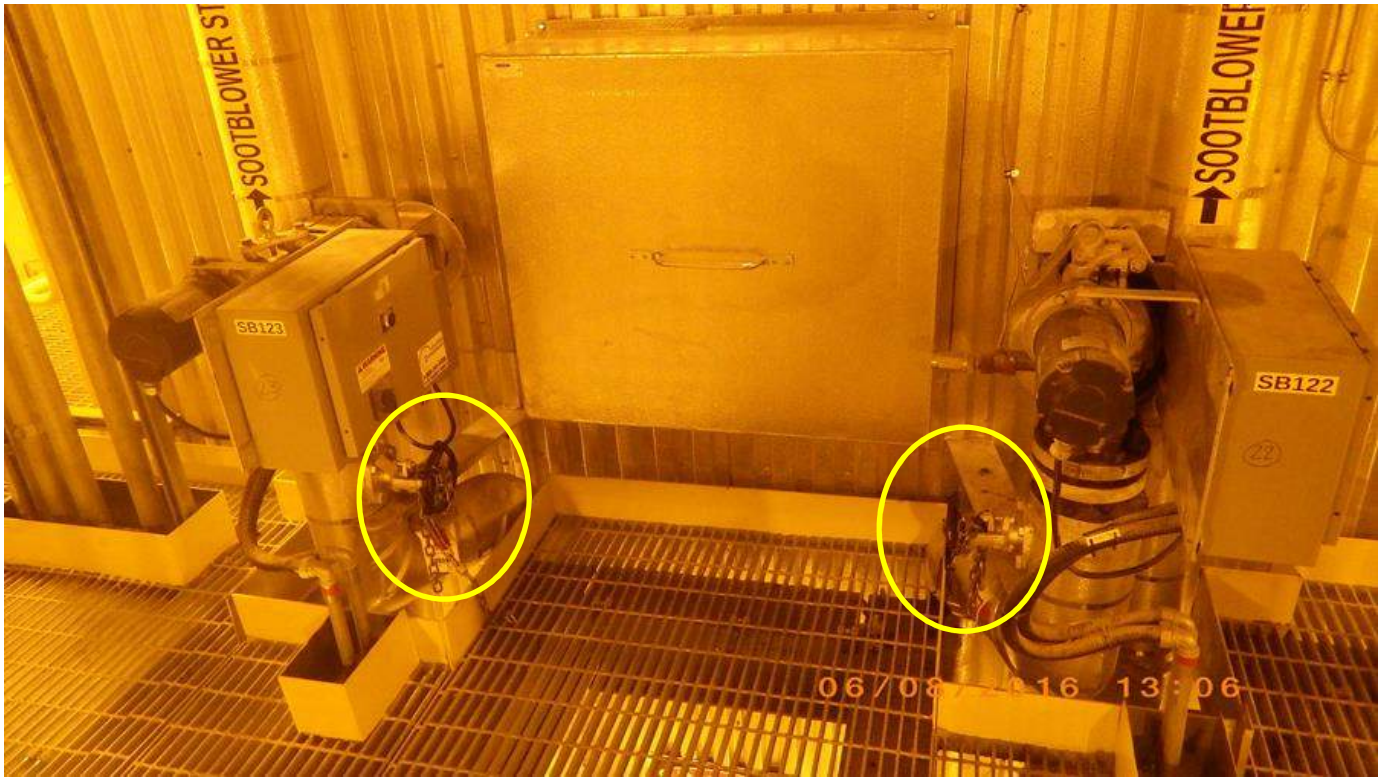
