FICHTNER
Consulting Engineers Limited

KRONOSPAN
CHIRK PARTICLEBOARD FACTORY
SCHEDULE 5 RESPONSE

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Table of Contents

1 SITE PLAN

(1) **An updated site plan showing the location of all combustion plant and associated air emission points to be regulated by NRW has been submitted. The plan has been reviewed and meets all the requirements specified in the original Schedule 5 notice. However, the numbering of the Natural Resources Wales Emission Points on the updated plan does not fully match the emission point references given in Table S4.1 of the NRW permit as given in variation notice EA/EPR/BW9999IG/V003.**

Please provide an amended site plan showing all the existing air emission points as numbered in Table S4.1 of EA/EPR/BW9999IG/V003 and the Natural Resources Wales emission points shown on the site plan. Each air emission point needs to have a unique identifier (e.g. A4) and the additional NRW combustion emission points on the site plan should follow on sequentially from those emission points which are already listed in Table S4.1. This allows emission points in the site plan to be cross referenced with those in Table S4.1.

An updated Site Plan is presented in Appendix A. The site plan submitted with the application for the EP Variation included emissions points A1 to A6 which have emission limits and monitoring requirements. This drawing did not include emission points A7 to A15 which are release points without emission limits and monitoring requirements.

This has been within the Site Plan and the additional emission points for the combustion processes have been renumbered as emission points A16 to A25.

2 Releases to Sewer

(2) The response to Q2 "Releases to Sewer" states that:

"The K1, K5 and K6 combustion systems are effectively heat exchangers and do not produce effluents which would require discharge to sewer".

Furthermore:

"The gas turbines (GT1 and GT2) and gas engines (Gas Engines 1 – 5) do not include a steam cycle, therefore do not produce effluents which would require discharge to sewer".

It is NRW's understanding from "Table 1.1 – Combustion Plant" on page 3 of the Fichtner Application Supporting Information document, that the K1, K5 and K6 combustion plant are natural gas boilers which would be expected to generate boiler blow down and waste condensate for disposal.

Table 1.1 also states that the Gas Engines are used as a source of steam production for MDF1 and MDF2 and that the 2 x Gas Turbines will act as standby plant for the gas engines. Paragraphs 1.3.1.5 and 1.3.1.6 on page 6 of the Fichtner Application Supporting Information document confirms that the standalone gas turbines:

"will provide a back-up supply of heat/steam and electricity if a gas engine is not available".

It would therefore also be the expectation that some quantity of blow down water and waste condensate would also be generated for disposal by the gas engines and gas turbines as well.

In view of this, please confirm if emission point "S1" shown on the overall site plan of the installation (submitted in response to Q1 "Site Plan" of the previous schedule 5 notice) receives boiler blow down and waste condensate from K1, K5, K6, Gas Engines 1 – 5 and Gas Turbines 1 and 2. If necessary, please provide further explanation to clarify if the point source release to sewer from the combustion plant subject to this variation is released from a single emission point or a number of different emission points. Please also update the overall site plan for the installation (as submitted in the previous Schedule 5 response) to show the location of this emission point(s), if it is not "S1".

K1, K5 & K6

K1, K5 and K6 are not conventional boilers although they are referred to as 'boilers' by Kronospan. K1, K5 and K6 are gas fired heaters for heating thermal oil and do not generate any effluents (blowdown and condensate) which would require discharge to sewer.

Gas Engines

The principal provider of steam for the MDF process is the K8 biomass boiler, the gas engines supplement that supply of steam and take some of the load off K8. If all the gas engines went off line steam would be supplied by K8 with K7 acting as a back-up.

The gas engines have a steam boiler associated with each engine. The capacity of each of the Gas Engine Boilers is 4.8 tons per hour of steam. At any one time, steam is only produced from two boilers. Therefore, the engines will generate up to 4.8 tonnes per hour, which is equivalent to 9.6 tonnes per hour of steam.

If it is assumed that approximately 5% of the steam is released as blowdown, it would equate to 0.05m^3 of effluent being released per hour. This effluent would be discharged to sewer via emission point S1 (as identified in the EP application).

Gas Turbines

Gas Turbines 1 and 2 do not have boilers with a steam cycle. The exhaust gases from the Gas Turbines are released via the MDF Driers. Therefore, there is no effluent generated from the Gas Turbines.

