Application for a variation to the Integrated Pollution Control Authorisation AA2488 at Drax Power Station, Selby, and North Yorkshire for the use of coal blended with petroleum coke

April 2007

Contents

1. Executive Summary

Drax Power Ltd (Drax) has conducted extensive tests to establish the environmental impact of burning a blend of coal and petroleum coke in one of the boilers at Drax Power Station. Evaluation of the results obtained has enabled Drax to demonstrate that the burning of blends of coal with blends of up to 20% (on an instantaneous basis, 15% monthly average) petroleum coke, of a similar specification to Motiva is BATNEEC (Best Available Techniques Not Entailing Excessive Cost).

Drax therefore applies for permission under IPC Authorisation AA2488 to burn petroleum coke blends commercially under the following conditions:

- **The petroleum coke will be of similar specification to Motiva petroleum coke, blended with coal**
- **That the petroleum coke is blended with coal to instantaneous blends of up to 20% (15% monthly average).**
- **That the petroleum coke /coal blend is to be burnt across all six units at Drax Power Station.**
- **Up to 120,000t of Petroleum coke/coal blend will be stored in a dedicated section of the existing coal stock yard.**
- **Maintenance of the existing off-site environmental monitoring to identify any local impacts**

2. **Introduction**

In February 2002 Drax submitted an application to the Environment Agency (EA) for a variation of its IPC Authorisation to permit the use of coal/petroleum coke blends of up to 15% petroleum coke by mass (weekly average) on a trial basis. The EA agreed that there was a realistic prospect that allowing Drax to burn a proportion of petroleum coke could be BATNEEC in the longer term. A variation to the IPC Authorisation (BR7178) was issued allowing a trial to allow the gathering of further information for the Agency to more accurately assess potential environmental impacts and to provide economic information regarding a longer term commercial burn.

The Drax application argued that, when using the coal/petroleum coke blend, no substances other than sulphur dioxide (SO_2**)** would be released to air in amounts that might be regarded as significant under the EA's H1 methodology. The EA agreed with the analysis and stated that a trial would not result in any overall environmental detriment. Indeed it was likely that there would be a small net environmental benefit as a result of using petroleum coke.

This BAT assessment is based on extensive trials on Unit 2 from June 2005 to May 2006 using Motiva petroleum coke to characterise the impact of burning a blend of petroleum coke and coal at Drax.

It is believed that the results obtained from the tests on this unit at Drax are representative of the results that would be obtained from the other units at the installation.

Drax applied for an Integrated Pollution and Prevention Control Permit (IPPC) in March 2006 in line with the Regulatory timetable. When issued, this permit will replace the existing IPC permit. However, it is anticipated that this application is likely to come into force before the final determination of the PPC application.

3. Scope

The aims of this application are;

- To identify the significant environmental and economic aspects associated with the burning of a petroleum coke / coal blend at Drax Power Station based on experience gained through the trial.
- To demonstrate that there have been no significant adverse environmental impacts from the trial burn of petroleum coke
- To confirm that these aspects contribute towards a BATNEEC case to burn petroleum coke / coal blends on a commercial basis
- To apply for a variation to site's IPC licence to allow commercial burn at Drax using petroleum cokes of the quality similar to that so far trialled and reported upon.

Drax therefore applies for permission under IPC Authorisation AA2488 to burn petroleum coke blends commercially under the following conditions:

- The petroleum coke will be of similar specification to Motiva petroleum coke, blended with coal (see Table 1 for typical analysis of Motiva).
- That the petroleum coke is blended with coal to instantaneous blends of up to 20% (15% monthly average).
- That the petroleum coke / coal blend to be burnt across all six units at Drax Power Station (see section 7.4 in this document).
- Up to 120,000t of Petroleum coke/coal blend will be stored in a dedicated section of the existing coal stock yard. (see Annex 2 to this document)
- The existing off-site environmental monitoring will continue to identify any local impacts

This report summarises data (including an environmental impact assessment under the EA's H1 methodology) already made publicly available in previous papers and in particular the report of the petroleum coke trial dated November 2006. It is not the intention to reproduce this report in the BATNEEC case; however it is attached as Annex 1 to this application.

The conclusions may be summarised as:-

1. Burning a coal/petroleum coke blend has been successfully demonstrated during the trial period
2. Local ambient and general site dust levels have remained similar to levels measured during coal only operation.
3. There has been no discernible effect on nickel, vanadium or Polycyclic Aromatic Hydrocarbons (PAH) levels in the local environment.
4. There has been no discernible effect on water discharge quality from the station purge, waste water treatment plant effluent or ash mound drains.
5. The quality of the ash has been within the ranges of the United Kingdom Quality Ash Association (UKQAA) published data.
6. Gypsum quality has been maintained within saleable quality during the trial period.
7. Compliance with National Air Quality Standards has been maintained.
8. All success criteria agreed with the EA and local stakeholders for the coal/petroleum coke trials have been met.
9. All current authorised limits have been met during the trial period.
10. There has been a significant reduction in particulate emissions from Unit 2 during the trial.
11. Considering the H1 analysis:-
    i. The variation in EQ_{TOTAL}, which was derived from the measurements made during the Trial, is within the range encountered as a result of normal operational variation. Based on the trial data, the co-firing of petroleum coke blended with coal has no measurable environmental impact.
    ii. The EQ values derived from the trial data show good agreement with those predicted in the BATNEEC Assessment. The values presented are generally similar to or lower than the values originally presented. Based on the trial data, the overall

long-term environmental impact of burning coal/petroleum coke blends is as predicted in the BATNEEC Assessment.

iii. Air dispersion modelling carried out as part of the Station's Annual Review of its Air Quality Management Plan supports the conclusion that no Environmental Assessment Levels for releases are likely to be exceeded as a result of the burning of coal/petroleum coke blend or coal only.

iv. The burning of coal/petroleum coke blends at Drax Power Station presents no threat to Maximum Deposition Rates for land, or Environmental Assessment Levels for water.

12. Handling, transport and transfer operations have had no adverse impact on the environment.

A separate BATNEEC justification has been provided for external storage of blends of petroleum coke and this is given in Annex 2.

4. Description of Trials

The trials were undertaken in order to identify the effects of burning a petroleum coke blend under typical conditions. All plant and off-site ambient monitoring data from the trial have been collected in accordance with agreed Industry / Environment Agency methodologies or, where agreed methodologies do not exist, in accordance with best current practice as agreed locally with the EA.

The coal/petroleum coke blend was supplied to Unit 2. Extensive Baseline Trials were conducted to establish the typical range of emissions and associated impacts from the normal operational regime of the test unit. Separate baseline tests were conducted in order to gain representative results from typical operation and variations within that. During this period, the coals used varied according to their availability on the open market and delivery scheduling.

Following the baseline trials, petroleum coke blend was fired at up to 20% Petroleum Coke (by weight) with average weekly blend ratios of up to 15%. Blending took place on site at a specially built blending plant.

All emission abatement plant was operated throughout the trial as required by the IPC Authorisation.

Within any given time period, there are natural variations in process parameters at large coal fired power stations. The tests at Drax were designed in order to minimise influence from variation in operational and plant characteristics between the baseline and the coal/petroleum coke blend tests. Both sets of tests were carried out over a suitable period of time to characterise ‘normal’ performance under each scenario. This was to enable any significant differences in results between the stages of the trial to stand out.

Emissions when burning petroleum coke blend were within the normal range experienced when burning typical coals alone at Drax. This has been demonstrated through the large quantity of data provided to the Environment Agency and is described in the trial report referred to above. Monitoring of the site's fuel handling, transport and transfer operations also demonstrated no adverse impact on the environment. There have been some data quality and data interpretation issues to resolve, resulting either from the very low concentrations of some of the trace species present in the stack gas, or from the significant 'stratification' of flue gases within the very large ducts present at the Station. This is further discussed in Section 6.3.

Petroleum coke, or blends of petroleum coke and coal, were stored internally throughout the trial. However, to enable commercial burn of petroleum coke blend, external storage of blended material will be required and a separate BATNEEC justification has been provided regarding this aspect of the plant's operation (See Annex 2).

A significant portion of the trial tests concentrated on environmental effects, from increased amount of water and by product sampling and testing to in-stack and extractive tests of the gas stream and tests specifically undertaken to assess the effects of petroleum coke coal blends on the local environment. The monitoring programme for the petroleum coke trial was agreed between the Environment Agency and Drax as a condition of the IPC variation notice (BR7178). The programme was developed between 2002 and 2004 following extensive consultation with the Environment Agency, Local councils, the general public, Public Health Authority, Primary Care Trust and Drax.

5. Petroleum coke analyses

Table 1 shows a summary of the results for the analyses of Motiva petroleum coke during the trial compared to some coals used on the station during the period of the trials.

Table 1: Composition of fuels used.

Element	Unit	Rossington	Maltby	Daw Mill	Scottish	Russian	South African	Columbian	Petroleum Coke
Carbon	%	42.63	42.8	43.65	44.66	45.28	50.43	44.85	81.92
Sulphur	%	1.35	1.13	1.62	0.88	0.57	0.55	0.64	7.12
Chlorine	%	0.51	0.21	0.36	0.06	0.02	0.02	0.04	0.01
Ash	%	15.28	23.78	17.40	15.96	15.07	14.57	10.4	0.41
Moisture	%	13.33	8.86	9.5	11.28	11.43	9.5	12.45	6.7
Net CV	kJ/kg	22957	22443	23617	22381	23412	24085	24710	31609
Nickel	mg/kg	25.25	30.6	38.0	29.19	35.29	82.0	4.85	116.1
Vanadium	mg/kg	32.58	38.2	64.0	38.04	76.0	64.67	18.0	382.86
Aluminium	mg/kg	18000	23000	23500	33933	11708	18667	6500	360
Iron	mg/kg	8653	11000	14200	12133	8096	5000	31.50	250.05
Silver	mg/kg	ND	ND	0.14	ND	ND	0.24	0.04	0.06
Arsenic	mg/kg	10.42	19.60	15.90	6.52	4.34	1.93	6	2.16
Boron	mg/kg	ND	ND	378.5	ND	ND	ND	ND	16.1
Cadmium	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	mg/kg	4.17	5.90	8.10	10.18	4.95	7	1.2	0.58
Chromium	mg/kg	20.17	29.80	32.00	24.83	17.04	19.20	35.0	1.43
Copper	mg/kg	29.00	26.20	47.0	34.71	25.84	24.17	10.0	1.90
Mercury	mg/kg	ND	ND	ND	ND	ND	ND	3.9	1.43
Molybdenum	mg/kg	ND	ND	ND	ND	ND	ND	10	3.22
Manganese	mg/kg	73.00	116.0	185.0	85.0	88.38	86.0	32.5	3.04
Lead	mg/kg	11.00	9.40	18.95	48.08	12.88	37.17	25	1.13
Antimony	mg/kg	0.82	1.06	ND	2.03	ND	ND	ND	6.4
Selenium	mg/kg	ND	ND	ND	ND	ND	ND	ND	5.80
Tin	mg/kg	6.22	1.80	ND	1.81	ND	1.47	1	25.02
Thallium	mg/kg	0.69	0.56	ND	0.46	0.23	ND	1.35	0.40
Zinc	mg/kg	18.33	31.40	30.0	41.28	31.63	ND	11	4.65
Fluoride	mg/kg	ND	ND	ND	13.6	ND	179.0	ND	18.29

As shown in the Table, the concentrations of the majority of trace elements in Motiva petroleum coke are generally lower than coal except for nickel and vanadium.

