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April 22nd 2015

Ref: Permit BU2110IS –IP24 Follow Up

Dear Mr. Kemp,
I am writing to you to provide an update on the progress on improvement action 24 (IP24) as identified in our Environmental Permit variation issued on 23 November 2011 and in response to recent recommendations by NRW regarding multiple 30 minute testing, (with outliers removed). Further proposals are presented for NRW consideration with the view to bringing closure to this IP action.

Improvement Programme 24

The Operator shall notify the Environment Agency in writing upon completion of commissioning of the modifications described in the application for variation EPR/BU2110IS/V005 and the date from which the chlorine emission limit value for release point A1 shall revert to 10mg/m³ as an hourly average.

NRW Proposal:

"In order to reach a conclusion to this outstanding matter, at least until BAT conclusions are published and IED implementation taken forward for this installation, the following approach is proposed:

Reversion to the 10 mg/m³ chlorine ELV with compliance based upon the average of multiple tests during a day (e.g. a number of consecutive 30 minute tests) with outliers removed (>3 standard deviations) down to a minimum of triplicate 30 minute sampling (to be introduced by IED) if confidence in the method improves with time. No single test result to exceed 150% of the ELV."

Alternatively, a longer term test (e.g. 8 hours) will be required to meet the BAT ELV due to the unstable emissions close to the ELV.

Action: Cabot Carbon to propose a monitoring and compliance approach for chlorine emissions from release point A1 based upon the alternatives outlined

Brief History/Current Status

- Additional A1 stack chlorine data gathered since April 2013: discussion with NRW brought firm conclusion on the suitability of monitoring method USEPA 26A. (isokinetic).
- Results continue to indicate that Cabot is 'broadly' in compliance. Still concern around the 'within' run variation -statistical analysis infers an 8% probability of quarterly sampling returning results above Permit ELV of 10mg/m³ during steady state plant conditions. Ref chart 1. p4
- We believe the main issue of variation experienced by Cabot Barry is driven by the reliability of EPA26A technique which maybe further exacerbated by the likelihood of liquid entrainment.
- May 2014 – USEPA 26A Confidence Interval Analysis (Statistical Outlier Sigma and Std Dev) Method) calculated and submitted to NRW (Mean 5.6, SD 3.23, 3 σ = 15.27, >15.3mg/m³ outlier)
- June 2014 – Met with NRW Inspectors at a site visit. Presented storyboard of work on IP24. Cabot made recommendations for statistical tolerance/relaxation of ELV.
- June 2014- Cabot consulted with Northumbrian Water (Compliance Stack Emission test providers), explored ways to prove/disprove the false positive results. Response Section 3. P5-6 of July 2014 report.
- Cabot continued with 1hr sample intervals throughout 2014 until February 2015. With the view of bringing IP24 to resolution and closure, Cabot trialled the multiple 30 minute consecutive analysis method. The results are shown as a discrete set on p3 then added to the data pool for the updated Confidence Interval Analysis illustrated on p4. & p5.

• Constraints/Barriers

- No comparable plant within Cabot
- No accessible comparable industry
- No further research USEPA 26A (Wet Scrubber systems). Test limitations are documented in STACK SAMPLING METHODS FOR HALOGENS AND HALOGEN ACIDS *Larry D. Johnson, Methods Branch, MD-44, Air Methods Research Division, National Exposure Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711*(p7). **SUMMARY (p.7)** “These methods require care! Given careful operation, they have been shown to work well for HCl and chlorine in sampling "normal" stack emissions such as those from incinerators and power plants. More complicated and more reactive gas mixtures may cause problems which will require research to overcome. Efficacy of the methods for other halogens and halogen acids has not been as well evaluated, and the limited data available show mixed results. **Good precision and accuracy become difficult to achieve with these methods at concentrations below approximately 5ppm** ⁽¹⁾ Performance data at concentrations above 500 ppm HCl are uncommon”.

(1) 5 ppm Chlorine equal to 15.8 mg/Nm³ (molecular weight 71, molar volume 22.4)

Cabot Response

Cabot adopted the multiple 30 minute sample analysis from the proposal presented by NRW. (The 8hr analysis option would not be appropriate due to restrictions regarding grade changes and process adjustments on production units).

