FINAL REPORT

Castle Peak Power Company Limited

EIA of the Proposed 6000MW Thermal Power Station at Black Point: *Key Issue Assessment*

Air Quality

September 1993

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ERM

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Project No. C1036

For and on behalf of ERM Hong Kong
Approved by: A H Lawston
Position: Project Manager
Date: 10th September 1993

1 *SCOPE*

The Air Quality Key Issue Assessment (AKIA) focused on the following potential impacts:

- human health impacts resulting from stack emissions of SO_2 and NO_x and
- ecological impacts from increased levels of regional acidification.

The IAR concluded that there was no risk of the LTPS causing either the 24-hour or the annual average Air Quality Objectives to be exceeded, but that there was sufficient uncertainty surrounding the results of 1-hour average numerical modelling results to warrant further, more detailed analyses as part of a KIA. It also concluded that the potential for acidification through wet deposition required further attention. The key concern was that exceedance of the AQOs might be caused by the LTPS emissions in conjunction with adverse meteorological conditions, even though such occurrences would be infrequent.

2 *CONCLUSIONS*

The KIA revolved around a comprehensive programme of wind tunnel tests, using a scale model of the surrounding terrain. Tests were undertaken for the worst-case operating scenarios, for both the gas-fired and coal-fired options, over a range of wind speeds and directions. The complex-terrain wind tunnel results, in conjunction with a statistical frequency analysis (based on likely probabilities of specific operating scenarios coinciding with meteorological scenarios which would cause AQO limit values to be exceeded) indicated that there would be no significant impacts. This was presented in the Phase 2 Part 2 Report and is reproduced in final form as **Part A** of this report. Supporting Annexes are presented in a separate document.

The conclusions are summarised below.

- *A Coal-Fired LTPS*

  Given the introduction of new, low-NO_x burners at Castle Peak, a coal-fired LTPS with 250m stacks would not cause the NO_2 1-hour AQO to be exceeded at any affected receptors, even allowing for future increase in background levels due to other planned developments. The low NO_x burners at Castle Peak are assumed to reduce source NO_x concentrations from 1100 ppm to 1000 ppm at Station A and to 600 ppm at Station B respectively.

Assuming the employment of FGD to 90% removal efficiency, there would also be no exceedance of the SO_2 1-hour AQO due to emissions from a coal-fired LTPS.

- *A Gas-Fired LTPS*

Assuming a gas-fired LTPS and 100m stacks, only impacts due to NO_x emissions would be relevant. The emissions would be sufficiently lower than from a coal-fired plant to ensure no exceedance of the NO_2 AQO. Reduction in overall NO_2 ground level concentrations could be achieved by reducing NO_x emissions from Castle Peak as decribed for the coal-fired units.

- *A Combined-Fuel LTPS*

With 4 x 600MW gas-fired units together with 4 x 680MW coal-fired units, the NO_2 AQO would not be exceeded at critical receptors. Likewise, the SO_2 AQO would not be exceeded.

- *The Use of Oil in Main Generating Units*

Substitution of fuel oil for coal (with FGD) or distillate oil for gas (without FGD) in the main generating units could be accommodated for any of the scenarios above without causing the AQOs to be exceeded.

- *Open-Cycle Gas Turbine Units*

1000MW of open-cycle gas turbine units with 50m stacks would not cause any AQOs to be exceeded or act as a constraint to planned developments to the south of Black Point. Considering the potential on-site air quality benefits and the reductions in very near-field impacts, 80 m stacks are recommended.

- *Acid Deposition*

Given that Castle Peak power station will be retrofitted with lower-NO_x burners as discussed in the AKIA, there should be no more than a 2% net increase in acid deposition as a result of a coal-fired LTPS (with FGD). For a gas-fired station the net increase would be about 1%. These are insignificant compared with the current year-to-year variation and would not result in any significant impacts.

To overcome residual concerns, however, CLP agreed with EPD that a 'Rigorous Frequency Analysis' should be undertaken to confirm this conclusion. This used the wind tunnel results, together with a seasonal profile of load and actual meteorological observations for a 6-year period, to simulate off-site impacts in detail, for both the LTPS at Black Point and Castle Peak power station. The results, summarised in **Part B** of this report, confirmed the basic conclusions reached in the Phase 2 Part 2 Report and EPD have since taken a position that:

- The air quality impacts of the proposed Phase 1 development of the Power Station (ie 4 x 600MW CCGT units with light industrial diesel oil as back up fuel together with the recommended measures for its design, construction and operation) are acceptable.

- Mitigation measures are available to reduce the air quality impacts of the power station, if coal-fired with heavy fuel oil as back up, to levels that are acceptable by the present air quality standards, on the basis of the current sensitivity of environment and the assumed operation scenarios in this study.

However, an air quality review as outlined below shall be carried out before the final approval of the Phase II development.

3 *ISSUES FOR FUTURE REVIEW*

The comprehensive analyses undertaken have provided a wealth of data with which to assess the likely impacts of all of the development options which have been proposed. The validity of the analytical results is accepted by all parties and the current assessment conclusions which have been reached should remain valid and applicable to future stages of the development, all things being equal. However, at each stage of the development it will be necessary to review the findings of the AKIA, taking into account any subsequent changes relating to:

- operational conditions, fuel characteristics and emissions;

- location of sensitive receptors;

- background air quality at sensitive receptors;

- EPD's requirements for Best Practicable Means of emissions control; and

- air quality objectives.

If the review work indicates that any such changes could possibly invalidate the original EIA conclusions, appropriate further assessment, as agreed between EPD and CLP, will be required in order to achieve a clear and solid basis for planning purposes.

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Part A - Complex Terrain Wind Tunnel Tests

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PART A

COMPLEX TERRAIN WIND TUNNEL TESTS

PART A

COMPLEX TERRAIN WIND TUNNEL TESTS

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1 INTRODUCTION

1.1 BACKGROUND

The Castle Peak Power Company Ltd (CAPCO), a joint venture of Exxon Energy Limited and China Light and Power Company Limited (CLP), plans to develop a power station at Black Point to provide, ultimately, about 6000 MWe. Following a site search in 1990, which recommended Black Point as the best site overall, ERM (formerly ERL (Asia) Ltd) was commissioned by CLP to undertake an environmental impact assessment (EIA) study to provide essential information as inputs to the detailed planning process for the facility. It was decided at the beginning of the study that the EIA would require a Key Issue Assessment (KIA) of the potential impacts associated with emissions of sulphur dioxide (SO_2) and nitrogen oxides (NO_x) from the stacks.

The KIA was structured into three phases:

- Phase 1 provided scoping assessments, using numerical modelling techniques, to direct the subsequent wind tunnel tests towards the most important scenarios of concern resulting from operation of the new power station.

- Phase 2 provides the essential information for the appropriate design of the power station to ensure that offsite impacts will be acceptable. This is based on the results of the complex–terrain wind tunnel tests and predictive analyses of acidification impacts.

- Phase 3 of the study would provide any final, more detailed information required to support the licence application for the new facility, should this be necessary.

This draft report presents the findings and recommendations of Phase 2 of the study.

1.2 PURPOSE AND SCOPE

The purpose of this phase of the KIA is to determine, for each general power station development scenario, what measures would be necessary to make the proposals acceptable with respect to air quality criteria relating to impacts on human health and the natural environment and compatibility with other planned developments. In particular, acceptable specifications for the design and operation of the first units need to be agreed upon as a priority.

The programme of wind tunnel tests was therefore designed to provide the building blocks of information required to predict the human health impacts of the development (resulting from SO_2 and NO_x emissions) under different development scenarios. From this information the design implications associated with any mitigation requirements could be specified.

At this stage the final design of the development has not been decided upon, in terms of the fuel to be used or the power generation plant to be employed. These decisions will be made over the course of the station's development, on the basis of a range of considerations relating to fuel supply and electricity demand. The development scenarios being considered by CLP are presented in *Section 2.3*.

The Initial Assessment Report of the EIA concluded that 24–hr and annual average concentrations of SO_2 and NO_2 resulting from the new power station would be acceptable. It also concluded that any additional acidification of the environment resulting from dry deposition of emitted gases would not be significant. It was proposed and agreed, therefore, that the KIA should focus on human health impacts resulting from effects on 1–hour average ambient concentrations of the gases and any natural environment impacts resulting from *total acid* deposition (i.e. dry + wet).

1.3 *GENERAL APPROACH*

In Part 1 of Phase 2 a programme of wind tunnel tests was proposed to provide most of the information required to achieve the Phase 2 objectives. Initially, 16 test 'options' relating to the new power station were modelled, as well as Castle Peak stations A and B. A preliminary assessment was made of the results, followed by a number of further tests to clarify various points arising from the initial set of results. The test programme is summarised in *Section* 2.

The focus of the tests was on 1–hour average ambient concentrations resulting from the power station emissions. This was to provide sufficient information to identify any credible exceedance of the Hong Kong 1–hour average air quality objectives, (AQOs) and appropriate mitigation measures to be recommended if necessary. The AQOs are expressed as limit values of SO_2 and NO_2 (800 $\mu g\ m^3$ and 300 $\mu g\ m^3$ respectively) which should not be exceeded on more than three 1–hourly occasions per year. In reality, this is virtually indistinguishable from a single–violation criterion and for this reason the 'worst–case' impact scenarios were identified and modelled. As detailed below, this includes worst–case meteorological conditions and maximum emissions scenarios associated with the power stations operating at full load.

In *Section 3* the results of the tests are summarised, highlighting the main points concerning the relationship between plume dispersion and wind speed and direction and the trends of ambient concentration with downwind distance, etc. An assessment is made of the possible impacts associated with the new power station, taking account of a number of important issues which must be considered:

- background concentrations resulting from Castle Peak power station emissions when plumes from Castle Peak and Black Point coincide;
- contributions to ambient air quality from other sources;
- effects on future background air quality along north Lantau due to new developments, including the airport at Chek Lap Kok, industrial facilities and the planned North Lantau Expressway;
- new receptors associated with planned PADS developments to the southeast of the power station and along the north Lantau coast;
- the frequency with which particular wind directions and speeds could cause the power station emissions to affect sensitive receptors; and
- the frequency with which specific wind conditions and operational scenarios might cause the AQOs to be exceeded as a result of total emissions from the power station and other developments.

It should be noted that modelling the worst–case combinations of meteorological and emissions scenarios, as described above, inevitably results in predicted air quality impacts which are generally higher than the very worst which might occur. For the vast majority of the time, impacts will be considerably less than the predictions would suggest. This is examined in *Section 3.2.2* to provide an important complimentary consideration in assessing the real impacts of the proposed development.

In *Section 4* an assessment is made of the potential for acidification impacts on the natural environment for each of the main development options. This is made on the basis of numerical predictions of wet and dry deposition and consideration of the likely significance of any increases in acid deposition due to the new power station's emissions.

2 WIND TUNNEL TEST PROGRAMME

2.1 INTRODUCTION

The tests were undertaken by British Maritime Technology in a large (4.8m wide, 2.4m high and 15.0m long), closed return-circuit wind tunnel which has been used extensively for plume and gas cloud dispersion. The programme and methodology for the tests was previously presented in Part 1 of Phase 2 of the KIA. The test programme consisted of two parts which are presented in the following sections.

2.2 BOUNDARY LAYER AND PREPARATORY TESTS

The first part of the test programme was designed to ensure that the wind tunnel could adequately simulate the actual dispersion characteristics of the atmospheric boundary layer into which the stack emissions would be discharged, using a physical model at 1:2000 scale. *Annex A* presents the results of these tests and compares them against appropriate criteria for judging the acceptability of the simulated boundary layer. Most importantly, the following conclusions were made relating to issues discussed with EPD at the beginning of the Phase 2 work:

- reasonable simulation of an equilibrium sea-state boundary layer was achieved;
- plume rise and concentration were properly simulated at 1:2000 scale;
- near-field interactions between the plumes and buildings were adequately simulated at 1:2000 scale compared with 1:500 scale; and
- the approach flow and the flow around the topographical model were properly simulated, as indicated by Reynolds number independence tests.

Overall it was concluded that a 1:2000 scale model could be used with confidence to obtain measurements of ambient concentrations in the second part of the test programme.

2.3 CONCENTRATION MEASUREMENTS

2.3.1 *LTPS Development Options*

The main development options being considered by CLP can be summarised as follows:

- Base-load generating plant could be made up of:
    - 8 x 680 MW coal-fired units;

  - 8 x 600 MW gas-fired combined-cycle gas-turbine (CCGT) units;
  - a mixture of coal-fired and gas-fired units.

- The base-load plant will need to be able to run on oil as well as coal or gas, to provide additional operational flexibility and, thereby, security of electricity supply.

- Up to 10 x 100 MW open-cycle gas-turbine (OCGT) units, running on distillate oil, will also be required to meet short-term peak lopping and emergency demand.

Source characteristics and emissions data used for modelling each option are presented in *Annex B*.

2.3.2 *Castle Peak Power Station*

The new power station will operate in addition to existing generating plant at Castle Peak. The two will in fact rarely (less than 5% of the time) operate at full load together, as discussed in *Section* 3.2.2. However, due to the relative proximity of Castle Peak to Black Point (about 4km), emissions from Castle Peak power station could influence the significance of impacts resulting from the effect of Black Point emissions on ambient concentrations. This will only be the case when the two sets of plumes overlap in northwesterly and southeasterly winds, as follows:

- The simple merging of the plumes from the two power stations will reduce the capacity of the surrounding ambient air to dilute the concentrations of polluting gases within the plumes. This can be thought of as the Castle Peak plumes providing an elevated background concentration of these gases at the affected receptors, to which the emissions from Black Point will be added. These receptors include Chek Lap Kok airport and the north Lantau coast.

- The physical interaction of the plumes will have some effect on their thermal buoyancy since the heat energy within the plumes will also be dissipated less by the surrounding air. The flat terrain tests in Part 1 of Phase 2 had already indicated that this interaction would help maintain the buoyancy, and thus plume rise, of Black Point plumes after crossing Castle Peak.

For these reasons the wind tunnel tests included emissions from Castle Peak. To measure the effect of Black Point emissions alone, for the relevant wind directions, the Castle Peak plumes were still generated but without any tracer gas present, so that the effects on buoyancy would be properly modelled.

Source characteristics and emissions data for Castle Peak are presented in *Annex B*.

2.3.3 *Sequence of Tests, Receptors and Meteorological Scenarios*

Table 2.3a lists the tests made for concentration measurements, indicating the development option considered and wind directions for which measurements were made. The main test options relating to the new power station were chosen to generate the following information:

- ambient concentrations, across all relevant wind directions, for two 'completed' base-load development options, (4x2 coal-fired units and 8 gas-fired CCGT units) and for 10 x 100 MW OCGT units;
- the impacts of individual components of a complete development;
- sensitivity of the results to stack height and flue gas exit temperature in selected cases;
- the effect of substituting fuel oil for coal and distillate oil for gas; and
- the effect of Flue Gas Desulphurisation.

In addition, the initial tests modelled Castle Peak emissions for particular wind directions.

After the results from these tests had been reviewed, further tests were undertaken to provide more detail on near-field impacts resulting from operation of open-cycle and combined-cycle gas turbine units.

For the completed-development options measurements were made for wind directions covering the range 232° through 360° to 15°, to examine impacts on receptors in the New Territories and on Lantau. *Table 2.3b* lists the main receptors at which concentrations were measured for the completed-development test options. The receptors are illustrated in *Figure 2.3a*.

To test individual components of the development, and sensitivity to stack height, flue gas exit temperature and type of fuel, a more limited range of tests was undertaken for wind directions of 340° and 270°.

In general, the receptors were chosen to represent the main areas of residential and commercial development and areas used for recreational activity. *Figure 2.3a* shows the wind directions for which concentration measurements were made and also indicates the exact location of receptors in each case.

The tests were run at wind speeds ranging from 3 ms^{-1} to 15 ms^{-1}. However, it should be noted that the higher wind speeds of 12 ms^{-1} and 15 ms^{-1} occur very rarely (about 4% of the time across all wind directions and 1% for directions towards land, based on Chek Lap Kok data for 1980-90). They have been included primarily to obtain information on the relationship between wind speed and downwind concentration. In fact, 12 ms^{-1} is only applicable for a few wind directions and receptors. 15 ms^{-1} is unlikely ever to occur for a duration of one hour or more on a single occasion and cannot, therefore, be considered a credible dispersion scenario for the receptors in question. *Annex C* presents information to support these conclusions.

Table 2.3b *Wind Tunnel Test Receptors*

Sensitive Areas	Nature	Bldgs Ht (m)	Sensor position
Mai Po Marshes	Conservation area	-	G.L.
Tin Shui Wai New town	Residential	100m max.	G.L. 50m 100m
Sheung Pak Nai	Rural village (existing) Industrial (planned)	Village: 10m I:30m	G.L. 50m
Ha Pak Nai	Rural village (existing) Industrial (planned)	Village:10m I:30m	G.L. 50m
Yuen Long New Town	Residential	70m max.	G.L. 70m
Hung Shui Kiu	rural village	10m	G.L.
Castle Peak Firing Range	Undeveloped area	-	G.L.
Lung Kwu Tan areas	Residential Industrial (planned)	R:10m I:30m	GL 50m
Tuen Mun New Town	Residential area	100m	G.L. 50m 100m
Pearl Island	Residential	10m	G.L. 50m
Area 38	Industrial (planned)	<30m	G.L. 50m
Chep Lap Kok	Airport (planned)	20-30m	G.L. 50m
Northeast Lantau	General Industry (planned), Residential (existing)	100m	G.L. 50m 100m
Tai Ho Wan	Residential (planned)	100m	G.L. 50m 100m
Lantau Peaks	Country Park	-	G.L.
North Lantau coast	General industry	app. 100m	G.L. 50m 100m
Mui Wo	Rural residental town	30m	G.L. 50m
Tung Chung	Residential (planned)	100m	G.L. 50m 100m
Ngong Ping	Rural village, hostel, camping area, monastery	10m	G.L.
Tai O	Residential	20m	G.L. 50m

Note: G.L. denotes ground level

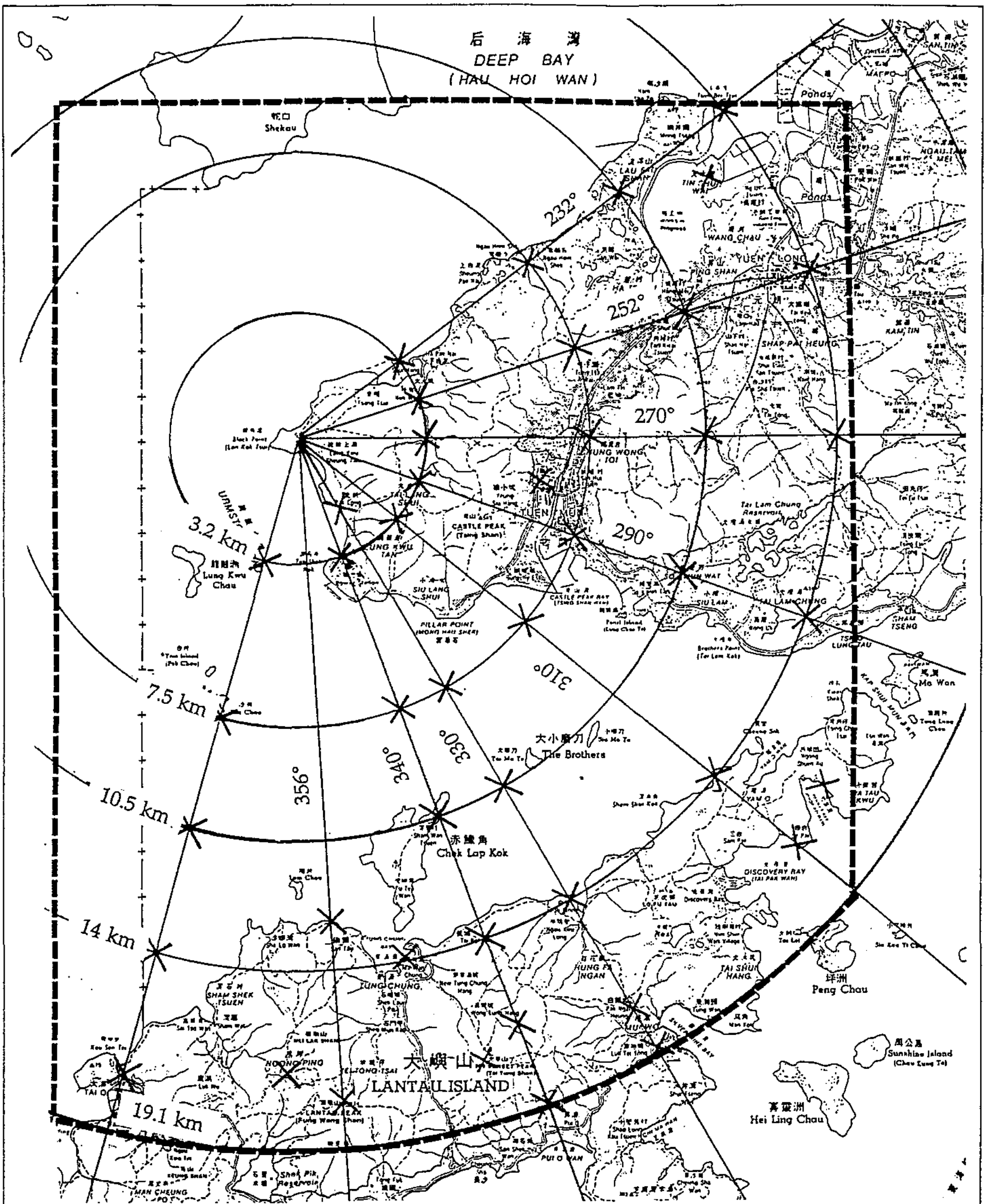

Figure 2.3a Receptor Bearings and Locations

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3 ASSESSMENT OF HUMAN HEALTH IMPACTS AND OPTIONS FOR MITIGATION

3.1 METHODOLOGY

The assessment has been structured around each of the main development options being considered and involves the following main steps:

- identify the worst-case impact scenarios which are credible with regard to frequency of occurrence for each receptor;
- consider the main features of the results obtained from concentration measurements, illustrating trends of concentration with distance from source and wind speed, as appropriate;
- consider the likely annual frequency distribution of 1-hour average pollutant concentrations due to the new power station;
- assess the likelihood of short-term impacts being unacceptable (using the Hong Kong 1-hour average AQOs as criteria), taking account of likely coincident background levels;
- examine the sensitivity of measured concentrations to variables such as stack height, flue-gas temperature and stack arrangement; and
- where necessary, assess the scope for mitigation of impacts.

The complete set of results is presented in *Annex D*; in this section only selected examples are used to illustrate trends. In identifying the worst-case impact scenarios we have taken account of the likelihood of different meteorological scenarios occurring, as discussed in *Annex C*.

It can be seen from the results in *Annex D* that there is a significant difference between the downwind total NO_x and NO_2 concentrations. This is because most NO_x is emitted from the stacks in the form of NO which is only gradually converted to NO_2 during plume dispersion (mainly by the oxidising action of ozone in the ambient atmosphere).

The NO_2 concentration has been calculated from the NO_x results using an empirical formula developed by Janssen et al, as discussed in *Annex E*. The consultants consider use of this formula to be the most reliable means of deriving accurate estimates of the NO_2 content of a plume since it is based on a large number of measurements in power station plumes, over a range of meteorological conditions and for different ambient ozone concentrations.

This chemical conversion factor explains why the trends for NO_2 do not perfectly match those for SO_2 which is emitted directly from the stacks.

3.2 4X2 680MW COAL-FIRED UNITS

3.2.1 *Base-Case Wind Tunnel Results*

The base-case 4x2 coal-fired units development scenario was tested comprehensively across all relevant wind directions, assuming 250m stacks and flue-gas desulphurisation at 90% removal efficiency. The complete set of results is presented as Option 2 in *Annex D*.

Table 3.2a presents the maximum concentrations of NO_2 and SO_2 which could possibly affect each of the main receptors due to Black Point emissions alone. They are expressed as percentages of the 1-hour average AQOs (300 $\mu g\ m^{-3}$ of NO_2 and 800 $\mu g\ m^{-3}$ of SO_2). The percentage figures have been rounded to the nearest 5% which is consistent with the likely accuracy of the wind tunnel results.

The main observations to be made are summarised below.

- Higher concentrations of NO_2 will be observed, relative to the AQO, than SO_2, as concluded in the site search and earlier, preliminary analyses during this EIA.

- Maximum concentrations in the territory would occur between about 3 km and 8 km downwind, in Castle Peak Range (12 ms^{-1} wind), in Area 38 (12 ms^{-1} wind) and along the Deep Bay coastline (8 ms^{-1} wind), but these are never likely to exceed 60-70% of the NO_2 AQO and 20% of the SO_2 AQO. Given the extremely low probability of a 12 ms^{-1} wind affecting any of these receptors, maximum concentrations will more than likely not exceed 40% (except 60% at Sheung Pak Nai) and 15% of the NO_2 and SO_2 AQOs respectively in these areas.

- Elsewhere in the Northwest New Territories, maximum concentrations could reach 45% of the NO_2 AQO at Lau Fau Shan and Tin Shui Wai in an 8 ms^{-1} wind and elsewhere between 20% and 35% of the NO_2 AQO and between 5% and 15% of the SO_2 AQO.

- On Lantau and at Chek Lap Kok the maximum concentration is less sensitive to wind speed, ranging from 20% of the NO_2 AQO in parts of southeast and northeast Lantau to 40% and 45% along the north Lantau coast and at Chek Lap Kok respectively. Along the peaks of Lantau the maximum is likely to be 25-35% of the NO_2 AQO. Nowhere on Lantau is the SO_2 concentration likely to exceed 5% of the AQO.

Table 3.2a *Maximum Measured Pollutant Concentrations (1-hr average) due to Black Point Emissions - 4x2 680MW Coal Fired Units*

Distance from Black Point (km)	Wind Directions	Example Receptors (ground level (gl) unless height given)	Wind Speed (ms^{-1})	NO_2	SO_2
				Max Conc'n (% of AQO)[1]	Max Conc'n (% of AQO)[2]
2.0	310°, 330°	Lung Kwu Tan areas	12	35	15
3.2	232°, 252°	Ha Pak Nai (gl, 40m)	8	30	10
3.2	290°, 310°	Castle Peak Range (gl, 60m)	12	50–70	15–20
4.8	330°	Area 38 (gl, 60m)	12	50–60	10–15
7.5	232°	Sheung Pak Nai (gl, 40m)	8	60	10
7.5	252°, 290°	Tuen Mun Valley (gl, 60m)	8	25–30	5–10
10.5	252°	Hung Shui Kiu	8	35	5
10.5	330°, 340°	Chek Lap Kok (gl, 40m)	8, 12	40	5–10
10.5, 12.0	232°	Lau Fau Shan, Tin Shui Wai (gl, 40m)	8	40–45	5–10
10.5, 14.0	270°, 290°	Tai Lam, Pearl Island (gl, 60m)	8	20–25	<5
13.4, 14.0	340°, 356°	North Lantau coast- Tung Chung, Tai Ho Wan	8, 12	30–40	5
14.0	252°	Yuen Long (gl, 40m, 80m)	8	30	5
14.0, 16.0	310°	Northeast Lantau- Yam O, Discovery Bay	8, 12	20–30	<5
18.0, 19.1	330°, 340°	Southeast Lantau- Mui Wo, Pui O (gl, 60m)	8, 12	20–25	<5
17.0, 17.6	340°, 356°	Lantau/Sunset Peaks, Ngong Ping	8	25–35	5
16.8	15°	Northwest Lantau- Tai O	8	30	5

1 300 $\mu g\ m^{-3}$

2 800 $\mu g\ m^{-3}$

Figure 3.2a provides graphical illustrations of how downwind concentration varies with wind speed for selected wind directions. These show quite clearly how wind speed becomes less important with distance from the source. Close to the source, however, there can be sharp differences in concentration between wind speeds. The graph for 290° shows the peak concentrations to occur at about 3km downwind.

The concentrations measured above ground level indicate, in general, that in winds above 5 ms^{-1} the plume is fairly well mixed vertically so that no significant difference in concentration is found between ground level and elevated receptors. At the lower wind speeds concentrations at elevated receptors are sometimes higher than at ground level but not often by any significant amount. In some cases elevated concentrations are lower. Most of the situations where marked differences are observed between ground-level and elevated receptor concentrations involve the plumes blowing over Castle Peak Range, indicating the effects of terrain.

