

The Power Station Manager
Attention: Mr. R Mathebula
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PEIC/BLR/APC/FEB16/03/RR

Dear Rhulani

DATA INTEGRITY– PARTICULATE MATTER EMISSIONS INTERIM REVIEW FY 2016 FINAL PHASE MATIMBA POWER STATION – DESKTOP REVIEW

BACKGROUND

Technology Engineering, in preparation for the year-end external audit of Eskom's emission figures, performed a desktop review of the Business Unit's (BU's) reporting of monthly emissions. Previously, emissions data integrity reviews were based on assessing the reported emission figures for repeatability and then checking conversion calculations on site.

Matimba Power Station was the first station in Eskom to have an automated emissions reporting system. The automation is done directly in the DCS. Past site based reviews basically verified if the final figures were accurately captured in GenProd and if the correlation curves were correct.

This desktop review was done slightly different in that a new MS Excel based tool was developed in order to redo all the reports and then compare the final data that the station reported. A small variation would be expected due to the resolution that the station DCS (retrieved via VA View) uses which is much higher compared to the 5 minute average that the MS Excel tool uses.

PURPOSE

To ensure the integrity of emissions data reported prior to Eskom's year-end financial report deadline and to determine the level of readiness for an external audit (should your BU be selected).

SCOPE

The assessment covered the BU's ability to effectively compile monthly emission reports, including the management of resources, documented controls and the recording of all activities for compliance to Eskom's Emissions Monitoring and Reporting Standard 240-56242363 and adherence to the BU's Local Emissions Reporting procedure.

ASSESSMENT FINDINGS

A repeatability test is performed in order to establish if the raw data from VA View has changed since the initial download. In this review the raw data from April to December 2015 was re-downloaded, then copied and pasted into the newly developed MS Excel tool. A small variation is expected due to the fact that the comparison is based on two different methods.

The table below shows the results of the repeatability test. For indication purposes the variations below are satisfactory and further highlights that a desktop review is possible thus removing the need to travel to Matimba on a bi annual basis.

Repeatability Test			
2016FY	MTB	TEST	VAR. (%)
April	101.67	103.14	1.43
May	169.02	170.17	0.67
June	163.81	165.91	1.27
July	120.21	121.71	1.24
Aug.	175.16	177.25	1.18
Sept.	219.27	221.58	1.05
Oct.	163.00	165.14	1.30
Nov.	97.00	98.65	1.67
Dec.	161.46	163.61	1.32
Sum	1370.6	1387.2	1.20

A more technical explanation on Matimba's automation (specifically focusing on the resolution) in the DCS from the Supplier is as follows. The reports get calculated using a built in integration function which does an accurate averaging over time based on the underlying system resolution. So if a system can provide data at 1 sec resolution then the actual resolution used is 1 sec. For data from the TXP (dust readings) they have a typical resolution of 1s. It is expected that the gaseous measurements could be similar.

The calculations are done using 64bit floating point values to eliminate rounding off errors. Also the averaging is time based rather than a sample count which gives a much more accurate averaging method .So all values are integrated with an accuracy of 10ms over the period then divide by the total time in ms to get a weighted average. A sample summation / number of samples may yield a slightly different value as it is an approximation based on the resolution of the data.

On that note a recommendation here is that single flue sites that use VA View should consider getting their emissions automated directly in the DCS instead of using the PEIC MS Excel version of automation. However a cautionary note is that with automation like Matimba's, reliability and availability of raw data is important in order to ensure accuracy of the final figures. Single flue sites that readily come to mind are, Majuba and Duvha. The automation can also be extend to combined flue stacks sites that uses VA View provided that they are FFP retrofit sites, where no cleaning of data is required for shut downs and light ups. These sites are Camden and Hendrina.

GenProd Tonnage Review

This section compares the tonnages as reported to Eskom Environmental Management (EEM) versus the actual tonnages as noted in the stations' PDF reports (MTB). In general the reporting of tonnages to EEM is well done.

GenProd Tonnage Reporting			
2016FY	EEM	MTB	VAR. (%)
April	101.67	101.67	0.00
May	169.02	169.02	0.00
June	163.81	163.81	0.00
July	120.21	120.21	0.00
Aug.	175.16	175.16	0.00
Sept.	219.27	219.27	0.00
Oct.	163.00	163.00	0.00
Nov.	97.00	97.00	0.00
Dec.	161.00	161.46	0.28
Sum	1370.1	1370.6	0.03

Post Review Tonnage

This section compares the tonnages as reported to Eskom Environmental Management (EEM) versus the tonnages after this review. There were no other changes to the tonnages. The stations' figures are correct. The small variation noted is only due to the resolution used for this review is not the same as the station and should thus be ignored.