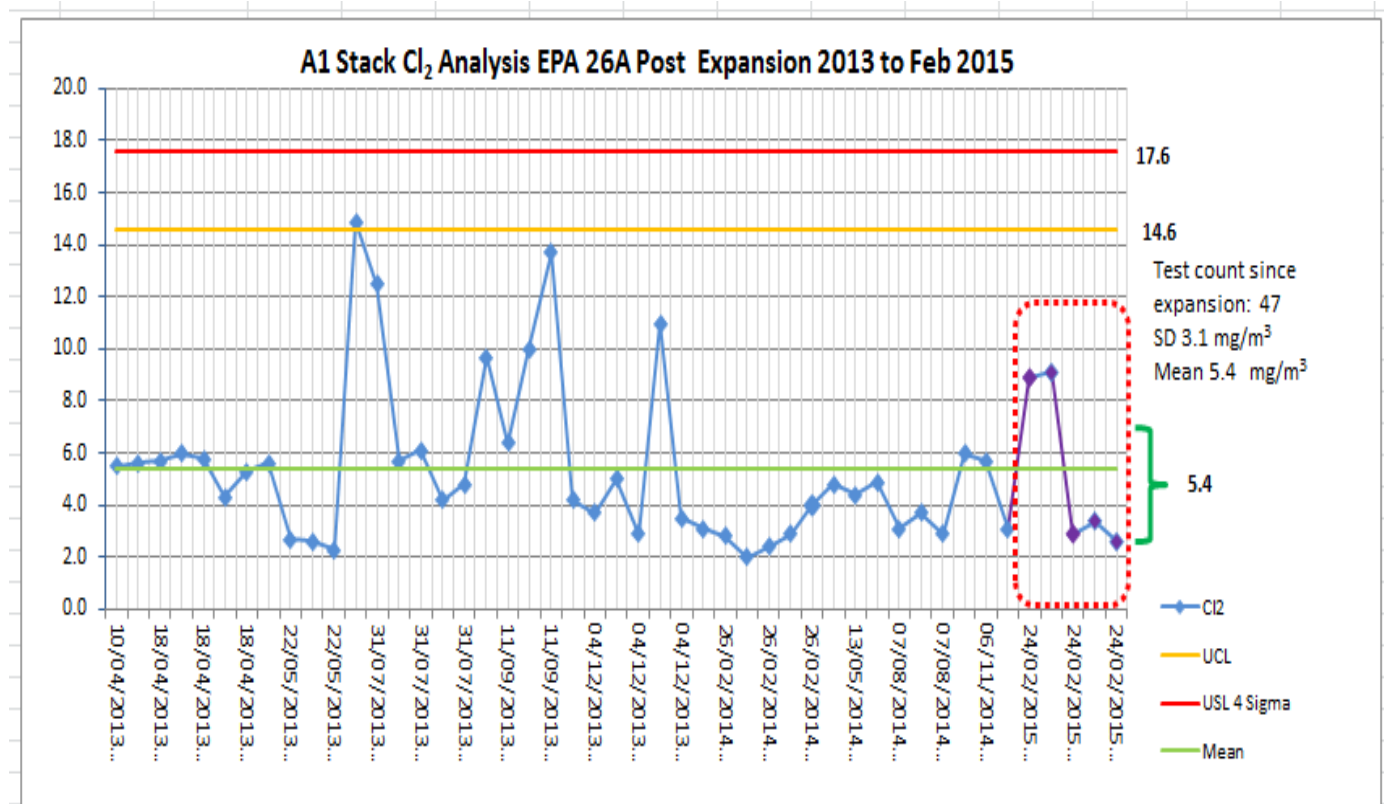
Analysis carried out on 24th February 2015 delivered the following results:

24/02/2015	Time	Cl ₂ mg/m ³	30 min sampling statistics:	
1	10:15:00	8.9	Test run mean mg/m ³	5.4
2	10:50:00	9.1	Std. Deviation	3.3
3	11:25:00	2.9	Statistical Outliers (>15.3)	Nil
4	12:00:00	3.4	No single test result to exceed 150% of the ELV	Nil
5	12:30:00	2.6		

Please note continuation of high 'within run' variation. During steady state plant conditions throughout the 5 x 30 minute tests, the results varied from 2.6 to 9.1mg/m³.