3.2.2 *Assessment of Impacts*

Background Air Quality – General

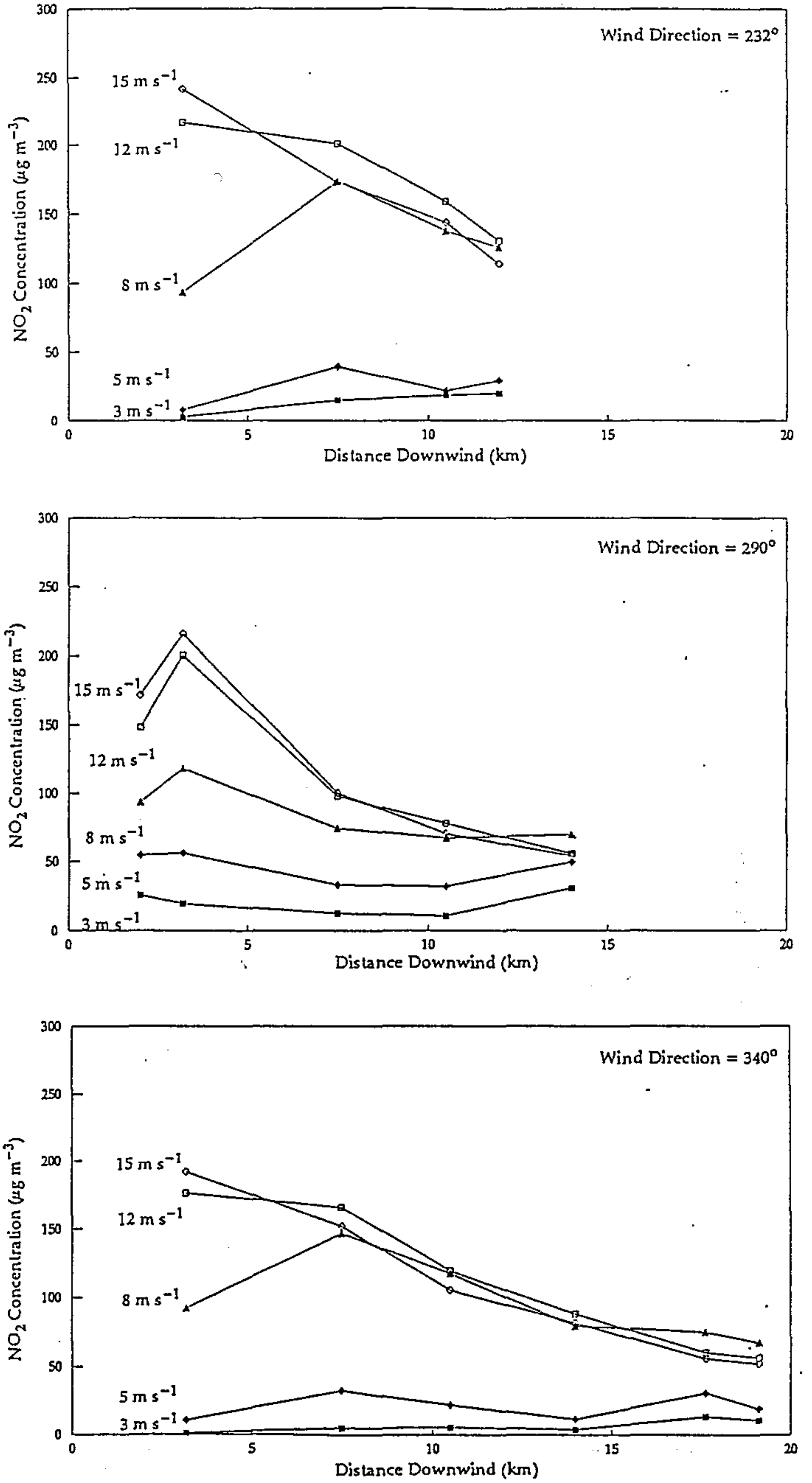
An advantage of the Black Point site is that for the wind directions affecting most receptors the plumes from the power station will be dispersing in relatively clean air from the sea, i.e. the background pollutant levels at the point of discharge will be low. This is confirmed by the results from CLP's monitoring station at Black Point – between April 1st and July 31st 1991 SO_2 and NO_2 concentrations remained below 25 $\mu g\ m^{-3}$ and 35 $\mu g\ m^{-3}$ respectively.

This means that the ambient background affecting such receptors will be mainly due to local sources or those lying between Black Point and the receptor, i.e. not upwind of Black Point. For the most part, this is only likely to result in significant background levels in or downwind of industrial or urban areas, e.g. Tuen Mun, Yuen Long, Pearl Island, and Tai Lam. However, the results indicate that the maximum concentration from the power station likely to affect these receptors would be in the range 20–35% of the NO_2 AQO and 5–15% of the SO_2 AQO. It is not considered likely that the coincident background in such cases would cause the AQO to be exceeded. This is because the relatively high wind speeds which would cause the power station plumes to affect these receptors in this way would actually encourage dispersion of the lower-level local sources more than otherwise and create a balancing effect.

Background Air Quality – Emissions from North Lantau Developments

Receptors at Chek Lap Kok and along north Lantau will also be affected by additional pollutant loadings resulting from the new airport at Chek Lap Kok, the new North Lantau Expressway and developments along the north coast, such as at Tung Chung and Tai Ho Wan. The air quality impacts of these developments have been examined as part of the respective EIA studies. The relevant results can be summarised as follows:

Figure 3.2a *Variation of One – Hour Average NO_2 Ground Level Concentrations ($\mu g\ m^{-3}$) With Wind Speed – Coal Fired Option*



- Peak concentrations of NO_2 will occur in northeasterly winds blowing along the north coast of Lantau, largely due to the importance of background sources and the new Expressway.

- Airport and local industrial sources will have maximum impacts in very light winds of 1 – 2 ms^{-1} from between 290° and 50°, resulting in NO_2 concentrations of about 150–175 $\mu g\ m^{-3}$ (50% – 58% of AQO) at the airport terminal and from 70–250 $\mu g\ m^{-3}$ (23% – 83% of AQO) at various points along north Lantau.

- Peak concentrations of SO_2 for the relevant wind directions range between 20 $\mu g\ m^{-3}$ and 65 $\mu g\ m^{-3}$ (2.5%–8.1% of the AQO).

Several points are important to note here:

- Firstly, the maximum NO_2 concentrations were predicted using the PAL numerical model which is acknowledged to be conservative, particularly in light winds.

- Secondly, the analyses concentrated on the 'worst–case' scenarios, just as this assessment of power station impacts does. However, whereas for the power station the worst–case dispersion scenarios are characterised by relatively high wind speeds (which cause the stack emissions to disperse more rapidly towards the ground), for the lower–level sources along north Lantau much lighter winds are necessary to result in maximum impacts at the nearby receptors. In light winds (e.g. 3 ms^{-1}) the Black Point emissions result in downwind NO_2 concentrations in the order of 2% of the NO_2 AQO along north Lantau and so the interaction at low wind speeds is irrelevant. The impacts of the north Lantau developments at higher wind speeds, which are more relevant to this KIA, have not been reported in the PADS studies. However, under the more 'probable' conditions of a 5 ms^{-1} easterly wind the predicted NO_2 concentration at the western airport boundary is nearly 75 $\mu g\ m^{-3}$ (25% of the AQO). For the purpose of this report, this is taken as a conservative estimate of the upper limit to the concentration along north Lantau and at Chek Lap Kok which could co–exist with impacts from the power station under such conditions. In higher wind speeds much lower concentrations would be observed, perhaps less than 50 $\mu g\ m^{-3}$ (about 15% of the AQO) for 8 ms^{-1} and less than 25 $\mu g\ m^{-3}$ (8% of the AQO) for 12 ms^{-1}.

Background Air Quality – Emissions from Castle Peak Power Station

There are two dispersion scenarios which present a more complex situation regarding background levels and are critical regarding acceptability of impacts and mitigation requirements. These are the scenarios where the plumes from Black Point overlap with those from Castle Peak, which effectively contribute to the background on Lantau (northwesterly winds) and at Shekou in the PRC (southeasterly winds). This was identified as the key issue during the site search study. To assist with the assessment, therefore, Castle Peak emissions were included in the wind tunnel tests so that their contribution to the background could be evaluated. The results are presented in full in *Annex D* and summarised below.

Tables 3.2b summarises the potential impacts of Castle Peak emissions on receptors on Lantau for the power station operating at full load. It can be seen that there is the potential for Castle Peak emissions alone to result in ground level concentrations, at Chek Lap Kok in very high winds above the NO_2 AQO. Clearly this represents a significant background level but it is important to consider the frequency with which such concentrations could coincide with high concentrations due to Black Point emissions. This is discussed below.

Table 3.2b *Summary of Key Test Results for Castle Peak Power Station - Potential Impacts on Lantau*

Receptor	Wind Speed (m/s)	SO_2 Concentration (% of AQO)	NO_2 Concentration (% of AQO)
Chek Lap Kok	5	5–10	5–10
Chek Lap Kok	8	20–40	45–55
Chek Lap Kok	12	65–70	95–110
North Lantau Coast	5	5–10	10
North Lantau Coast	8	30–35	50–55
North Lantau Coast	12	50	85
Lantau Peaks	5	10	15
Lantau Peaks	8	15–30	30–50
Lantau Peaks	12	35	60

Frequency Considerations - Black Point

By combining the information relating concentration to wind speed and direction with statistics on the frequency of occurrence of the wind speeds for specified wind directions, an indication of the year-round influence of Black Point emissions on 1-hour average concentrations can be obtained. This provides an important qualifier to the maximum concentrations presented in *Table 3.2a*. The approximate frequencies, for NO_2, are presented in *Tables 3.2c-e* for three example receptors - Chek Lap Kok, Tin Shui Wai and Pearl Island.

The frequencies are obtained by taking the best available climatological data (Chek Lap Kok 1980-1990) and assuming that a receptor will only be affected by the plumes when the wind is blowing steadily within a 20° band centred on the receptor in question, e.g. 290-310° for Pearl Island; it is assumed that on such occasions plume-centreline concentrations will affect the receptor. This is a simple and somewhat pessimistic approach since it ignores inherent uncertainties and the fact that to record a 1 hour average direction at least six 10-minute readings would have to be recorded within the 20° band. Nevertheless, it provides a useful indication of the overall distribution and is considered a suitable worst-case for the purpose of this assessment.

It can be seen from the Tables that between 95% and 98% of the time these receptors will not be affected by the power station's plumes to the extent that any 1-hour average concentration would be noticeably increased. This is due entirely to the infrequency of wind directions affecting the receptors. For this reason also, as concluded in the IAR, the new power station will not have any significant impact on longer-term (24-hour and annual average) ambient concentrations.

Wind speed/direction scenarios which could lead to concentrations of 40% of the AQO or higher (which could be significant, depending on the background), occur for about 0.3% of the time (i.e. about 30 hours per year). In fact, the incidence of the highest concentrations is likely to be even lower given the fact that for much of the year the power station will be operating at less than full load. However, although this is very low, the Hong Kong AQOs require that the 1-hour limit value should not be exceeded on more than *three* occasions per year. Therefore, such rarely occurring events must be considered with regard to their potential contribution to cumulative air pollutant levels, taking account of the background air quality due to other sources.

Frequency Considerations – Black Point plus Castle Peak

The combined impacts due to Black Point and Castle Peak emissions hold the greatest potential for exceedance of the AQO limit values. However, the frequency of such combined impacts must be evaluated for comparison with the AQO criterion of exceedance on more than three occasions per year.

Table 3.2f summarises the frequency distribution of expected total output from Black Point and Castle Peak power stations for the year 2008 when Black Point will be completely developed and operational. It can be seen that for only 5% of the time (438 hours per year) will the two stations be operating at or something close to 100% of total capacity. In order that any impacts can be compared with the 1-hour average AQOs, the combined frequency of operation and meteorological conditions must amount to at least three hours per year, or 0.034% of the time. Thus, impacts arising from 'peak-output' operation of the two power stations, at 91-100% of total capacity, will only be credible, from a frequency point of view, for meteorological scenarios with a frequency of occurrence of 0.7% or more (0.034 ÷ 0.05). Peak output occasions will occur almost exclusively in the summer months when there will be a demand for such high levels of output and therefore summer meteorological data should be used to reflect the monsoonal changes (see *Annex C*). From *Annex* C it can be seen that this limits the meteorological conditions to about 5m/s for 340° towards Lantau.

Table 3.2c *Estimated Frequency of 1-hr Average NO_2 Concentrations – Chek Lap Kok, Coal-Fired Option*

Wind Speed (m/s)	Concentration (% of AQO)	% of the time	Cumulative % of time
–	0	97.18	97.18
0 – 8	<5	2.62	99.80
>8	40	0.20	100

Table 3.2d *Estimated Frequency of 1-hr Average NO_2 Concentrations – Tin Shui Wai, Coal-Fired Option*

Wind Speed (m/s)	Concentration (% of AQO)	% of the time	Cumulative % of time
–	0	98.65	98.65
0 – 8	<10	1.29	99.94
>8	45	0.06	100

Table 3.2e *Estimated Frequency of 1-hr Average NO_2 Concentrations – Pearl Island, Coal-Fired Option*

Wind Speed (m/s)	Concentration (% of AQO)	% of the time	Cumulative % of time
–	0	96.17	96.17
0 – 8	<5	3.75	99.92
>8	20 – 25	0.08	100

Table 3.2f *Frequency Distribution of Output from Black Point and Castle Peak Power Stations*

Coal-Fired Plant Power Output as % of Total Coal-Fired Capacity	Percentage of Time	Cumulative Percentage of Time	Worst-case average output as % of total capacity (taking upper values of discrete ranges)
91-100	5	5	95.5
81-90	8	13	90
71-80	8	21	86
61-70	12	33	80
51-60	13	46	75
41-50	11	57	70
31-40	14	71	64
21-30	11	82	60
11-20	12	94	54
0-10	6	100	52

Table 3.2g summarises the calculation of total impacts for this scenario, taking account of contributions from Black Point and Castle Peak power stations (each at maximum output) and north Lantau developments. It can be seen that total predicted concentrations lie safely within the AQOs.

Overall, the real impacts of the 'peak-output' scenario are therefore limited due to the extreme infrequency with which it would occur in combination with worst-case meteorological conditions.

As an alternative worst case, which will occur more frequently, we might consider the impacts associated with operation of the two power stations at more than 80% of total capacity. This is expected to occur for 13% of the time so that coincident meteorological conditions would need to occur with a frequency of at least 0.26% (0.034 ÷ 0.13). Assuming this operational scenario to take place around the summer months, this limits the meteorological conditions to just below 8 ms^{-1} for 340°.

If an even distribution across the year were assumed for this operational scenario the equivalent wind speeds would be 8 ms^{-1}.

Table 3.2g *Maximum Total Concentrations[1] (% AQO) Associated with Maximum Output from Black Point and Castle Peak – Base Case[2]*

Source	Chek Lap Kok		North Lantau		Lantau Peaks	
	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2
Black Point	7	2	4	1	10	2
Castle Peak	10	10	10	10	15	10
North Lantau and other Developments	25	8	25	8	<<25	<<8
Total	42	20	39	19	<<50	<20

[1] *Which could occur for three or more hours per year.*
[2] *Individual source contributions above 10% rounded to nearest 5%.*

The worst–case average output under this operational scenario would be 90% of the total capacity. Castle Peak has the greater potential for impacts and so as a worst case it can be assumed that Castle Peak would be operated in preference, at 100% of capacity, and Black Point would be operated at an average of 80% of capacity. In this case the total impacts are summarised in *Table 3.2i*, using the summer wind speed scenarios of 8 ms^{-1} for 340°. For the purpose of this exercise the Black Point concentrations have been estimated as 80% of the values measured for the 100% load scenario.

Table 3.2h *Maximum Total Concentrations[1] (% AQO) Associated with 80% Output from Black Point[2] and 100% Output from Castle Peak – Base Case[3]*

Source	Chek Lap Kok		North Lantau		Lantau Peaks	
	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2
Black Point	30	5	20	4	25	4
Castle Peak	55	40	45	30	50	30
North Lantau and other Developments	15	8	15	8	<15	<8
Total	100	53	80	47	<90	<42

1 Which could occur for three or more hours per year.
2 Obtained as 80% of measured value for 100% load scenario.
3 Individual source contributions above 10% rounded to nearest 5%.
4 Lower background NO_2 at higher wind speed of 8 ms^{-1}.

It can be seen that the likelihood of high contributions from both Black Point and Castle Peak are greater than for the maximum output scenario summarised in *Table 3.2g*. This is a direct consequence of the increase in frequency of operation at this capacity, resulting in higher wind speeds becoming credible dispersion scenarios. These cause relative increases in downwind concentrations which more than balance the reduction in emission rates associated with the lower operational outputs. In particular ground level NO_2 concentrations equal to or close to AQO levels could occur for three hours per annum at the above locations. SO_2 concentrations are much lower, the maximum being 53% of the AQO at Chek Lap Kok. Nevertheless this is still higher than for the maximum output scenario. It should be noted that if Black Point was assumed to operate at 100% and Castle Peak at 80% the results would not be significantly different, displaying only a slight decrease in total concentrations.

Summary and Conclusions

In deriving the worst-case impacts of the LTPS development a conservative approach with respect to weather data, pollutant outputs and ambient levels has been adopted. With this in mind it is concluded that the base-case coal-fired option alone would not cause the 1-hour average AQOs to be exceeded. Except in the Castle Peak Range, NO_2 concentrations, due to the power station emissions, are unlikely to exceed 60% of the 1-hour average AQO. SO_2 concentrations are not predicted to exceed 15% of the AQO except in Castle Peak Range.

By adding the Castle Peak background values to the maximum concentrations due to Black Point for relevant wind directions, the maximum total concentrations, due to both power stations have been found for receptors at Chek Lap Kok, north Lantau and the Lantau Peaks. From a consideration of the frequency of wind conditions and combined operational scenarios for the two power stations, it is concluded that the impacts associated with combined operation in the 81–100% ranges of total capacity represent the worst-case. These will be used as the basis for assessment of mitigation requirements.

Maximum total concentrations due to the two power stations are estimated to reach up to 85% of the NO_2 AQO at Chek Lap Kok and 65 to 75% of the AQO in North Lantau and Lantau Peaks. SO_2 concentrations are estimated to range up to about 50% of the AQO. Adding the estimated background contribution due to local sources along north Lantau to the maximum concentrations due to the two power stations results in the NO_2 ground level concentrations at north Lantau and Chek Lap Kok rising to 80% and 100% of the AQOs respectively. No exceedances of the AQOs are predicted for the Lantau Peaks or for SO_2 at any receptor. *Table 3.2i* summarises the percentage contributions of the different sources to the predicted ground level NO_2 concentration.

Table 3.2i *Summary of Maximum predicted NO_2 1-hour AQO Percentages and Source Contributions - Coal-Fired Option*

Source	Chek Lap Kok[1]	North Lantau[1]
Total GLC (% AQO)	100	80
% of total concentrations at each receptor		
Black Point	30	25
Castle Peak	55	55
Other	15	20

1 from Table 3.2h

Despite the conservative assumptions built into these predictions consideration must be given to mitigating the impacts at North Lantau and Chek Lap Kok, as discussed below.

3.2.3 *Mitigation Options*

A number of the test options were used to investigate the effects of changing the physical characteristics of the Black Point source and are discussed in *Annex F*. These represent one set of options which could be considered for mitigating NO_2 impacts and are summarised below.

- A 2x4 stack arrangement (two stacks, each linked to four generating units - test Option 16) produces no significant benefit for the critical receptors, though significant benefits are observed for 270°.
- Increasing the flue gas exit temperature to 120°C from 80°C (test Options 4, 8 and 9) has no significant effect for the source-receptor scenarios of most concern.
- A lower stack height (test Option 13), not unexpectedly, results in greater impacts (test Option 13), though the difference is not great.

Although a higher stack (300m) was not tested it is considered unlikely to produce any significant benefits since it may result in a loss of buoyancy (observed in the flat terrain tests) through less vertical interaction with the Castle Peak plumes when dispersing southeast towards Lantau. Furthermore, based on the measured benefits of a 250m stack over one 200m high (test Options 2 and 13), there would be little to gain.

Reducing source concentrations of NO_x at Black Point and/or Castle Peak is therefore the only way in which to achieve the desired result. The options are summarised below, taking mitigation of the worst-case impacts at Chek Lap Kok as the critical issue.

- *Phasing in lower-NO_x burners at Castle Peak,* as CLP have planned, could clearly have significant benefits since between about 55 and 60% of the concentrations where ground level NO_2 concentrations are predicted to approach AQO levels are due to Castle Peak. The background contribution from Castle Peak for the worst-case impact scenario is estimated to be 55% of the NO_2 AQO, at Chek Lap Kok.

  It is understood from CLP that reductions to about 90% of current levels at Castle Peak A (1000 ppm (v/v) from 1100 ppm source concentration of NO_x) and 55% of current levels at Castle Peak B (600 ppm from 1100 ppm) are possible. These measures would reduce Castle Peak's contribution to the maximum concentration at Chek Lap Kok to about 40% of the AQO, resulting in a total concentration of about 70% of the AQO from the two power stations and perhaps 85% of the AQO if all other sources are also considered, though this figure is somewhat uncertain because of the lack of appropriate background data relating to impacts of the new airport at Chek Lap Kok.

  The proposed Castle Peak emission reductions represent the equivalent of the removal of 83% of the total worst case NO_x emissions from the LTPS. Emissions reductions at Black Point would provide a means of further mitigation.

- *Employing lower-NO_x burners at Black Point,* for example down to 220ppm (v/v) from the 330 ppm BPM (Best Practicable Means) limit set by EPD, could further contribute to mitigation of the impacts, reducing the concentration at Chek Lap Kok by 10% of the AQO. Black Point's maximum contribution to NO_2 concentrations would then be about 20% of the AQO at Chek Lap Kok. Taken in conjunction with the emissions reductions at Castle Peak, outlined above, this could result in total NO_2 concentrations of 75% of the AQO at Chek Lap Kok. At Chek Lap Kok power station emissions would account for 65% of the AQO.

  The mitigation measures outlined are the only practical measures considered by CLP to be available and there is some doubt regarding the ability to achieve the 220ppm figure as a maximum on the new Black Point boilers. CLP are fairly confident however of their ability to achieve the lower figures at Castle Peak.

Table 3.2j *Benefits of NO_x Emissions Control Measures at Castle Peak and Black Point - Coal-Fired Option - Worst Case Scenarios*

Emissions reduction scenario	**Source of impact**	**Concentration (% of AQO) at Chek Lap Kok[1]**	**Concentration (% of AQO) at north Lantau[1]**
None	Black Point	30	20
None	Castle Peak	55	45
None	Other	15	15
None	All	100	80
Castle Peak A to 1000 ppm, Castle Peak B to 600 ppm	All	85	70
Castle Peak reductions plus Black Point to 220 ppm	All	75	60

1. from *Table 3.2h*

3.3 *GAS-FIRED CCGT UNITS*

3.3.1 *Base-Case Wind Tunnel Results*

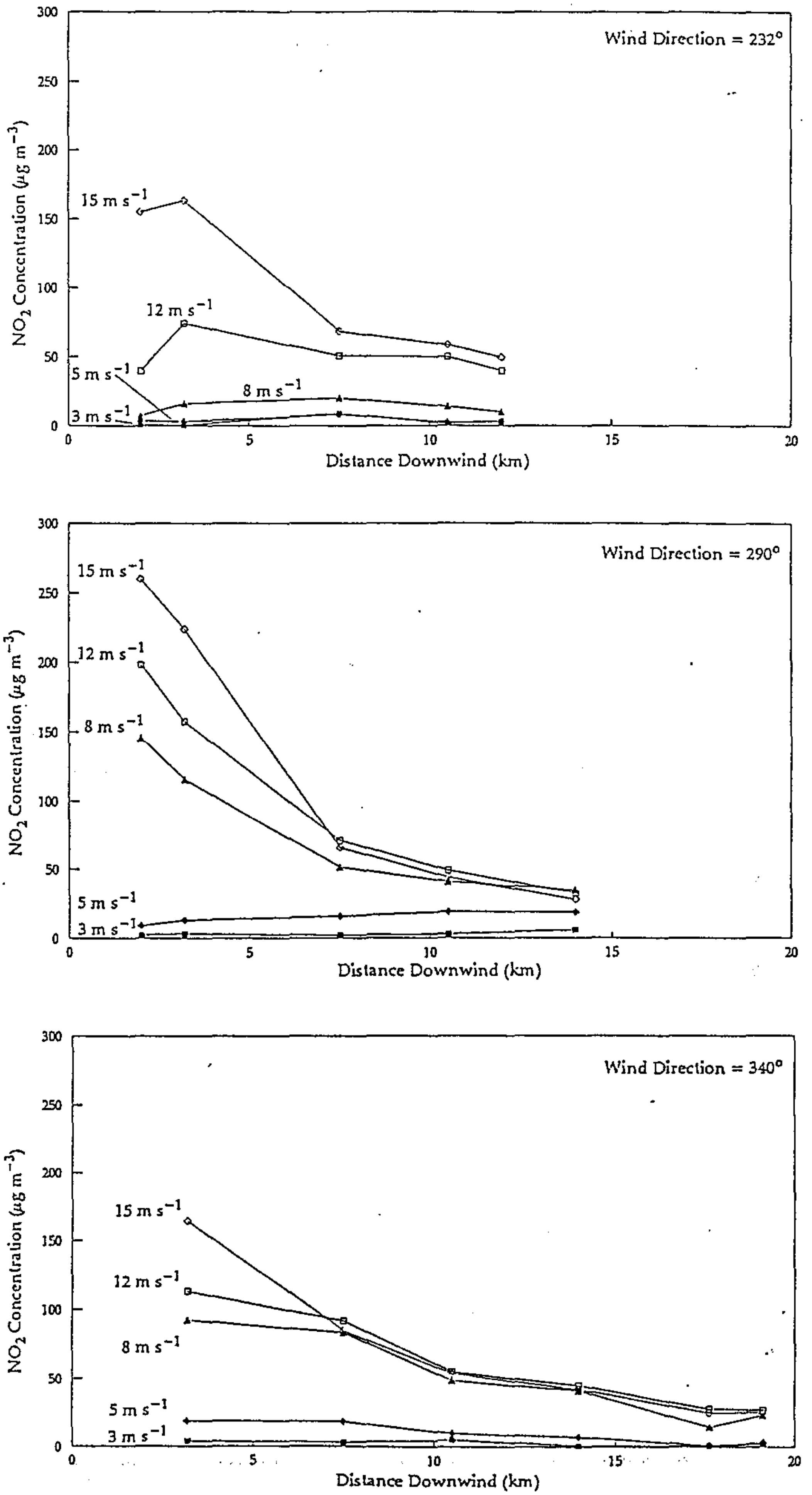
The base-case 8 gas-fired CCGT units development scenario was tested comprehensively across all relevant wind directions, assuming 100m stacks. The complete set of results is presented as Option 3 in *Annex D.*

Table 3.3a presents the maximum concentrations of NO_2 which could possibly affect each of the main receptors due to Black Point emissions alone. They are expressed as percentages of the 1-hour AQO (300 $\mu g\ m^3$). The percentage figures have been rounded to the nearest 5% which is consistent with the likely accuracy of the wind tunnel results.

In general, the CCGT option has a very low potential for impacts by itself. Maximum NO_2 concentrations only rise above 20% of the AQO in Area 38 (20%), Lung Kwu Tan (30%) and Castle Peak Range (40%). SO_2 will only be emitted in small quantities if gas is used as the fuel and so there would be no impacts on air quality by this pollutant.

Figure 3.3a provides graphical illustrations of how downwind concentration varies with wind speed for selected wind directions. As for the coal option, these demonstrate clearly how concentrations become less sensitive to wind speed with distance from the source. Likewise, close to the source there can be sharp differences in concentration between wind speeds.

Figure 3.3a Variation of One – Hour Average NO_2 Ground Level Concentrations ($\mu g\ m^{-3}$) With Wind Speed – Gas Fired CCGT Option



3.3.2 *Assessment Of Impacts*

As with the coal–fired option, the frequencies with which any of the maximum concentrations in *Table 3.3a* would occur are extremely low. The main difference is that the maximum concentrations are much lower because of the lower emission rates. The maximum ground level concentration predicted is 80% of the NO_2 AQO at Chek Lap Kok and specific mitigation measures are therefore not required. Introduction of such measures may however allow CLP flexibility with regard to lower chimneys than the 100m which were modelled in the wind tunnel tests.

Table 3.3a *Maximum Measured NO_2 Concentrations (1–hr average) due to Black Point Emissions – 8 x 600 MW Gas Fired CCGT Units*

Distance from Black Point (km)	Wind Directions	Example Receptors (ground level (gl) unless height given)	Wind Speed (m/s)	Max Conc'n (% of AQO)
2.0	310°, 330°	Lung Kwu Tan areas	12	30
3.2	232°, 252°	Ha Pak Nai (gl, 40m)	8	10
3.2	290°, 310°	Castle Peak Range (gl, 60m)	12	40
4.8	330°	Area 38 (gl, 60m)	12	20
7.5	232°	Sheung Pak Nai (gl, 40m)	8	5
7.5	252°, 270°, 290°	Tuen Mun Valley (gl, 60m)	8	10–15
10.5	252°	Hung Shui Kiu	8	10
10.5	330°, 340°	Chek Lap Kok (gl, 40m)	8, 12	10–15
10.5, 12.0	232°	Lau Fau Shan, Tin Shui Wai (gl, 40m)	8	5
10.5, 14.0	270°, 290°	Tai Lam, Pearl Island (gl, 60m)	8	10–15
13.4, 14.0	340°, 356°	North Lantau coast–Tung Chung, Tai Ho Wan	8, 12	5–10
14.0	252°	Yuen Long (gl, 40m, 80m)	8	10
14.0, 16.0	310°	Northeast Lantau–Yam O, Discovery Bay	8, 12	5
17.6, 18.0, 19.1	330°, 340°	Southeast Lantau–Mui Wo, Pui O (gl, 60m)	8, 12	5
17.0, 17.6	340°, 356°	Lantau/Sunset Peaks, Ngong Ping	8	5–10
16.8	15°	Northwest Lantau–Tai O	8	5

Table 3.3b *Summary of Maximum Predicted NO_2 1-hour AQO Percentages and Source Contributions – Gas-Fired Option*[1]

Source	Chek Lap Kok	North Lantau
Total GLC (% of AQO)	80	70
% of total concentration at each receptor		
Black Point	13	14
Castle Peak	69	64
Other	18	22

1. Based on 8 ms^{-1} wind velocity.

3.3.3 *Mitigation Options*

Reductions in NO_2 ground level concentrations could be achieved by reducing NO_x emissions from Castle Peak as described for the coal-fired option. The benefits of emissions control measures are summarised in *Table 3.3c*.

Table 3.3c *Benefits of NO_x Emissions Control Measures at Castle Peak for the Black Point Gas-Fired Option*

Emissions reduction scenario	Source of impact	Concentration (% of AQO) at Chek Lap Kok	Concentration (% of AQO) at north Lantau
None	Black Point	10	10
None	Castle Peak	55	45
None	Other	15	15
None	All	80	70
Castle Peak A to 1000 ppm, Castle Peak B to 600 ppm	All	65	60

Further reductions are possible by limiting emissions from the LTPS to 42 ppm rather than the 75 ppm assumed here. CLP believe such a limit would be difficult to guarantee and incur excessive penalties with regard to thermal efficiencies and water consumption.