GenProd Tonnage Post Review				
2016FY	EEM	MTB	REVIEW	VAR. (%)
April	101.67	101.67	103.14	1.43
May	169.02	169.02	170.17	0.67
June	163.81	163.81	165.91	1.27
July	120.21	120.21	121.71	1.24
Aug.	175.16	175.16	177.25	1.18
Sept.	219.27	219.27	221.58	1.05
Oct.	163.00	163.00	165.14	1.30
Nov.	97.00	97.00	98.65	1.67
Dec.	161.00	161.46	163.61	1.60
Sum	1370.1	1370.6	1387.2	1.23

Particulates Section 30 (S30) Reporting

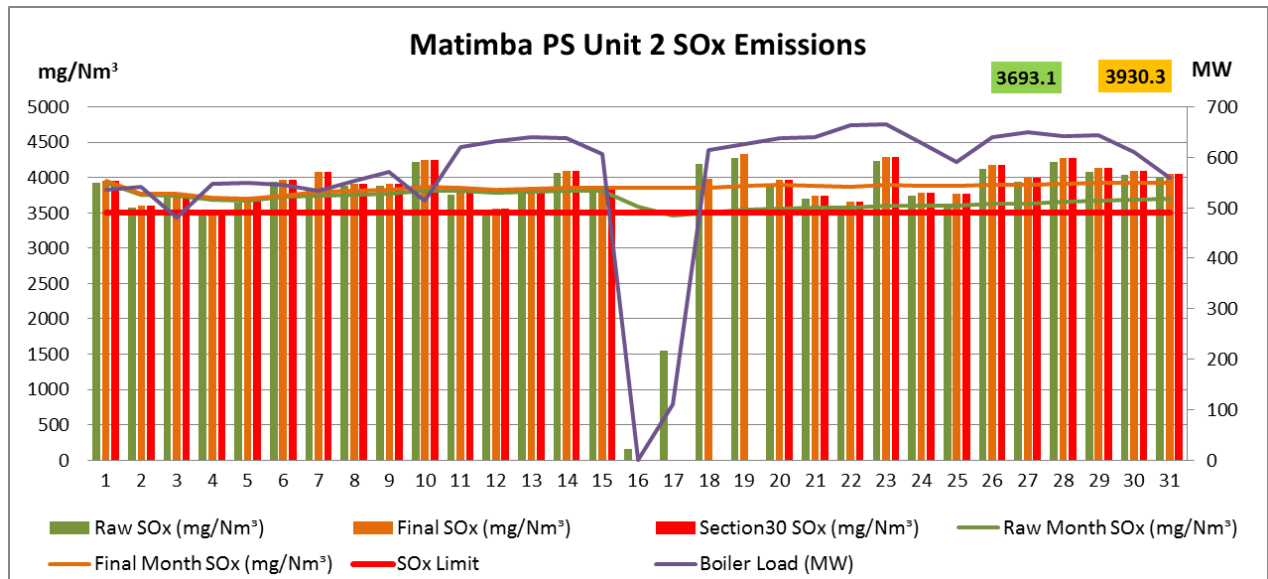
The station had no S30's for this review period.

CEMS Review/Reporting

As part of the particulate review a high level analysis was done on the gaseous emissions data. The monthly emissions report for January 2016 (most recent) was used in order to determine validity of the gaseous readings. Below are some concerns that were identified:

- The CO reading on Unit 3 seems a bit higher comparatively to the other 4 operating Units. Unit 3 CO monthly average is 89 mg/Nm³ whilst the other 4 units are averaging 6 mg/Nm³. Anything under 75 mg/Nm³ is still acceptable for units with optimised combustion but the station should investigate why on Unit 3 it is comparatively higher.
- The station seems to have a problem with high coal sulphur content. Coupled with high sulphur and if the O₂'s are high then this leads to the license limit being exceeded. The station needs to closely look at the O₂ readings to ensure that they are correct at all times. The station did incur a Section 30 on Unit 2 even though the raw SO_x readings in PPM are the similar to the other Units. The main difference on Unit 2 is that the monthly O₂ average is 9.2% versus the monthly average for the other Units of approximately 7.0%. The high SO₂ could either be attributed to an inaccurate O₂ reading or an actual high air in-leakage. If the latter is true, then the Section 30 stands and priority should be given to curtailing the air in-leakage.

The graph below shows the extent of SO_x Section 30.



- Unit 3 O₂ is too low, January 2016 monthly average was 4.9% at the stack outlet. The station should check the monitor if it's working properly. The average for the remaining units is approximately 7.0%.
- For more than half of January all gases on Unit 4 were not working. The problem has been subsequently corrected. Reporting of SO_x and NO_x emissions is a legal requirement and the station should not allow non-reporting for extended period of times. Non-availability of CEMS is in itself is a non-compliance. Eskom standard requires a 95% CEMS availability (Ref: 240-56242850) whilst the Minimum Emissions Standard (MES dated 22 November 2013) requires an 80% validity of data. On Unit 4 the CEMS availability for the month was 49.1% on average for all gases. The station need to implement an availability calculation for both Particulates and Gases in their report.
- The table below contains the CEMS data using the daily average for 30 January 2016. It compares the data as derived using the PEIC Tool versus the Station's VA View Report.