3 Air Quality Assessment

(3) The documentation provided in response to questions 4a and b of the original schedule 5 notice explains that the gas engines are currently "tuned for TA luft"

(500 mg/Nm3 @ 5% O2 for dry exhaust gas) and that retuning from the current setting to "half TA luft" (250 mg/Nm3 @ 5% O2 for dry exhaust gas) can be done at the same time as the hot commissioning of the plant.

In addition, the document entitled "Wärtsilä 34SG engine tuning for different NOx emission levels" states that:

"Wärtsilä has developed engine concept for different NOx tunings by running laboratory engines. By means of testing and process simulation there are known base settings that can be implemented on engine for each NOx emission level limitation. Limited fine tuning takes place on-site".

In view of this, please confirm if it is technically possible to use a different tuning configuration which would achieve NOx emissions of less than 250mg/m3 (@ 5% O2 for dry exhaust gas). If a different tuning configuration can be adopted, please update the air quality modelling assessment to reflect this. If an alternative tuning configuration is technically possible, but will not be adopted, please provide full justification for this position.

It can be confirmed that it is technically possible to use a different tuning configuration for the gas engines to achieve NOx emissions less than 250mg/m3@5% O_2. If the engine supplier further detuned the engines to reduce NOx levels, this will result in a potential increase in the carbon monoxide emissions, and engine efficiency will further reduce. The engine supplier has advised that the optimum setting at 500mg/m3@5% O_2, and half TA Luft as the lesser alternative, achieves the right balance between operating performance, efficiency and environmental impact.

The justification for tuning the engines at a reduced emission limit for NOx to 250mg/m3 is that this will be the NOx concentration as the flue gases leave the gas engines. The flue gases will then be ducted to the MDF Refiner plant where the heat from the flue gases will be recovered in the drying processes. This process acts as additional abatement for the reduction of NOx emissions.

The only scenario when flue gases from the engines will discharge directly to atmosphere through the individual engine stacks will be when one or both of the MDF 1 & 2 presses are off line. Under normal operations the individual engine emission points are considered to be emergency stacks.

(4) Item d) on page 9 of the original Schedule 5 response states that:

"The (K7) monitoring showed that at standard temperature and pressure (STP) dry gas i.e. no correction for oxygen, the concentration of NOx was 270 mg/Nm3, and the measured oxygen content was 15.7% on a dry basis. Therefore, corrected to the 11% reference oxygen content, this equates to a NOx concentration of 509 mg/Nm3 (dry air, 273K, 101.3kPA, 11% ref O2) is considered to be conservative".

However, the table in Appendix B of the submitted initial Dispersion Modelling Assessment report (dated 15/12/2016) shows that both K7 (550 mg/Nm3) and K8 (300 mg/Nm3) have a reference oxygen content of 6%. The Schedule 5 response also suggests that 6% reference oxygen content is used in the WCBC permit in respect of K8. On this basis, we consider that the use of the 11% reference O2 in the risk assessment for K7 and K8 may not be conservative. Please provide further clarification on this and update the modelling results to reflect the correct O2 content for K7 and K8 if appropriate.

There was an error when calculating the emission rate in the initial Dispersion Modelling Assessment. The volumetric flow rate and concentration (or ELV) should be at the same reference conditions. Therefore, as noted the emission concentration at 11% should have been converted to 6% reference oxygen content, this results in the unabated emission concentration from the K7 boiler being 825 mg/Nm^3 (dry air, 273K, 101.3kPA, 6% ref O2). As the volumetric flow and emission concentration is at the same reference conditions there is no difference between the emission rate calculated using the 11% or 6% reference oxygen content.

The monitoring from K7 of unabated emissions showed concentrations were 270 mg/Nm^3, and the measured oxygen content was 15.7% on a dry basis. Therefore, corrected to the 6% reference oxygen content, this equates to a NOx concentration of 763.5 mg/Nm^3 (dry air, 273K, 101.3kPA, 6% ref O2). The dispersion model was set up using an emission concentration of 550 mg/Nm^3 therefore for those scenarios with emissions from the K7 boiler the impact will be underpredicted. This includes the following scenarios:

- Normal operations – limits case; and
- MDF 1 and 2 offline - worst-case emissions.

The dispersion modelling has been re-run for the above scenarios and the impacts predicted and the results presented in the following tables.