3.4 COAL-FIRED AND GAS-FIRED COMBINATIONS

Not surprisingly, the mixed-fuel development option (2x2 coal-fired plus 4 gas-fired CCGT) results in receptor concentrations lying generally between the two single-fuel options, as shown in *Table 3.4a*. These estimates were obtained using results from the partial-development test Options 5 and 8. For the most critical receptors, the results indicate that emissions reductions at Castle Peak would not be required to ensure that the AQOs are not exceeded.

Implementation of the lower NO_x output levels for Castle Peak however would result in a maximum NO_2 concentration at Chek Lap Kok (the worst-case scenario) of 75% of the AQO (compared with 85% for the coal-fired option). This illustrates clearly how dominant the background air quality is and how emissions reductions at Castle Peak provide the key to reducing the background, and thereby creating capacity within the airshed for the Black Point emissions.

3.5 OIL-SUBSTITUTION OPTIONS

The sulphur contents of distillate oil for CCGT and fuel oil for coal-fired units as backup or substitution fuels are 0.5% and 3.5% (by weight) respectively.

A number of the tests examined the effects of substituting oil for coal and gas in the main units. These tests were targeted to significant receptors, and so a complete set of results for all receptors can not be presented. The tests were intended to provide the base information required to determine the likely air quality implications of fuel substitutions in one of the main development options already discussed. The main conclusions can be summarised as follows:

- *600MW CCGT Units.* Substituting oil for gas in the CCGT units makes no significant difference to the conclusions regarding NO_2 for relevant development options. The main difference relates to SO_2 such that the 8 x CCGT option would result in about twice the downwind SO_2 concentrations measured for the 4x2 coal-fired option. This is the result of discharging from 100m high CCGT stacks compared with 250m high stacks in the coal-fired case and the higher SO_2 emission rate associated with oil firing. Combined with Castle Peak emissions this could result in a total concentration of 50% of the AQO at Chek Lap Kok.

  Likewise, in the case of 2x2 coal-fired units combined with 4 oil-fired CCGT units, there would be an increase in downwind SO_2 concentrations but not so much as to cause the AQO to be exceeded, even when combined with the effect of Castle Peak emissions. So, when judged against the AQOs this option is as acceptable as the completely gas-fired option.

Table 3.4a *Maximum Pollutant Concentrations (1-hr average NO_2) due to Black Point Emissions – Coal-Fired, Gas-Fired CCGT and Mixed-Fuel Options*

Distance from Black Point (km)	Wind Directions	Example Receptors (ground level (gl) unless height given)	Coal-Fired Option	Gas-Fired CCGT Option	Mixed Fuel Option
2.0	310°, 330°	Lung Kwu Tan areas	35	30	30-35*
3.2	232°, 252°	Ha Pak Nai (gl, 40m)	30	10	10
3.2	290°, 310°	Castle Peak Range (gl, 60m)	50-70	40	40*
4.8	330°	Area 38 (gl, 60m)	50-60	20	30*
7.5	232°	Sheung Pak Nai (gl, 40m)	60	5	15
7.5	252°, 290°	Tuen Mun Valley (gl, 60m)	25-30	10-15	10-30
10.5	252°	Hung Shui Kiu	35	10	25
10.5	330°, 340°	Chek Lap Kok (gl, 40m)	40-45	10-15	25-35
10.5, 12.0	232°	Lau Fau Shan, Tin Shui Wai (gl, 40m)	40-45	5	20
10.5, 14.0	270°, 290°	Tai Lam, Pearl Island (gl, 60m)	20-25	10-15	15-25
13.4, 14.0	340°, 356°	North Lantau coast-Tung Chung, Tai Ho Wan	30-40	5-10	20-25
14.0	252°	Yuen Long (gl, 40m, 80m)	30	10	15
14.0, 15.0, 16.0	310°	Northeast Lantau-Yam O, Discovery Bay	20-30	5	15-25
18.0, 19.1	330°, 340°	Southeast Lantau-Mui Wo, Pui O (gl, 60m)	20-25	5	15-20
17.0, 17.6	340°, 356°	Lantau/Sunset Peaks, Ngong Ping	25-35	5-10	10-20
16.8	15°	Northwest Lantau-Tai O	30	5	20

* Estimates obtained by interpolation between wind speeds

- *680MW Conventional Units.* Assuming 90% SO_2 reduction by FGD, substituting oil for coal has the effect of increasing SO_2 concentrations and reducing NO_2 concentrations, approximately in proportion to the changes in source concentrations. As for oil substitution in the CCGT units, the increase in SO_2 concentrations would result in levels of 55% of the AQO.

3.6 *FGD CONSIDERATIONS*

In order to evaluate the situation pertaining to varying degrees of Flue Gas Desulphurisation, wind tunnel modelling was carried out with maximum (90%), medium (50%) and no FGD for the coal fired (1% sulphur as received) case. The results are shown in *Table 3.6a*.

The results indicate that for a 8 x 680 MW coal-fired LTPS under the most credible worst-case wind speeds of 8 ms^{-1} the SO_2 AQOs could be exceeded at Chek Lap Kok were FGD not available. However, the AQO for SO_2 would not be exceeded at any receptors under the four combined cycle/four coal fired unit scenario without FGD, although FGD would significantly reduce ground level concentrations.

Table 3.6a *Summary of Key Test Results of Various FGD*

Receptor	Wind Speed ms^{-1}	SO_2 Concentration % AQO			
		BP Max FGD	BP Med FGD	BP No FGD	CPPS
Chek Lap Kok	5	-	-	-	5 - 10
Chek Lap Kok	8	5 - 10	35	90	20 - 40
Chek Lap Kok	12	5 - 10	-	-	65 - 70
N. Lantau Coast	5	0	-	-	5 - 10
N. Lantau Coast	8	5	30	60	30 - 35
N. Lantau Coast	12	5	-	-	50
Lantau Peaks	5	0	-	-	10
Lantau Peaks	8	5	15	40	15 - 30
Lantau Peaks	12	5	-	-	35
Ha Pak Nai	8	10	-	20	0
Tin Shui Wai	8	5	-	40	0
Yuen Long	8	5	-	40	0
C.P. Range	8	0 - 5	10 - 15	10 - 15	0
Tuen Mun	8	5	-	40	0
Pearl Island	8	5	-	40	0
Lung Kwu Tan	8	10	-	35 - 40	0
Area 38	8	10	-	50 - 60	0
Tai O	8	10	-	40	0

3.7 *OPEN-CYCLE GAS TURBINE UNITS*

3.7.1 *Base-Case Wind Tunnel Results*

The OCGT units will discharge flue gases at very high temperatures, ensuring considerable buoyancy and plume rise. For this reason concentrations at receptors are only likely to become significant in relatively high wind speeds when the plumes tend to bend over towards the ground more rapidly after leaving the stacks. The base-case wind tunnel results (test Option 1), using a stack height of 50m, have confirmed this, indicating that in the majority of cases for winds below 12 ms^{-1} and receptors 2km or more downwind, the SO_2 and NO_2 concentrations will be less than 10% of the AQOs.

Impacts in the PADS reclamation area to the south will be small; the maximum concentrations, measured in a 12 ms^{-1} wind, only 800m downwind, were about 25% of the SO_2 AQO and 7% of the NO_2 AQO (lower because little of the NO would have converted to NO_2 in such a short distance).

However, much higher concentrations were measured in the near field (less than 3km downwind) for wind directions towards the land (232–310°), as a result of terrain effects. The maximum concentrations reach nearly 105% of the SO_2 AQO and 25% of the NO_2 AQO 800m downwind in 12 ms^{-1} southwesterly winds. Even 1km away the SO_2 concentration was measured to be up to 60% of the AQO. Vertical profiles of the plume indicate that similarly high concentrations extend up to elevations of 120m. Slightly lower concentrations were measured for westerly and northwesterly winds.

3.7.2 *Assessment of Impacts*

There is the likelihood of high SO_2 concentrations, which may exceed the AQO value in southwesterly winds, within 1km of the stacks. The frequency of such wind conditions is likely to be very low (less than 0.1% of the time) and the probability of this coinciding with peak emissions from the OCGTs almost negligible. It should also be noted that these high SO_2 concentrations will be adding to a very low background level (the air will generally be coming off the sea and there will not be any interaction with plumes from coal-fired units at this distance). It can therefore be concluded that the AQO will not be exceeded offsite. However, CLP should consider the possibility that onsite impacts may on occasion be high, and while occupational exposure levels are unlikely to be exceeded, it would be worthwhile reviewing the possibility of higher stacks to maintain high air quality standards onsite.

3.7.3 *Mitigation Options*

Test Options 11 and 12 investigated the potential benefits of increasing the height of the OCGT stacks to 80m and 100m respectively. In summary, it was found that 80m stacks, while having relatively little benefit for receptors beyond about 2.5 km, would substantially reduce the very near-field impacts. Maximum SO_2 concentrations at ground level would be about 50% of the AQO compared with 105% for 50m stacks. Considering also the potential onsite benefits we would recommend this to be an option worth consideration by CLP.

100m stacks would reduce concentrations further still, but the significance of any additional benefits over those gained by choosing 80m stacks would be questionable. This option is not recommended.

4 ASSESSMENT OF ACIDIFICATION IMPACTS ON THE NATURAL ENVIRONMENT

4.1 INTRODUCTION

4.1.1 Scope

A clear distinction exists between the two main effects of atmospheric pollutants on vegetation:

- direct exposure to pollutants in the atmosphere, where the effect is often instantaneous; and

- indirect exposure, via acid deposition, where the impact is long-term and effects may be cumulative; this applies, for example, to soils, plant roots, catchments, surface and ground waters.

It was concluded in the IAR, that there is no evidence to suggest that direct vegetation damage of any significance would result from the additional load of LTPS emissions from Black Point. However, it was concluded that further consideration should be given to the impact of acid deposition in the KIA.

4.1.2 Acid Deposition

Acid precipitation refers to the process of wet deposition of acidic material. However, it also includes the process of dry deposition of gaseous pollutants, and as a result, the two processes combined are referred to as acid deposition. In the absence of precipitation, atmospheric pollutants are removed from the atmosphere by gravitational settling and by direct contact with the ground, vegetation and buildings.

Evidence for the impact of sulphur and nitrogen compounds from atmospheric sources is well established. Natural and man-made ecosystems which have been shown to sustain damage include:

- lakes;
- rivers;
- reservoirs;
- forests;
- grasslands; and
- a wide variety of crops.

With regard to the LTPS, consideration should be given to the dry deposition of NO_2 and SO_2 and the wet deposition of sulphate (SO_4^{2-}) and nitrate (NO_3^-). Sulphate and nitrate are oxidation products of SO_2 and NO_2, respectively.

Generally, dry deposition makes a small contribution to the overall acidity problem. However, this process can be significant close to large point sources, such as the LTPS, where atmospheric concentrations are highest. Wet deposition of acidic species is associated with the long range transport of pollutants due to the time dependence of sulphate and nitrate production and deposition in rainfall.

Until recently, the oxides of nitrogen have ranked second to sulphur compounds in their contribution to acid deposition which may affect terrestrial and aquatic ecosystems. However, whereas the contribution of sulphate to the problem of acid precipitation is levelling off (due to the implementation of emissions control policies for SO_2), that of nitrate is increasing, mainly as a result of vehicle emissions of NO_x.

This section of the report assesses the general impact of the LTPS on acid deposition within the region. A discussion of the following is included:

- criteria which may be used for assessing the impacts of acid deposition on the natural environment;
- existing acidification loads to the region;
- a description of the methodology used to determine the likely additional load due to the LTPS emissions; and
- assessment of the LTPS impacts on the natural environment via acid deposition.

4.2 *CRITICAL LOADS*

The critical load is a term used to describe the sensitivity of the environment to acid deposition and is defined as:

A quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge.

The standard units used to express critical loads of acid deposition are kilo equivalents per square kilometre per year (keq km^{-2} yr^{-1}).

Critical loads applicable to Hong Kong will depend on the following:

- *Geology and soils;* in Hong Kong the bulk of soils are naturally acidic and, as a result, they will have limited buffering capacity and are likely to be susceptible to further acidification in response to the addition of acid via the atmosphere.

- *Climate*; annual rainfall in Hong Kong (approximately 2250 mm) is above the amount considered to increase sensitivity to acid deposition in Europe (1200 mm). The pattern of precipitation is highly seasonal, with the bulk of the rain falling in the warmer months, when solute dissolution and leaching effects are exacerbated, and pollutant loads affecting the Territory due to power generation are greatest.

Consideration of these and other factors has enabled critical load maps to be calculated for the UK [1]. The estimates are based on mineralogy, which is related to the ability of soils to resist acidification. Allowance is made for the moderating influence of land use, since land is limed and acidity neutralised in arable areas. Currently, critical loads within the UK vary between 20 keq km^{-2} yr^{-1} and 400 keq km^{-2} yr^{-1}.

With regard to Hong Kong, the actual threshold level, above which damage is likely to occur, is difficult to determine precisely, and will vary across the territory. However, due to the acidic soils and high precipitation rates, critical loads across the territory are likely to be at the lower end of the range estimated for the UK. Therefore, rather than attempting to predict critical loads for Hong Kong from the limited amount of information available, it is considered more appropriate to compare predicted deposition rates from the proposed LTPS with existing deposition within the Territory.

4.3 *EXISTING ACIDIFICATION IN HONG KONG*

4.3.1 *Introduction*

Results of acid rain sampling in Hong Kong for the period 1986 to 1988 were analysed. Sampling was performed at the following EPD air quality monitoring sites:

- Kwun Tong – an industrial area;
- Central/Western – a residential area; and
- Junk Bay – a rural area;

Monitoring involves the deployment of wet and dry deposition samplers at rooftop level adjacent to the air quality monitoring stations. Samples were collected at weekly intervals.

Sampling was also performed at an industrial site in Kwai Chung, during 1988. However, only seven weekly samples were collected. Therefore, these results are unlikely to be representative of the annual average deposition rate.

(1) Critical Loads Maps for the United Kingdom, Keith Bull and Members of the Critical Loads Advisory Group to the Department of the Environment

4.3.2 *Monitoring Results*

The results of acid deposition for the monitoring period are summarised in *Tables 4.3a* to *4.3c*. As can be seen from *Table 4.3a*, wet deposition rates for 1986 and 1987 are comparable. However, there is a significant decrease in the amount of wet deposition during 1988. This is due to a significantly lower precipitation rate during 1988; 31% compared to 1986 and 1987.

There is a significantly higher proportion of SO_4^{2-} wet deposited compared to NO_3^-. However, a proportion of the total SO_4^{2-} will consist of SO_4^{2-} derived from sea salt spray, particularly in locations such as Hong Kong and the UK. In the UK, between 20 and 60% of deposited sulphate is of marine origin.

Table 4.3a *Summary of Wet Deposition of NO_3^- and SO_4^{2-} (keq km^{-2} yr^{-1}) in Hong Kong*

Monitoring Site	Pollutant	1986	1987	1988
Kwun Tong	NO_3^-	22.5	22.1	11.8
	SO_4^{2-}	161.4	151.0	80.5
Central Western	NO_3^-	20.4	21.7	12.0
	SO_4^{2-}	124.3	94.9	76.6
Junk Bay	NO_3^-	22.9	23.9	14.5
	SO_4^{2-}	85.3	67.1	62.6

Table 4.3b *Summary of Dry Deposition of NO_2 and SO_2 (keq km^{-2} yr^{-1}) in Hong Kong*

Monitoring Site	Pollutant	1986	1987	1988
Kwun Tong	NO_2	4.6	4.2	5.5
	SO_2	35.8	48.4	71.0
Central Western	NO_2	6.4	4.4	6.0
	SO_2	30.0	25.2	45.8
Junk Bay	NO_2	5.8	5.1	6.3
	SO_2	17.5	14.9	18.1

Table 4.3c *Summary of Total Wet and Dry Deposition (Nitrogen plus Sulphur) Monitored in Hong Kong (keq km^{-2} yr^{-1})*

Monitoring Site	1986	1987	1988
Kwun Tong	224.3	225.7	168.8
Central Western	181.1	146.1	140.4
Junk Bay	131.5	111.0	101.5

Generally, wet deposition is largely the result of the long range transport of pollutants. Therefore, it is likely that much of the wet deposition at these monitoring sites result from emissions outside of the Territory, ie from the People's Republic of China (PRC). However, Kwun Tong (an industrial area) and Junk Bay (a rural area) experience significantly different wet deposition rates for sulphate, although they are located quite close to each other. This suggests that emissions from industrial areas within the Territory do have a significant contribution to the wet deposition of sulphur. The difference between Kwun Tong and Junk Bay suggests that this contribution is at least 80 keq km^{-2} yr^{-1} (1986, 1987 data).

Dry deposition rates (see *Table 4.3b*) are significantly less than the wet deposition rates. In addition, dry deposition rates were significantly higher during 1988; again this is a result of decreased precipitation rates – a higher proportion of pollutants are removed by dry, rather than wet processes.

Generally, dry deposition of pollutants will be from emissions within the Territory itself. This is illustrated by the spatial variation of dry deposition at these three sites. Highest deposition rates of SO_2 were observed at Kwun Tong, an industrial area, the predominant source of SO_2. Conversely, lowest SO_2 deposition rates were observed at Junk Bay, a rural area.

At Central Western (residential) and Junk Bay (rural) dry deposition of SO_2 was significantly lower than at Kwun Tong, whereas dry deposition of NO_2 was slightly higher. This is probably due to the influence of vehicular emissions of NO_x at these locations.

The total wet and dry deposition of sulphur and nitrogen at the three sites is summarised in *Table 4.3c*. During the measurement period, deposition rates are lowest at the rural site (Junk Bay), and highest at the industrial site (Kwun Tong). The deposition rate at Junk Bay is probably indicative of the background deposition rate for the region, representing deposition from sources within and outside of the region. This would suggest a background deposition rate of approximately 110 keq km^{-2} yr^{-1}, the monitoring sites at Kwun Tong and Central Western being influenced by additional local sources.

4.4 *ASSESSMENT METHODOLOGY*

4.4.1 *Introduction*

In order to assess the impact of the LTPS on acidification within the region, consideration must be given to the dry deposition of NO_2 and SO_2, and to the wet deposition of SO_4^{2-} and NO_3^-.

4.4.2 *Dry Deposition*

The contribution of dry deposition to the total deposition of acid species is relatively easy to calculate since the flux of gas to the ground can be expressed by the following equation:

$$F = V_g C$$

Where F is the flux ($\mu g\ m^{-2}\ s^{-1}$), V_g is the deposition velocity ($m\ s^{-1}$) and C is the gas concentration ($\mu g\ m^{-3}$, usually measured at a standard height of 1 m above the ground). The deposition velocity is dependent on physical, chemical, biological and meteorological parameters. As a result, deposition velocities for various pollutants show a wide range.

Pollutant concentrations resulting from the operation of the LTPS have been obtained using dispersion models. Detailed modelling of the emissions from the proposed LTPS at Black Point and the existing power station at Castle Peak were performed as part of the IAR. The model utilised was the US Environmental Protection Agency (US EPA) approved Industrial Source Complex dispersion model. The dispersion model was used with meteorological data obtained from Chek Lap Kok. The results of the wind tunnel experiments were not used as these predicted short-term, rather than long-term, pollutant concentrations. Providing information regarding the deposition velocities (V_g) of NO_2 and SO_2 are available, the general impact of the LTPS on the dry deposition load of the region can be determined in this way.

There is a wide variation in published deposition velocities, for example, V_g for SO_2 is quoted to be 0.1 to 4.5 $cm\ s^{-1}$ over grass, but 0.1 to 1.0 $cm\ s^{-1}$ over a pine forest. For this assessment deposition velocities have been obtained from the Third Report of the United Kingdom Review Group on Acid Rain (RGAR), prepared at the request of the UK Department of the Environment, September, 1990.

For SO_2, a mid-day maximum in the deposition velocity is often observed reflecting a maxima in stomatal opening and increasing uptake by plants. Seasonal variations with minimum values when vegetation is dry, for example, are also observed. Maximum deposition velocities are observed over water bodies. However, the concern with regard to the proposed development is the deposition of acidic species to land surfaces. Deposition velocities between 0.25 and 0.65 $cm\ s^{-1}$ are quoted by RGAR, with the maximum occurring during the day and the minimum at nighttime.

Therefore, an average daily deposition velocity of 0.4 cm s^{-1} was used in this assessment to predict the contribution of SO_2 to dry deposition.

For NO_2, the lowest deposition velocities have been found over water with values of between 0.01 and 0.02 cm s^{-1}. On soil and cement, values of between 0.3 and 0.8 have been quoted. RGAR quote deposition velocities of 0.1 to 0.2 cm s^{-1} for NO_2. Therefore, for this assessment a deposition velocity of 0.2 cm s^{-1} was used to predict the contribution of NO_2 to dry deposition.

These deposition velocities differ from those used in the IAR as they were obtained from current research material. In the IAR, deposition velocities for SO_2 [(1)] and NO_2 [(2)] of 0.5 cm s^{-1} and 0.4 cm s^{-1} were used, respectively.

4.4.3 *Wet Deposition*

The wet deposition of nitrate and sulphate can be calculated using the following equations and assumptions:

For nitrate wet deposition:

$$[NO_3]_D = [NO_2]_A \; x \; \frac{Z}{W} \; x \; CR_N \; x \; N_{eq} \; x \; B \; x \; K_m \; x \; C_w$$

Where:

$[NO_3]_D$ = Wet deposition of nitrate (Keq $km^{-2}yr^{-1}$);

$[NO_2]_A$ = Ground level concentration ($\mu g \; m^{-3}$) of nitrogen dioxide at a distance Z (m);

W = Wind speed, assumed to be 5 m s^{-1};

CR_N = Conversion rate for nitrogen dioxide to nitrate equivalent to 1.39 x 10^{-5} s^{-1} (5% hr^{-1});

N_{eq} = keq per μg of nitrogen dioxide, assumed to be 1/46 x 10^{-9} keq μg^{-1};

B = Boundary layer height, assumed to be 500 m;

K_m = Conversion from m^{-2} to km^{-2}, equivalent to 10^6 m^2 km^{-2};

C_W = Washout Coefficient 1,000 yr^{-1}.

(1) C S Davies and R G Wright, Journal of Geophysical Research, 90, 2091 (1985)

(2) G J McRae and A G Russell, Acid Deposition Series, Chapter 9, Pages 153–193, Butterworth, Boston (1984)

Therefore:

$$[NO_3]_D = [NO_2]_A \; x \; Z \; x \; 3.02 \; x \; 10^{-5}$$

For Sulphate wet deposition:

$$[SO_4]_D = [SO_2]_A \; x \; \frac{Z}{W} \; x \; CR_s \; x \; S_{eq} \; x \; B \; x \; K_m \; x \; C_W$$

Where:

$[SO_3]_D$ = Wet deposition of sulphate (Keq $km^{-2}yr^{-1}$);

$[SO_2]_A$ = Ground level concentration ($\mu g \; m^{-3}$) of sulphur dioxide at a distance Z (m);

W = Wind speed, assumed to be 5 m s^{-1};

CR_s = Conversion rate for sulphur dioxide to sulphate equivalent to $1.39 \times 10^{-6} \; s^{-1}$ (0.5% hr^{-1});

S_{eq} = keq per μg of sulphur dioxide, assumed to be $2/64 \times 10^{-9}$ keq μg^{-1};

B = Boundary layer height, assumed to be 500 m;

K_m = Conversion from m^{-2} to km^{-2}, equivalent to $10^6 \; m^2 \; km^{-2}$;

C_W = Washout Coefficient 1,000 yr^{-1}.

Therefore:

$$[SO_4]_D = [SO_2]_A \; x \; Z \; x \; 4.34 \; x \; 10^{-6}$$

The contribution of the proposed LTPS to wet deposition is much more difficult to assess since it involves estimating the proportion of SO_2 and NO_2 which is converted to SO_4^{2-} and NO_3^-, respectively. In addition, the rate of deposition of these species must also be determined.

The formation of the strong acids, sulphuric acid (H_2SO_4) and nitric acid (HNO_3), depends to a large extent on the oxidation rates of SO_2 and NO_2, respectively. There are many chemical pathways in which these primary pollutants can be oxidised, many of which are driven by photochemical processes. Oxidation can occur in the atmosphere by homogeneous gas phase reactions, in aqueous droplets and on surfaces of aerosol particles. The rates of these reactions depend upon the environment being considered.

Maximum SO_2 oxidation rates in Central Europe [1] are of the order of 2% hr^{-1} in full sunlight. However, during winter the corresponding rates are expected to be slower by a factor of 3 to 5. Daily average rates during summer are in the order of 0.5% hr^{-1}, and this value has been assumed for estimating the rate of oxidation of SO_2 emissions from the LTPS.

The oxidation rate of NO_2 is significantly higher than for SO_2; maximum conversion rates in the order of 20 % hr^{-1} in full sunlight have been quoted for Central Europe[3]. During winter, these are reduced by a factor of 3 to 5 due to a decrease in photochemical activity. Daily average rates for summer are of the order of 5 % hr^{-1}, and this value has been taken as indicative of the oxidation rate of NO_2 emissions from the LTPS.

The conversion rates used for the assessment are probably quite conservative as they are based on daily summer averages. However, these values were chosen since precipitation and pollutant emissions also peak during the summer months.

Information regarding precipitation in Hong Kong is also required for the assessment. Data from the Royal Observatory covering the period 1951 to 1980 gives an average precipitation rate of 2,225 mm yr^{-1} with an average duration of 777 hours yr^{-1}. This information has been used to estimate the proportion of SO_4^{2-} and NO_3^- removed from the atmosphere.

4.4.4 *Emission Characteristics*

The emission characteristics which have been used to predict the ground level concentration of SO_2 and NO_2 are summarised in *Annex B*. It is not appropriate to model the power stations at full operational load since the model results will be used to determine annual deposition rates. Data regarding the percentage of time the LTPS and the Castle Peak power station will be operational throughout the year, and emission characteristics at 50, 75 and 100%, as supplied by CLP, have been used to estimate annual average emissions from the various emissions sources.

4.5 *ACIDIFICATION IMPACTS OF THE LTPS*

4.5.1 *Introduction*

In order to assess the impact of the LTPS on the acidification of the region a number of scenarios have been examined as follows:

- coal–fired option;
- coal–fired option with oil substitution;

(1) S Beilke, Acid Deposition – An updated review on atmospheric physio–chemical aspects of the acid deposition problems in Europe (1985)

- CCGT gas-fired option;
- CCGT oil-fired option; and
- contributions from Castle Peak.

4.5.2 *Results*

The contribution of the LTPS (coal-fired) to wet and dry deposition of sulphur and nitrogen has been calculated individually in order to assess the relative contributions of each to the total deposition rate. The deposition rate of each is summarised in *Table 4.5a* and *Figures 4.5a – 4.5h* present the contours of total deposition under different scenarios.

Table 4.5a *Summary of Wet and Dry Deposition (keq km^{-2} yr^{-1}) Resulting from the LTPS (Coal-Fired Option with FGD)*

	Westerly Maximum keq km^{-2} yr^{-1}	**Location of Maximum[1] (x km, y km)**	**Southeasterly Maximum keq km^{-2} yr^{-1}**	**Location of Maximum[1] (x km, y km)**
Dry Deposition of NO_2	2.9	(–20, 0)	3.1	(5, –2.5)
Dry Deposition of SO_2	1.8	(–20, 0)	2.0	(5, –2.5)
Wet Deposition of NO_3^-	1.8	(–50, 0)	0.7	(50, –20)
Wet Deposition of SO_4^{2-}	0.1	(–50, 0)	0.05	(50, –20)
Total Deposition	5.9	(–26, 0)	4.7	(9, –4)

[1] Measured relative to the LTPS at Black Point

The maximum dry deposition rates occur quite close to the source where ground level pollutant concentrations are higher. However, the maximum wet deposition rates occur much further from the source due to the increased production of these pollutants further downwind. In fact the maximum wet deposition rate occurs beyond the distance modelled.

The deposition of the nitrogen species is more significant than that of the sulphur species since with FGD the ground level concentrations of SO_2 are lower. In addition, the oxidation rate is a factor of ten higher for NO_2.

The total deposition rate illustrates that the contribution from both wet and dry deposition maximises at approximately 26 km to the west of the LTPS.

With respect to sensitive receptors the secondary maximum, occurring to the southeast of the LTPS, is of more importance. This rate applies to the southern most part of the Tai Lam Country Park.