6. Overview of Trial results

6.1. Introduction

Table 2 describes the dates of the phases and major parameters monitored during the trial.

Table 2 – Description of Tests Undertaken in Trials

BASELINE TRIALS (07/04 – 07/05)	**PETROLEUM COKE TRIAL (07/05 – 05/06)**
Stack Emissions Continuous Emissions Monitors (CEMs): SO_2 , NO_x, Particulate, O_2, CO.	Stack Emissions Continuous Emissions Monitors (CEMs): SO_2, NO_x, Particulate, O_2, CO.
Stack Emissions Extractive Testing: SO_2, SO_3, NO_x, Carbon Monoxide, HCl, HF, Nickel, Vanadium, Dioxins, Furans, PAH, PCB.	Stack Emissions Extractive Testing : SO_2, SO_3, NO_x, Carbon Monoxide, HCl, HF, Nickel, Vanadium, Dioxins, Furans, PAH, PCB.
Ambient Air Monitoring: SO_2, NO_x, PM_{10}, PM_{10},(Ni,) PM_{10},(V), PAH	Ambient Air Monitoring: SO_2, NO_x, PM_{10}, PM_{10},(Ni,) PM_{10},(V), PAH
Water Analysis, Purge, Waste Water Treatment Plant, Ash Mound Drains.	Water Analysis, Purge, Waste Water Treatment Plant, Ash Mound Drains.
Gypsum Analysis: Ni, V, Al, Fe, As, B, Cd, Cu, Cr, Hg, Mn, Mo, Pb, Sb, Se, Zn, F, pH, Dry Solids.	Gypsum Analysis: Ni, V, Al, Fe, As, B, Cd, Cu, Cr, Hg, Mn, Mo, Pb, Sb, Se, Zn, F, pH, Dry Solids.
Ash (PFA & FBA) Analysis: Ni, V, Al, Fe, As, B, Cd, Cu, Cr, Hg, Mn, Mo, Pb, Sb, Se, Zn, Sn, Tl, Ag, Co.	Ash (PFA & FBA) Analysis: Ni, V, Al, Fe, As, B, Cd, Cu, Cr, Hg, Mn, Mo, Pb, Sb, Se, Zn, Sn, Tl, Ag, Co.

The monitoring regime was agreed between Drax and the EA. Where possible, the monitoring protocols agreed centrally between the major UK Large Combustion Plant operators and the Environment Agency as generally embodied within the IPC regime were used. These include:

- National Air Quality Strategy Monitoring Methodology (*Issue 6, March 2003)*
- Continuous Emissions Monitoring Methodology.

Table 3 below describes the standards employed during the trial.

Table 3 - Monitoring Standards Employed in the Trials

PARAMETER	STANDARD
IN STACK MONITORING	
Extractive Sampling;	
Particulate Matter	BS EN 13284-1: 2002
Carbon monoxide	ISO 12039: 2001
Carbon dioxide	ISO 12039: 2001
Oxides of nitrogen	ISO 10849: 1996
Sulphur dioxide	BS 6069 section 4.4
Sulphur trioxide	US EPA Method 8
Hydrogen chloride	BS EN 911 Parts 1 – 3
Hydrogen fluoride	US EPA Method 26a
Nickel, vanadium, mercury	US EPA Method 29
Dioxins / furans	BS En 1948 – 1 – 1997
PCB's	BS En 1948 – 1 – 1997
PAH's	ISO 113381 – 1
In Stack Continuous Emission Monitoring; SO_2, Nox, Particulates	BS EN ISO 14181, Industry Monitoring Protocol. All instruments MCERTS compliant.
AMBIENT MONITORING	
Vanadium, Nickel	Analysed by independent UKAS accredited laboratory.
SO_2, NOx, Particulates	Agreed Industry / Environment Agency Protocols for NAQS Monitoring Methodology.
WATER ANALYSIS	
CW Purge, WWTP Effluent, Ash Mound Drains.	Sampling undertaken by internal staff. Analysis completed by UKAS accredited laboratory.

BY-PRODUCT ANALYSIS	
Gypsum, PFA FBA	Analysed to ensure compliance with agreed sales specifications by independent UKAS accredited laboratory

Independent consultants were employed to monitor ambient levels during the trial and report to Drax. All samples were tested at independent laboratories accredited to international standards.

The in-stack Continuous Emissions Monitors (CEMs) used to supply real time data have all been accredited to the most recent Industry / Environment Agency agreed monitoring protocols and international standards. This includes rigorous calibration and assessment of performance to minimise the effect of uncertainties in the process.

6.2. Continuous Emission Monitor Data Quality.

With particular reference to CEM measurements, the international standard to demonstrate quality assurance of results is EN 14181. To comply with EN14181 a Continuous Emissions Monitor must be shown to meet an extensive set of quality assurance requirements, that is it must meet certain performance characteristics (as stipulated in BS EN ISO 14956). Instrument performance must be validated in all cases by a field trial. MCERTS provides this validation and demonstrates that the instruments meet the required standard. The certified instrument must also meet the monitoring requirements of the specific process or application; this requires assessment of the specific characteristics of the installation to ensure that the monitor results are representative of the conditions in the ductwork.

The procedures described above address the recognised phenomena across the industry and regulatory authorities that ‘stratification’ can occur in the large ductwork associated with combustion plant of this type. Stratification essentially means that at any one time, there will be a variable concentration of stack gases across the cross section of a piece of ductwork. Detailed discussions have taken place between the power industry and the Environment Agency over several years

in order to provide a monitoring protocol which takes this into account and results in representative output from continuous emissions monitors. This protocol has been agreed and all continuous monitoring undertaken during the trial was carried out in accordance with it. The emissions reported in this BATNEEC case have been measured using instruments located in an unstratified zone and hence variability of the measurements across the flue gas duct is not relevant to the analysis.

6.3. Identification of Significant Aspects

The information provided below summarises the full assessments made in the trial report as given at Annex 1 which assessed the following aspects:

- Emissions to Air:
  - Particulates and PM_{10}
  - Metals
  - Sulphur Dioxide
  - Sulphur Trioxide
  - Nitrogen Oxides
  - Trace Organic Compounds
    - PAH
    - Dioxins and Furans
    - PCB
  - Hydrogen chloride
  - Hydrogen fluoride
  - Carbon monoxide
- Releases to Water
  - Station Purge
  - Ash Mound Drains
  - Waste Water Treatment Plant Effluent
- Releases to Land
  - Pulverised Fuel Ash
  - Furnace Bottom Ash
  - Gypsum

Waste Water Treatment Plant Residue

Ambient Monitoring

Particulate PM_{10}

PAH Local Ambient Monitoring

Nickel and vanadium

Occupational Dust levels

This application focuses on the significant or potentially significant effects or impacts of the trial upon the local community and the criteria for significance are based on three principles;

- Differences in fuel analyses. Major differences in components within the fuel and their monitored impacts were assessed. It should be noted that under commercial burn petroleum coke will make up no more than 20% of the blend with coal (as an instantaneous value, monthly average of no more than 15%).
- Issues of public interest as established through the ongoing wide-ranging public consultation exercise. These may not have been identified as potentially significant through comparison of coal and petroleum coke characteristics.
- Assessment of effects described in the Trial Report.

The criteria for significance based above have been applied with regard to:

- Geographical location
- Local environmental conditions.
- Technical characteristics of the plant

An aspect is deemed as ‘not significant’ if there was no discernible change or the effect reduced during the introduction of petroleum coke blends.

Table 4 below describes the potentially significant aspects, based on this analysis:

Table 4 – Identification and Significance of Aspects

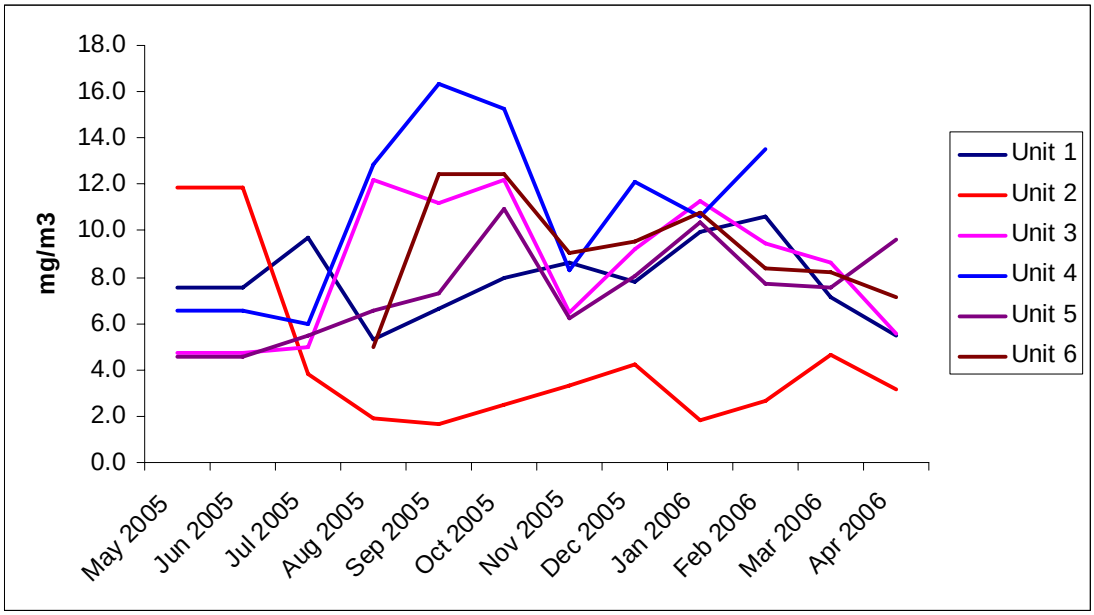
Aspect	Significance
Ambient Particulate Levels	Not significant. Particulate levels reduce when burning petroleum coke due to greater production of sulphur trioxide in the flue gas which enhances the performance of the electrostatic precipitators. Discussed in this document due to public interest and association with emissions of nickel and vanadium.
Ambient levels of nickel and vanadium	Potentially significant due to relatively increased levels in petroleum coke in comparison with typical coals.
Ambient levels of PAH / PCB	Not significant. Measured levels in flue gas during trials were below levels generally anticipated from UK power stations. There was no trend indicating an increase in PAH when burning petroleum coke blend in comparison with the baseline. Measured concentrations close to the Limit of Detection in the stack and hence off-site impacts were not discernible. Measurements at Long Drax and Camblesforth do not demonstrate any impact of the station.
Ambient levels of Dioxins and Furans	Not significant. Measured levels in flue gas during trials were within the ranges used to quantify the emissions from UK large combustion plant for reporting to the Pollution Inventory. The trial did not show adverse trends of emissions when burning petroleum coke. Measured concentrations close to the Limit of Detection in the stack and hence off-site impacts are exceptionally small
Increased levels of antimony, selenium and tin in specification	Not significant. These elements are concentrated in the pulverised fuel ash (PFA) during combustion. Sales of PFA have been unaffected during the trials. See 'Effect on by-products'. Section 6.10.
Stack emissions of sulphur dioxide	This substance was noted in the 2002 BATNEEC application as potentially significant under the EA's H1 methodology. However, the plant's FGD was in operation at all times during the trials and emissions have remained well within authorised limits.
Stack emissions of oxides of nitrogen	Not significant. Normal operation requires combustion optimisation to minimise formation of oxides of nitrogen. Discussed in this document as an issue of public interest.
Effect on water	Not significant. Analyses show no identifiable trends attributable to petroleum coke trials. Discussed in this document as an issue of public interest.
Effect on by-products (ash and gypsum)	Not significant. By-product sales have not been affected throughout the trials. All materials continued to be within specification. Discussed in this document as an issue of public interest.