Revised Table 9.1: Summary – Normal Operations				
Scenario	Annual Mean (as % of AQAL)		99.79%ile of 1-hour Mean (as % of AQAL)	
	Max Outside the Site Boundary	Max at an area of relevant exposure – i.e. residential areas	Max Outside the Site Boundary	Max at an area of relevant exposure – i.e. residential areas
Process Contribution				
NOx based on BAT AELs and ELVs (Limits)	22	21.5	35	18.5
PEC				
NOx based on BAT AELs and ELVs (Limits)	54.8	54.3	48.1	31.6

Revised Table 9.3: Summary – MDF 1 and 2 Offline				
Scenario	Annual Mean (as % of AQAL)		99.79%ile of 1-hour Mean (as % of AQAL)	
	Max Outside the Site Boundary	Max at an area of relevant exposure – i.e. residential areas	Max Outside the Site Boundary	Max at an area of relevant exposure – i.e. residential areas
Process Contribution				
MDF 1 and 2 Offline – Worst-case emissions	34	28	60	28
PEC				
MDF 1 and 2 Offline – Worst-case emissions	66.8	60.8	73.1	41.1

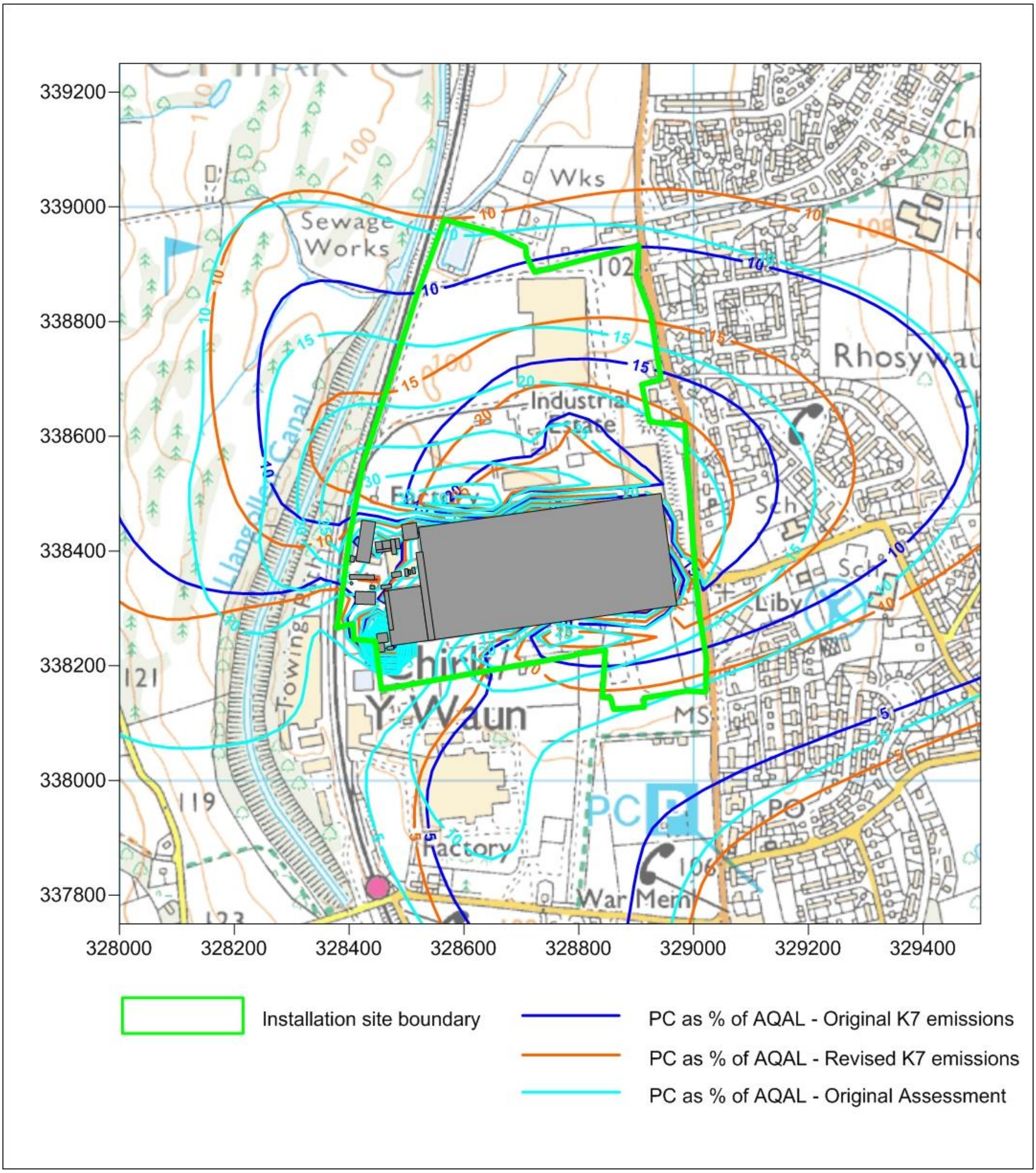
The original modelling was undertaken using ADMS 5.1 and the revised modelling has been undertaken using ADMS 5.2, therefore in addition to changes to the emissions from the K7 boiler the above results also take into account changes to the dispersion model.