The secondary maximum deposition rate represents about 4% of the existing background deposition rate and suggests the addition to existing acidification due to the LTPS will be minimal for this option. Most importantly, it could not be concluded that this additional load would result

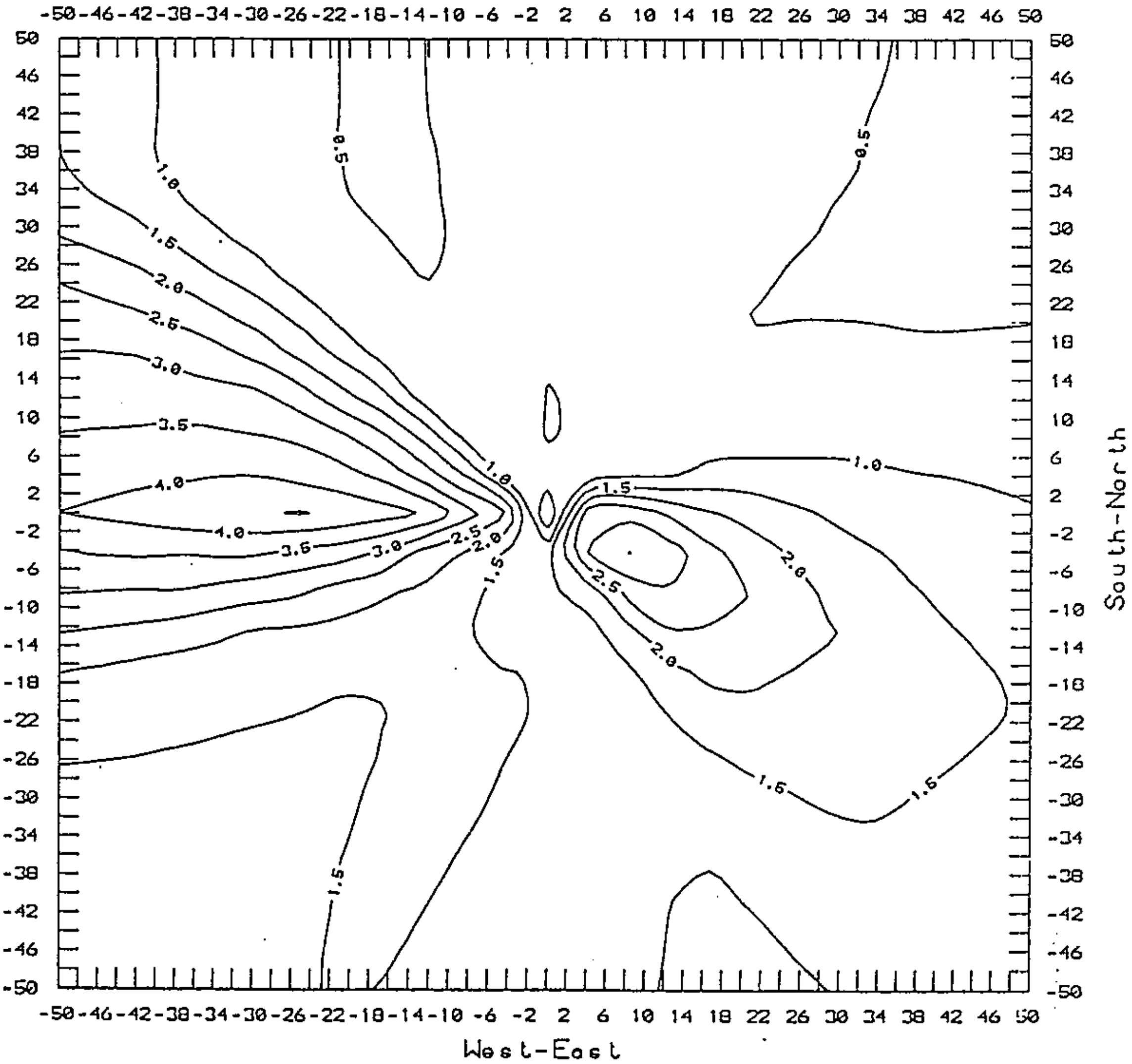


Figure 4.5a

Total Deposition keq km^{-2} yr^{-1} Mitigated Black Point

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

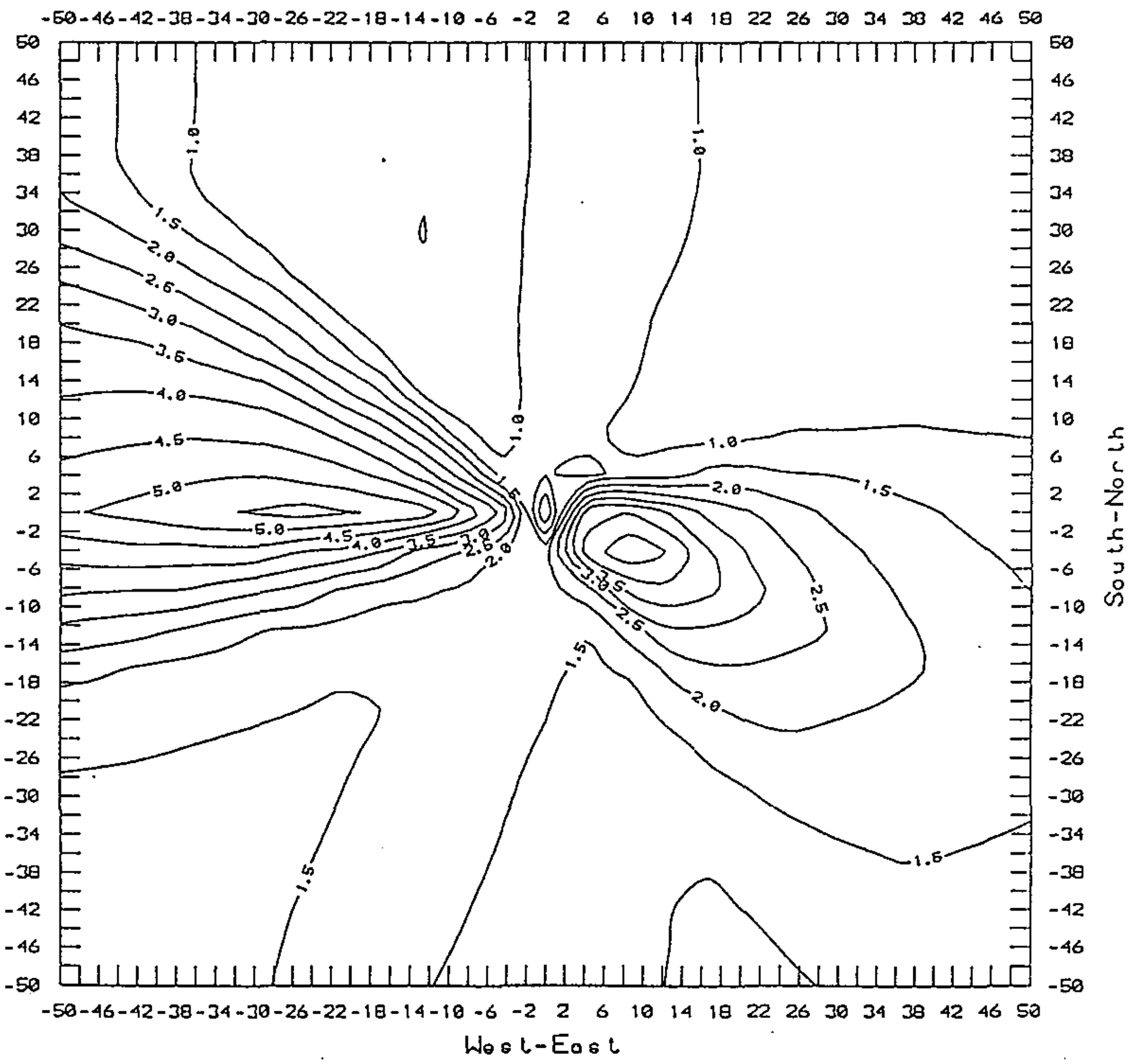


Figure 4.5b

Total Deposition keq km^{-2} yr^{-1} Black Point Oil Fired

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

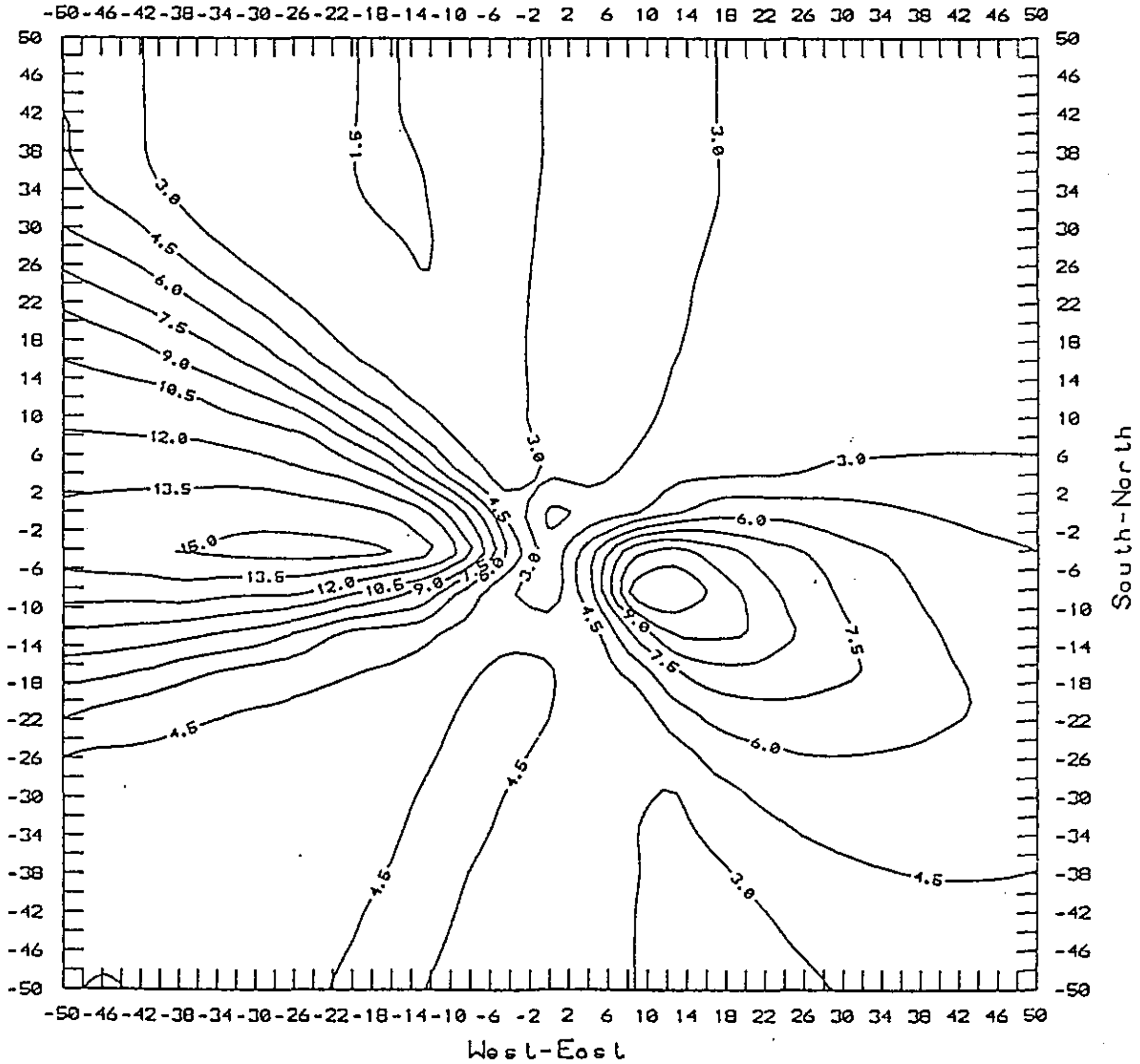


Figure 4.5c

Total Deposition keq km^{-2} yr^{-1} Castle Peak Mitigated

ERM Hong Kong
10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

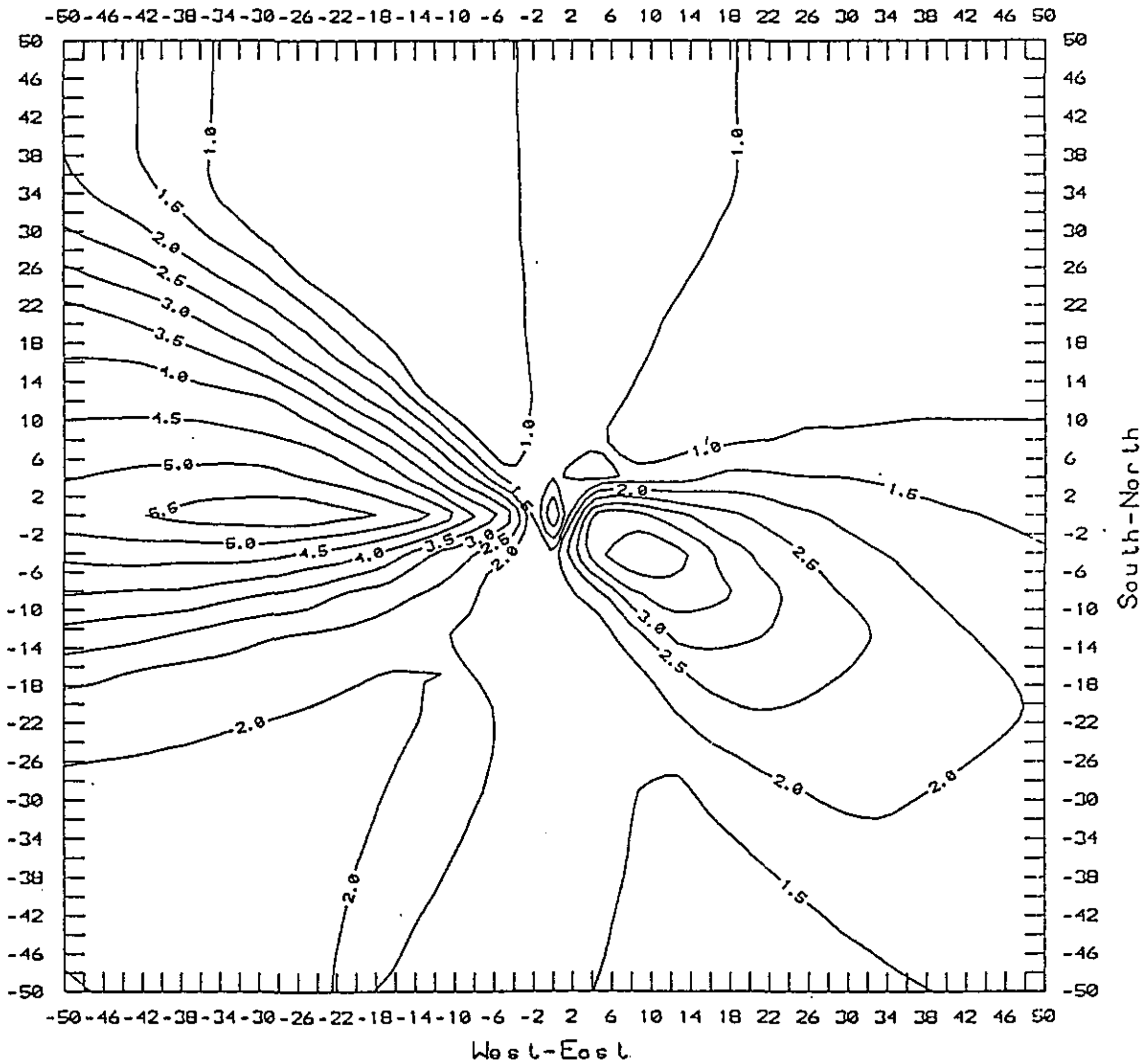


Figure 4.5d

Total Deposition keq km^{-2} yr^{-1} Black Point (coal-fired)

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

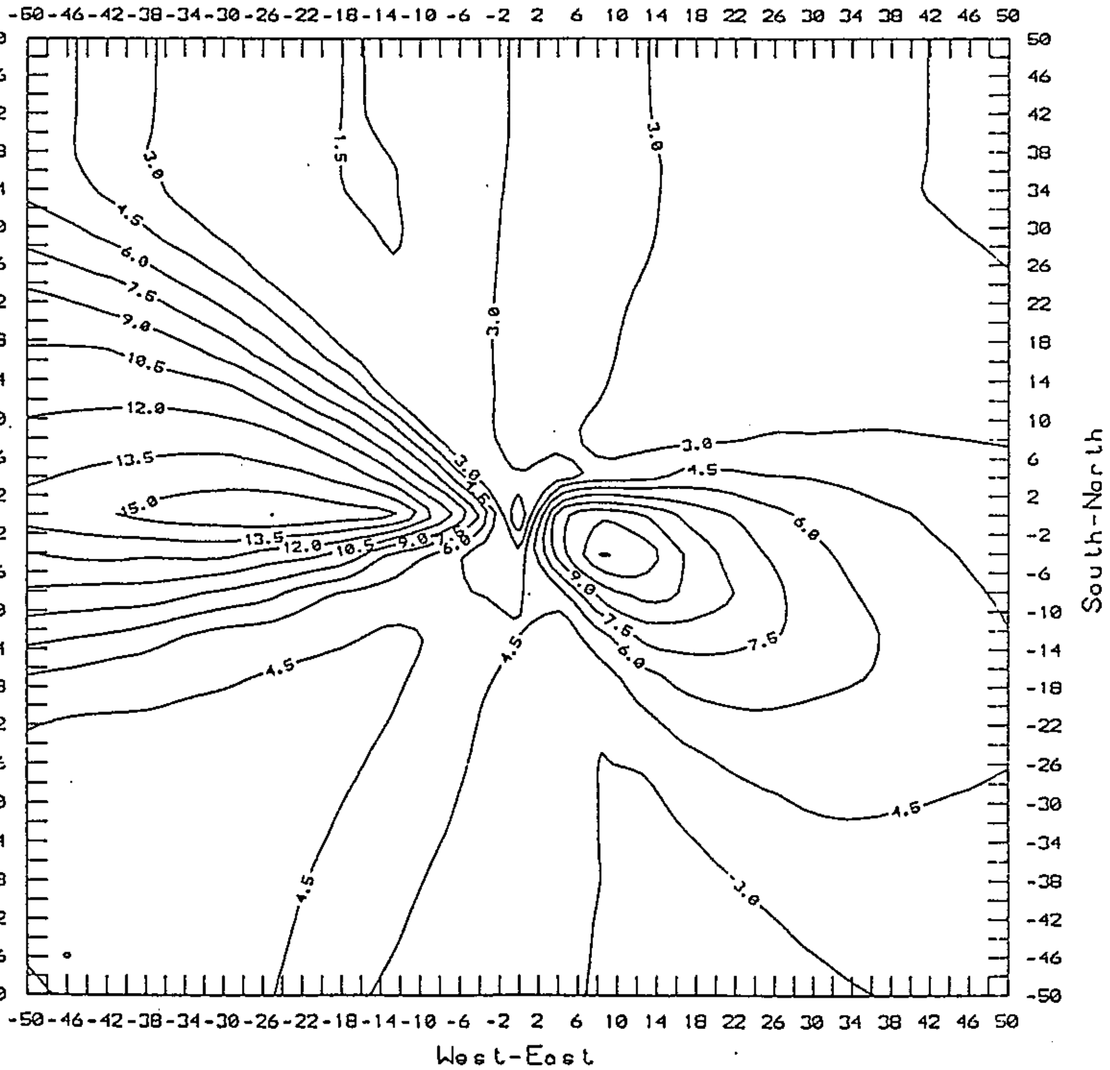


Figure 4.5e

Total Deposition keq km^{-2} yr^{-1} Black Point (coal-fired without FGD)

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

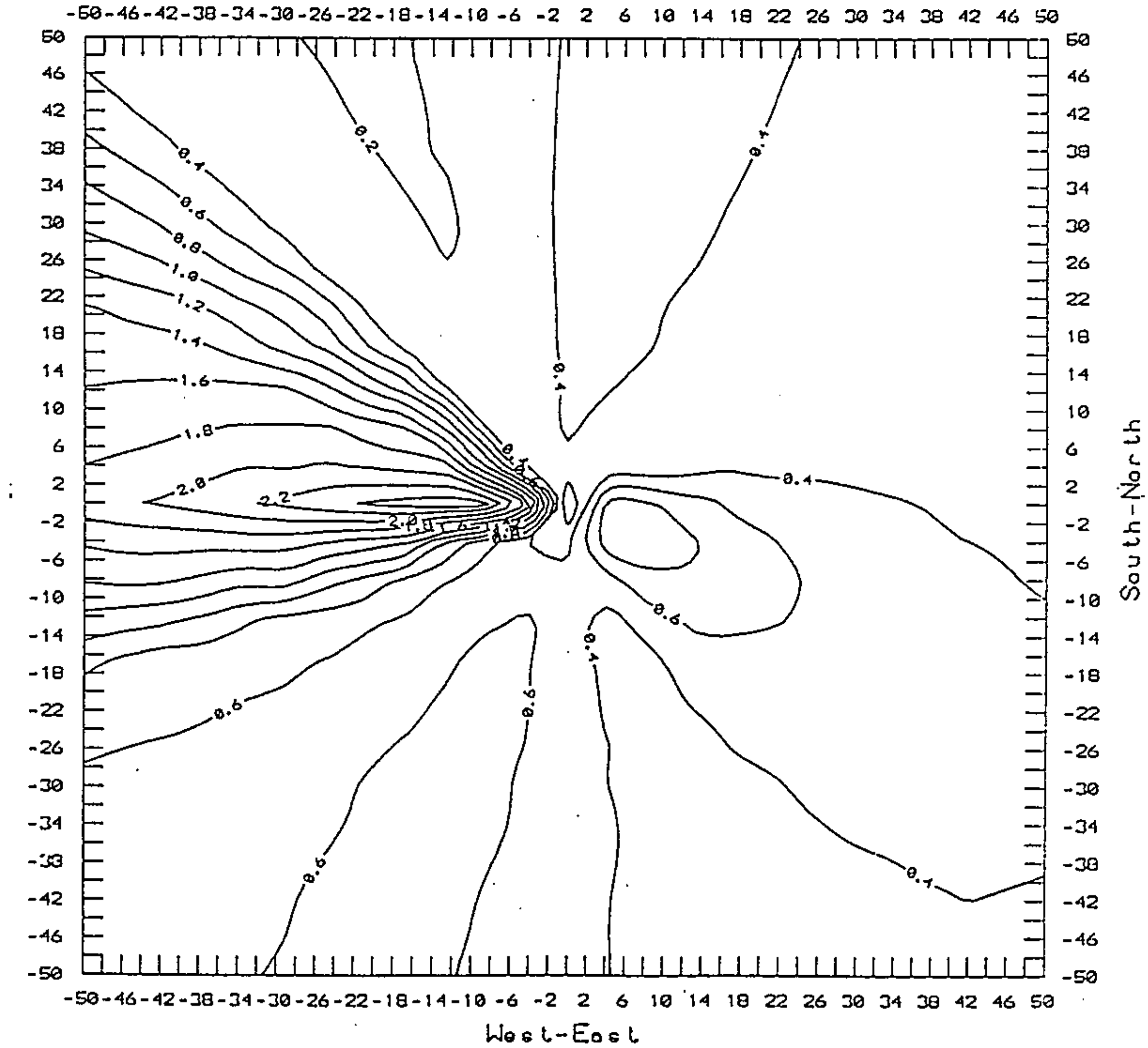


Figure 4.5f

Total Deposition keq km^{-2} yr^{-1} Black Point CCGT (gas-fired)

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

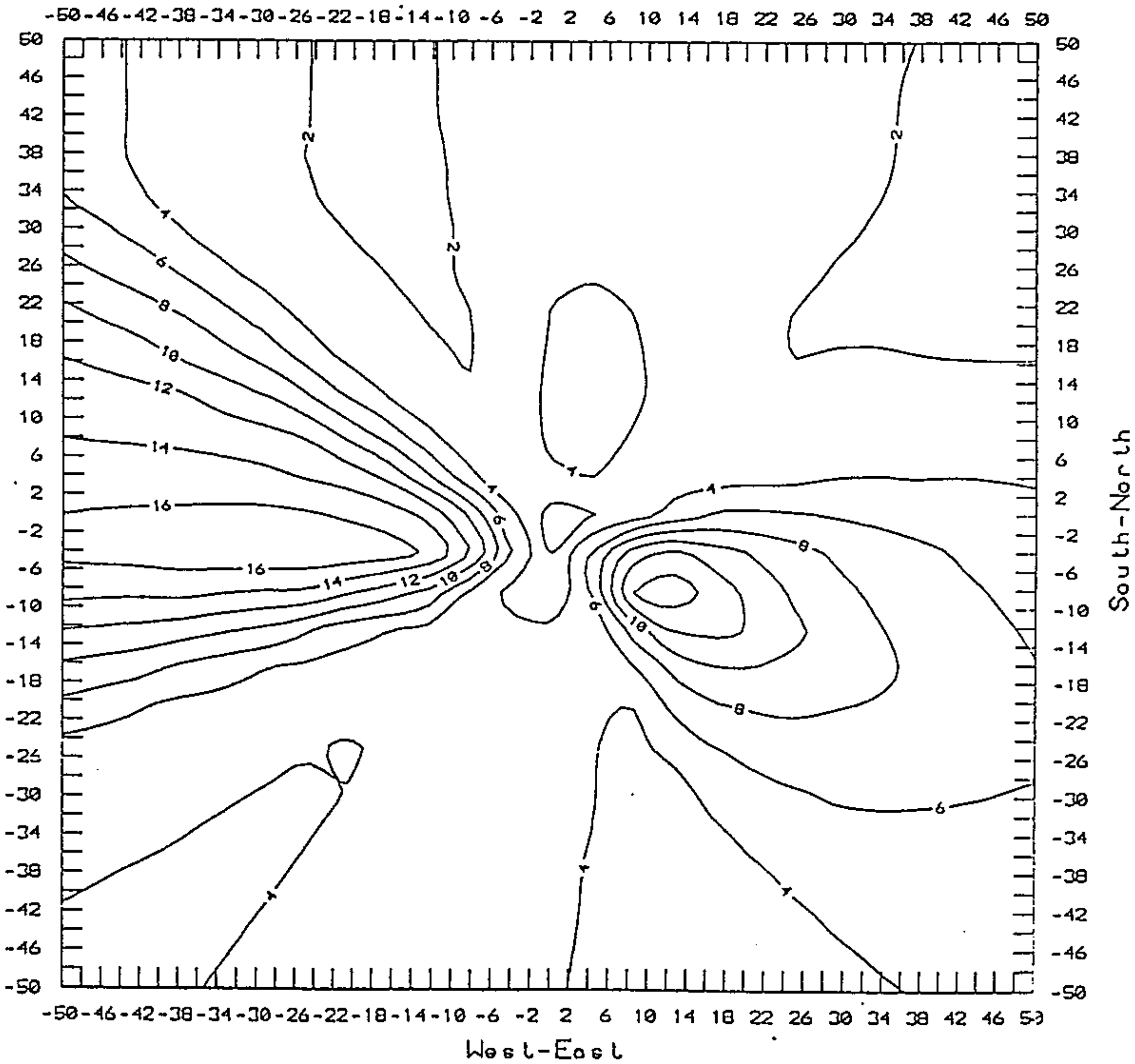


Figure 4.5g

Total Deposition keq km^{-2} yr^{-1} Castle Peak only

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

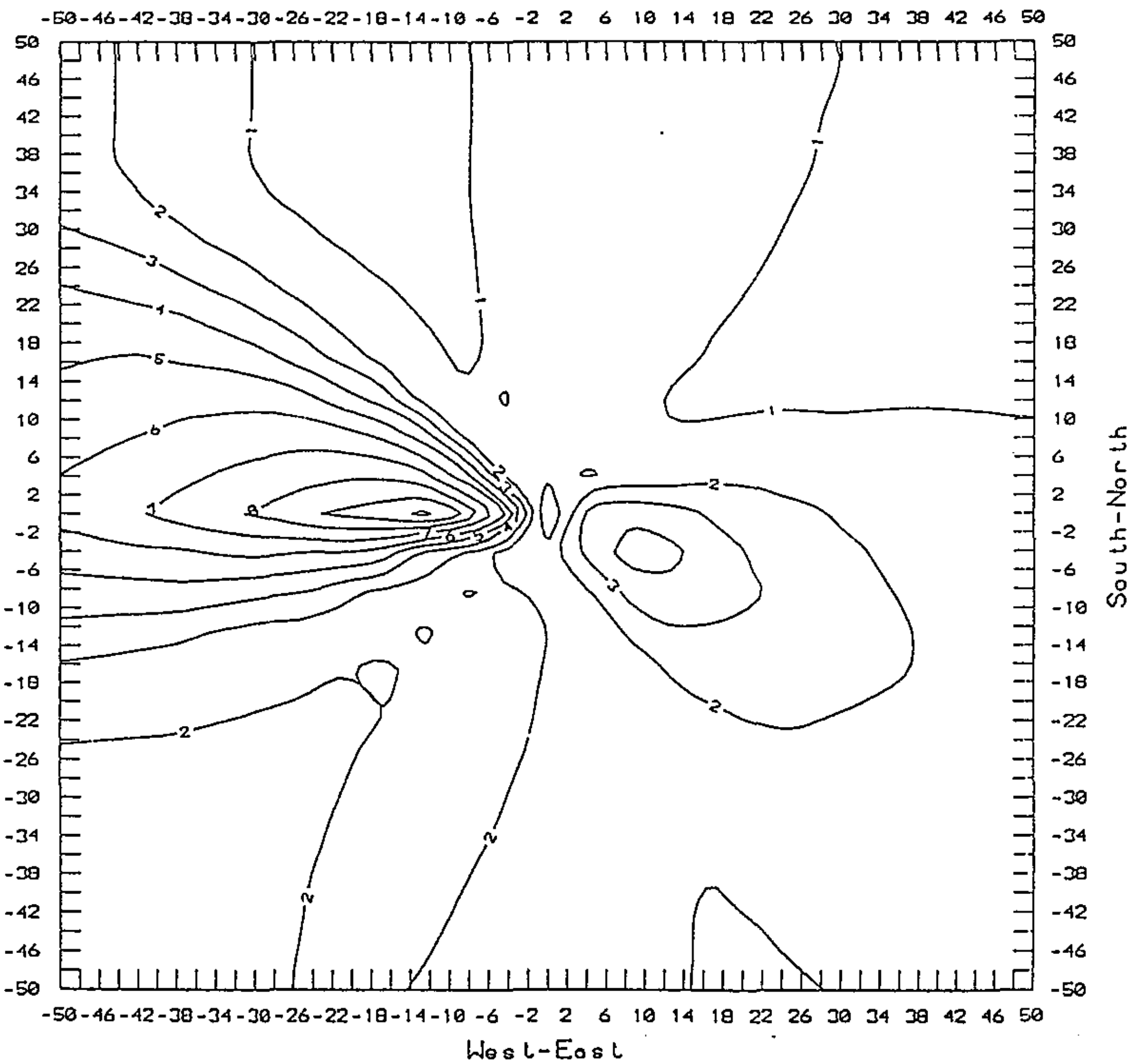


Figure 4.5h

Total Deposition keq km^{-2} yr^{-1} Black Point CCGT (oil-fired)

ERM Hong Kong

10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

in total deposition exceeding the local critical load. Therefore, it would not constitute a significant impact.

Total deposition rates for all of the options considered are summarised in *Table 4.5b*.