Those aspects described as potentially significant are described in further detail below. All analyses are based on findings in the trial report (Annex 1), where full data, analysis and justification for the summary conclusions can be found.

6.4. Particulate Levels

The BATNEEC case submitted to, and accepted by, the Environment Agency for the trial indicated that the particulate emissions from the plant would decline as petroleum coke was burnt due to an increase in the efficiency of the particulate arrestment equipment. Evidence from the tests has confirmed this; Figure 1 demonstrates a reduction of 50-70% in particulate emissions from Unit 2 during the trial. This decline in particulate emissions can be attributed to the increase in SO_3 generated within the boiler and the related change in the surface chemistry of the dust particle which is beneficial for abatement by the electrostatic precipitators.

Figure 1. Total Particulates Levels Measured Across all units by station CEMS (48hr mean values).

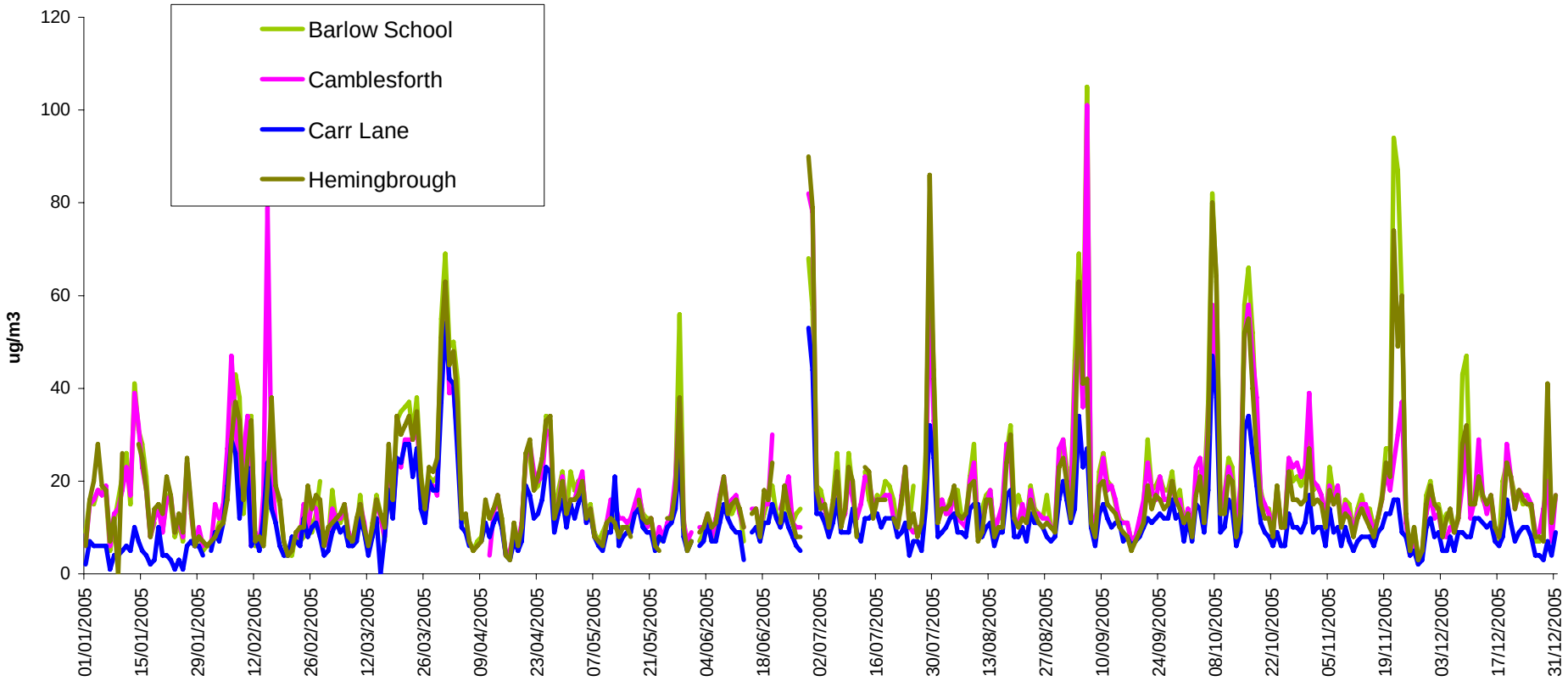


6.5 BAT Assessment - The measurement of particulate in the vicinity of the plant

Particulate matter emissions from the stack of Drax, at the current limits of emission, do not contribute significantly to local ambient levels. Indeed, the Environment Agency no longer requires coal fired power stations in England and Wales to monitor for PM_{10} for the purposes of the National Air Quality Strategy.

Figure 2 shows data for the year 2005 from the four monitoring stations located at different points around Drax. It is noteworthy that the same trends for PM_{10} usually tend to occur simultaneously at all four measuring sites that have been located to effectively encircle the power station This phenomenon leads to the conclusion that regional sources are the prime driving force determining local ambient concentrations rather than the emissions from the Power Station.

Figure 2. 24 hourly average PM_{10} measurements at four locations surrounding Drax for 2005.



It is evident that the low concentration of emitted particulate, combined with effective dispersion of flue gases from the Drax chimney is sufficient to ensure that there is little or no measurable effect of the plant on the local environment and hence it is unlikely that the effect of changing fuel diet would be detected.

Conclusion – emissions of particulate matter are not adversely affected when burning petroleum coke and indeed, there is good evidence to suggest that overall levels have reduced from the baseline when petroleum coke is burnt. There is no evidence to indicate that Drax impacts significantly on the local environment although, due to the association between particulate levels and levels of nickel and vanadium, it is proposed to continue monitoring ambient particulate levels under commercial burn conditions. (See Monitoring Proposals, Section 9)

6.6. BAT Assessment - Ambient Levels of Nickel and Vanadium

After combustion, the majority of nickel and vanadium that remains in the flue gas stream is chemically combined within the particulate matter due to the gas temperatures through the boiler More than 99% of particulate matter is arrested in the electrostatic precipitator abatement equipment. The flue gas then passes through the FGD equipment which removes large proportion of any remaining particulate matter, further reducing levels of nickel and vanadium before discharge through the stack. During the trial monitors collected particulate samples (PM_{10}) from the stack gas which have been analysed for concentrations of nickel and vanadium.

The concentrations of nickel and vanadium in the ash on the test unit depend not only on the amount and composition of petroleum coke fed to the plant, but also on the ash content and composition of the coal used. Over the period of the test there has been only a slight observable increase in vanadium and a marginal change in nickel.

Detailed results relating to nickel and vanadium levels in the local environment are summarised in Figures 3-7 indicating

- total dust levels at Barlow and Hemingborough (Figure 3)
- concentration of Ni and V in the collected dust (Figures 4 and 5)
- Ni and V concentrations in ambient air derived from the above (Figures 6 and 7)