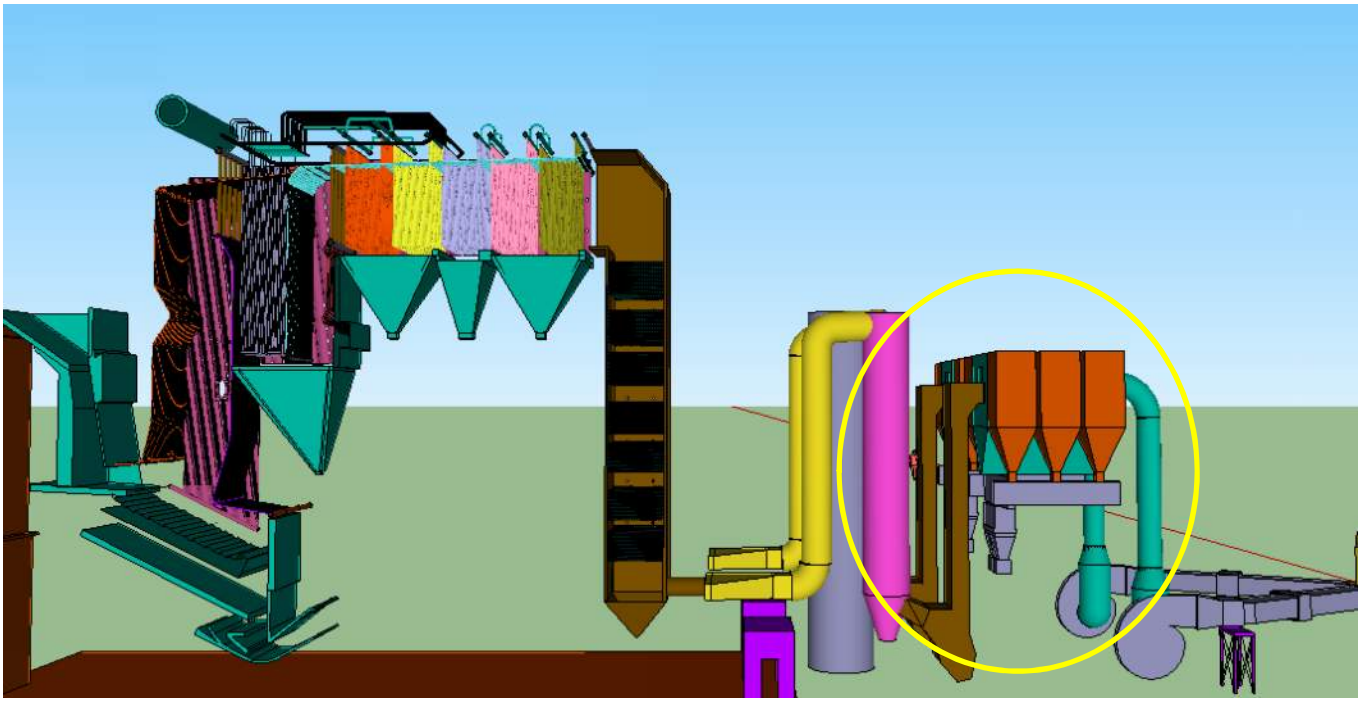