Table 4.5b *Summary of Total Deposition Rates for the Various Options Considered*

Option	Westerly Maximum keq km^{-2} yr^{-1}	Location of Maximum (x km, y km)[1]	Southeasterly Maximum keq km^{-2} yr^{-1}	Location of Maximum (x km, y km)[1]
Black Point (Coal-Fired with FGD)	5.9	(-26, 0)	4.7	(9, -5)
Black Point (Coal-fired without FGD)	16.5	(-26, 0)	13.9	(9, -5)
Black Point CCGT (Gas-Fired)	2.5	(-12, 0)	2.0	(10, -4)
Black Point CCGT (Oil-Fired)	10.2	(-12, 0)	7.2	(10, -5)
[2]Black Point (Oil-Fired)	5.9	(-26, 0)	4.8	(10, -5)
[3]Castle Peak	17.8	(-27.5, -2.5)	16.6	(10, -7.5)
[4]Mitigated Black Point (Coal-Fired Option with FGD)	4.5	(-26, 0)	3.6	(9, -5)
[5]Mitigated Castle Peak	15.8	(-27.5, -2.5)	14.7	(10, -7.5)

1 Measured relative to the LTPS at Black Point
2 NO_x: 200 ppm
3 NO_x: 1100 ppm CPA and CPB
4 NO_x: 253 ppm BP
5 NO_x: 1000 ppm CPA, 600 ppm CPB

Without FGD, the secondary maximum concentration of 13.9 keq $km^{-2}yr^{-1}$, again occurs to the southeast of the LTPS. Although the SO_2 emission rate increases by a factor of ten without FGD, the predicted acid deposition rate only increases by a factor of about three. This is due to the influence of contributions from NO_x and increased pollutant dispersion as a result of the higher emission temperature without FGD. Without FGD the LTPS would add about 15% to the existing acid deposition rate.

For the CCGT gas-fired options the acid deposition rates are lower than for the coal-fired option due to negligible SO_2 emissions. Over land, the gas-fired CCGT option would add about 2% to the existing acidification. This is almost negligible and would not result in any impacts.

For the CCGT oil-fired option the total deposition rate over land, 7.2 keq km^{-2} yr^{-1}, is significantly increased, compared to the gas-fired mode, due to the additional emissions of SO_2 for the distillate oil. Over land, the addition to existing acidification, as a result of oil-fired CCGT emissions would be about 8%.

For the LTPS substituting oil for coal predictions are similar to the coal-fired operation. This contribution is approximately 4% of the existing background acid deposition rate over the Territory. Although SO_2 emissions are higher for the oil-fired mode, NO_x emissions are approximately half that of the coal-fired operation, resulting in little net difference.

The contribution of emissions from the power station at Castle Peak to the existing acid deposition rate was also assessed. The secondary maximum occurs in northeast Lantau and represents approximately 15% of the existing background acid deposition rate for the Territory as estimated in *Section 4.4*. Compared to the estimated deposition rate measured at the industrially located monitoring site at Kwun Tong, the contribution from Castle Peak is approximately 8%.

As a result of human health effects the following mitigation options have been assessed:

- NO_x emissions on Castle Peak "A" are reduced from 1100 ppm to 1000 ppm;

- NO_x emissions on Castle Peak "B" are reduced from 1100 ppm to 600 ppm; and

- NO_x emissions from the LTPS (Coal-fired) are reduced from 380 ppm to 253 ppm.

The effect of applying the mitigation option to the LTPS at Black Point is to reduce the secondary maximum to 3.6 keq $km^{-2}yr^{-1}$. This represents a 25% reduction in the LTPS addition to the existing acid deposition rate. With respect to the secondary maximum, the future contribution to acid deposition would be reduced from 5% to 4%.

The effect of applying the mitigation options to the Castle Peak power station is to reduce the existing contribution of Castle Peak to the background deposition by 2%, ie from 15% for the unmitigated situation to 13% for the mitigated situation.

Overall, the predictions suggest that the application of the proposed mitigation measures to Castle Peak would reduce the existing total acid deposition rate by 2%. With mitigation measures applied to the LTPS at Black Point (coal-fired option) the predicted contribution to the total acid deposition rate is approximately 4%. Therefore, assuming the proposed mitigation measures are applied to both Castle Peak and the proposed LTPS at Black Point, the overall increase in the total acid deposition rate for the region is predicted to be insignificant at approximately 2%, and if mitigation is only applied to Castle Peak the overall increase is approx 3%.

5 CONCLUSIONS

From a consideration of worst case impacts incorporating conservative assumptions with regard to weather data, pollutant emissions, operating scenarios and ambient concentrations, Phase 2 of the study has arrived at the following main conclusions:

- The proposed power station, even when fully developed and running at full load, will not by itself cause the Hong Kong 1-hour Air Quality Objectives for SO_2 and NO_2 to be exceeded. This conclusion applies to all of the proposed development options and to the options for substituting oil for coal or gas.

- For the main development options ambient NO_2 concentrations are affected more than SO_2 concentrations, relative to their respective AQOs.

- For the large majority of the time (95% or more) individual receptors will be unaffected by the power station plumes. For about 98% of the time or more, most receptors will be affected by NO_2 concentrations no more than 10% of the AQO for the coal-fired option. For other options including gas-fired units the magnitude of impacts due to the power station emissions will be significantly less.

- Regardless of the development option, however, the overall impacts of stack emissions are dependent upon the coincident background levels. It is concluded that for receptors in the New Territories and most of Lantau background levels will not be sufficiently high to cause the AQOs to be exceeded with addition of the pollutant load from the new power station. The situation is marginal for Chek Lap Kok and the north Lantau coastline, all of which will be affected by emissions from Castle Peak power stations at the same time as emissions from the new power station, though at a very low frequency. In addition the north Lantau coastline will be affected by emissions from Chek Lap Kok airport and other planned developments along the coastline (including the North Lantau Expressway).

- As indicated during the site search study, CLP are planning to retrofit some of the Castle Peak plant with new burners which will emit less NO_x. This analysis has now provided a firmer estimate of how that retrofit programme can be tailored to reduce Castle Peak emissions to balance the new pollutant load from Black Point. By phasing in low-NO_x burners at Castle Peak B with a source concentration of 600 ppm and achieving 1000 ppm at Castle Peak A, the new power station could be completed with coal-fired units and, not cause AQOs to be exceeded. Total emissions of NO_x from CPPS and Black Point together would then be 6.6% higher than those from the existing CPPS Plant.

- If gas-fired CCGT units are to be used exclusively at the new power station, offsite impacts on NO_2 levels will be less than for the coal-fired option and acceptable. However, the planned NO_x reductions at Castle Peak are still desirable and may permit lower stack heights.

- If gas-fired units are to be combined with coal-fired units the precise set of mitigation measures will depend on the plant mix, but if it is a 50/50 mix the reduction in the NO_x levels below the base coal case will reduce the likelihood of AQO exceedence. Mitigation measures at Castle Peak are still considered desirable however.

- Without Flue Gas Desulphurisation, and burning 1% sulphur coal (as received basis), the LTPS under 8 x 680 MW coal-fired scenario could result in exceedence of the SO_2 AQO at Chek Lap Kok. However, under the four combined cycle/four coal-fired unit (mixed fuel) scenario without Flue Gas Desulphurisation, such exceedences would not occur.

- Substitution of oil for coal or gas could be accommodated without causing the AQOs to be exceeded.

- The open-cycle gas turbine units should not cause any AQOs to be exceeded or act as a constraint to planned developments to the south of the site. Nevertheless, high concentrations of SO_2 are likely to occur on occasion in the very near-field (less than 1km downwind) over existing upland areas to the northwest, west and southwest, (and principally within the LTPS site). Taking account in particular of onsite air quality, there may be potential benefits of an 80m stack height which would make it worth CLP's consideration.

- An analysis of the regional potential for acidification impacts, through wet and dry deposition of pollutants has concluded that, on the assumption that the mitigation measures outlined above for Castle Peak and the proposed LTPS are implemented, there should be an increase in acid deposition of no more than 2% of current levels for the coal fired option (representing the worst case). This is considered to be an insignificant amount, well within the normal year-to-year range of variability, and no 'acidification' impacts on the natural environment due to this increase would be likely to occur.

- It is recommended that the conclusions of Phase 2 of the study be discussed and CLP's preferred development option be established, if at all possible, before firm proposals are made for any further wind tunnel tests and analyses in Phase 3.

To confirm the above findings regarding the SO_2 and NO_2 impacts, CLP agreed to make a more rigorous assessment of the frequency of probable AQO exceedance for the critical receptors under the short-listed study options, based on 6-year actual hourly meteorological data at Chek Lap Kok, and the seasonal profiles of loads for both LTPS and CPPS. This "Rigorous Frequency Assessment" is reported as *Part B* of this AKIA.

Key To Development Options

Option	Description	Stack Height (m)
1	10 OCGTs (100MW) stack A	50
2	4 x 2 Coal–Fired (680 MW) max FGD of 90%	250
3	8 Gas–Fired CCGTs (600 MW)	100
4	2 x 2 Coal–Fired (680 MW) no FGD	250
5	4 Gas–Fired CCGTs (600 MW)	100
6	4 Oil–Fired CCGTs (600 MW)	100
7	8 Oil–Fired CCGTs (600 MW)	100
8	2 x 2 Coal–Fired (680 MW) max FGD of 90%	250
9	2 x 2 Coal–Fired medium FGD of 50%	250
10	10 OCGTs (100 MW) stack A	80
11	10 OCGTs (100 MW) stack A	100
12	8 Gas–Fired CCGTs (100 MW) stack A	150
13	4 x 2 Coal–Fired (680 MW) max FGD of 90%	200
14	4 x 2 Oil–Fired (680 MW) max FGD of 90%	250
15	2 x 2 Oil–Fired (680 MW) max FGD of 90%	250
16	2 x 4 Coal–Fired (680 MW) max FGD of 90%	250
(5 + 8)	2 x 2 Coal–Fired with max FGD plus 4 Gas–fired CCGTs	250

PART B

RIGOROUS FREQUENCY ANALYSIS

PART B

RIGOROUS FREQUENCY ANALYSIS

CONTENTS

1 *INTRODUCTION*

This document describes a refined frequency analysis assessment for the air quality at key sensors, arising from the development of the Black Point LTPS. This aspect of study follows the Part A Report "Complex Terrain Wind Tunnel Tests" of the AKIA and was the subject of the scope of further assessment agreed with EPD. The outline intentions were agreed in the response to EPD comments on the Part A Report "Complex Terrain Wind Tunnel Tests".

The purpose of the work is to simulate at sensitive receptors realistic concentration levels over many years of actual wind records and, thereby, produce statistics of concentration which can be compared with the Air Quality Objectives. The impact of different development options at Black Point, combined with the influence of the Castle Peak stations, can be gauged through these parameters.

2 GENERAL APPROACH

2.1 COMPLEX TERRAIN WIND TUNNEL TESTS

The complex terrain wind tunnel tests modelled various configuration and emission scenarios for the Black Point LTPS, together with the influence of Castle Peak A and B stations for appropriate cases. The tests were performed for discrete wind directions and speeds and the principle measurements were those of ground level concentration along the various wind directions.

Judgement of the impact of these predictions of air–quality is made relative to the prevailing Air Quality Objectives (AQOs). The AQOs are expressed in terms of the magnitude of concentration of a pollutant not to be exceeded for specified periods of time (1 hour limit: 3 hours per year; 24 hour limit: 1 day per year; magnitude limit on annual average).

The AQOs refer, therefore, to the probability distributions of different concentration averages and ideally, the statistics of concentration at a given location should be determined. This requires the combination of representative wind speed and direction variations with the (deterministic) wind tunnel predictions. In view of the number of scenarios and calculations in this process, the Part A Report adopted a more approximate approach, wherein the wind data was examined for frequency of occurrence of speeds for particular directions, leading to the choice of a single wind speed to compare with the 1 hour AQO. General conclusions were drawn and discussion with EPD led to the agreement by CLP to examine the most important cases by the more rigorous frequency analysis method.

The fundamentals of the frequency analysis approach are familiar to EPD to the extent that they were discussed and then used in a previous study for Hong Kong Electric. The principle extensions required for this particular study relate to the multiple sources which comprise the Black Point and Castle Peak stations. The method of analysis is described further in the following section.

2.2 ANALYSIS LOCATIONS AND OPERATION SCENARIOS

2.2.1 *Analysis Locations*

During the wind tunnel measurements of plume dispersion and ground level concentrations, results were obtained at many receptor locations, both in the near field surrounding and at more distant locations. The data gathered allows reliable predictions to be made at a variety of locations and the nature of the power station plumes to be well described.

For the rigorous frequency analysis five specific locations were selected for detailed investigation. The locations were chosen to reflect the centres of population (***Butterfly Estate***), areas of development (***Tung Chung***), regions of special sensitivity (***Mai Po Natural Reserve***) and the villages local to the power station location (***Lung Kwu Tan*** and ***Ha Pak Nai***).

The precise locations for Lung Kwu Tan and Ha Pak Nai are 2km on a heading of 140° (40° east of south) and 3.2km on a heading of 52° (east of north) from Black Point respectively.

Figure 2.1a depicts the various rigorous analysis locations.

2.2.2 *Assessment Scenarios*

The Black Point LTPS is assumed to be configured as:

- Scenario 1: all coal
- Scenario 2: all gas
- Scenario 3: half coal – half gas

For the above scenarios, Castle Peak has been considered with and without mitigation by retrofitting low NO_x burner as:

- Case A : no NO_x mitigation at CPPS
- Case B : with NO_x mitigation at CPPS

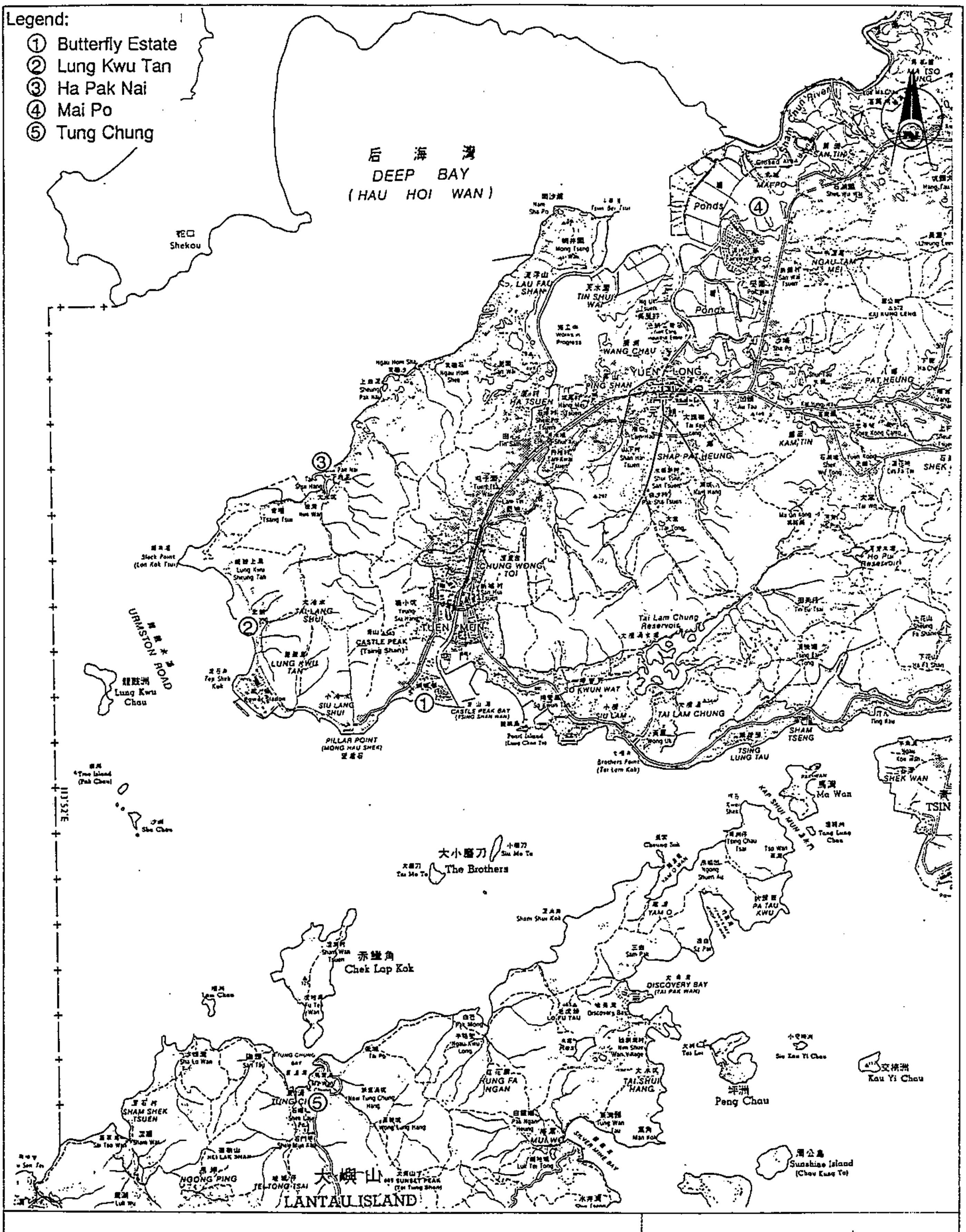


Figure 2.1a

Rigorous Frequency Analysis Locations

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9 Chatham Road,
Tsimshatsui,
Kowloon, HONG KONG

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3 *DETAILED METHODOLOGY*

3.1 *METEOROLOGICAL DATA*

Detailed meteorological records were available for six years between 1985 and 1990 at Chek Lap Kok. Data of wind, rainfall and temperature were available continuously at one minute intervals.

Fluctuations in the wind are caused by local turbulence and by large scale synoptic effects. A common meteorological standard is the use of ten minutes as an averaging period to remove the local turbulence fluctuations but to retain the longer time changes of wind speed and direction.

The wind tunnel measurements contain the effects of local turbulence with mean wind speed and direction constant. Mean wind speed changes on a ten minute basis, therefore, represent a logical choice for the frequency analysis. Longer time averages for the wind record (eg one hour) can be used, but greater realism should exist by averaging the output of the analysis (concentration) over such longer periods rather than the input (the wind).

The analysis uses each successive ten minute wind average as the input.

3.2 *PROFILE OF LOADS*

A seasonal profile of load and a load sharing plan (*Tables 3.2a & 3.2b*) have been used to determine the emission levels. Source NO_x and SO_2 concentrations are shown in *Table 3.2c*. The wind tunnel data of concentration versus speed and direction is used to allow interpolation for the predicted concentration at the particular point in time. An angular spread of the plumes has been taken as +/−11°, with a conservative "top-hat" profile of concentration (i.e. the maximum centre-line concentration has been assumed over the plume width).

Table 3.2c *Source NO_x and SO_2 concentrations[1] for frequency analysis*

	Wind Tunnel Option	NO_x as NO_2 ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)
Black Point CCGT	[3], [5]	97686	negligible
Black Point Coal	[2], [8]	595740	190421
CPA	CPA	1577066	1635476
CPB	CPB	1578512	1726498
Mitigated CPA[2]	-	1433696	1635476
Mitigated CPB[3]	-	861007	1726498

Note:
1. Quoted from Annex B of this AKIA Report.
2. Mitigated NO_x of 1000 ppm from 1100 ppm at CPA.
3. Mitigated NO_x of 600 ppm from 1100 ppm at CPB.

3.3 *Derivation of Concentration Functions*

Although the Castle Peak Power Station was only modelled for directions to Lantau in this study, directly modelled results were available from previous work by the UK Central Electricity Research Laboratories (CERL, 1981).

For Tung Chung, Lung Kwu Tan and Butterfly Estate, direct measurements existed. For the Mai Po wind direction from Castle Peak, CERL measurements were available, but extrapolation was required to reach Mai Po itself. The further dilution with distance was estimated on the basis of measured dilution with distance at other angles. For Ha Pak Nai cross plots of concentration with wind angle incorporating BMT and CERL results were used to interpolate an estimate at each wind speed.

Annex H contains further details of this process.

3.3.1 *Time History of Concentrations*

Data on plume spread is available from the wind tunnel results. Some indication is given in *Figure 3.3a*, where data at a number of locations has been plotted together.

The resulting time history of concentration at a particular location has been analyzed for different time weighted averages – hourly, daily and annual – and the resulting distributions interrogated for concentration values at the non–exceedance frequencies specified in the AQO.

3.3.2 *Hourly and Daily Concentrations*

From a distribution of hourly concentrations, the value of concentration at a frequency of three hours per year can be determined. Similarly, from a distribution of daily averaged concentrations, the value of concentration at a frequency of once per year can be determined.

3.3.3 *Annual Concentrations*

Six years of meteorological data from Chek Lap Kok have been used for the frequency analysis. Ideally a longer period would have been preferred but no further information of detail was available. This record of the past has been used to predict typical conditions for the future. But future years will never be exactly like 1985, 86, 87, 88, 89 or 90, but on **average** future years can be expected to be like **average** past years.

If it is possible for an AQO to be exceeded then the frequency of occurrence will entirely depend on the frequency of the required meteorological conditions. No one can presume to suggest whether any future year will have a large number or a small number of such conditions. All one can say is that the overall **likelihood** or **probability** will be that a particular number will occur. Besides, the number of exceedances in a year will entirely depend on the arbitrary choice of when one year ends and the next begins.

Table 3.2a ***Typical Weekday Hourly Loading for Castle Peak and Black Point Stations All Eight Units at Black Point Are Coal Fed***

FY03	STN	HR01	HR02	HR03	HR04	HR05	HR06	HR07	HR08	HR09	HR10	HR11	HR12	HR13	HR14	HR15	HR16	HR17	HR18	HR19	HR20	HR21	HR22	HR23	HR24
	CPA	757	645	597	583	581	605	775	994	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1093	930
	CPB	1514	1290	1290	1193	1166	1211	1550	1987	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2187	1941
Winter. Dec-Feb	CP	2271	1935	1790	1749	1744	1816	2325	2981	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3280	2911
	BP	0	0	0	0	0	0	0	92	1049	2359	2899	3128	2770	2342	2729	2737	2758	2843	2938	2195	2156	1104	533	37
	CPA	861	348	691	670	666	693	881	1135	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1224	1080
	CPB	1721	1496	1381	1340	1332	1386	1363	2271	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2448	2160
Spring Mar-May	CP	2582	2244	2072	2010	1998	2079	2644	3406	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3672	3240
	BP	0	0	0	0	0	0	0	134	1489	3109	3727	4002	3565	3094	3582	3583	3540	3294	2995	2373	1661	1193	564	37
	CPA	1167	1035	962	912	929	1117	1342	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1342
	CPB	2334	2070	1923	1851	1824	1858	2233	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2684
Summer Jun-Aug	CP	3501	3105	2885	2776	2736	2787	3350	4026	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4026
	BP	0	0	0	0	0	0	0	297	2204	3802	4337	4453	4211	3857	4224	4232	4136	3886	3402	2946	2308	1770	1134	215
	CPA	851	738	678	650	642	675	880	1075	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1025
	CPB	1702	1476	1356	1301	1284	1351	1760	2149	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2051
Autumn Sep-Nov	CP	2553	2214	2034	1951	1926	2026	2640	3224	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3346	3076
	BP	0	0	0	0	0	0	0	343	2027	3661	4246	4478	4087	3666	4105	4115	4075	3976	3676	2886	2081	1532	854	154

Note: Same Distribution for "all gas" at Black Point.

Table 3.2b *Typical Weekday Hourly Loading for Castle Peak and Black Point Stations 4 Coal–fired and 4 Combined Cycle Plants at Black Point*

FY03	STN	HR01	HR02	HR03	HR04	HR05	HR06	HR07	HR08	HR09	HR10	HR11	HR12	HR13	HR14	HR15	HR16	HR17	HR18	HR19	HR20	HR21	HR22	HR23	HR24
	CPA	757	645	598	587	586	606	735	994	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1093	930
	CPB	1514	1290	1196	1174	1171	1211	1550	1987	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2187	1941
Winter Dec-Feb	CP	2271	1935	1794	1761	1757	1817	2325	2981	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3313	3280	2911
	BP(COAL)	0	0	0	0	0	0	0	92	1049	2310	2548	2597	2531	2182	2483	2477	2485	2546	2613	2163	1527	1105	533	37
	BP(GASCC)	0	0	0	0	0	0	0	0	0	47	331	480	225	151	231	245	256	280	306	30	0	0	0	0
	CPA	861	748	695	678	676	697	881	1135	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1236	1224	1080
	CPB	1721	1496	1389	1356	1353	1394	1763	2271	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2471	2448	2160
Spring Mar-May	CP	2582	2244	2084	2034	2029	2091	2644	3406	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3707	3672	3240
	BP(COAL)	0	0	0	0	0	0	0	134	1489	2297	2297	2297	2297	2297	2297	2297	2297	2297	2284	2101	1661	1193	564	37
	BP(GASCC)	0	0	0	0	0	0	0	0	0	763	1345	1551	1193	753	1208	1210	1169	938	668	256	0	0	0	0
	CPA	1167	1035	962	923	910	927	1117	1342	1364	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369	1342
	CPB	2334	2070	1923	1845	1820	1854	2233	2684	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738	2684
Summer Jun-Aug	CP	3501	3105	2885	2768	2730	2781	3350	4026	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4107	4026
	BP(COAL)	0	0	0	0	0	0	0	297	2204	2720	2720	2720	2720	2720	2720	2720	2720	2720	2720	2662	2308	1770	1134	215
	BP(GASCC)	0	0	0	0	0	0	0	0	0	1019	1522	1644	1403	1071	1416	1423	1332	1097	643	267	0	0	0	0
	CPA	851	738	680	660	655	678	880	1075	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1121	1025
	CPB	1702	1476	1360	1321	1309	1356	1760	2149	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2243	2051
Autumn Sep-Nov	CP	2553	2214	2040	1981	1964	2033	2640	3224	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3364	3346	3076
	BP(COAL)	0	0	0	0	0	0	0	343	1963	2297	2297	2297	2297	2297	2297	2297	2297	2297	2297	2265	1985	1532	854	154
	BP(GASCC)	0	0	0	0	0	0	0	0	60	1283	1833	1997	1684	1288	1700	1710	1672	1579	1298	585	90	0	0	0

CPA = 0.333 x CP
CPB = 0.667 x CP

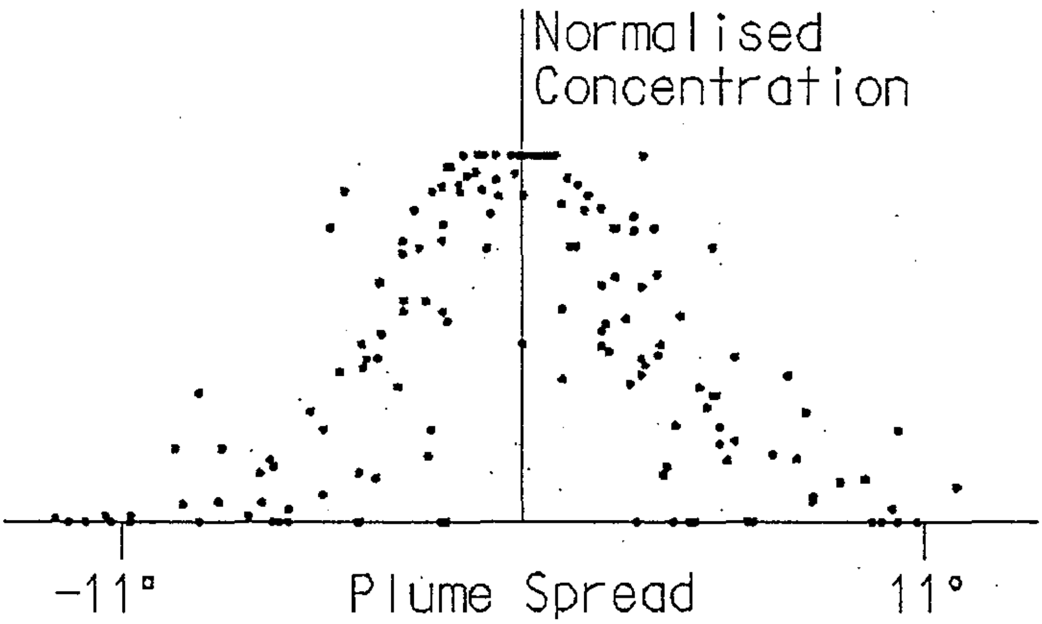

Figure 3.3a Measured Cross Wind Plume Spread.

(glc/glc_{max} versus angle for various locations)

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9 Chatham Road,
Tsimshatsui,
Kowloon, HONG KONG

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To be conservative, worst case hourly concentrations in any one year of the six candidate years were established. Since the hourly AQOs are based on maximum three exceedance per year, the worst case annual 99.966 percentile values of concentrations were compared to the hourly AQOs for compliance. If these worst case annual 99.966 percnetile values are less than the respective AQOs, it can be concluded that there will be no violation of the hourly AQO in the future combined operation of Black Point LTPS and CPPS.

During the simulations, a record was kept of the individual exceedance events (including the date, time, and individual power station contributions). Detailed outputs from the log file are given in *Annex F*.

3.4 *BACKGROUND AIR QUALITY*

Background concentrations are an essential part of the total air quality concentrations to be considered in determining impacts. Background emission sources are referred to the existing sources and the planned future sources in the vicinity, other than the CPPS and the LTPS.

3.4.1 *Existing Background Air Quality Monitoring*

Tables 3.4a and *3.4b* depict the existing air quality at various CLP monitoring stations pertinent to this rigorous analysis. All these results were measured under the influence of all emission sources in the vicinity and under a full spectrum of meteorological conditions. It is clear that the existing NO_2 and SO_2 levels at the various locations are well within the respective AQOs.

These monitoring results can be used to determine the existing background air quality for the meteorological conditions and averaging times of concern, by excluding values when CPPS is impacting the monitoring locations. For future background air quality, planned future should also be considered.

3.4.2 *Background Emission Sources*

Table 3.4c indicates the major background emission sources that would compound on the impacts from the CPPS and LTPS, for the wind directions of concern. These include both the existing and planned future emission sources.