Figure 3.Total PM_{10} dust levels in the local Environment

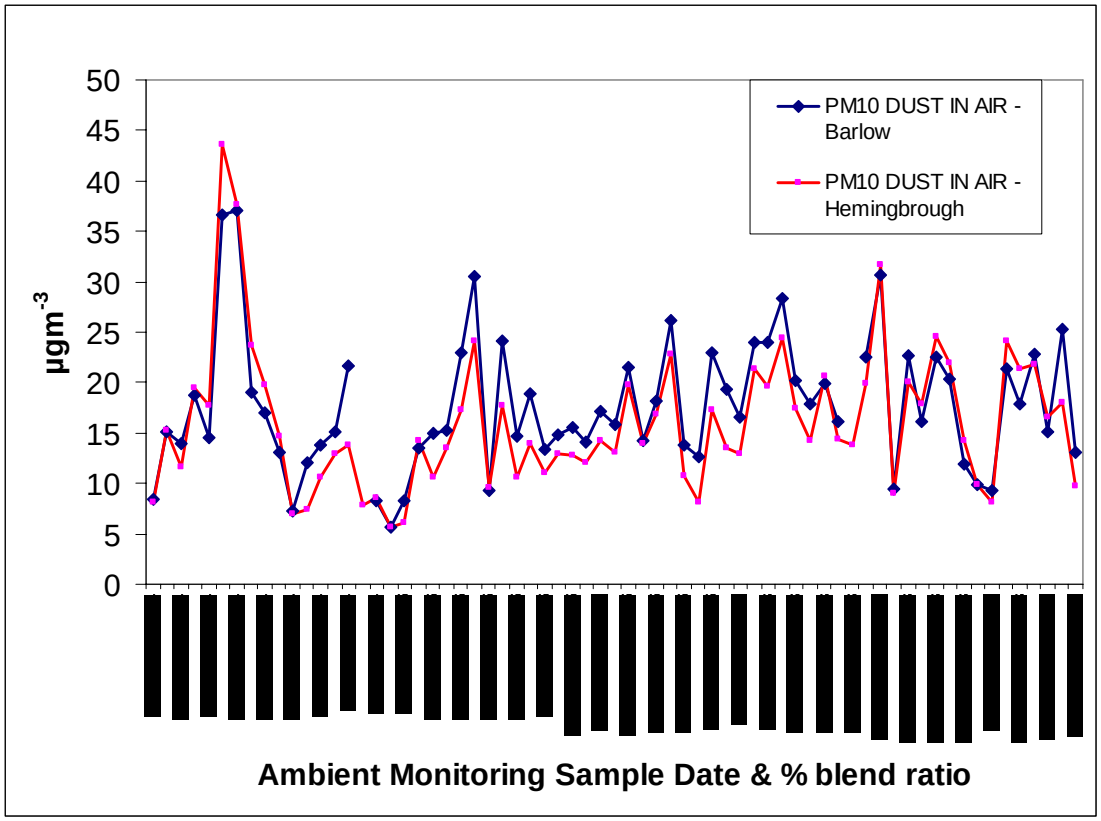


Figure 4. Nickel in the PM10 in the local Environment

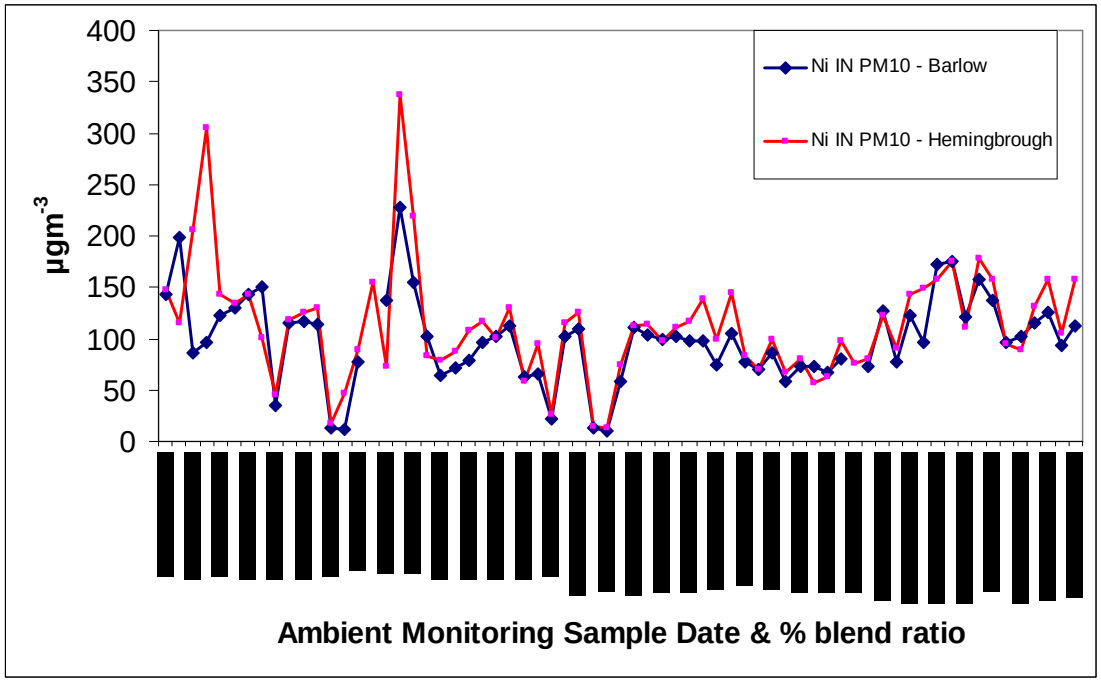


Figure 5 Vanadium in the PM10 in the local Environment

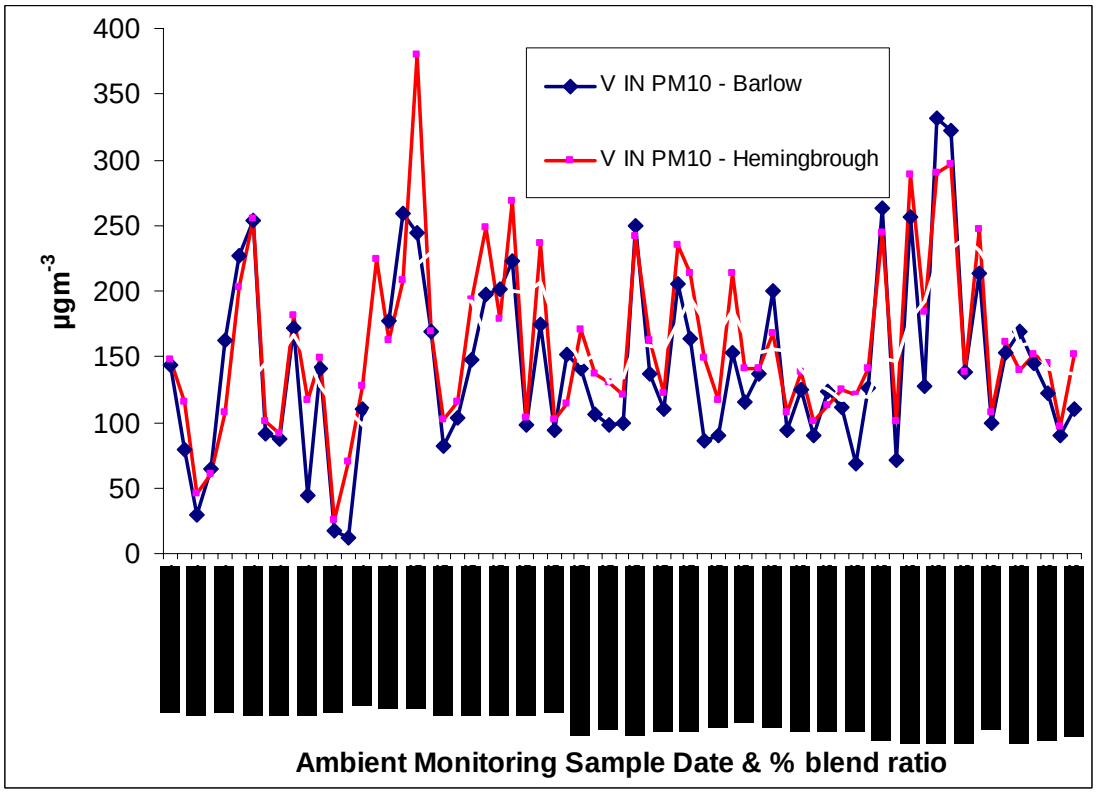


Figure 6. Ambient air concentrations of Nickel

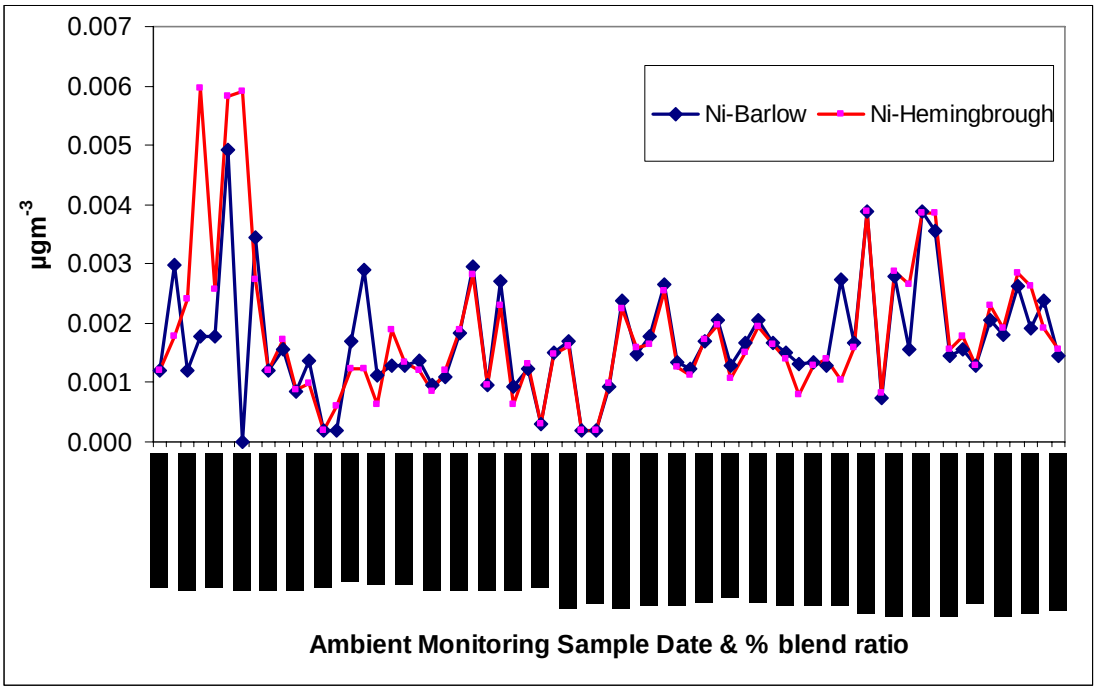
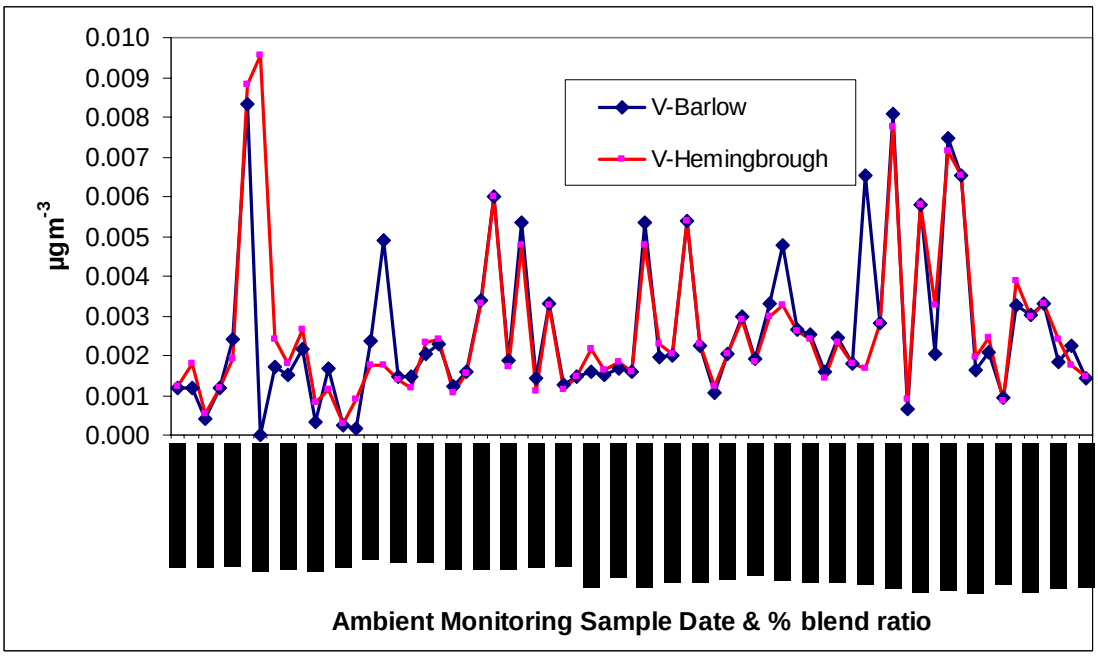


Figure 7. Ambient air concentrations of Vanadium



These data indicate an excellent degree of agreement between the nickel and vanadium concentration data collected at Barlow and Hemingborough, with similar concentrations being experienced at these geographically opposed sites at similar times. This leads to the conclusion that the power station has little effect on local particulate concentrations at these measuring points and that the metal concentrations in the dust reflect regional effects rather than local sources.

It is clear that whilst particulate levels have exhibited a degree of variability over the period of the tests (including the period before the petroleum coke test) the concentration of metals in the dust has not shown any significant change. There is therefore no evidence that Drax Power Station, or the petroleum coke test, is responsible for any detectable change in metal concentrations in the local environment.

Levels of nickel and vanadium measured in Barlow and Hemingbrough air sampling deposits are at low levels compared to the World Health Organisation (WHO) guidance levels (currently 5 µg m^{-3} for vanadium and 1 µg m^{-3} for nickel). The current average levels measured since June 2005 are around one six hundredth of the WHO levels for Ni and around one sixteen hundredth of the WHO guidance level for vanadium.

Ni Barlow = 0.0016 µg m^{-3} (0.16% of the WHO Ni guidance figure)

Ni Hemingbrough = 0.0017 µg m^{-3} (0.17% of the WHO Ni guidance figure)

V Barlow = 0.0025 µg m^{-3} (0.06% of the WHO V guidance figure)

V Hemingbrough = 0.0025 µg m^{-3} (0.06% of the WHO V guidance figure)

Modeling exercises (reported in the site's March 2006 application to the EA for a permit under the PPC Regulations) have also demonstrated no adverse effect of emissions of nickel and vanadium..