Photo 18 - Economizer Sootblowers 122 and 123 – Lances Repaired but Steam Remain Locked Out
HDR to monitor during startup)



APC System

Photo 19 - Baghouse Tube Sheet – Dust Indicates Bags in That Area Have Been Pulled for Replacement or Inspection

Photo 20 - Looking up into Baghouse Bags -

Photo 21 - Bottom of Baghouse Bags – Replaced bags are Evident

Photo 22 - Bags Replaced in Baghouse 1

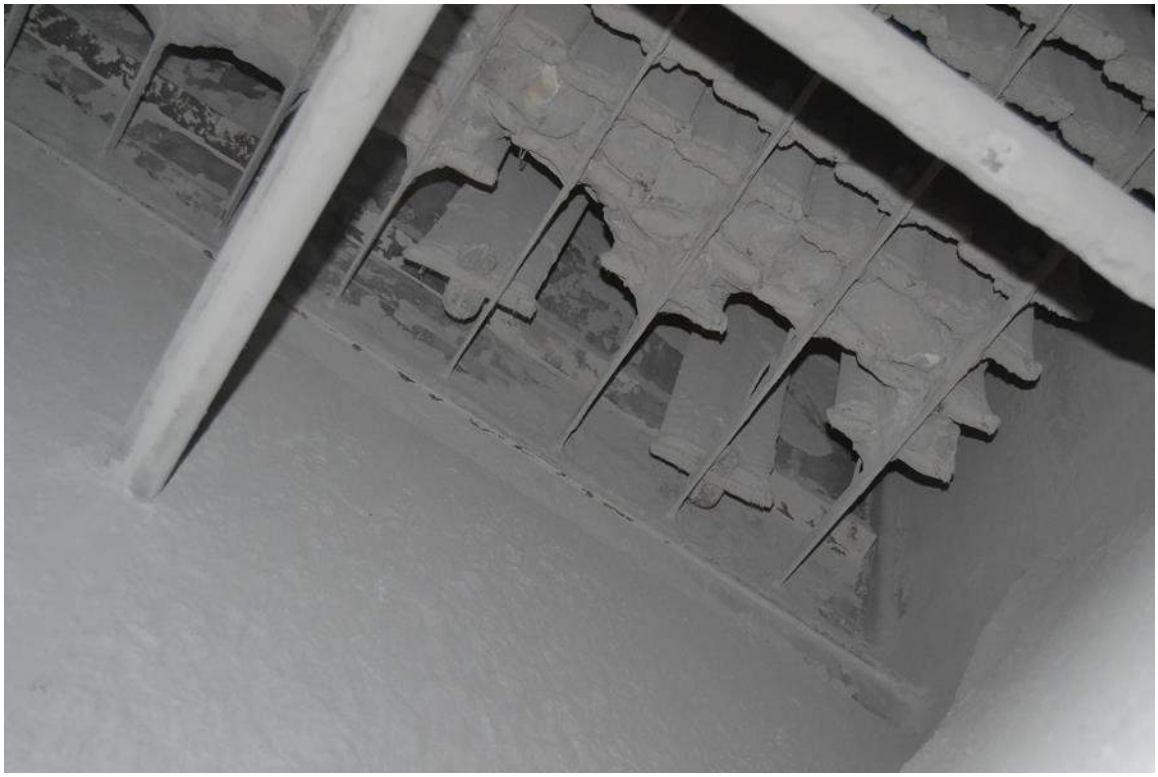


Photo 23 - As Found Condition of Unit #1 Bags – Out of Position

Photo 24 - View Looking Through Hole in Tubesheet – Shows Plugging Between Bags – NOT TYPICAL

Photo 25 - View of Buildup Between Bags – NOT TYPICAL

Photo 26 - View up at bottom of Bags – Fouled
Build up That Appears to Have Formed When Moist or Wet (NOT TYPICAL)

Photo 27 - Baghouse 1 -Hopper Level probe – Installed With Incorrect Orientation (Gap should be vertical)

Photo 28 - Baghouse 1 -Hopper Level probe – Installed With Correct Orientation (Gap vertical)

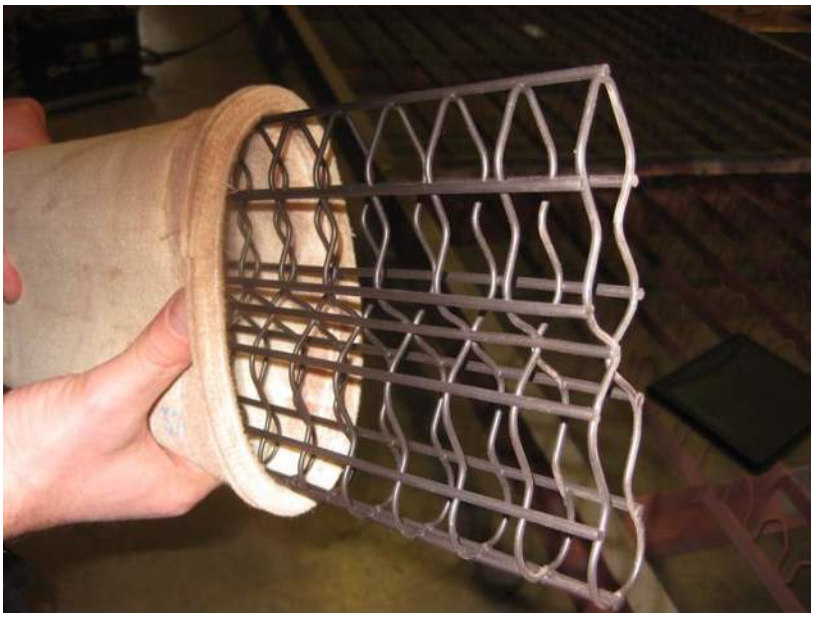


Photo 29 - Bag and Cage

Photo 30 - Vanes at Discharge of Quench Reactor – some Buildup – Not Considered Excessive