3.4.3 *Future Background Air Quality*

The original *"Complex Terrain Wind Tunnel Tests"* have predicted that the maximum impacts would occur under relatively high wind speeds, typically in the range of 8–15 m s^{-1}. Under these wind speeds, the general background air quality is anticipated to be fairly good. The following paragraphs discuss the formulation of the future background hourly SO_2 and NO_2 at the various locations. Inclusion of background into the predicted long term impacts would not be of real substance because of the relatively insignificant overall long term impacts.

Table 3.4a Summary Results of SO_2 Monitoring ($\mu g\ m^{-3}$)

Years	Monitoring Locations						
	San Hui	Tuen Mun	Hung Shui Kiu	Au Tau	Black Point/ Lung Kwu Tan	Lau Fau Shan	Tung Chung
Annual average SO_2 concentrations							
1990	N/A	54	28	32	N/A	N/A	N/A
1991	13	29	33	49	12	14	9
1992	18	25	16	27	19	15	16
Annual daily maximum SO_2 concentrations							
1990	N/A	85 (Dec)	78 (Dec)	79 (Jul)	N/A	N/A	N/A
1991	63 (Dec)	117 (May)	90 (Jan)	93 (Aug)	59 (May)	51 (Feb)	50 (Feb)
1992	144 (Mar)	127 (Nov)	95 (Dec)	74 (Jan)	153 (Dec)	79 (Oct)	77 (Dec)
Annual hourly maximum SO_2 concentrations							
1990	N/A	267 (Jul)	355 (Jul)	231 (Jul)	N/A	N/A	N/A
1991	160 (Dec)	413 (May)	468 (May)	320 (Aug)	291 (Feb)	280 (Apr)	331 (Oct)
1992	553 (Mar)	427 (Jan)	219 (Dec)	208 (Dec)	288 (Jan)	420 (Jan)	295 (Mar)

Note (1) N/A denotes 'not available'.
(2) Words in bracket denote the month of occurrence.

Table 3.4b *Summary Results of NO_2 Monitoring ($\mu g\ m^{-3}$)*

Years	Black Point/Lung Kwu Tan	Lau Fau Shan	Tung Chung
Annual average NO_2 concentrations			
1991	18	25	13
1992	15	23	18
Annual daily maximum NO_2 concentrations			
1991	60 (Jun)	69 (Dec)	31 (Mar)
1992	56 (Jan)	100 (Dec)	108 (Apr)
Annual hourly maximum NO_2 concentrations			
1991	201 (Jun)	153 (Dec)	131 (Apr)
1992	155 (Sep)	180 (Dec)	236 (Apr)

Note (1) Words in bracket denote the month of occurrence.

Table 3.4c *Major Background Emission Sources for the Wind Directions of Concern*

Receptor	Existing Sources	Future Additional Sources	Wind Dir'n of concern (1)
Mai Po	Yuen Long Industrial Estate Traffic emissions from highways networks	Potential furthur industrial and highways developments	Southwesterly
Lung Kwu Tan	Nil	Tuen Mun Port and Area 38 Developments	Southeasterly
Ha Pak Nai	Nil	Tuen Mun Port Developments	Southwesterly
Butterfly Estate	Traffic emissions from highways	Area 38 Developments Tuen Mun Port Traffic	Westerly
Tung Chung	Nil	Tung Chung Developments	Northerly

Note (1) The wind directions of concern are the likely range of wind vectors that produce the maximum overall impacts.

Tung Chung

In the Part A AKIA Report, the future background NO_2 levels in Tung Chung have been assumed to be 45 $\mu g\ m^{-3}$ (15% AQO) and 75 $\mu g\ m^{-3}$ (25% AQO) under high and moderate wind speeds respectively. The SO_2 level has been assumed to be 65 $\mu g\ m^{-3}$ (8% AQO) with considerations of the North Lantau Developments. These figures were also used in this Part B AKIA Report.

Mai Po

Delineation of monitoring data to estimate the background air quality without the impacts from the CPPS and under particular combination of meteorological conditions is very difficult. To overcome this, background air quality estimates from monitoring results averaged over a relatively longer periods are used as an alternative. These relatively long-term averages are lower than the short-term maximum and would 'numerically' reflect the anticipated situation of fairly good air quality under the influence of strong winds. This estimation is also supported by the fact that maximum hourly monitoring figures tend to occur in successive periods rather than as isolated events, which indicates highest hourly monitoring figures are likely to be accompanied by relatively higher daily figures. The average daily maximum monitoring results were used to indicate the existing background air quality without the impacts from the CPPS, for the concerned high wind speed meteorological conditions.

Monitoring results at Lau Fau Shan should be representative of that at Mai Po and therefore, the background hourly SO_2 and NO_2 levels were taken to be 65 $\mu g\ m^{-3}$ (8% AQO) and 80 $\mu g\ m^{-3}$ (27% AQO) respectively.

Lung Kwu Tan

Air quality impacts from the Tuen Mun Port Developments and the Area 38 Developments can be derived from previous related studies by further dispersion modelling works. Under southerly wind having a typical speed of 8 $m\ s^{-1}$, modelling results indicate that the overall SO_2 and NO_2 impacts would only be about 4 $\mu g\ m^{-3}$ (1% AQO) and 8 $\mu g\ m^{-3}$ (3% AQO) respectively. Whereas under northerly wind, the overall SO_2 and NO_2 impacts would become 46 $\mu g\ m^{-3}$ (6% AQO) and 53 $\mu g\ m^{-3}$ (18% AQO) respectively. However, as the impacts from the CPPS are more significant than the LTPS, the lower future background data under southerly wind was adopted.

Ha Pak Nai

Similar to the case at Lung Kwu Tan, future background air quality at Ha Pak Nai can be derived from other studies carried out for the area by the technique of dispersion modelling. Additional modelling results indicate that SO_2 and NO_2 impacts from the Tuen Mun Port Developments would only be about 20 $\mu g\ m^{-3}$ (3% AQO) and 7 $\mu g\ m^{-3}$ (2% AQO) respectively.

Butterfly Estate

The SO_2 and NO_2 impacts from the Area 38 Developments would be very limited. Additional dispersion modelling works, based on the emission characteristics used in previous studies, indicate that the SO_2 and NO_2 impacts would only be about 2 $\mu g\ m^{-3}$ (1% AQO) and 2 $\mu g\ m^{-3}$ (<1% AQO) respectively.

Based on the Tuen Mun Port Developments Study, additional modelling works indicate that the existing and proposed highways networks in the vicinity of the Butterfly Estate would produce a NO_2 impact of about 65 $\mu g\ m^{-3}$ (21.6% AQO) at ground level under a typical wind speed of 8 m s^{-1}. Therefore, an overall future NO_2 background of 22 % AQO was assumed.

Due to the similar urban settings between Butterfly Estate and Tung Chung, the same background SO_2 was assumed for Butterfly Estate.

In summary, *Table 3.4d* shows the assumed future background SO_2 and NO_2 levels for consideration of the hourly impacts predicted from this rigorous analysis.

Table 3.4d *Assumed Future Background SO_2 and NO_2 levels*

Receptors	**(% hourly AQO)**	
	SO_2	**NO_2**
Mai Po	8	27
Lung Kwu Tan	1	3
Ha Pak Nai	3	2
Butterfly Estate	8	22
Tung Chung	8	25

4 DETAILED RESULTS

The scenarios considered required the runs indicated in *Table 4.1* to be undertaken. These were also repeated for reduced NO_x emissions at CPPS.

4.1 WIND TUNNEL TEST SCENARIOS

Receptor Location	Pollutant	BP Gas	BP Coal	CPA	CPB
				% of Total CPPS output	
Lung Kwu Tan	NO_2, SO_2	–	[2]	35	65
Lung Kwu Tan	NO_2, SO_2	[3]	–	35	65
Lung Kwu Tan	NO_2, SO_2	[5]	[8]	35	65
Ha Pak Nai	NO_2, SO_2	–	[2]	35	65
Ha Pak Nai	NO_2, SO_2	[3]	–	35	65
Ha Pak Nai	NO_2, SO_2	[5]	[8]	35	65
Mai Po	NO_2, SO_2	–	[2]	35	65
Mai Po	NO_2, SO_2	[3]	–	35	65
Mai Po	NO_2, SO_2	[5]	[8]	35	65
Butterfly Estate	NO_2, SO_2	–	[2]	35	65
Butterfly Estate	NO_2, SO_2	[3]	–	35	65
Butterfly Estate	NO_2, SO_2	[5]	[8]	35	65
Tung Chung	NO_2, SO_2	–	[2]	35	65
Tung Chung	NO_2, SO_2	[3]	–	35	65
Tung Chung	NO_2, SO_2	[5]	[8]	35	65

Note
1. [ ] option number in Annex B.
2. All for 10 min wind data at CLK (6 years).
3. All for year 2003 and four seasons load data, CLP 27/3/92, L. Wong.
4. All runs for hourly, daily and annual concentrations.
5. NO_2 conversion from NO_x : reference Annex E and emissions data from Annex B.

4.2 DETAILED RESULTS

The result for the five receptors are summarised in *Tables 4.2a – 4.2j*. Each receptor location has two tables, ie with and without NO_x mitigation at CPPS. The following information is pertinent:

- All results for all receptors fall within the relevant AQO. The tables show the concentration levels for both pollutants as a % of the relevant AQO. The hourly levels are the worst case annual 99.966 percentile values of the six candidate years.

- For the hourly NO_2 data the largest value is 95% (at Ha Pak Nai, *Table 4.2c*) and the lowest is 41.3% (at Mai Po, *Table 4.2f*). With mitigation at Castle Peak the maximum is reduced to 67.9% (*Table 4.2d*).

- For the hourly SO_2 data the largest value is 72.1% (at Lung Kwu Tan, *Table 4.2a*) and the lowest is 34.2% (at Mai Po, *Table 4.2e*).

- For the daily NO_2 data the largest value is 36.9% (at Tung Chung, *Table 4.2i*) and the lowest is 9.2% (at Butterfly Estate, *Table 4.2h*). With mitigation at Castle Peak this maximum is reduced to 28.1%.

- For the daily SO_2 data the largest value is 21.9% (at Tung Chung, *Table 4.2i*) and the lowest is 7.6% (at Butterfly Estate, *Table 4.2g*).

- For the annual average NO_2 the largest value is 3.0% (at Tung Chung, *Table 4.2i*) and the lowest is 0.3% (at Lung Kwu Tan, *Table 4.2b*). With mitigation the maximum is reduced to 2.3%.

- For the annual average SO_2 the largest value is 4.2% (at Tung Chung, *Table 4.2i*) and the lowest is 0.8% (at Lung Kwu Tan, *Table 4.2b*).

- At Lung Kwu Tan, Ha Pak Nai and Butterfly Estate, the hourly NO_2 and SO_2 data as % of AQO have the same concentration values for all development options of BP (*Tables 4.2a–4.2d*, and *4.2g–4.2h*). This is due to the fact that these top hourly events are solely caused by emissions from CPPS.

- The *Tables 4.2a – 4.2j* and the statements in this section, satisfy the requirements of the Air Quality Objectives in full, subject only to discussion on additional background pollution and the possible exclusion of stable atmospheric conditions.

- At Butterfly Estate the top hourly events have the same concentration value. This is due to the assumption, in the absence of data for winds greater than $15ms^{-1}$, that the value at $15ms^{-1}$ applies. This is a conservative assumption as there is evidence that the dilution of the plume increases at higher wind speeds and therefore concentration would decay above $15ms^{-1}$, rather than remain constant.

Annex F presents a summary of the analysis output, concentrating on hourly data and the largest events are also recorded in some detail. The wind speed and direction was averaged over the same period as the pollution predictions. In both cases the basic data was created at every ten minutes interval.

Table 4.2a *Case A Impacts (no NO_x mitigation at CPPS) at Lung Kwu Tan*

	1 - all coal	2 - all gas	3 - half coal, half gas
NO_2			
% of 1 hr AQO(1)	58.9 (1987)	58.9 (1987)	58.9 (1987)
% of 1 day AQO(2)	10.7	12.9	12.2
% of annual AQO	0.4	0.7	0.5
SO_2			
% of 1 hr AQO(1)	72.1 (1987)	72.1 (1987)	72.1 (1987)
% of 1 day AQO(2)	8.9	8.6	9.1
% of annual AQO	1.0	0.7	1.1

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2b *Case B Impacts (with NO_x mitigation at CPPS) at Lung Kwu Tan*

	1 - all coal	2 - all gas	3 - half coal, half gas
NO2			
% of 1 hr AQO(1)	45.7 (1987)	45.7 (1987)	45.7 (1987)
% of 1 day AQO(2)	10.1	12.1	11.3
% of annual AQO	0.3	0.6	0.5
SO_2			
% of 1 hr AQO(1)	72.1 (1987)	72.1 (1987)	72.1 (1987)
% of 1 day AQO(2)	8.9	8.6	9.1
% of annual AQO	1.0	0.8	1.1

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2c *Case A Impacts (no NO_x mitigation at CPPS) at Ha Pak Nai*

	1 – all coal	2 – all gas	3 – half coal, half gas
NO2			
% of 1 hr AQO(1)	95.0 (1987)	95.0 (1987)	95.0 (1987)
% of 1 day AQO(2)	20.7	15.4	20.5
% of annual AQO	0.9	0.7	1.1
SO_2			
% of 1 hr AQO(1)	65.8 (1987)	65.8 (1987)	65.8 (1987)
% of 1 day AQO(2)	13.5	13.3	13.5
% of annual AQO	1.7	1.5	1.9

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2d *Case B Impacts (with NO_x mitigation at CPPS) at Ha Pak Nai*

	1 – all coal	2 – all gas	3 – half coal, half gas
NO2			
% of 1 hr AQO(1)	67.9 (1987)	67.9 (1987)	67.9 (1987)
% of 1 day AQO(2)	16.1	11.3	16.0
% of annual AQO	0.7	0.5	0.9
SO_2			
% of 1 hr AQO(1)	65.8 (1987)	65.8 (1987)	65.8 (1987)
% of 1 day AQO(2)	13.5	13.3	13.5
% of annual AQO	1.7	1.5	1.9

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2e *Case A Impacts (no NO_x mitigation at CPPS) at Mai Po*

	1 - all coal	2 - all gas	3 - half coal, half gas
NO2			
% of 1 hr AQO(1)	63.2 (1988)	62.5 (1986)	63.1 (1988)
% of 1 day AQO(2)	23.8	20.6	23.9
% of annual AQO	1.0	0.8	1.2
SO_2			
% of 1 hr AQO(1)	34.2 (1986)	34.2 (1986)	34.2 (1986)
% of 1 day AQO(2)	13.2	12.5	13.2
% of annual AQO	1.3	1.1	1.3

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2f *Case B Impacts (with NO_x mitigation at CPPS) at Mai Po*

	1 - all coal	2 - all gas	3 - half coal, half gas
NO2			
% of 1 hr AQO(1)	48.6 (1985)	41.3 (1985)	44.7 (1988)
% of 1 day AQO(2)	18.8	14.6	18.7
% of annual AQO	0.9	0.6	1.0
SO_2			
% of 1 hr AQO(1)	34.2 (1986)	34.2 (1986)	34.2 (1986)
% of 1 day AQO(2)	13.2	12.5	13.2
% of annual AQO	1.3	1.1	1.3

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2g *Case A Impacts (no NO_x mitigation at CPPS) at Butterfly Estate*

	1 - all coal	2 - all gas	3 - half coal, half gas
NO2			
% of 1 hr AQO[1]	77.8 (1990)	77.8 (1990)	77.8 (1990)
% of 1 day AQO[2]	18.4	9.66	16.8
% of annual AQO	1.3	0.8	1.3
SO_2			
% of 1 hr AQO[1]	63.5 (1990)	63.5 (1990)	63.5 (1990)
% of 1 day AQO[2]	8.7	7.6	8.7
% of annual AQO	1.5	1.0	1.4

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2h *Case B Impacts (with NO_x mitigation at CPPS) at Butterfly Estate*

	1 - all coal	2 - all gas	3 - half coal, half gas
NO2			
% of 1 hr AQO[1]	58.0 (1990)	58.0 (1990)	58.0 (1990)
% of 1 day AQO[2]	17.9	9.2	14.9
% of annual AQO	1.2	0.7	1.2
SO_2			
% of 1 hr AQO[1]	63.5 (1990)	63.5 (1990)	63.5 (1990)
% of 1 day AQO[2]	8.7	7.6	8.7
% of annual AQO	1.6	1.0	1.4

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2i *Case A Impacts (no NO_x mitigation at CPPS) at Tung Chung*

	1 – all coal	**2 – all gas**	**3 – half coal, half gas**
NO2			
% of 1 hr AQO(1)	73.7 (1988)	64.6 (1985)	66.6 (1986)
% of 1 day AQO(2)	36.0	31.8	36.9
% of annual AQO	2.9	2.5	3.0
SO_2			
% of 1 hr AQO(1)	36.5 (1985)	36.0 (1985)	38.3 (1985)
% of 1 day AQO(2)	21.8	20.8	21.9
% of annual AQO	4.1	3.9	4.2

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

Table 4.2j *Case B Impacts (with NO_x mitigation at CPPS) at Tung Chung*

	1 – all coal	**2 – all gas**	**3 – half coal, half gas**
NO2			
% of 1 hr AQO(1)	59.7 (1988)	45.2 (1985)	45.1 (1986)
% of 1 day AQO(2)	26.8	23.1	28.1
% of annual AQO	2.2	1.8	2.3
SO_2			
% of 1 hr AQO(1)	36.5 (1985)	36.0 (1985)	38.3 (1985)
% of 1 day AQO(2)	21.8	20.8	21.9
% of annual AQO	4.1	3.9	4.2

Note (1) The maximum 99.966 percentile values in the six candidate years.
(2) The maximum 99.726 percentile values in the six candidate years.

5 OTHER METEOROLOGICAL CONDITIONS

Because of the high turbulence intensity, the condition examined in the wind tunnel is judged to be slightly unstable/neutrally stable instead of neutrally stable (the turbulence intensity, measured at 10m height, is 20–25% compared with neutral conditions of say 13–17%). Not represented therefore, are Pasquill stability A/B (highly convective conditions) and stability E/F (moderately stable conditions). Highly convective and moderately stable conditions occur at low wind speeds. By contrast, the exceedance limits calculated in the study are generated by the blowing down of plumes at higher wind speeds.

In the KIA Phase 2, Part 1 Report: "Analysis of Climatological Data", it was reported that stable conditions rarely occur and that their modelling is not justified. Even for a receptor which is located in a sector where stable conditions are most likely to occur, the likely frequency of occurrence of stable conditions is on average only about one night per year. Another important factor is the most stable conditions would normally occur at night time when Black Point Power Station will produce little or no emissions and Castle Peak is relatively lightly loaded. Stable conditions are therefore not expected to have any significant effect on the concentration exceedance limits calculated in this study.

In highly convective conditions, the plume is dispersed mainly by large scale turbulence eddies, and sinuosities (or loops) in the plume shape are large compared with the width of the instantaneous plume. The profile of longer term average concentration measured across the region, swept by the sinuosities will contain a smaller maximum concentration than that measured across the instantaneous plume (see for example, Environmental Aerodynamics by R.S . Scorer, Section 10.7). Consequently, significantly smaller maximum ground and near ground level concentrations will occur in highly convective conditions than at high wind speeds where the plume is blown down.

It is therefore considered that the most significant conditions have been dealt with and that predicted concentration limits are robust.

The three base cases examined for the LTPS were (a) 8x680 MW coal fired conventional units; (b) 8x600 MW gas fired combined cycle units; and (c) four of each type. Subsequent adjustment was made to these figures to derive data demonstrating the effect of low NO_x burners at Castle Peak (ie with and without NO_x mitigation) and the use of oil firing in place of the primary fuel.

The following discussions were based on the interpretation of hourly AQO exceedance being not more than three hours per year in all six candidate years..

6.1 8X680 MW CONVENTIONAL COAL-FIRED UNITS

Tables 6.1a and *6.1b* summarise the maximum NO_2 and SO_2 ground level concentrations at the various locations with and without NO_x mitigation at CPPS. The results show that the calculated ground level concentrations were well within Government AQOs.

Table 6.1a *NO_2 and SO_2 Ground Level Concentrations (no NO_x mitigation at CPPS)*

Receptor	% hourly NO_2	AQO(1) SO_2	% Daily NO_2	AQO(2) SO_2	% Annual NO_2	AQO SO_2
Mai Po	63.2	34.2	23.9	13.2	1.1	1.3
Lung Kwu Tan	58.9	72.1	10.7	8.9	0.4	1.0
Ha Pak Nai	95.0	65.8	20.7	13.5	0.9	1.7
Butterfly Estate	77.8	63.5	18.4	8.7	1.3	1.6
Tung Chung	73.7	36.5	36.0	21.8	2.9	4.1

Note: (1) Maximum 99.966 percentile values in the six candidate years.
(2) Maximum 99.726 percentile values in the six candidate years.

Table 6.1b *NO_2 and SO_2 Ground Level Concentrations (with NO_x mitigation at CPPS)*

Receptor	% hourly NO_2	AQO(1) SO_2	% Daily NO_2	AQO(2) SO_2	% Annual NO_2	AQO SO_2
Mai Po	48.6	34.2	18.8	13.2	0.9	1.3
Lung Kwu Tan	45.7	72.1	10.1	8.9	0.3	1.0
Ha Pak Nai	67.9	65.8	16.1	13.5	0.7	1.7
Butterfly Estate	58.0	63.5	17.9	8.7	1.2	1.6
Tung Chung	59.7	36.5	26.8	21.8	2.2	4.1

Note: (1) Maximum 99.966 percentile values in the six candidate years.
(2) Maximum 99.726 percentile values in the six candidate years.

As mentioned before, the hourly figures represent the values pertaining to the worst case annual 99.966 percentiles of the six candidate years. Reference to the tables in *Annex F* shows that technically the NO_2 AQO could have been breached on one occasion at Butterfly Estate on the 11th July 1986 (11–7–86).

This date correspond to periods of very high wind speed resulting from Typhoon Peggy. In this situation, however the generated load would have been substantially lower than that modelled, because reduced demand resulting from the shut down of factories and offices; this is illustrated by the Daily system Demand Curves in *Annex I*. The plot for 10–7–86 shows a broadly "normal" power demand curve, whereas that for the 11–7–86 shows a dramatic drop in power demand during the usual mid-afternoon 2pm–6pm peak period, as a result of the hoisting of the Number 8 Signal.

The situation with SO_2 is similar, with a technical breach of the AQO occurring at the Butterfly Estate due to the Typhoon Peggy.

Of interest overall is the very small contribution made to each of these events by the LTPS. In general the ground level effects are the results of the plumes from CPPS.

6.2 *8X600 MW Gas-Fired CCGT Units*

Tables 6.2a and *6.2b* summarise the maximum NO_2 and SO_2 ground level concentrations at the various locations with and without NO_x mitigation at CPPS. The results show that the calculated ground level concentrations were well within Government AQOs.

Table 6.2a *NO_2 and SO_2 Ground Level Concentrations (no NO_x Mitigation at CPPS)*

Receptor	% hourly NO_2	AQO(1) SO_2	% Daily NO_2	AQO(2) SO_2	% Annual NO_2	AQO SO_2
Mai Po	62.5	34.2	20.6	12.5	0.8	1.1
Lung Kwu Tan	58.9	72.1	13.0	8.6	0.7	0.8
Ha Pak Nai	95.0	65.8	15.4	13.3	0.7	1.5
Butterfly Estate	77.8	63.5	9.6	7.6	0.8	1.0
Tung Chung	64.6	36.0	31.8	20.8	2.5	3.9

Note: (1) Maximum 99.966 percentile values in the six candidate years.
(2) Maximum 99.726 percentile values in the six candidate years.

Table 6.2b *NO_2 and SO_2 Ground Level Concentrations (with NO_x Mitigation at CPPS)*

Receptor	% hourly NO_2	AQO(1) SO_2	% Daily NO_2	AQO(2) SO_2	% Annual NO_2	AQO SO_2
Mai Po	41.3	34.2	14.6	12.5	0.6	1.1
Lung Kwu Tan	45.7	72.1	12.1	8.6	0.6	0.8
Ha Pak Nai	67.9	65.8	11.3	13.3	0.5	1.5
Butterfly Estate	58.0	63.5	9.2	7.6	0.7	1.0
Tung Chung	45.2	36.0	23.1	20.8	1.8	3.9

Note: (1) Maximum 99.966 percentile values in the six candidate years.
(2) Maximum 99.726 percentile values in the six candidate years.

The daily and annual figures are correspondingly lower than the 8x680 MW Coal Fired results due to the reduced emissions from the Combined Cycle Units. The hourly figures are virtually the same as in the case of coal-fired units for most of the receptors, due to the dominance of CPPS. The dominance of CPPS however results in technical exceedences occurring on the same days as for the conventional plant units.

6.3 4 CONVENTIONAL - 4 CCGT UNITS

Tables 6.3a and *6.3b* summarise the maximum NO_2 and SO_2 ground level concentrations at the various locations with and without NO_x mitigation at CPPS. The results show that the calculated ground level concentrations were well within Government AQOs. As expected the results for this case are a hybrid of the two former cases.

Table 6.3a *NO_2 and SO_2 Ground Level Concentrations (no NO_x mitigation at CPPS)*

Receptor	% hourly NO_2	AQO(1) SO_2	% Daily NO_2	AQO(2) SO_2	% Annual NO_2	AQO SO_2
Mai Po	63.1	34.2	23.9	13.2	1.2	1.3
Lung Kwu Tan	58.9	72.1	12.2	9.1	0.5	1.1
Ha Pak Nai	95.0	65.8	20.5	13.5	1.1	1.9
Butterfly Estate	77.8	63.5	16.8	8.7	1.3	1.4
Tung Chung	66.6	38.3	36.9	21.9	3.0	4.2

Note: (1) Maximum 99.966 percentile values in the six candidate years.
(2) Maximum 99.726 percentile values in the six candidate years.

Table 6.3b *NO_2 and SO_2 Ground Level Concentrations (with NO_x mitigation at CPPS)*

Receptor	% hourly NO_2	AQO[1] SO_2	% Daily NO_2	AQO[2] SO_2	% Annual NO_2	AQO SO_2
Mai Po	44.7	34.2	18.7	13.2	1.0	1.3
Lung Kwu Tan	45.7	72.1	11.3	9.1	0.5	1.1
Ha Pak Nai	67.9	65.8	16	13.5	0.9	1.9
Butterfly Estate	58.0	63.5	15	8.7	1.2	1.4
Tung Chung	45.1	38.3	28.1	21.9	2.3	4.2

Note: (1) Maximum 99.966 percentile values in the six candidate years.
(2) Maximum 99.726 percentile values in the six candidate years.

6.4 OIL-SUBSTITUTION OPTIONS

The following *Tables 6.4a and 6.4b* illustrates the effects of substituting oil instead of the primary fuel for the LTPS. The sulphur contents of distillate oil (DistO) for CCGT and fuel oil (HFO) for coal-fired units are 0.5% and 3.5% (by weight) respectively. All figures depict the combined impacts from LTPS and CPPS. The combined impacts from LTPS and CPPS are well within the AQOs, and the use of oil would only have marginal effects.

Table 6.4a *Maximum NO_2 and SO_2 Impacts as % hourly AQO[1] (with NO_x mitigation at CPPS)*

Receptor	8x680MW HFO units		8x600MW DistO CCGTs		4x680MW HFO units + 4x600MW DistO CCGTs	
	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2
Mai Po	50.9	34.3	43.7	34.3	43.7	34.2
Lung Kwu Tan	45.7	72.1	45.7	72.1	45.7	72.1
Ha Pak Nai	68.0	65.8	68.0	65.8	68.0	65.8
Butterfly Estate	58.0	63.5	58.0	63.5	58.0	63.5
Tung Chung	50.7	41.1	44.6	37.7	45.2	37.9

Note: (1) The maximum 99.966 percentile values in the six candidate years.

Table 6.4b *Maximum NO_2 and SO_2 Impacts as % hourly AQO[(1)] (without NO_x mitigation at CPPS)*

Receptor	8x680MW HFO units		8x600MW DistO CCGTs		4x680MW HFO units + 4x600MW DistO CCGTs	
	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2
Mai Po	62.5	34.3	62.5	34.3	62.5	34.2
Lung Kwu Tan	58.9	72.1	58.9	72.1	58.9	72.1
Ha Pak Nai	95.0	65.8	95.0	65.8	95.0	65.8
Butterfly Estate	77.8	63.5	77.8	63.5	77.8	63.5
Tung Chung	65.0	41.1	63.2	37.7	64.0	37.9

Note: (1) The maximum 99.966 percentile values in the six candidate years.

If DistO of 0.2% sulphur is to be used, the SO_2 impacts from BP CCGTs will be proportionally lower. However, top hourly events during the future combined operation of BP with CPPS will not alter significantly due to the dominance of CPPS. As an illustration, *Table 6.4c* depicts the differences in the combined hourly SO_2 impacts when DistO of 0.2% sulphur is used for the BP CCGTs. The SO_2 figures are the worst case annual 99.966 percentile values of concentrations.

Table 6.4c *Sensitivity of Maximum SO impacts as % hourly AQO[(1)] to Sulphur Contents in DistO*

Receptors	8x600 MW DistO CCGTs		4x680 MW HFO + 4x600 MW	
	0.2% S DistO	0.5% S DistO	0.2% S DistO	0.5% S DistO
Mai Po	33.7	34.3	34.2	34.2
Lung Kwu Tan	72.1	72.1	72.1	72.1
Ha Pak Nai	65.8	65.8	65.8	65.8
Butterfly Estate	63.5	63.5	63.5	63.5
Tung Chung	32.3	37.7	36.2	37.9

Note: (1) The maximum 99.966 percentile values in the six candidate years.

Details of the concentration statistics are shown in *Annex F*.

6.5 *CONSIDERATIONS OF BACKGROUND AIR QUALITY*

To check compliance with the hourly AQOs, background SO_2 and NO_2 levels as tabulated in *Table 3.4d* should be included for all cases. As such, breach of maximum allowable three exceedance of hourly AQOs would not be anticipated even under the worst case development regime of no NO_x mitigation at CPPS.