30-Jan-16	Final CEMS (PEIC MS Excel Tool)					Final CEMS (Station Report)					Percentage Variation				
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 1	Unit 2	Unit 3	Unit 4	Unit 6
SOx (mg)	3852.1	4092.7	3302.2	3273.4	3382.5	3486.8	3658	3009.3	3023.2	3138.2	9.5%	10.6%	8.9%	7.6%	7.2%
NOx (mg)	469.6	728.2	565.7	543.4	671.6	399.1	425.2	336.2	327.1	405.7	15.0%	41.6%	40.6%	39.8%	39.6%
CO (mg)	8.7	7.6	72.0	3.2	3.7	8.2	7	67.8	2.9	3.5	6.1%	8.5%	5.8%	8.2%	6.2%
CO ₂ (%)	9	12	10	9	9	11.9	12.1	12.1	11.3	10.7	-33.6%	1.1%	-21.6%	-19.2%	-17.4%
O ₂ (%)	7.9	9.4	6.7	7.1	7.3	7.5	8.9	6.4	6.7	7	4.9%	5.1%	4.7%	5.0%	4.4%
H ₂ O (%)	5.2	5.4	5.4	4.7	4.8	5.1	5.3	5.3	4.7	4.8	1.7%	1.0%	1.8%	1.0%	0.2%
T (°C)	134.9	145.2	140.9	118.1	126.0	134.9	145.2	140.9	118.1	126	0.0%	0.0%	0.0%	0.0%	0.0%
P (mBar)	916.3	908.5	910.7	939.3	907.9	916.3	908.5	910.7	939.3	907.9	0.0%	0.0%	0.0%	0.0%	0.0%
Vel (m/s)	25.7	33.9	20.3	23.8	25.1	25.7	33.8	20.3	23.8	25.1	-0.1%	0.4%	0.0%	-0.1%	-0.2%

The values in the first five rows do not compare. There is a huge variance between the two systems. The station need to investigate the reason for this variation.

- The table below contains the CEMS data tonnage for 30 January 2016 as derived using the PEIC Tool versus the Station's VA View Report.

30-Jan-16	Tons (PEIC MS Excel Tool)					Tons (Station Report)					Percentage Variation				
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 1	Unit 2	Unit 3	Unit 4	Unit 6
SOx	239.7	301.4	180.7	223.3	225.8	23.2	33.9	16.6	14.6	22.7	90.3%	88.8%	90.8%	93.5%	89.9%
NOx	33.3	53.6	31.0	37.1	44.8	2.7	3.9	1.9	1.6	2.9	91.9%	92.7%	93.9%	95.7%	93.5%
CO	0.4	0.6	3.9	0.2	0.2	0.1	0.1	0.4	0	0	74.0%	82.2%	89.8%	100.0%	100.0%
CO ₂	12820	17773	10746	12755	12000	1268.8	1998.2	983.4	828.9	1195.6	90.1%	88.8%	90.8%	93.5%	90.0%

The stations gas tonnages are not correct. Firstly their final figure is off by a decimal. Secondly, it is uncertain what gas volume the station is using to calculate their final tons. Lastly it is also uncertain if the station is filtering out data that should not be part of the final daily average similar to the PEIC Tool.

Based on the sample for January 2016, gaseous emissions' reporting at Matimba PS is not done correctly. The station is not using the same automation that they use for the dust emissions. Also their gaseous reports does not have the capability (like the dust) to retrieved monthly data but needs to be done on daily basis and then accumulated manually for the month, which could be prone to errors. Validated gaseous emissions' reporting was a requirement from 1 April 2015. The station should either use the PEIC Tool for emissions reporting or ensure that their automation gives the same results as the PEIC Tool.

CONCLUSIONS

Particulate emissions reporting at Matimba Power Station is well done. Keep up the good work. There are no changes to the station tonnages.

In general there seems to be some uncertainty on gaseous emissions reporting. The station needs to review how the final concentrations are determined together with calculation of the gas tonnages.

Closing Remarks: The new external auditors are placing a great deal of emphasis on documentation. From the sites selected in the previous financial year the following documentation were required:

- All SAP PMs for the monitors including the signal loop check.
- Proof of calibration certificates for dust and air flow transmitters.
- All correlation test reports.
- Proof of implementation of dust and air-to-gas regression curves in the reporting template and the DCS/Operator interface.
- List of all Section 30's (if applicable).
- Proof of monthly internal verifications of emissions data prior to EEM submission (this feedback does not qualify)

Note the above points were not checked as part of this desktop review so the station should ensure that they are in place prior to the year-end audit. For the sites selected last year, excessive time was wasted as those stations did not have all the documents printed and located in a central location that was easily accessible for the external auditors.

Acknowledgement

I would like to thank Ernestus Pretorius from Matimba PS for developing a special query which allowed me to access their DCS remotely from Sunninghill. This made it possible to successfully conduct a desktop review.

Yours sincerely



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PRODUCTION, ENGINEERING, INTEGRATION – COAL**

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