For comparison purposes the following plot shows the annual mean nitrogen dioxide impact as a percentage of the AQAL for Normal Operations scenario with for the limits case using the 2011 weather data:

- As presented in the original Dispersion Modelling Assessment – ADMS 5.1 – in cyan;
- Updated dispersion model ADMS 5.2 – not changes to emissions from K7 – in blue; and
- Updated dispersion model ADMS 5.2 – and updated emissions from K7 in orange;

As shown there is a change between the two versions of the dispersion model. ADMS 5.2 generally predicts a lower impact than using ADMS 5.1. This is as result to refinements to the way the model calculates the results between the building wake effects and free flow. The changes to the emissions results in a slightly greater impact, as expected due to the higher amount of NOx released. However, the results show that this is not a significant impact. In any case this would only occur for very short periods.

Figure 1 – Annual Mean NO2 – Normal Operations – Limits Case



(5) Table 2 "Summary – All Driers Offline – Emergency Only" on page 10 of the original Schedule 5 response, contains a column for the 99.79%ile of 1-hour mean (as % of AQAL), maximum outside the site boundary. This column shows that the process contribution against the daily ELV and the process contribution against the half hourly ELV are the same. Furthermore, the PEC associated with the daily ELV is the same as the PEC associated with the half-hourly ELV.

Please explain why the predicted impacts associated with the half hourly ELV are the same as those associated with the daily ELV, given that the half hourly ELV is twice that of the daily ELV in the Wrexham County Borough Council permit (WCBC/IPPC/03/KR(V3)). Please also update the modelling results associated with this if appropriate.

This is an error when transferring the results into the report. However, as noted in response to question 4, the emissions from the K7 boiler were incorrectly calculated. Therefore, the following table presents the results for all scenarios with the revised emissions from the K7 boiler.