The maximum overall hourly NO_2 impacts will be at Butterfly Estate and will consume about 99% of the hourly AQO, this corresponds to all three options of BP development and with no NO_x mitigation at CPPS. The maximum hourly SO_2 impact will be at Lung Kwu Tan and will consume about 73% of the hourly AQO; this corresponds to all three options of BP development. Regarding the daily and annual impacts, inclusion of background will not be of real substance because of the insignificance of the long–term impacts.

6.6 *LIKELIHOOD OF HOURLY AQO EXCEEDANCES*

All the above discussions were based on the interpretation of hourly AQO exceedance being not more than three hours per year. It is also considered useful to include in the report the statistics of exceedance of the hourly AQO over the six years of meteorological data. The summary statistics of AQO exceedances are shown in detail in *Annex G*.

As an illustration, *Table 6.6a* shows the maximum number of AQO exceedances over the period 1985–1990 with the inclusion of background SO_2 and NO_2. The predicted AQO exceedance occurs only twice, and these two exceedances occur in separate years between 1985–1990, ie 1987 or 1990. It is also noted that the SO_2 contribution from Black Point is negligible to these SO_2 exceedances (*Annex F*). From the existing SO_2 monitoring results for 1991 and 1992, there were no SO_2 exceedance at Tuen Mun, San Hui, Lung Kwu Tan/Black Point, and Lau Fan Shan. These monitoring locations should be representative of the situation at Butterfly Estate, Lung Kwu Tan and Ha Pak Nai. Therefore, there are virtually eight years of predicted and monitoring data which indicate only a maximum of two SO_2 hourly exceedances in any one particular year between 1985–1992. Regarding the extent of exceedance over the hourly SO_2 AQO, the SO_2 exceedances at Butterfly Estate and Lung Kwu Tan are at most about 23% over the hourly AQO. For the case of NO_2, the maximum exceedance over hourly AQO at Butterfly Estate and Ha Pak Nai are about 32% and 3% respectively.

The case of fuel oil substitution will be similar. *Table 6.6b* shows the maximum numbers of AQO exceedance between 1985–1990.

Taking account of the years of available meteorological data and monitoring results, and in light of the predicted maximum and average numbers of exceedance, it is considered unlikely to have three exceedances over a year during the future combined operation of the BP LTPS and CPPS.

Table 6.6a Maximum Numbers of Hourly AQO Exceedance (Primary fuels)

Receptor	No of max AQO exceedance		Year of Max No. of AQO exceedance	
	SO_2	NO_2 (1)	SO_2	NO_2
8 x 680 coal-fired conventional units				
Tung Chung	0	0	–	–
Butterfly Estate	1	2	1986,90	1990
Ha Pak Nai	0	2	–	1987
Lung Kwu Tan	2	0	1987	–
Mai Po	0	0	–	–
8 x 600 MW Gas CCGTs				
Tung Chung	0	0	–	–
Butterfly Estate	1	2	1986,90	1990
Ha Pak Nai	0	2	–	1987
Lung Kwu Tan	2	0	1987	–
Mai Po	0	0	–	–
4 x 680 MW coal-fired + 4 x 600 MW CCGT				
Tung Chung	0	0	–	–
Butterfly Estate	1	2	1986,90	1990
Ha Pak Nai	0	2	–	1987
Lung Kwu Tan	2	0	1987	–
Mai Po	0	0	–	–

Note: (1) With NO_x mitigation at CPPS. (CPA: 1000 ppm NO_x, CPB: 600 ppm NO_x)
(2) Occasions of typhoon are excluded.

Table 6.6b *Maximum Numbers of Hourly AQO Exceedance (Oil Substitution)*

Receptor	No of max AQO exceedance		Year of Max No of AQO exceedance	
	SO_2	NO_2 (1)	SO_2	NO_2
8 x 680 conventional units with HFO				
Tung Chung	0	0	–	–
Butterfly Estate	1	2	1986,90	1990
Ha Pak Nai	0	2	–	1987
Lung Kwu Tan	2	0	1987	–
Mai Po	0	0	–	–
8 x 600 MW Disto CCGTs				
Tung Chung	0	0	–	–
Butterfly Estate	1	2	1986,90	1990
Ha Pak Nai	0	2	–	1987
Lung Kwu Tan	2	0	1987	–
Mai Po	0	0	–	–
4 x 680 MW HFO + 4 x 600 MW Disto CCGT				
Tung Chung	0	0	–	–
Butterfly Estate	1	2	1986,90	1990
Ha Pak Nai	0	2	–	1987
Lung Kwu Tan	2	0	1987	–
Mai Po	0	0	–	–

Note: (1) With NO_x mitigation at CPPS. (CPA: 1000 ppm NO_x, CPB: 600 ppm NO_x)
(2) Occasions of typhoon are excluded.

A refined frequency analysis assessment has been presented for the air quality impacts at key sensors arising from different development options (ie all-coal, all-gas, half coal-half gas) of the Black Point LTPS combined with Castle Peak stations. Realistic concentration levels over six years of actual wind records have been simulated and from the statistics of concentrations, the magnitude of concentration not exceeded for specified periods of time (1 hour limit; 3 hours per year; 24 hours limit; 1 day per year; magnitude limit on annual average) are calculated and compared with the Air Quality Objectives (AQO).

For all receptors, the maximum values of hourly concentration not exceeded more than three hours per year, of daily concentration not exceeded on the average more than one day per year, and of annual average concentration are shown in *Table 7.1a*. The hourly data are the worst case annual 99.966 percentile values of concentration in the six candidate years. The maximum values have been expressed as percentages of the relevant AQO. It is found that even without mitigation by retrofitting low NO_x burners at Castle Peak, all results for all receptors fall within the relevant AQO.

Table 7.1a *Summary Results of Rigorous Frequency Analysis*

	Combined effects of LTPS[1] and CPPS			
Criteria	**Pollutant**	**Without NOx mitigation at CPPS**	**With NOx mitigation at CPPS**	**Location of maximum**
1 hour limit (% AQO)	NO_2	95.0%	68.0%	Ha Pak Nai
	SO_2	72.1%	72.1%	Lung Kwu Tan
1 day limit (% AQO)	NO_2	36.9%	28.1%	Tung Chung
	SO_2	21.9%	21.9%	Tung Chung
1 year limit (% AQO)	NO_2	3.0%	2.3%	Tung Chung
	SO_2	4.2%	4.2%	Tung Chung

Note 1 The development options of all coal, all gas, 50% coal/50% gas, and the oil substitution cases are considered.

Considerations of the existing background air quality and the effects of oil substitutions have also been made to check compliance. The following findings are pertinent:

- Effects of oil substitution would only be marginal.

- The overall maximum hourly NO_2 and SO_2 levels (worst case annual 99.966 percentile values) will be at Butterfly Estate and Lung Kwu Tan Respectively, and these levels will fall within the respective hourly AQOs.

- The maximum predicted number of exceedance of hourly SO_2 and NO_2 AQOs with the inclusion of background is only two.

- The baseline monitoring works conducted by CLP indicate that the existing ambient SO_2 and NO_2 are well within the AQOs.

Taking account of the years of available meteorological data and monitoring results, and in light of the predicted maximum and average numbers of exceedance, it is considered unlikely to have three exceedances over a year during the future combined operation of the BP LTPS and CPPS.

The LTPS is situated at the southwestern end of Deep Bay in the western territories away from the urban environment. Emissions from the power station will escape from the Deep Bay airshed and get diluted before reaching sensitive receptors. At higher elevations plume impingement could cause high concentrations on the hillsides of Castle Peak Firing Range. However, this area is not considered to be a sensitive receptor and acts as a suitable buffer between existing and future industrial activities, to the south, and major residential areas to the east. It is therefore concluded that the proposed development at Black Point will not cause any land use implications to the surrounding environment though this may need to be reviewed before the final approval of the Phase II development.

Stable meteorological conditions rarely occur and are associated with very low emissions from the power stations while convective conditions are likely to generate significantly lower maximum hourly concentrations than wind blown-down plumes. Both conditions are considered unlikely to have a significant effect on the concentration exceedance limits predicted in the study.

8 *EPD'S POSITION AND THE WAY FORWARD*

With regard to EPD's position, and the way forward, the following points have been confirmed:

- The air quality impacts of the proposed Phase 1 development of the Power Station (ie 4 X 600MW CCGT units with light industrial diesel oil as back up fuel together with the recommended measures for its design, construction and operation) are acceptable.

- Mitigation measures are available to reduce the air quality impacts of the power station, if coal-fired with heavy fuel oil as back up, to levels that are acceptable by the present air quality standards, on the basis of the current sensitivity of environment and the assumed operation scenarios in this study.

- An air quality impact review shall be carried out before the final approval of the Phase II development to take account of the background air quality, the control technologies and the environmental standards at that time and to verify the required mitigation measures to meet the Air Quality Objectives. Such review shall take into account the data and findings in the Air Quality Key Issue Report under the Phase 2 EIA study for LTPS.

ANNEXES

Annex A

Wind Tunnel Tests – Boundary Layer and Preparatory Tests

A1 *WIND TUNNEL MODELLING OF ATMOSPHERIC BOUNDARY LAYER*

The modelling was carried out in BMT's No. 7 environmental wind tunnel. This is a large, closed return-circuit wind tunnel with a working section 15m long, 4.8m wide and 2.4m high. The working section is fitted with a 4.4m diameter turntable. The tunnel can be fitted with a range of devices to simulate a variety of atmospheric boundary layers.

The tunnel has been extensively used for plume and gas cloud dispersion and EPD will be familiar with similar Air Quality Studies performed in the tunnel.

The modelled terrain is complex with high hills and ridges, and the flow over the site will therefore be dominated by the local topography. The flow will be simulated correctly (a) if the model has been properly scaled with all features likely to influence the flow represented, and (b) if the approach flow (i.e. the boundary conditions) has been correctly modelled. Once the approach flow has hit the model, subsequent development of the boundary layer will be governed by the model itself. It follows that, the presence of an equilibrium boundary layer in the part of the empty tunnel where the dispersion will take place is unlikely to be crucial for the dispersion.

Nonetheless, the development of the boundary layer in the empty tunnel was measured in order to obtain the characteristics of the ambient flow into which effluents from the stacks will be discharged. The programme of work is given in Tables A1a, A1b and A1c. A low and a high wind speed, namely 3m/s and 15m/s full scale, were tested. Measurements were made at 6, 13.6 and 18.8km downstream of Black Point.

Figures A1a to A1f show results for the wind speed corresponding to 3m/s full-scale. The results presented include vertical profiles of mean velocity (Figure A1a), of the longitudinal component of turbulence intensity (Figure A1b), and of Reynolds stresses (Figure A1c). Figures A1d to A1f show the distribution of mean velocity across the study area at heights of 30m, 167m and 100m.

The above measurements were repeated at a wind speed of 15m/s. The results are presented in Figures A1g to A1k.

For large expanses of water, the roughness height Z_0, given by ESDU 82026 (Reference 20) ranges from 0.1 to 10^{-3}m for a calm sea to 1×10^{-2}m for a rough sea. The curves in Figures A1a and A1g are mean velocity profiles computed for $Z_0 = 1 \times 10^{-2}$m. It is clear from the figures that a reasonable simulation of an equilibrium sea-state boundary layer was achieved. Furthermore, when the topography was absent, flow properties were closely uniform across the site - see for example Figures A1d, A1e and A1f.

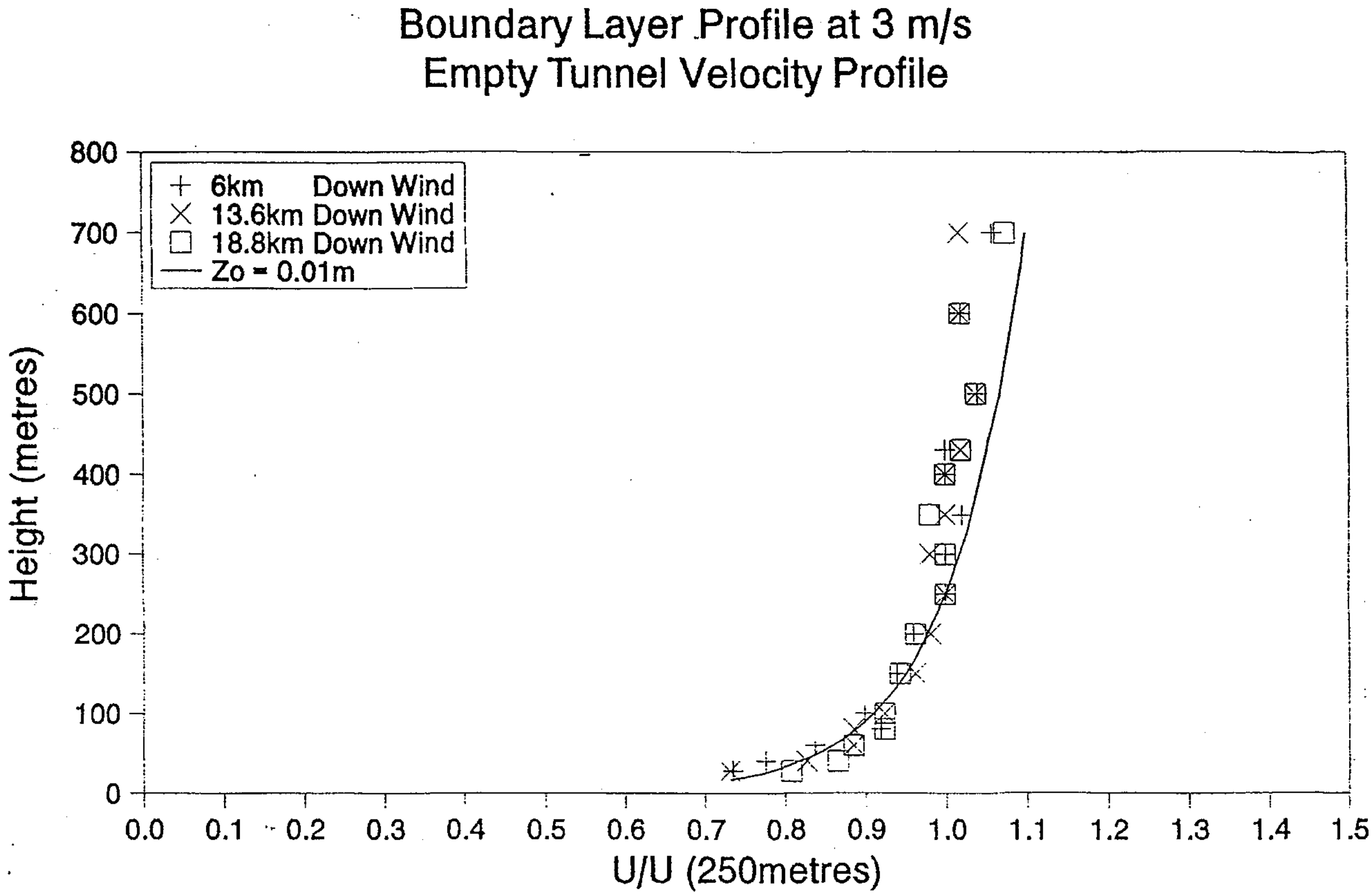


Figure A1a Mean velocity profile measured in 3m/s wind before the installation of the site model

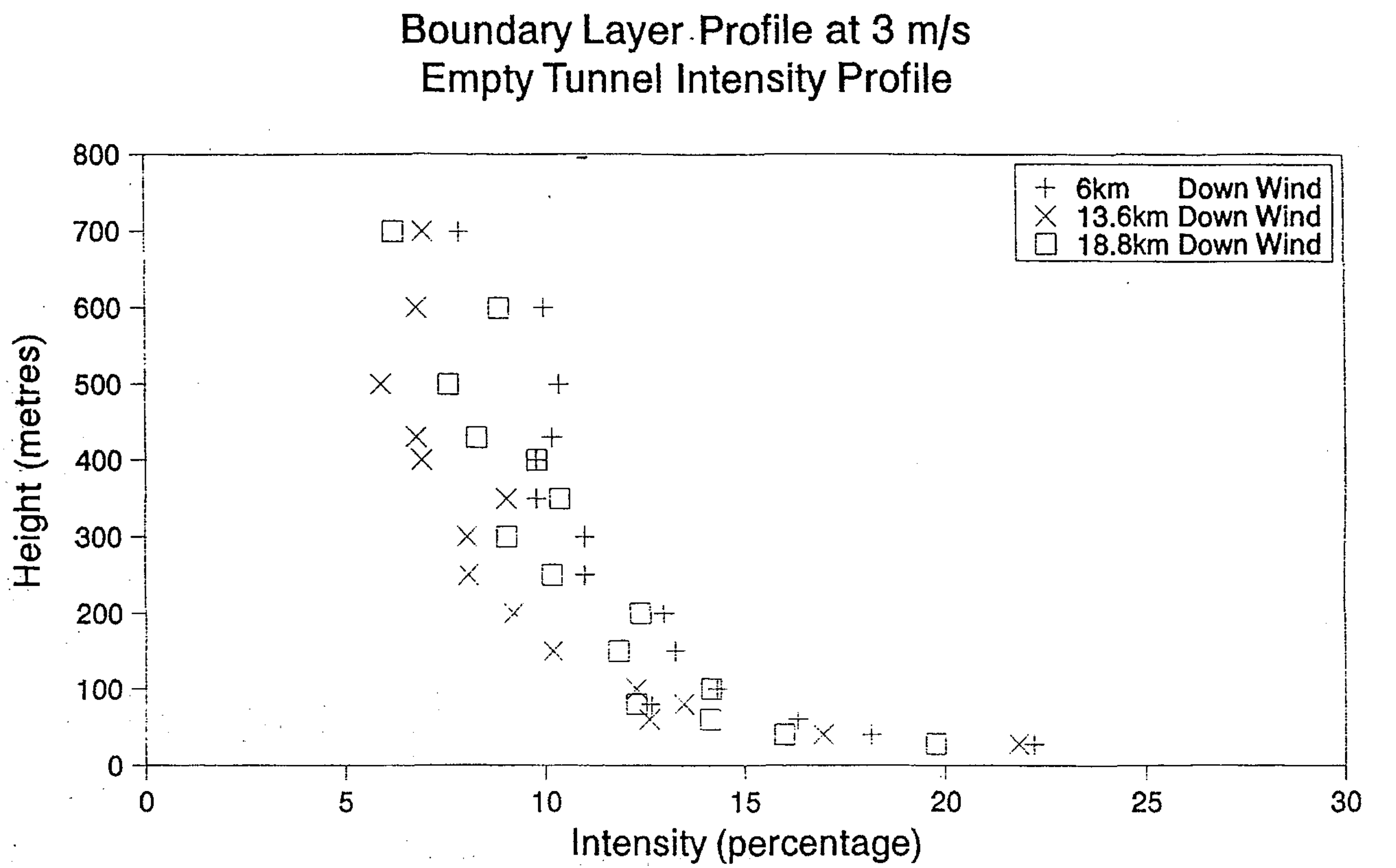


Figure A1b **Profile of longitudinal component of turbulence intensity measured in 3m/s wind before the installation of the site model**

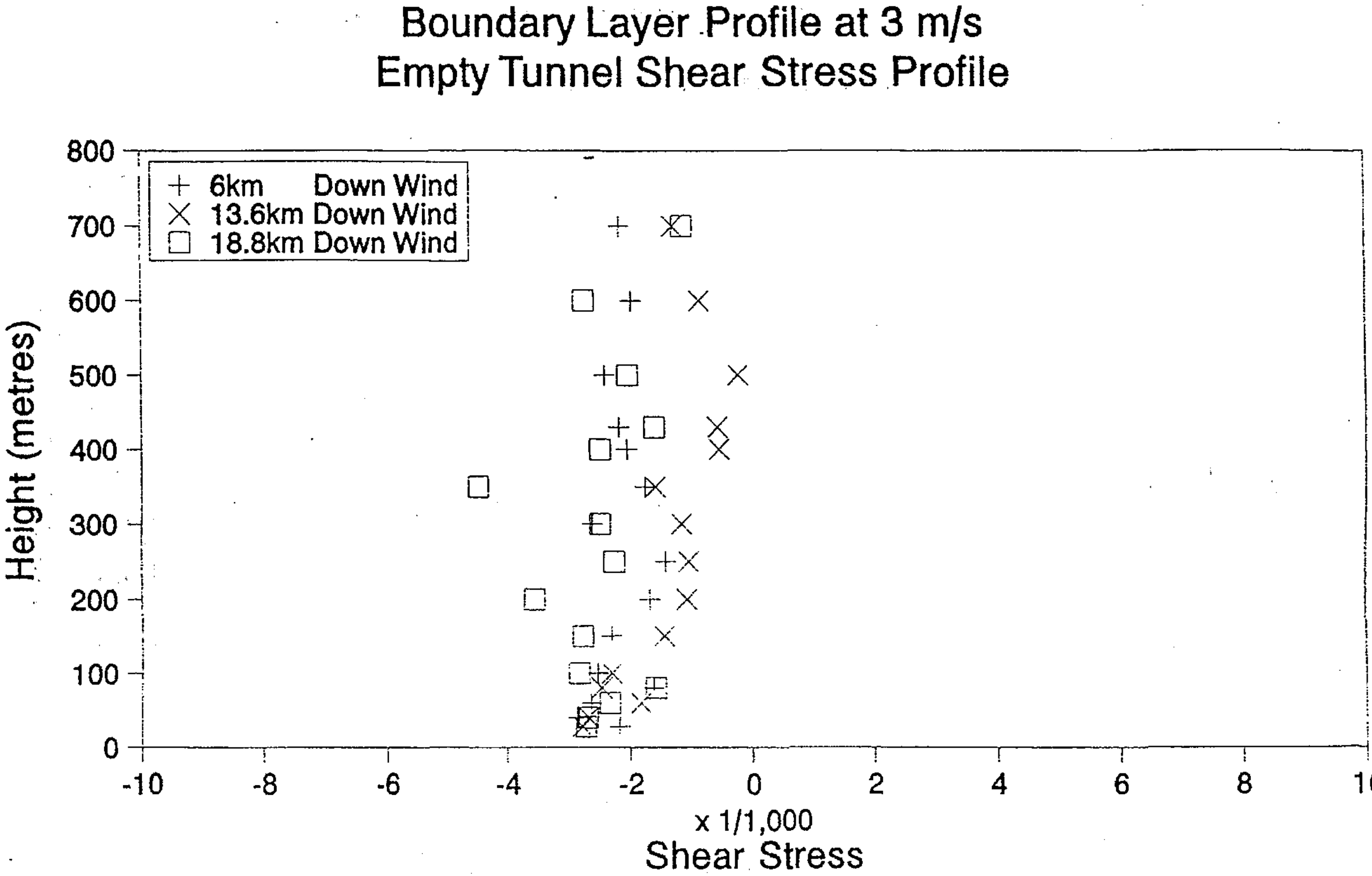


Figure A1c Profile of shear stress measured in 3m/s wind before the installation of the site model

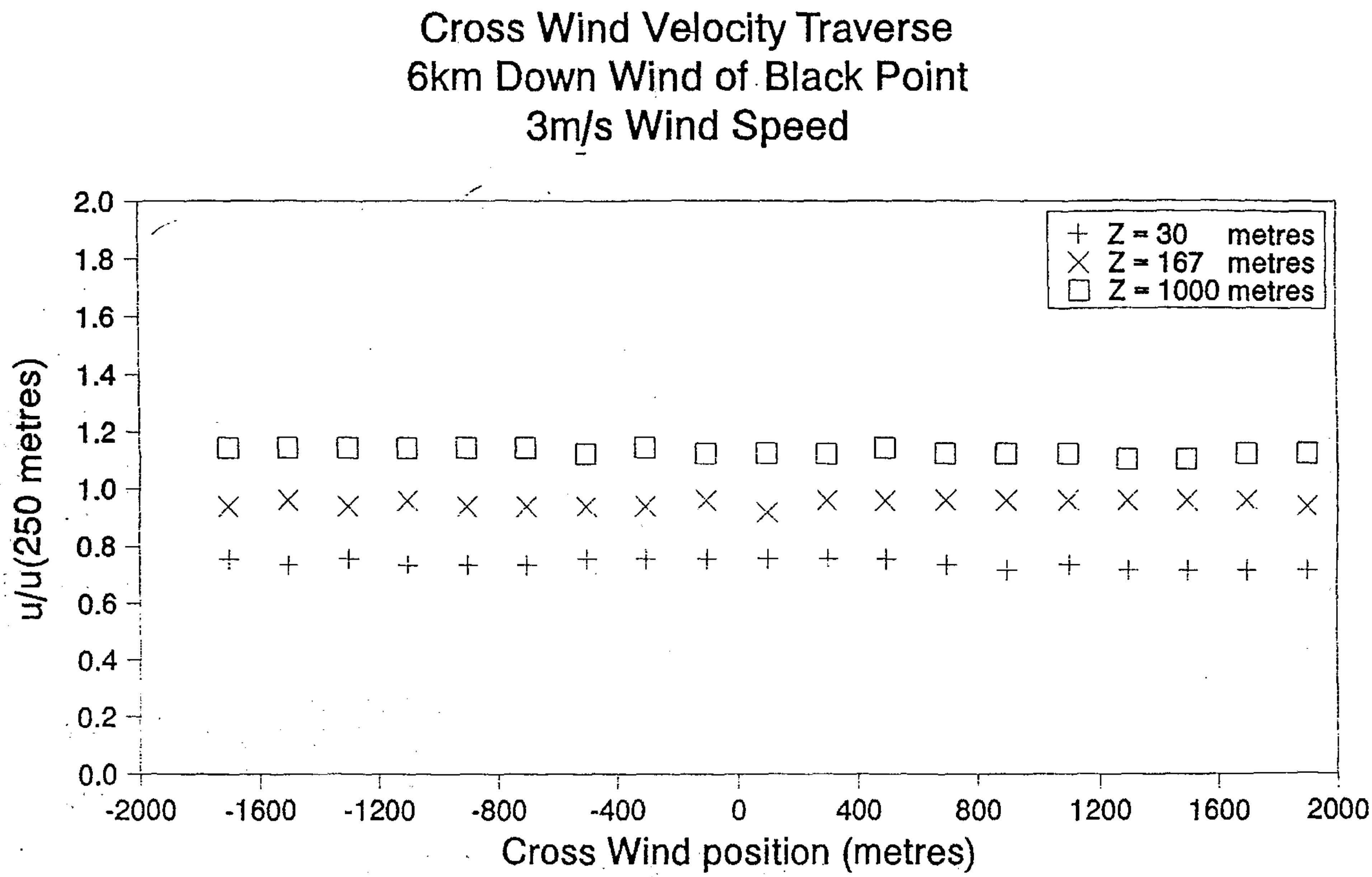


Figure A1d Lateral profile of mean velocity measured at 6km downstream of Black Point in 3m/s wind before the installation of the site model

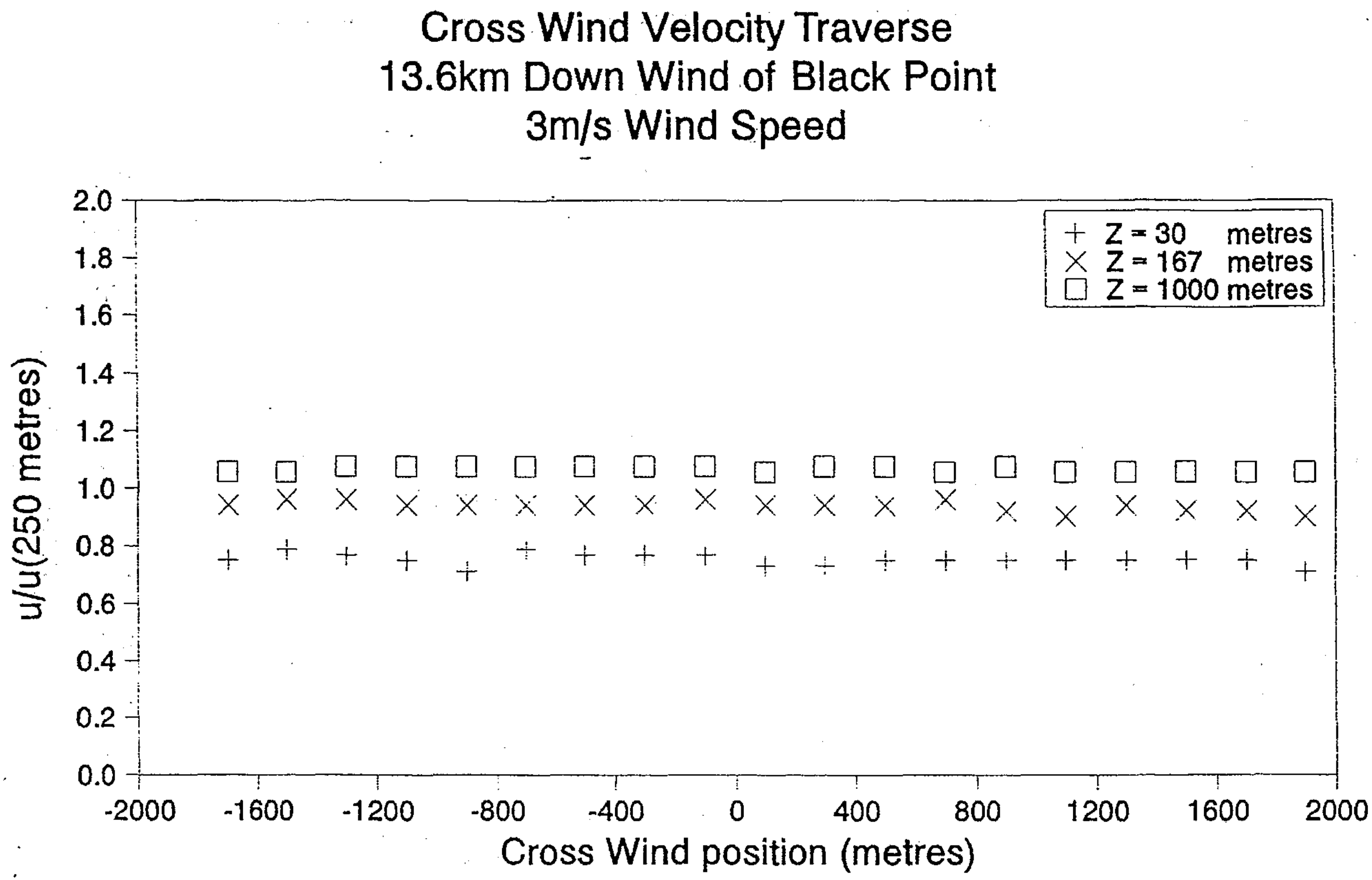


Figure A1e Lateral profile of mean velocity measured at 13.6km downstream of Black Point in 3m/s wind before the installation of the site model