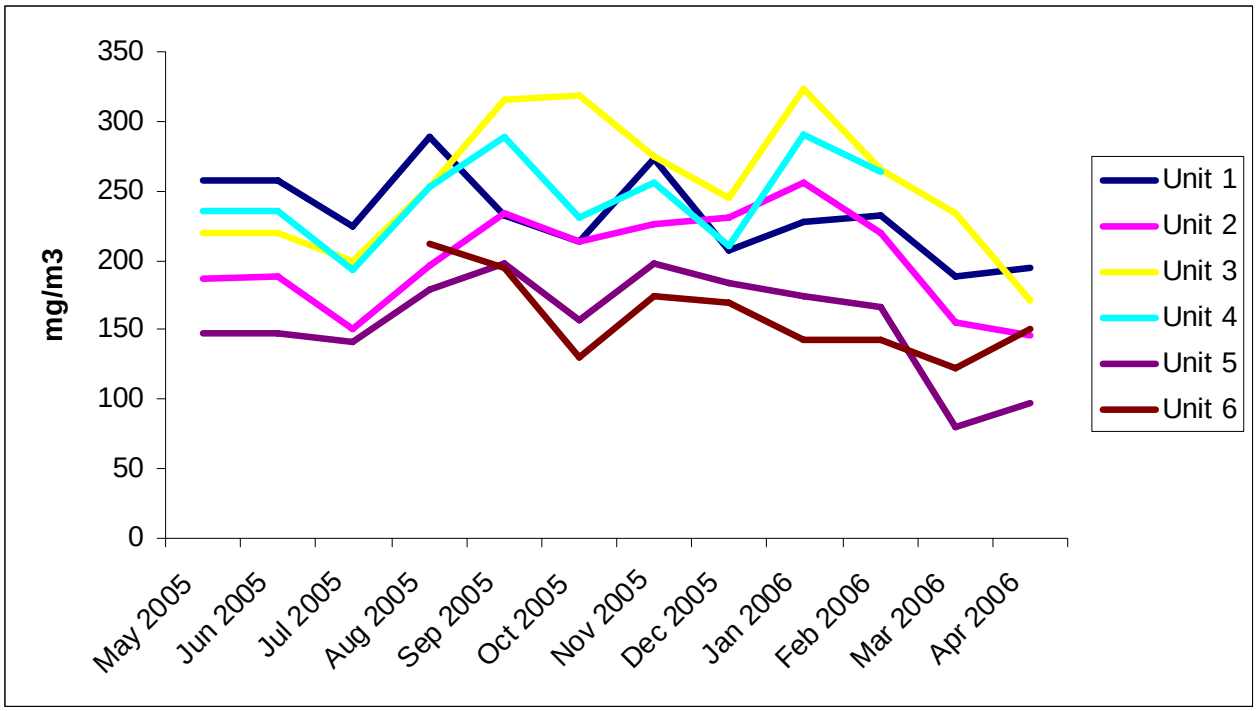
Conclusion – Nickel and vanadium levels are assumed to be closely associated with particulate emissions from the power station. Since the combustion of petroleum coke has demonstrated a corresponding reduction in the emission of particulate matter, the overall emission of these elements has been reduced. There is no evidence to indicate that Drax impacts significantly on the local concentrations of environment with measured nickel and vanadium levels being a minute fraction of levels at which there might be health concerns. Because of the public interest with regard to levels of nickel and vanadium, it is proposed to continue analysis for these substances during the commercial burn of petroleum coke. (See Monitoring Proposals in Section 9 below.)

6.7. BAT Assessment – Stack Emissions of Sulphur Dioxide

The level of sulphur in petroleum coke is greater than that in typical coals for Drax. Drax is fully equipped with FGD which removes over 90% of the sulphur dioxide from the flue gas. FGD was in operation at all times during the trial period.

Drax currently has a mass emission limit for sulphur dioxide which will decrease significantly from 2008 onwards as legislation associated with the Large Combustion Plant Directive comes into operation. In addition to this limit, the Environment Agency has identified a BAT benchmark emission level of 1.8t/GWhr (equivalent to around 400mg m^{-3}) to be applied across the plant, for implementation from 2008. The results from the trial demonstrates that during both the baseline and the petroleum coke tests emissions were generally below this future benchmark level and similar to non petroleum coke operation. Figure 8 shows the emissions of sulphur dioxide from all units during the trial – from continuous emissions monitor results (note – the trial took place on Unit 2, all other units were burning typical coals). The absence of a significant increase in emissions compared to the other Units indicates that emissions of sulphur dioxide are not significant with respect to BATNEEC.

Figure 8: Sulphur Dioxide Concentrations (monthly average of 48 hourly averages) in all 6 Units over the Testing Period



Conclusion: The emission of sulphur dioxide is abated by the FGD plant to within the current and anticipated future limits. FGD plant will continue to be in operation whenever petroleum coke is used on a unit under a commercial burn scenario. Continuous in stack and ambient monitoring, as required by the current IPC Authorisation, will continue for sulphur dioxide.

6.8. BAT Assessment – Stack Emissions of Oxides of Nitrogen

Emissions of oxides of nitrogen are mainly affected by two parameters – the nitrogen content of the fuel, and the combustion conditions. During the trial there were variations in the emissions of oxides of nitrogen although this may have been related to the variation in base coals used in the blend, the presence of petroleum

coke or the combustion conditions. The levels throughout the trial however, were within the typical range for Drax. Combustion is continuously optimised to minimise the production of oxides of nitrogen whilst recognising the requirement to simultaneously minimise the level of carbon in ash.

All Units at Drax are currently being fitted with enhanced furnace air delivery equipment to further reduce the emissions of oxides of nitrogen. New limits will be imposed by the Large Combustion Plants Directive (LCPD) from the beginning of 2008. These will reduce the station mass emissions permitted by about half from the current limits. In addition, the Environment Agency has determined a BAT benchmark level to be met from 2008.

Conclusion: Emissions of oxides of nitrogen when burning petroleum coke blends were within the ranges expected when burning a variety of coals and are within current authorisation limits and within the range considered normal when burning a range of typical coals at Drax.

6.9. BAT Assessment – Discharges to Water

Water samples were taken and analysed from the following areas:

- Station Cooling Water Purge System: This is the major use of water on site. Its primary purpose is for the condensation of steam in the condensers. The station drainage system also enters this stream.
- Ash Mound Drains: These collect run-off from the ash disposal site and drainage from beneath Barlow Mound
- Waste Water Treatment Plant Effluent: Water from the FGD process which has been treated prior to entering the station purge system.

Aqueous sampling was carried out during the tests in accordance with the programme agreed with the Environment Agency. Sampling was undertaken by station staff and independent contractors. Analysis was carried out by independent contractors to UKAS standards.

There were no discernible changes in trends in any parameter over the trial period. All results were within the station authorisation limits.

Conclusion: There have been no discernible impacts to water due to the burning of petroleum coke. Monitoring of the water streams will continue as prescribed in the Authorisation during commercial burn of petroleum coke blends.

6.10. BAT Assessment – Effect on By-products

The significant by-products produced by the site are pulverised fuel ash (PFA), furnace bottom ash (FBA) and gypsum. In order to sell these products into some markets, they have to be within strict specifications. By-product sales are important to Drax as an income stream and as a means of minimising environmental impact by recycling. PFA must meet British Standard Quality criteria prior to being processed and sold to the cement industry. This requires a carefully quality controlled product and samples are taken regularly to assess the particle size and carbon in ash values. The petroleum coke trials had no adverse impact on PFA sales. There is a market for all of the FBA produced at Drax. Sales were unaffected when burning petroleum coke blend. Similarly, the quality of gypsum has been carefully monitored since FGD was operational at Drax as a requirement to ensure that it is suitable for sale. The analysis conducted during the petroleum coke trial demonstrated that there were no adverse trends and that gypsum remained within the specification agreed with the customer

The Environment Agency's guidance for calculating emissions from combustion plant for the purposes of the Pollution Inventory indicates that, during the combustion process all the nickel and vanadium is retained in the ash with slightly enhanced levels in the fine particulate PFA. Since petroleum coke contains higher concentrations of nickel and vanadium than the average coal, it would therefore be expected that the ash from the resulting blend would demonstrate an elevated concentration of these two species. However, the coals used to blend with the petroleum coke for this particular trial contained significantly lower nickel and vanadium than average with the result that the expected change in ash composition could not be detected. The data are shown for PFA in Figures 9 and 10 and for FBA in Figures 11 and 12.