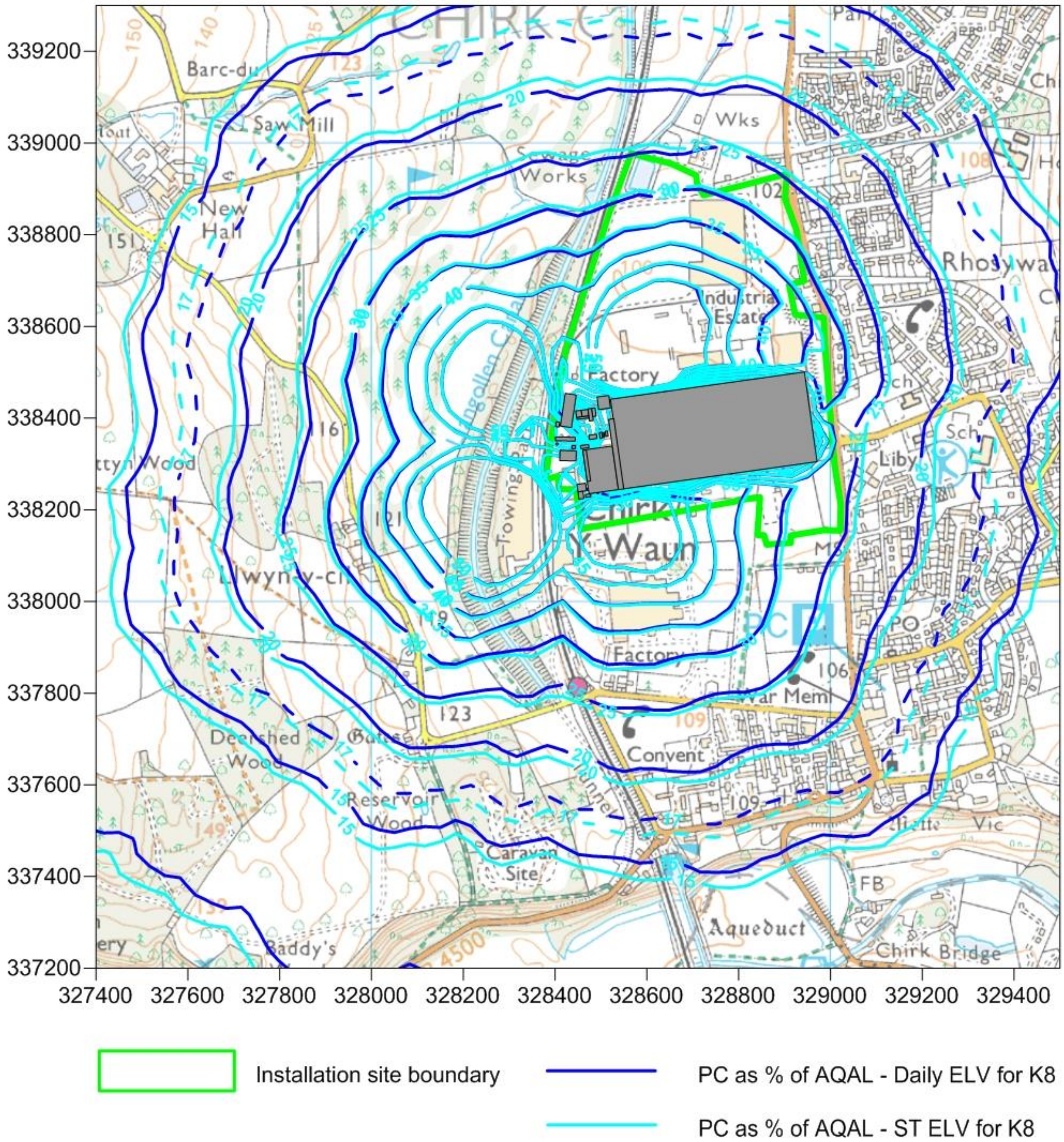
Corrected Table 2 of Sch5 : Summary – All Driers Offline – Emergency Only				
Scenario	Annual Mean (as % of AQAL)		99.79%ile of 1-hour Mean (as % of AQAL)	
	Max Outside the Site Boundary	Max at an area of relevant exposure – i.e. residential areas	Max Outside the Site Boundary	Max at an area of relevant exposure – i.e. residential areas
Process Contribution				
Normal Operations – likely emissions (1)	9	9	15	8
Driers Offline - Likely emissions – K8 Daily ELV (2)	Emergency only		73	30
Driers Offline - Worst-case emissions – K8 Daily ELV (2)	Emergency only		93	35
Driers Offline - Likely emissions – K8 Half-hourly ELV (2)	Emergency only		73	30
Driers Offline - Worst-case emissions – K8 Half-hourly ELV (2)	Emergency only		93	35
PEC				
Normal Operations – likely emissions	42	42	28	21
Driers Offline - Likely emissions – K8 Daily ELV (2)	Emergency only		84	43
Driers Offline - Worst-case emissions – K8 Daily ELV (2)	Emergency only		**106**	48

Corrected Table 2 of Sch5 : Summary – All Driers Offline – Emergency Only				
Scenario	**Annual Mean (as % of AQAL)**		**99.79%ile of 1-hour Mean (as % of AQAL)**	
	Max Outside the Site Boundary	**Max at an area of relevant exposure – i.e. residential areas**	**Max Outside the Site Boundary**	**Max at an area of relevant exposure – i.e. residential areas**
Driers Offline - Likely emissions – K8 Half-hourly ELV (2)	Emergency only		84	43
Driers Offline - Worst-case emissions – K8 Half-hourly ELV (2)	Emergency only		**106**	48
Notes: (1) results using ADMS 5.1, as presented in the Dispersion Modelling Assessment (2) Results using ADMS 5.2				

It should be noted that the actual impact between the operation of the K8 boiler at the daily and half hourly ELV is minimal as the overall impact is dominated by other sources. The plot files show that there is a very small difference in concentration but when rounded the impact is the same with the K8 boiler operating at the daily and half hourly ELV (as shown in the following figure). The exceedences of the AQAL are only predicted to occur if it is assumed that the Bab 2 and 3 driers operate at the BAT AEL. As discussed in the Dispersion Modelling Assessment monitoring has shown that typically emissions are around 100 mg/Nm^3. If it is assumed that the Bab 2 and Bab 3 driers operate as per the likely emissions scenario there are no predicted exceedences of the AQAL.

It should be noted that the dispersion modelling assumes that each item of plant continually operates at the maximum monitored volumetric flow rate and the emissions are at the ELVs. Therefore, all results are conservative.

Figure 2 – 99.79%ile 1-hour NO2 – Emergency Operations – Worst-Case – Effect of K8 Operating at Daily or ST ELV



Appendix A - Updated Site Plan

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