Photo 31 - Spray Nozzle – 3 of 5 Nozzles Plugged – PM Program Lacking

Photo 32 - Spray Nozzle – New Condition

Photo 33 - Damper between Quench and Dry Reactor. Only Slightly Open – Forces air down into Conditioning Rotor

Photo 34 – Lime Screw Feeder (center)– Plugged (as found)

Photo 35 Lime Screw Feeder (center)–Cleared (as left)

Photo 36 - Conditioning Mixer Clear – (As left)

Photo 37 - Inlet To Baghouse Inlet Duct – Baffle Screens at Far End Plugged (as found)

Photo 38 - Inlet To Baghouse Inlet Duct – Baffle Screens at Far End Cleared during Boiler #1 Shutdown (as left)

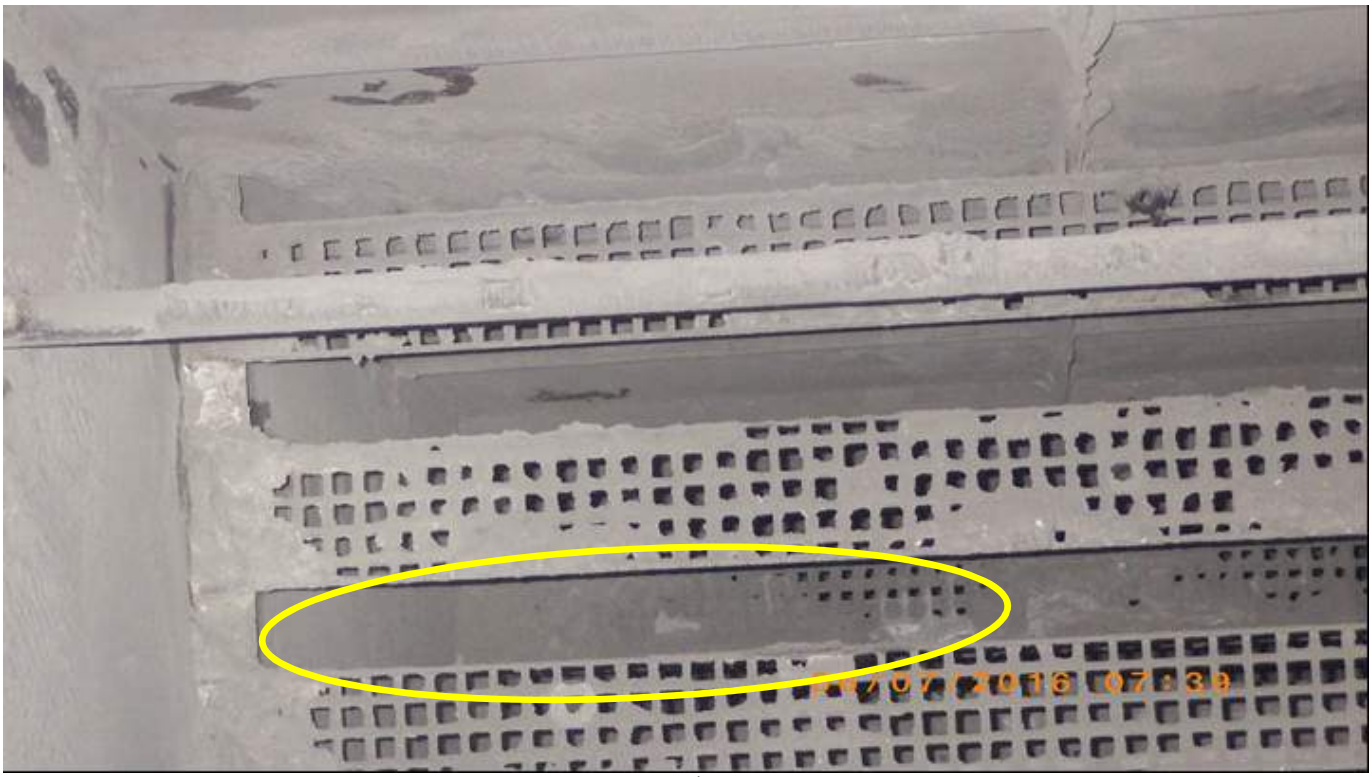


Photo 39 - Close up view of Inlet To Baghouse Inlet Duct – 2nd Row of Baffle Screens Remained Partially Plugged (as left)