Figure 9: Nickel levels in Unit 2 PFA

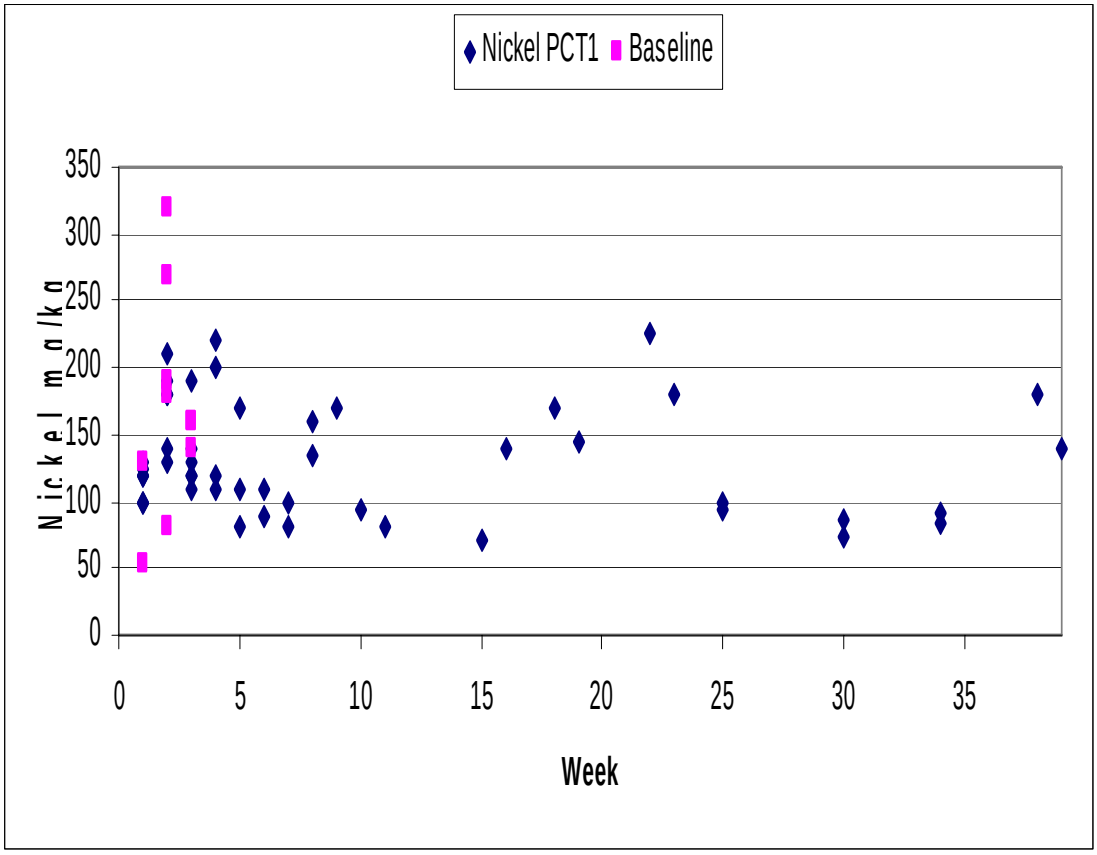


Figure 10: Vanadium levels in Unit 2 PFA

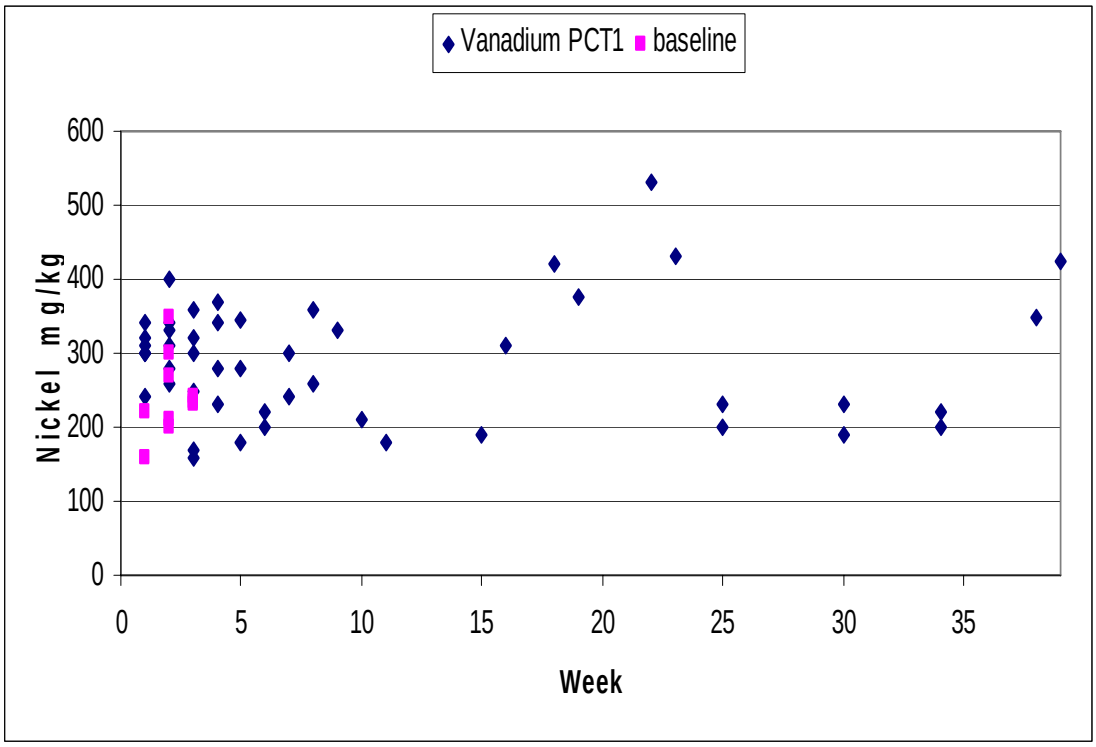


Figure 11: Nickel concentrations in Unit 2 FBA:

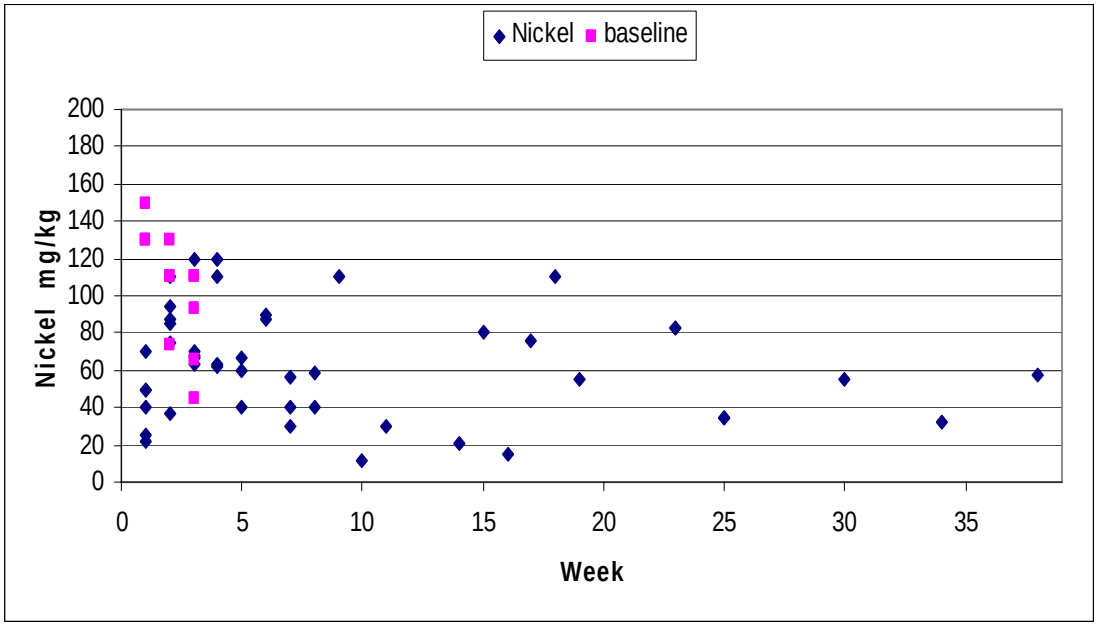
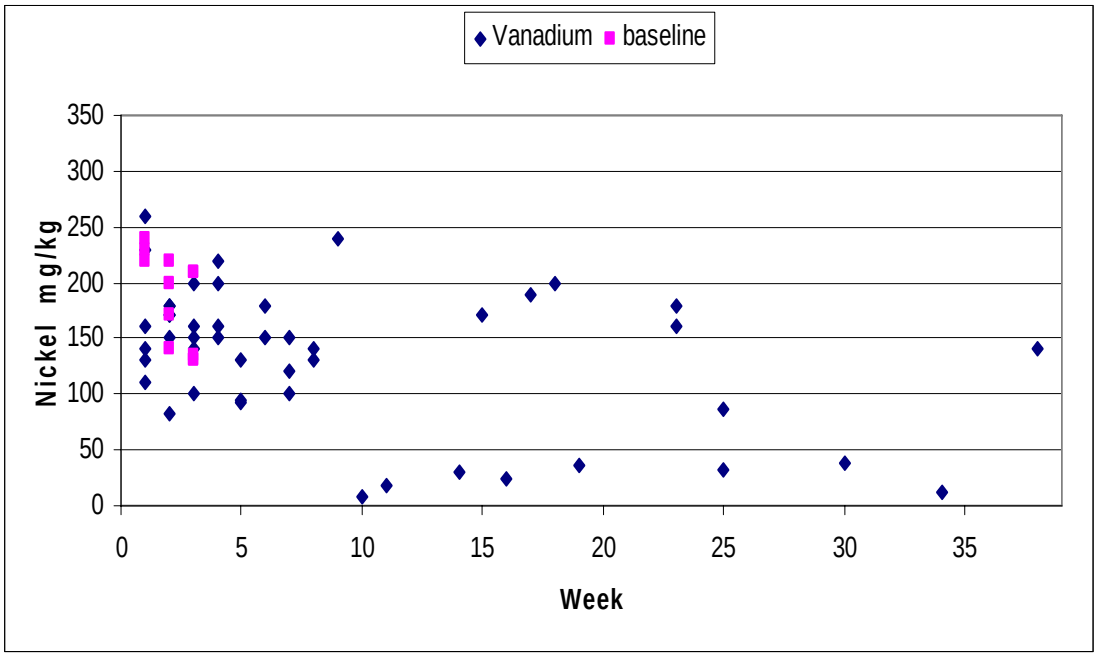


Figure 12: Vanadium concentrations in Unit 2 FBA



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Conclusions: The burning of a petroleum coke blend did not have a discernible impact on the quality of the important by-products produced by Drax although this may be an artefact of the particular combination of petroleum cokes and coals used in this trial. During a future commercial burn of petroleum coke, Drax expects that the effect of petroleum coke on ash quality to be more pronounced although there is an intention to continue to develop the valuable markets for ash, using similar quality controls and specifications.

6.11. BAT Assessment - H1 analysis

Given that Drax intends to move towards a commercial burn of Motiva petroleum coke and hence towards an increase in overall petroleum coke usage, it is appropriate to calculate the environmental impact of the burn using the EA's H1 methodology in order to ensure that no Environment Assessment Levels (EAL) are likely to be approached. For the purposes of this calculation, we have used the exaggerated assumption that 6 units at the station burn a 20% petroleum coke/coal blend at a similar load factor of around 68% using the FGD at all times and with a pessimistic assumption of a precipitator performance resulting in a particulate emissions of 25mg/Nm^3 from all units). The average Nickel and Vanadium concentrations in the ash when using Motiva-quality petroleum coke (with concentrations of Ni and V of 116 and 383ppm respectively – see Table 1) will increase for Nickel from 30.4 to 47.5 mg/kg and for Vanadium from 47.8 to 114.84 mg/kg.

Table 5. Ni and V Metals Emissions, Modelled Effects against Short Term Environmental Assessment Limits with 20% petroleum coke blend.

	Average Concentration In Dry Coal w/w mg/kg	Concentration in Flue Gas mg/Nm^3	Short Term Ground Level Concentration µg/m^3	Short Term EAL µg/m^3	Short Term Significance Factor
Nickel	47.51	1.35E-02	3.54E-03	30	0.0011801
Vanadium	114.84	2.49E-02	6.54E-03	1	0.06543966

Table 6. Ni and V Metals Emissions, Modelled Effects against Long Term Environmental Assessment Limits with 20% petroleum coke blend.

	Average Concentration In Dry Coal w/w mg/kg	Concentration in Flue Gas mg/Nm^3	Long Term Ground Level Concentration $\mu g/m^3$	Long Term EAL $\mu g/m^3$	Long Term Significance Factor
Nickel	47.51	1.35E-02	3.52E-05	50	7.0412E-05
Vanadium	114.84	2.49E-02	6.51E-05	No EAL	-

The lack of significance of potential worst case deposition is evident from these data with all Significance Factors being much less than unity.

A comparison of the Total Environmental Quotients (a quantitative measure of the environmental impact of the process) derived from measurements made during the trial against those predicted in the BATNEEC Assessment is presented in Annex 1 with the following conclusions:

- In the case of sulphur dioxide, the release rates in the Trial Assessment are significantly lower than those in the BATNEEC Assessment. The Trial values are less than 40% of the original BATNEEC values due to the reduction in the sulphur content of the baseline coal; the BATNEEC Assessment used baseline coals with an average sulphur content of around 1.4%, whereas the Trial Assessment used coals with sulphur contents ranging from 0.55% to 1.62%, and an average sulphur content of 0.96%.
- The variation in Total Environmental Quotient which was derived from the measurements made during the Trial is within the range encountered as a result of normal operational variation. Based on the trial data, the co-firing of petroleum coke blended with coal does not demonstrate adverse environmental impact.

- The Environmental Quotients derived from the trial data show good agreement with those predicted in the BATNEEC Assessment. The values presented are generally similar to or lower than the values originally presented.
- Based on the trial data, the overall long-term environmental impact of burning coal/petroleum coke blends is as predicted in the BATNEEC Assessment.

6.12. Overall Effect on the Environment

From the discussion above and the more detailed assessment provided in the Trial Report of the effects of burning petroleum coke blends, it is evident that it is unlikely that there will be any significant negative effect on the environment as a whole. Testing has demonstrated that whilst burning blends over a representative period of time and under a range of conditions, emissions do not approach IPC limits or any relevant guidelines. A summary of the conclusions is reproduced in Table 7.