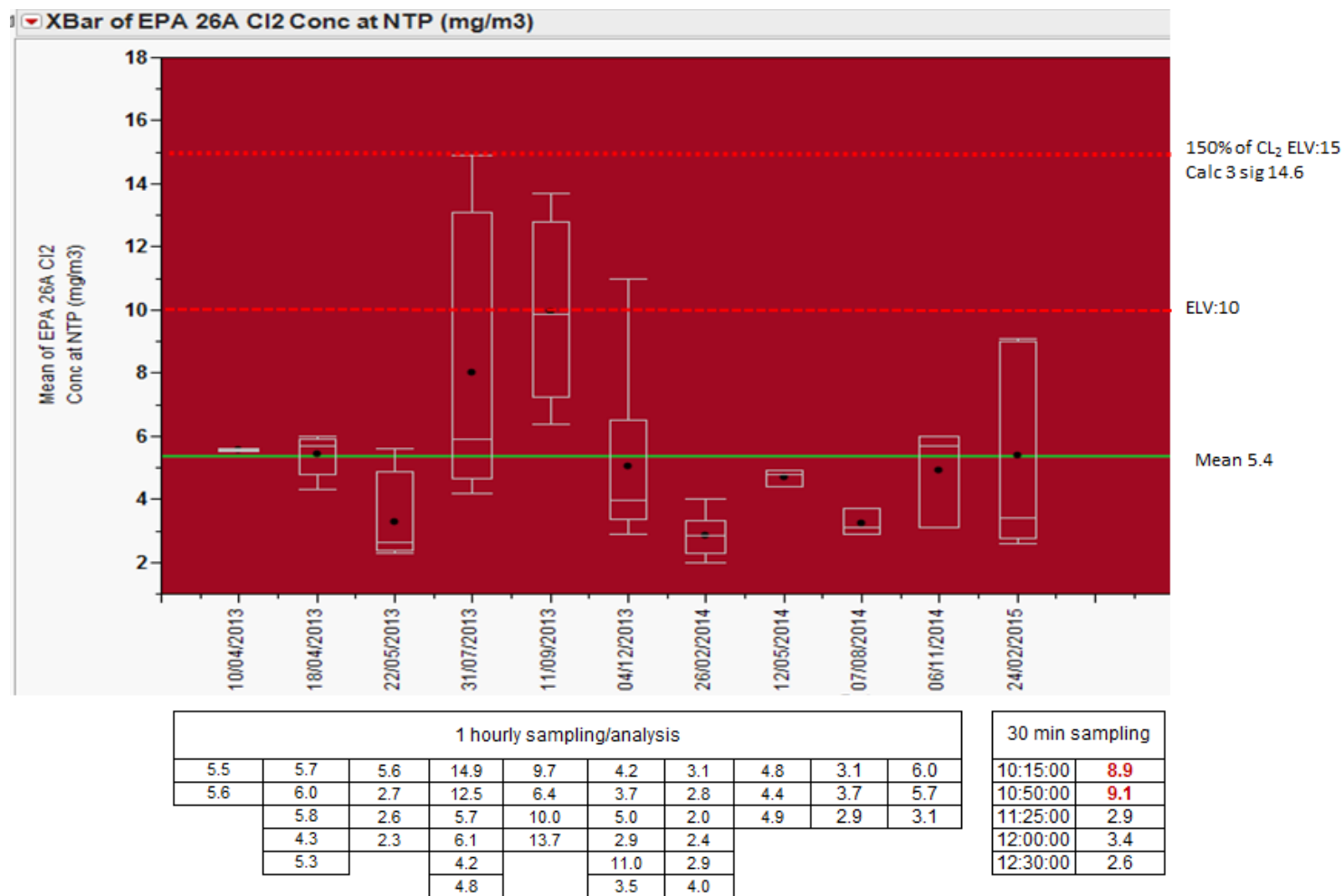
Statistical Evaluation of Cl₂ results from April 2013-to date

Individual Run Data:



Historical trend of within run variation:

Chart 1



Statistical Summary

EPA26A					
Data Set	Mean Cl ₂ mg/m ³	Standard Deviation (Sigma)		UCL	Calculated Upper Limit
47	5.37	SD1 (68.3%)	3.06	8.4	
		SD2 (95.5%)	6.12	11.5	
		SD3 (99.73%)	9.18	14.6	15
		SD4 (99.9937%)	12.24	17.6	18
		SD5 (99.99994%)	24.48	24.5	25
		SD6 (99.999998%)	36.72	36.7	37

A&B unit running (steady state, plant optimised) pH 8.8. EPA26A method since April '13, data pool 47.

USEPA 26A Confidence Interval Analysis, now a 47 point data pool (April 2013-February 2015)

The calculated Mean is 5.4mg/m³ and a standard deviation (σ) is 3.1.

3 σ = 14.6 (99.73% result is Out of Control (OOC) i.e. an “outlier”)

The Statistical Outlier is calculated as 14.6 mg/m³

150% ELV limit is calculated as 15 mg/m³

We continue to make significant efforts to draw firm conclusions on the causes of the within run variation observed in Cl₂ stack emissions testing and the impact of such variation on the ELV of 10mg/m³. The Agency has previously recognised that the BAT limit of 10mg/m³ may not be possible under our unique caustic tower process operation which is further exacerbated by the capability of the test method itself at concentrations below 15 mg/m³. The difficulty in achieving good accuracy and precision with USEPA 26A method concludes that there is a risk of breaching the current BAT ELV without statistical intervention or adaptation.

Proposals for NRW consideration

- 1) Adopt the statistical approach as recommended by NRW: *Average of multiple tests during a day (e.g. a number of consecutive 30 minute tests) with outliers removed (>3 standard deviations) down to a minimum of triplicate 30 minute sampling (to be introduced by IED) if confidence in the method improves with time. No single test result to exceed 150% of the ELV.*
- Cabot Barry to omit data calculated as 'statistical outliers' prior to reporting quarterly data to NRW, i.e. any result > 14.6 if the process is running normally, based on the expected range of results indicated by the data set.
- 2) Cabot to seek clarification from NRW on the proposed 150% ELV single point breach given that the calculated 3σ is 14.6 mg/m^3 and 150% of ELV is also 15 mg/m^3 . Can the proposed 150% ELV be reconsidered due to the close proximity of the calculated 3 sigma?

Cabot wishes to request the assistance of NRW in bringing IP24 to closure as soon as possible. If I can provide you with any further information in support of IP24 please do not hesitate to contact me.

Yours sincerely,



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