Photo 40 - Baghouse Outlet Duct (Baghouse Clean side)– Appeared Clean

Photo 41 - Double Shaft Mixers – Some Paddles out of Proper Orientation

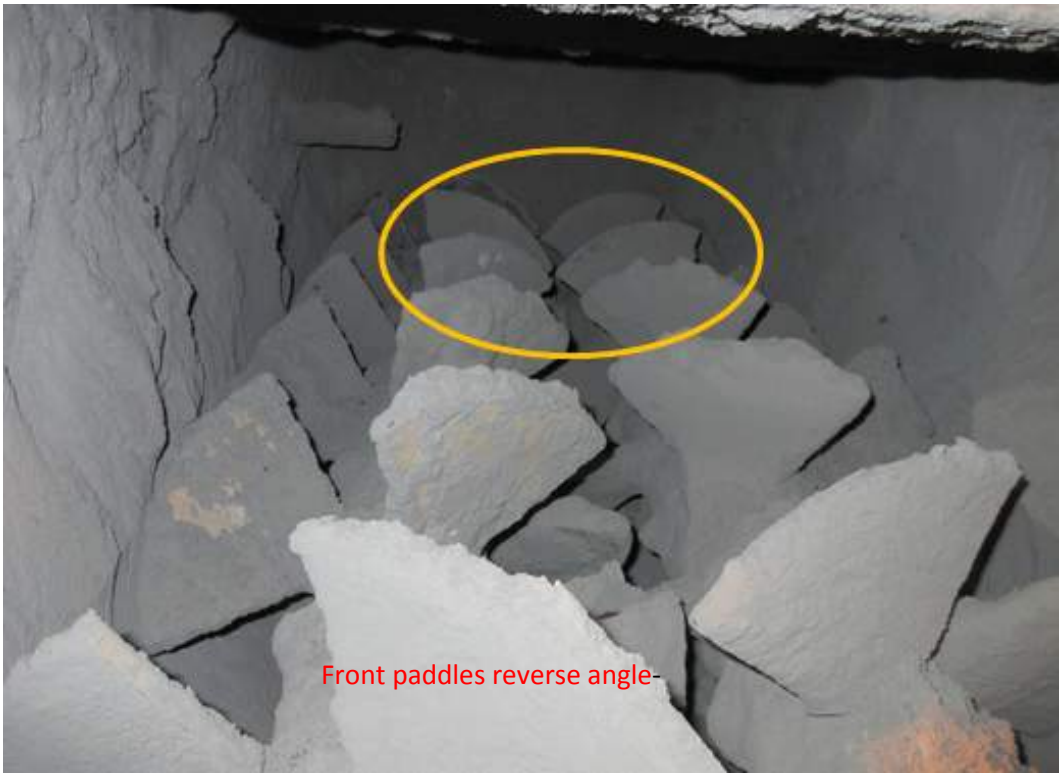


Photo 42 - Double Shaft Mixers – Some Paddles out of Proper Orientation
Front Paddles (under rotary) are reversed angled – reported to be by design

Photo 43 - Double Shaft Mixer for Flyash Recirculation – Spray Nozzles –

Photo 44 - IGR Fan Inspected – Some Holes in Housing – Refractory lined Inlet Holding up Well

BOILER 2 ON=LINE INSPECTION

Photo 45 - One Set of Bags in Boiler 2 Cell 2 were Plugged – All Others Clear (Better than Unit 1)