Table 7.Summary of Environmental Conclusions

Aspect	Summary Conclusion from Trial
Ambient Particulate Levels	Emissions of particulate matter are not adversely affected when burning petroleum coke and in most cases, would be expected to reduce.
Ambient levels of nickel and vanadium	Nickel and vanadium levels are assumed to be closely associated with particulate emissions from the power station. Since the combustion of petroleum coke has demonstrated a corresponding reduction in the emission of particulate matter, the overall emission of these elements has been reduced. Nickel and vanadium levels measured in the local environment are a minute fraction of levels at which there might be health concerns.
Stack emissions of sulphur dioxide	The emission of sulphur dioxide is abated by the FGD plant to within the current and anticipated future limits. FGD plant will

	continue to be in operation whenever petroleum coke is used on a unit under a commercial burn scenario.
Stack emissions of oxides of nitrogen	Emissions of oxides of nitrogen when burning petroleum coke blends are within the ranges expected when burning a variety of coals and are within current authorisation limits and within the range considered normal when burning a range of typical coals at Drax.
Effect on water	There have been no adverse impacts to water due to the burning of petroleum coke.
Effect on by-products (ash and gypsum)	The burning of a petroleum coke blend did not have an adverse impact on the quality of the important by-products produced by Drax.

Given that the conditions in the trial were representative of commercial operations, the conclusions give confidence that future emissions will not increase overall harm from operations at Drax when burning a blend of petroleum coke. Indeed it is anticipated that there would be a net environmental benefit to the local environment, principally as a result of lower particulate emissions.

7. BATNEEC Assessment – Economic Justification

7.1. Introduction

In January 2002, the then owner of Drax Power Station (AES Drax Power Ltd) submitted an application for a Non-substantial Variation to its Authorisation No. AA2488 to carry out an extended trial of up to eighteen months on a single unit. The proposal included a BATNEEC (Best Available Techniques Not Entailing Excessive Cost) assessment of the options potentially available for burning a blend of coal and petroleum coke on a long-term commercial basis, having due regard to the BPEO (Best Practicable Environmental Option).

The appraisal demonstrated that burning coal / petroleum coke mixtures on up to six units could give a beneficial overall reduction in environmental impact when burning only coal, compared to coal / petroleum coke blends. It supported the rationale behind carrying out an extended trial - burning coal / petroleum coke blends on one unit - as part of a process to assess the operational suitability and the technical impact on the plant of long-term use of coal / petroleum coke blends.

The main economic driver for using petroleum coke at the time was that the electricity market did not (and still does not) allow for the additional costs associated with electricity generation in plant equipped with FGD and that the predicted reduction in overall cost of burning such blended fuels will allow the Station to offset the additional costs linked with the operation of FGD. Indeed it was argued that burning a coal / petroleum coke blend of 15% in all six boilers at the forecast 2002 load factor (58%) would offset some £20 million per annum of the £30 million per annum total cost of FGD.

The downward movement in wholesale electricity prices between 2000 and 2002 which underpinned the 2002 BATNEEC assessment was indeed sufficiently sharp

to precipitate a refinancing of the company. The plant has been owned by Drax Power Limited since December 2003.

7.2. Current Fuelling Strategy

Whilst the concerns related to an inability to recover the costs related to operating the FGD are still present, the market place has changed considerably since 2002.

-The Large Combustion Plant Directive has encouraged the construction of further FGD at other coal stations, thereby 'levelling the playing field' somewhat;

- Selby coal field has closed (as well as several other UK pits) forcing a very different fuelling strategy on to Drax. It is this issue which is now the critical parameter in determining the role of petroleum coke at Drax.

Drax was designed and built to burn local high sulphur, relatively low quality coal and this has always been its predominant feedstock fuel. Up until 2004 very little international coal had been burnt at Drax which had largely been serviced through legacy indigenous fuel contracts and the renewal of these contracts in 2001 when HMG provided operating and investment subsidies to enable UK producers to compete with international suppliers.

During 2003 & 2004, against a continuing background of colliery closures and declining output levels from UK pits, Drax undertook a programme of coal trials and test burns to establish a portfolio of approved international coals which could be burnt at the station. Significant volumes of international coal started to be burnt from winter 2004 onwards.

Over the last five years coal burn has been as given in Table 8:

Table 8. Fuel burn at Drax

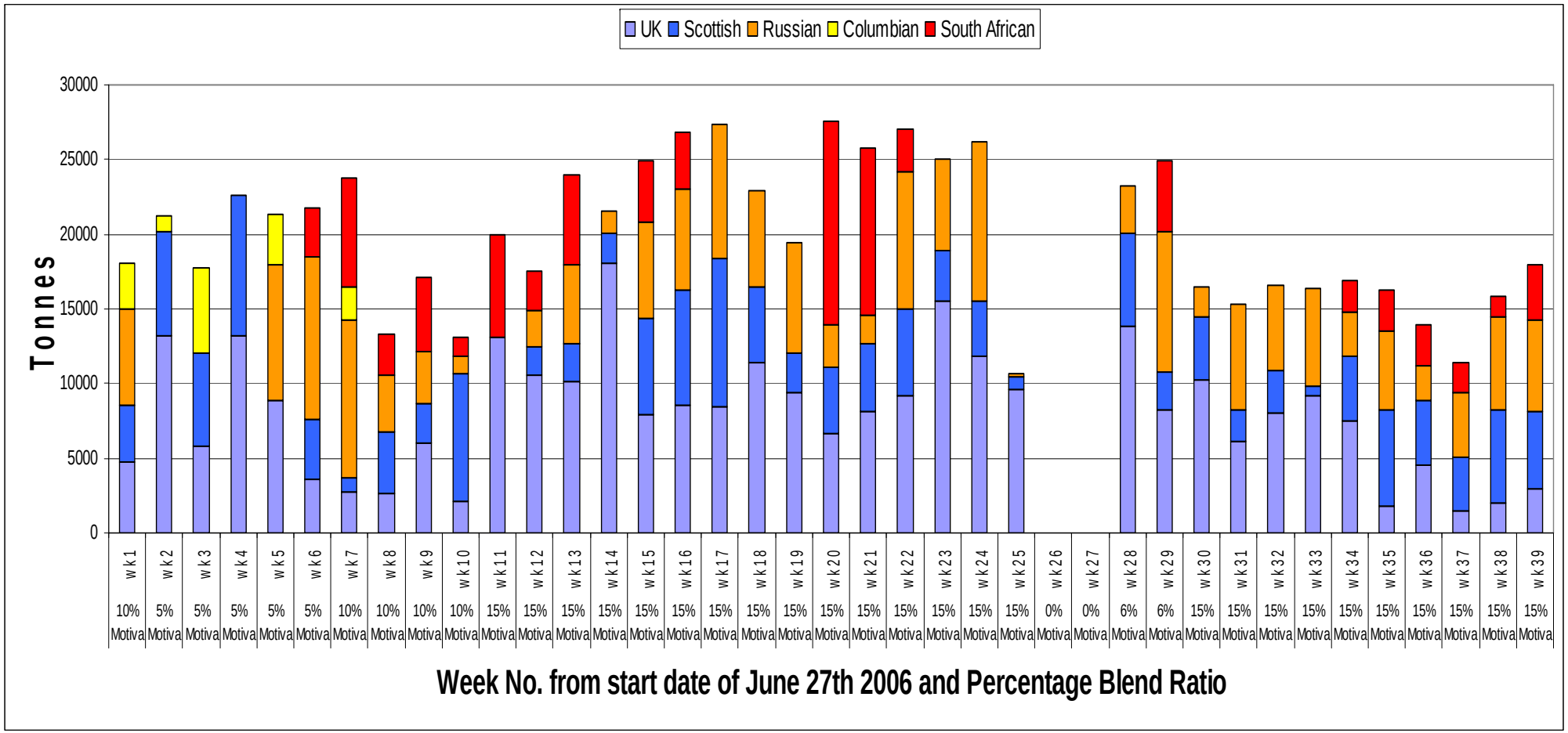
Year	Total coal burn ('000 t)	International coal
2002	7,336	NIL
2003	9,801	0.129
2004	9,254	1,233
2005	9,292	3,712
2006	10,373	4,858

The aim has been (and continues to be) to maximise the use of reliable indigenous fuel plus an optimal mix of best value international sources, recognising that indigenous coal is usually the most suitable for Drax's boilers and has the shortest logistic routes. However, in recent years it has proved difficult establishing long term reliable supplies from UK pits at the desired level. Some collieries have closed; adverse geological conditions are affecting a number of other collieries with severe doubts about whether mining operations will continue. This means that Drax is increasingly dependent on sourcing its fuel on the international market where there will generally be a trade off between price, quality and logistics. This makes fuelling much less certain with a requirement to manage potentially wide variations in quality and price across a fairly diverse range of counterparties. Added to this is the fact the other UK power generators also have to buy a significant proportion of their coal internationally, such that a large coal fired power station in England has already been permitted to burn petroleum coke commercially, based partly on an economic justification.

The practical implications of this are shown well in Figure 13 which shows the source of coals supplied to the petroleum coke trial unit indicating the changing contribution of the UK and imported coals. The overall objective of the company's

fuelling strategy is to establish a portfolio of suitable fuels which Drax can access and to select the optimum commercial mix at any time. To this end Drax has tested a range of high and low volatile international coals, and low sulphur fuels together with petroleum coke and biomass. Further testing will continue into the future as different fuels are made available and others become either difficult to obtain or demonstrate unacceptable operational / environmental characteristics.

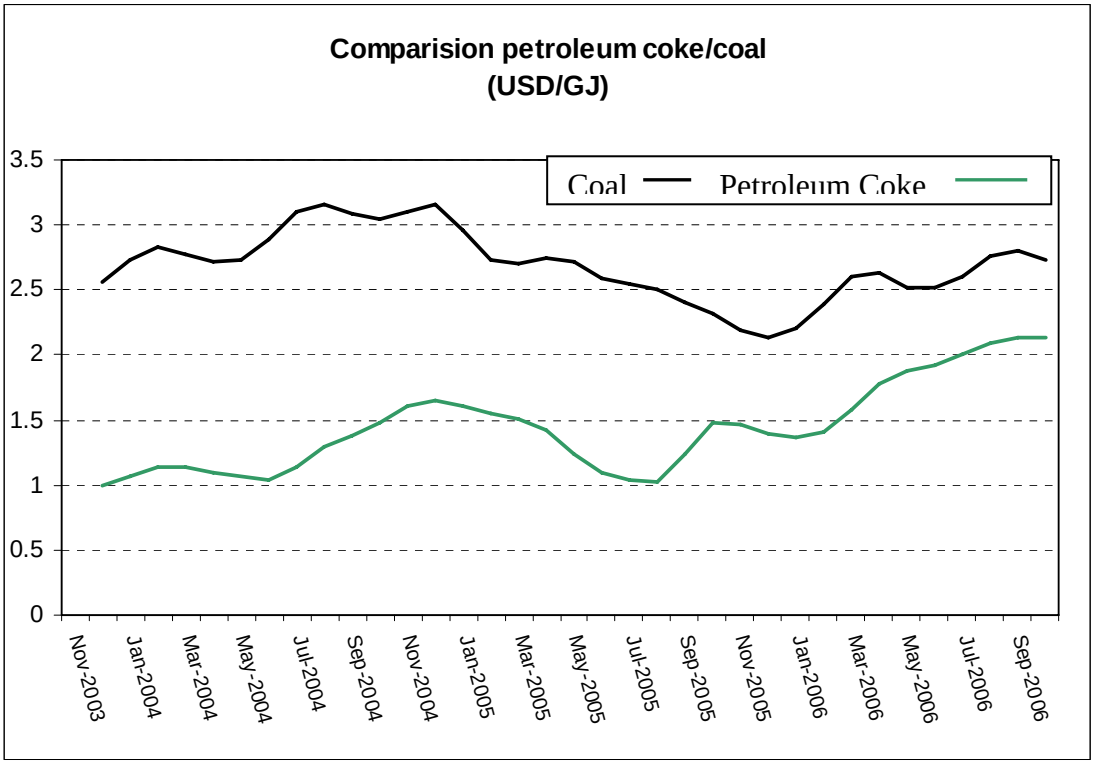
Figure 13: Coal Supplied to Trial Unit during Phase 2:



7.3 Fuel Costs

Petroleum coke is therefore one of the fuels which Drax needs to have available as a component of any future fuelling strategy. The amount of petroleum coke that Drax will burn going forward will depend on the price of petroleum coke relative to coal – historically petroleum coke has been between 50% and 75% of the price of coal as well as the balance of other fuels available. Figure 14 shows the relative costs (moving average) of the fuels over the last 3 years.

Figure 14. Petroleum coke and coal price history



The chart shows that the average price of petroleum coke has been consistently below that of coal. This trend is anticipated to continue in the foreseeable future. Commercial burn would enable Drax to optimise this benefit by increasing the size of consignments and benefiting from the resulting economies of scale and by allowing Drax to establish a more influential position in the market. It has to be

noted that these benefits are being exploited by another large UK power station which, similarly to Drax is equipped with Flue Gas Desulphurisation (FGD) equipment.

The use of biomass (particularly energy crop biomass) could significantly increase over the next few years provided that the regulatory frameworks are developed in such a way as to encourage its use. It is Drax's policy to move, over the next few years, towards 10% of the throughput being biomass. Biomass is a high volatile, low sulphur, fuel which has already been burnt in small quantities along with petroleum coke during the 2005-6 petroleum coke trial without encountering any operational difficulties. Indeed the characteristics of petroleum coke are such as to complement those of biomass, making the combination of the two fired in a Unit in similar volumes potentially valuable.

7.4. Boiler Configuration at Drax Power Station

The boilers at Drax were built in two stages. The first half of the boilers (units 1 – 3) were built in the 1970's. The second half were built in the 1980's. The second half units benefited from the experience gained from the earlier units and due to advances in technology were designed to further optimise combustion conditions. The main differences between the two stages is the burner configuration. Units 1 -3 have a 48 burner configuration while units 4 – 6 have a 60 burner configuration. Whilst there are fewer burners in the first stage boilers, some of the burners are rated at a higher energy input. All of the burners on the second stage units are rated at the same thermal input. Many years of operating experience on a variety of fuels has shown that this difference in configuration does not have a significant effect on combustion characteristics of fuel with negligible difference between emissions from units 1 – 3 and units 4 – 6. Hence, given that the second stage units were built using more advanced technology, it is not anticipated that the combustion of petroleum coke blends on the second stage boilers should differ significantly compared to the first stage boilers.

8. Overall BATNEEC Justification

The Baseline and petroleum coke trials were robustly designed to identify any adverse environmental effects associated with burning a blend of petroleum coke with the understanding that if any adverse operational or environmental effects were identified, the trial would be postponed. No immediate effects were identified and the trial continued. Vast quantities of data were collected during the trials in order to identify any effects at very low levels. Drax Power Limited has made the data available to the Environment Agency and has presented information in several public reports.

All monitoring and analysis has been conducted to the highest available industry standards to enable transparency and to ensure the quality of the data. Within the data-sets there is evidence of the inevitable process variables which would be expected due to generation variations and normal fuel type changes. The trial was set for an appropriate timescale to represent these changes and to allow for any significant trends associated with the burning of petroleum coke to be identified.
Taken as a whole, the data gained from the trials have not identified significant adverse environmental impact. In some cases there has been an apparent improvement in environmental performance when burning blends of petroleum coke.

The economics continue to be in favour of burning a blend of petroleum coke and are likely to continue to be given the position of Drax in the market and the availability of secure fuel supplies. Drax proposes that commercial burn commences, with ongoing monitoring as described in section 9.

Data derived directly from the trial so far show that it is BATNEEC to commence commercial burn under the following conditions:

- The petroleum coke will be of similar specification to Motiva petroleum coke, blended with coal (see Table 1 for typical analysis of Motiva).
- That the petroleum coke is blended with coal to instantaneous blends of up to 20% (15% monthly average).

Drax is able to assert that data from the trial as well as detailed knowledge of the plant supports the following condition:

- That the petroleum coke / coal blend can be efficiently burnt across all six units at Drax Power Station (see section 7.4. in this document).

9. Proposed ongoing monitoring under commercial burn scenario

In addition to the existing off-site monitoring, the petroleum coke trial has introduced monitoring of dust, Ni, V and PAH. The testing indicates that there has been no detectable impact of the trial on the local community and this gives confidence that the programme can be cautiously extended to cover increased volumes of petroleum coke. For example, as noted above, the nickel and vanadium concentrations in dust measured at local sites have remained low at less than 0.17% and 0.06% of the WHO guidance levels respectively.

A significant portion of the trial tests have concentrated on environmental effects, from increased amount of on and off site water and by product sampling and testing to in stack and extractive tests of the gas stream and tests specifically undertaken to assess the effects of petroleum coke and petroleum coke coal blends on the local environment. It is proposed that, as the throughput of petroleum coke is increased, these key environmental parameters would continue to be monitored to identify whether significant negative local impacts were identified, at which point further increases would be suspended. The current off-site monitoring programme for the petroleum coke trial was developed following extensive consultation with the Environment Agency, Local Councils and the Primary Care Trust and it is proposed that similar consultation and reporting is maintained in order to maintain the flow of information and views on the trial. It is considered essential that the programme is conducted in a planned and progressive manner with environmental data being discussed prior to embarking on the next phase.

It is proposed that the off-site health and safety monitoring covers the following

- Nickel and vanadium levels in PM_{10} dust collected at Barlow School and Hemingborough
- Poly-aromatic hydrocarbons (PAH) collected at Long Drax and Camblesforth.

- TEOM real time dust collectors at: Barlow School and Hemingbrough Landing. To be augmented in time with systems at Camblesforth and Carr Lane.

- LN15 real time dust collectors at: Camblesforth, Carr Lane, Barlow School and Hemingbrough Landing (to be replaced in time by TEOM monitors).

- Monitoring of SO_2 and NO_x as an integral part of the Aire Valley Air Quality Working Group with sites at Carr Lane, Hemingbrough, Downes Lane, West Bank, Smeathalls Farm and Park Farm

It is proposed that the on-site testing covers the following

- Regular monitoring of coal stock drainage system to address potential concerns regarding petroleum coke storage
- Regular monitoring of airborne dust around coal stock storage area
- Regular monitoring of Ni and V in power station ash
- A single period of in-stack testing for PAH's, Dioxins and PCBs in order to generate more robust emission data

10. Proposed burn programme

Drax Power Limited's overall aim is to establish a programme to increase throughput of petroleum coke towards a commercial burn of up to 15% (monthly average) petroleum coke on 6 units, subject to environmental and operational acceptability. This needs to be done in a planned manner that takes account of petroleum coke availability, fuel logistics, combustion testing and environmental impact assessment. This current application recognises that, to date, full data has only been prepared for Motiva petroleum coke. Hence the commercial burn application is restricted to fuels of qualities similar to that trialled. The current aim is to complete the existing trial programme using different fuel qualities on different units by the end of Quarter 1 2007 and then move to a commercial burn using Motiva-quality fuels in Quarter 2 2007.

Based on the extensive trial and the accompanying assessments, the nature and scale of proposed commercial burn can be described in terms of general characteristics of proposed petroleum coke and scale of operations based on assessed effects on the environment.

The type of petroleum coke to be burnt will have similar characteristics to the types described in Annex 1 to this document (i.e Motiva). The percentage of petroleum coke material included in the blend will be up to around 20% on an instantaneous basis, 15% as a monthly average. It has been demonstrated that at this level, handling and operational performance can be optimised.

11. Storage

Drax operates a dedicated blending facility to produce a consistent high quality mixture of coal and petroleum coke which has been in operation since June 2005. The plant was designed around an existing rail unloading head with very limited underground storage capacity (c. 1000 tonnes). This arrangement has limited the tonnage of each rail delivery and has therefore not permitted optimum effectiveness of transport arrangements.

Drax recognises the need to improve the efficiency of rail deliveries in order to reduce the number of train movements as the rate of use of blended material increases, as is likely to be the case during extended trials or commercial burn of blends. Stocking out will have the added benefit of improving the consistency of blended fuel supplied to the boilers and facilitating more efficient programming of train movements as well as overall process efficiencies.

The stocking out process would be similar to existing short term coal stocks in that 'turnover' of the material would be fairly rapid, stocks would be continuously stocked out and reclaimed according to process requirements. Stocking out and reclaim operations would be conducted according to established methods which are standard across the industry.

The maximum tonnage of blended coal and petroleum coke stored will be 120 thousand tonnes (kt) at a maximum average percentage blend ratio of 20% petroleum coke in coal. This represents the blend proportion accommodating approximately 4% of the maximum coal stock capacity implying that the pure petroleum coke component would represent approximately 0.8% of stock capacity. Although the storage of blended material does not present a risk of adverse environmental impact, a period of 12 months of environmental monitoring is suggested as a precautionary measure and to identify any longer term requirements.

The proposed storage area is a discrete section of the coal stock which would be dedicated for the storage of petroleum coke / coal blend as described in this document. A full justification of this is given in Annex 2.

12. Conclusions

In depth analysis of the high quality monitoring data gathered during the trial period has demonstrated no adverse impact on the environment as a result of burning blends of a single petroleum coke with coal. The economic case for burning petroleum coke continues to be robust, with additional factors becoming apparent since the initial application was made. Drax proposes to undertake commercial burn of petroleum cokes, with agreement of the Environment Agency under the requirements identified through assessment of this application.

- Commercial burn of a blend would be economically advantageous to Drax and would not cause adverse environmental impact. Rigorous testing over a substantial trial period has not identified adverse environmental impact and has, in some cases, demonstrated an improvement in environmental performance.
- On balance, the environmental impact when burning petroleum coke blends is either beneficial or neutral when compared to the base case. Not burning petroleum coke would not be BATNEEC.

In conclusion Drax considers that the following represents BATNEEC

- A commercial burn of petroleum coke, of similar specification to Motiva petroleum coke, blended with coal, across all 6 units
- That the petroleum coke is blended with coal to instantaneous blends of up to 20% (15% monthly average).
- Up to 120,000t of Petroleum coke/coal blend will be stored in a dedicated section of the existing coal stock yard.
- The existing off-site environmental monitoring will be maintained to identify any local impacts
-