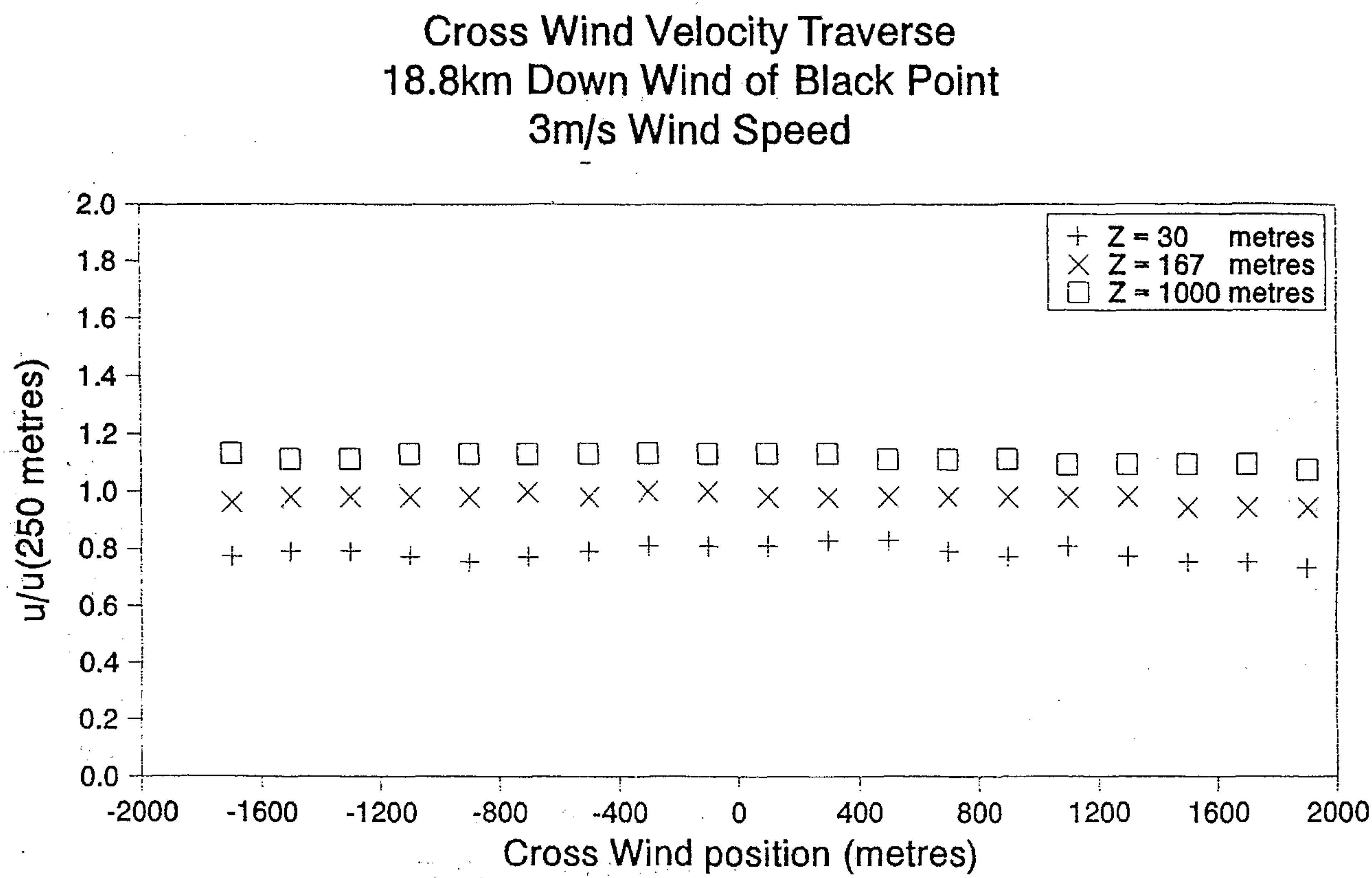


Figure A1f Lateral profile of mean velocity measured at 18.8km downstream of Black Point in 3m/s wind before the installation of the site model

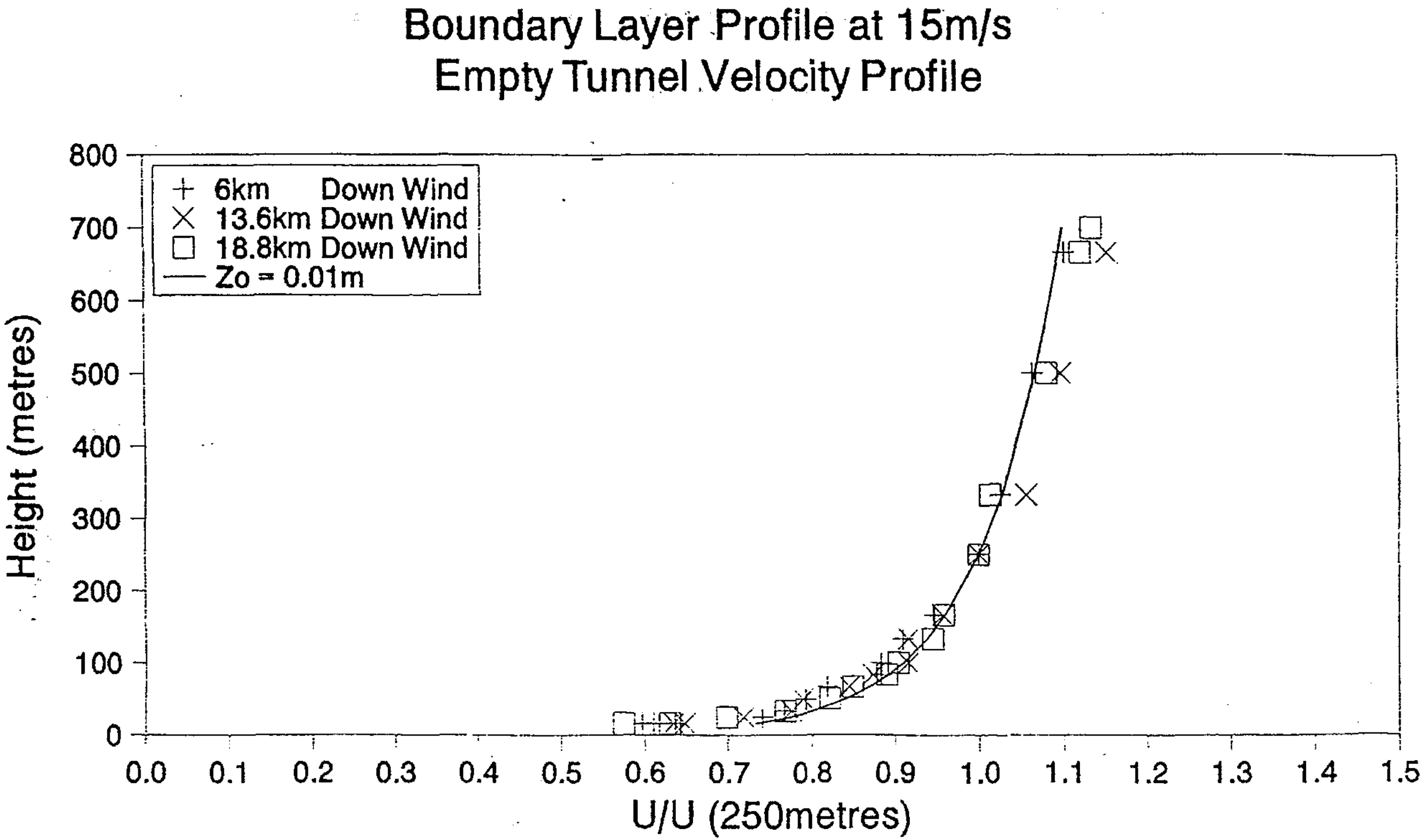


Figure A1g Mean velocity profile measured in 15m/s wind before the installation of the site model

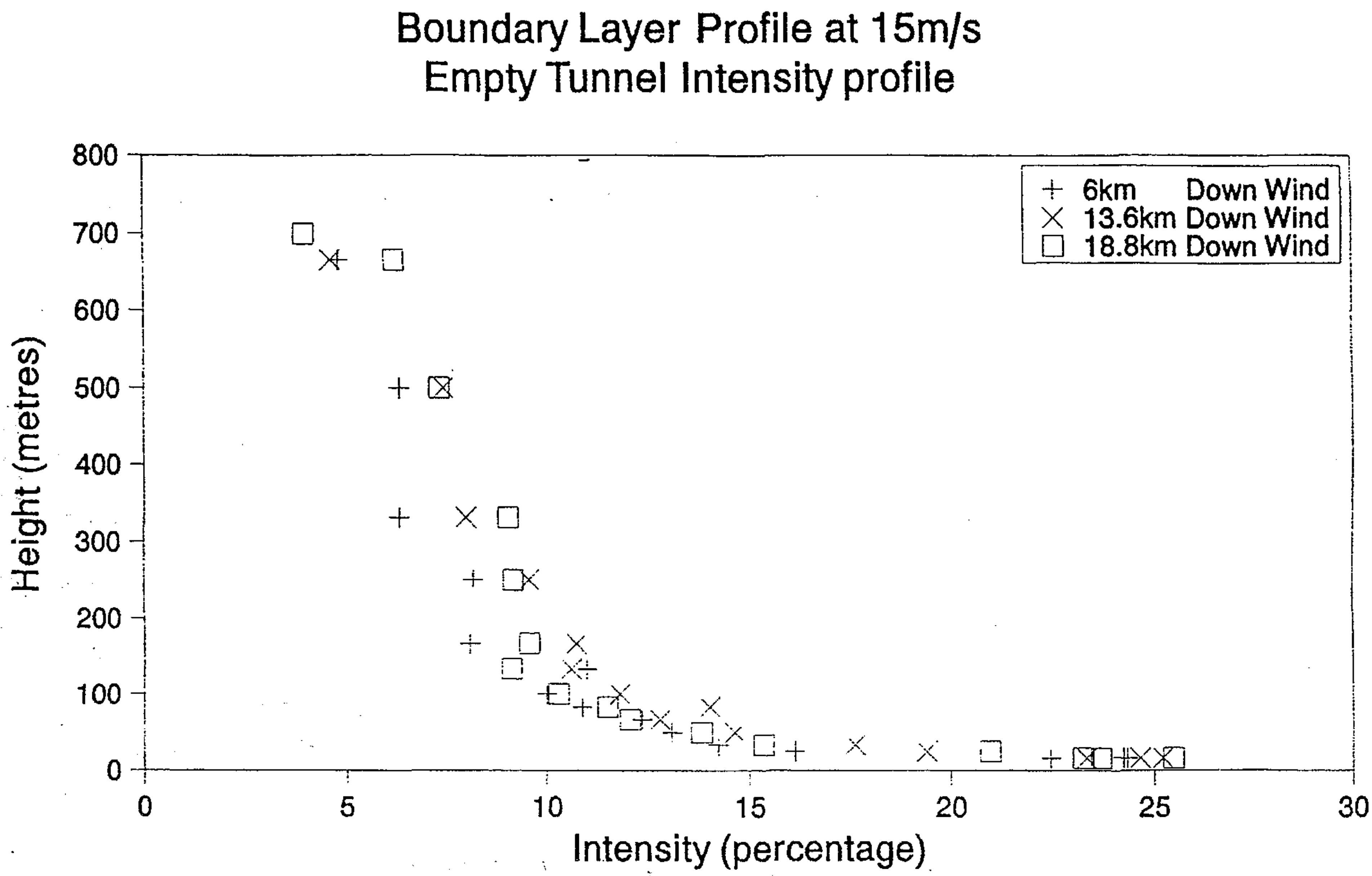


Figure A1h Profile of longitudinal component of turbulence intensity measured in 15m/s wind before the installation of the site model

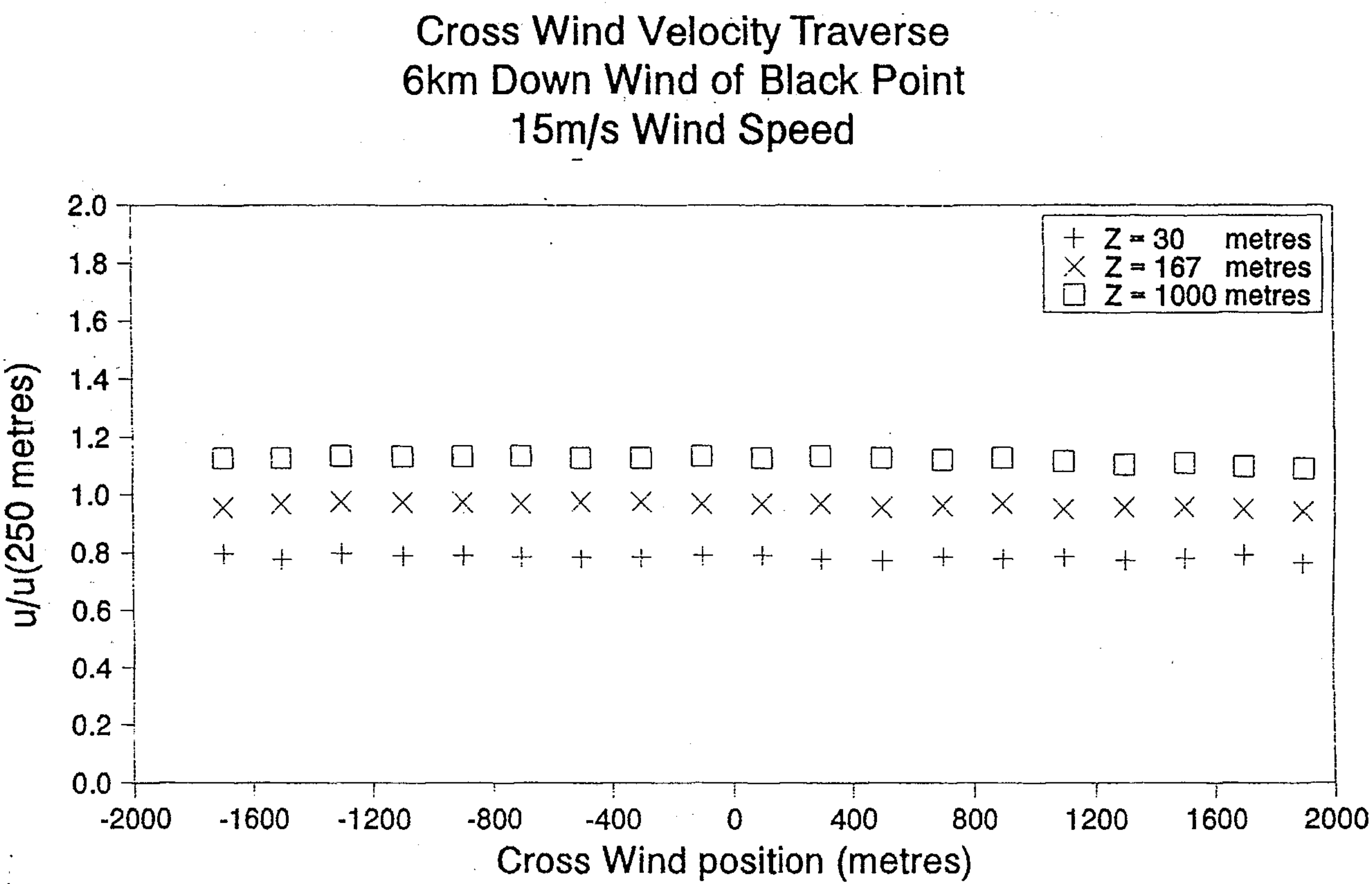


Figure A1i **Lateral profile of mean velocity measured at 6km downstream of Black Point in 15m/s wind before the installation of the site model**

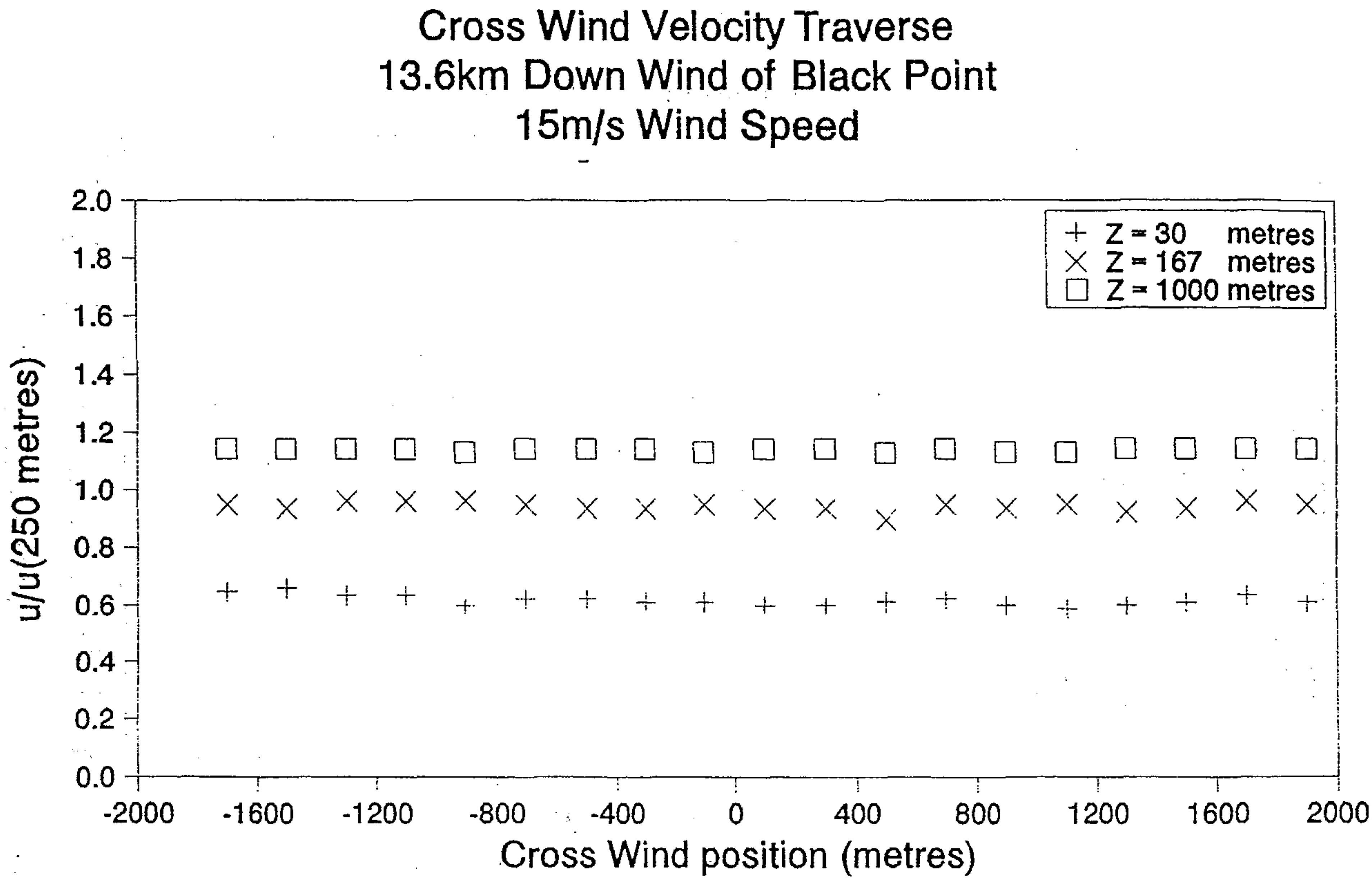


Figure A1j **Lateral profile of mean velocity measured at 13.6km downstream of Black Point in 15m/s wind before the installation of the site model**

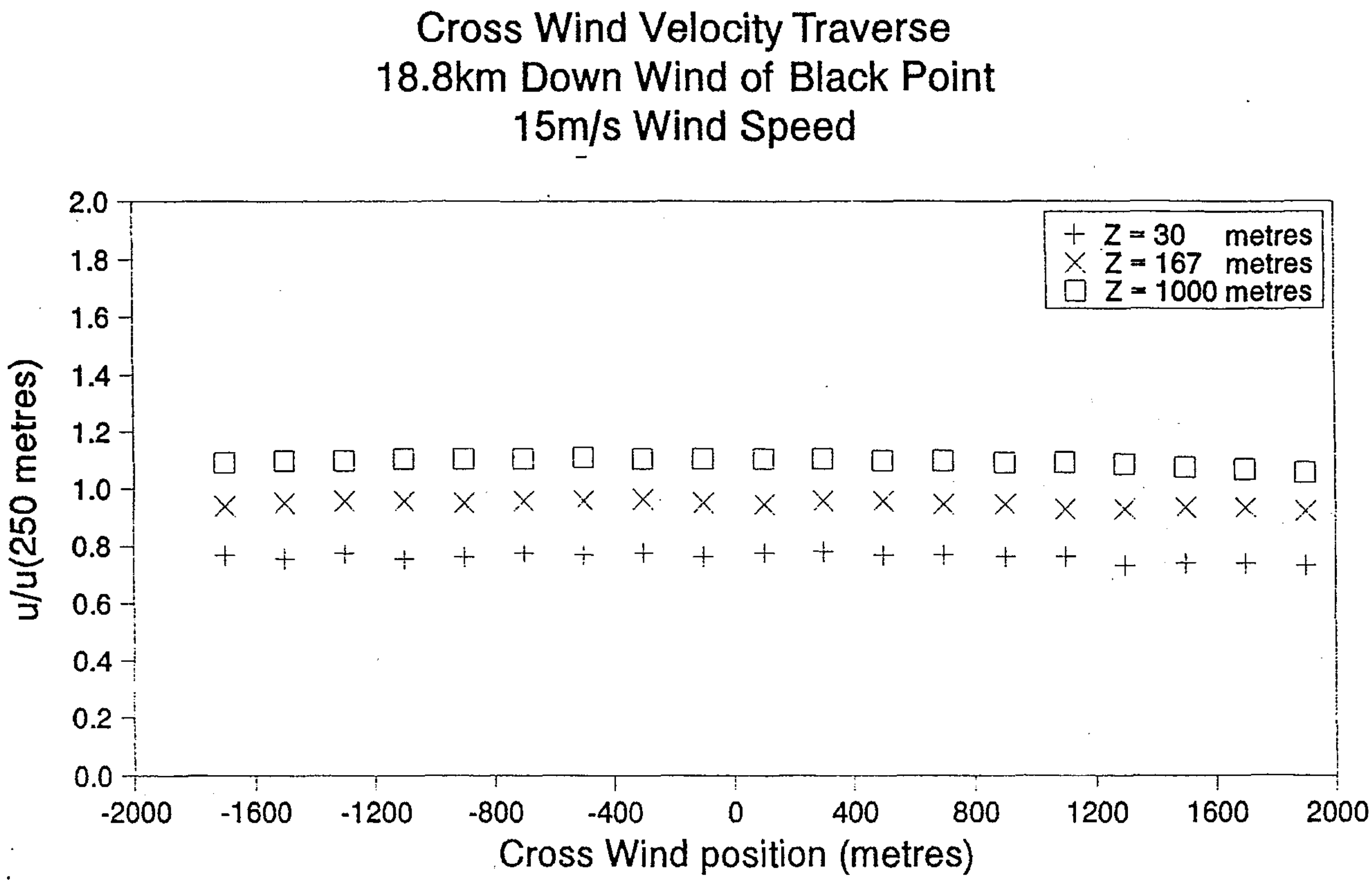


Figure A1k **Lateral profile of mean velocity measured at 18.8km downstream of Black Point in 15m/s wind before the installation of the site model**

Table A1a   Wind Speed Measurements (High Speed)

TEST NO.	TYPE OF TRAVERSE HORIZ.	TYPE OF TRAVERSE VERT.	UNDISTURBED WIND SPEED AT 10m HEIGHT (m/s)	DOWNWIND DISTANCES CONSIDERED (1)	DOWNWIND DISTANCES CONSIDERED (2)	DOWNWIND DISTANCES CONSIDERED (3)	HEIGHTS CONSIDERED 18m	HEIGHTS CONSIDERED 100m	HEIGHTS CONSIDERED 600m	IS MODEL IN THE TUNNEL? YES	IS MODEL IN THE TUNNEL? NO
1	-	✓	15	✓	-	-	N/A	N/A	N/A	-	✓
2	-	✓	15	-	✓	-	N/A	N/A	N/A	-	✓
3	-	✓	15	-	-	✓	N/A	N/A	N/A	-	✓
4	✓	-	15	-	✓	-	✓	-	-	-	✓
5	✓	-	15	-	✓	-	-	✓	-	-	✓
6	✓	-	15	-	✓	-	-	-	✓	-	✓
7*	-	-	15	See	note 2						
8*	-	✓	3 - 20	See	note 3						

1. Downwind distance (1) is at 6km from Black Point
   Downwind distance (2) is at 13.6km from Black Point
   Downwind distance (3) is at 18.8km from Black Point

2. For Test 7* vertical traverse will be made at Black Point

3. For Test 8* velocities measured at 250m height at Black Point by a Dantec X-wire will be compared to the reading of the reference meters, that is the pitot-static tube and the ball probe

4. Vertical traverses will cover a range equivalent to about 20m to 1000m

5. Horizontal traverses will cover a range equivalent to about ±2km

6. For all the traverses, the longitudinal and vertical components of the mean wind speed and of the turbulence intensity will be measured

Table A1b Wind Speed Measurements (Low Speed)

TEST NO.	TYPE OF TRAVERSE		UNDISTURBED WIND SPEED AT 10m HEIGHT (m/s)	DOWNWIND DISTANCES CONSIDERED			HEIGHTS CONSIDERED			IS MODEL IN THE TUNNEL?	
	HORIZ.	VERT.		(1)	(2)	(3)	18m	100m	600m	YES	NO
1	-	✓	3	✓	-	-	N/A	N/A	N/A	-	✓
2	-	✓	3	-	✓	-	N/A	N/A	N/A	-	✓
3	-	✓	3	-	-	✓	N/A	N/A	N/A	-	✓
4	✓	-	3	-	✓	-	✓	-	-	-	✓
5	✓	-	3	-	✓	-	-	✓	-	-	✓
6	✓	-	3	-	✓	-	-	-	✓	-	✓

1. Downwind distance (1) is at 6km from Black Point
   Downwind distance (2) is at 13.6km from Black Point
   Downwind distance (3) is at 18.8km from Black Point

2. Vertical traverses will cover a range equivalent to about 20m to 1000m

3. Horizontal traverses will cover a range equivalent to about ±2km

4. For all the traverses, the longitudinal and vertical components of the mean wind speed and of the turbulence intensity will be measured

Table A1c   Supplementary Boundary Layer Measurements

TEST NO.	TYPE OF TRAVERSE		UNDISTURBED WIND SPEED AT 10m HEIGHT (m/s)	DOWNWIND DISTANCES CONSIDERED			HEIGHTS CONSIDERED			IS MODEL IN THE TUNNEL?	
	HORIZ.	VERT.		(1)	(2)	(3)	18m	100m	600m	YES	NO
1	✓	-	3	✓	-	-	✓	-	-	-	✓
2	✓	-	3	✓	-	-	-	✓	-	-	✓
3	✓	-	3	✓	-	-	-	-	✓	-	✓
4	✓	-	3	-	-	✓	✓	-	-	-	✓
5	✓	-	3	-	-	✓	-	✓	-	-	✓
6	✓	-	3	-	-	✓	-	-	✓	-	✓
7	✓	-	15	✓	-	-	✓	-	-	-	✓
8	✓	-	15	✓	-	-	-	✓	-	-	✓
9	✓	-	15	✓	-	-	-	-	✓	-	✓
10	✓	-	15	-	-	✓	✓	-	-	-	✓
11	✓	-	15	-	-	✓	-	✓	-	-	✓
12	✓	-	15	-	-	✓	-	-	✓	-	✓

1. Downwind distance (1) is 6km from Black Point
   Downwind distance (2) is 13.6km from Black Point
   Downwind distance (3) is 18.8km from Black Point

2. Horizontal traverses will cover a range equivalent to about ±2km

3. For all the traverses, the longitudinal and vertical components of the mean wind speed and of the turbulence intensity will be measured

Under the enhanced scaling, when full-scale wind speed ranges from 3 to 15m/s, the friction velocity, U., ranges from 14.0mm/s to 70mm/s at model scale. Now, by constructing the model such that the height of the topography changed in steps of 20mm (i.e. 40m full-scale), the roughness of height K = 20mm has effectively been distributed over the model. Therefore for a full scale ambient wind speed range from 3 to 15m/s, the model scale roughness Reynolds number, $R_K = U_*K/\nu$, ranged from 18.3 to 91.7.

Textbooks (e.g. "A first course in turbulence" by H. Tennekes and J.L. Lumley (1972) and "Fluid mechanics and transfer processes" by J.M. Kay and R.M. Nedderman (1985)) classify surfaces as aerodynamically smooth if $R_K < 5$, transitional if $5 < R_K < 30$. Therefore the site model is judged to be aerodynamically rough when the full-scale wind is higher than 4.9m/s and to be predominantly rough when the wind speed is 3m/s. (Note that the R_K criterion can easily be related to the critical Reynolds number criterion given in Snyder's Guideline for Fluid Modelling of Atmospheric Diffusion (EPA-600/8-81-09)).

A2 *SIMULATION OF PLUME RISE AND PLUME CENTRELINE CONCENTRATION*

The objective of these measurements is to demonstrate that plume rise and concentration are properly simulated at 1:2000 scale. For the measurements, the site model was absent and only the effluent from one of the chimneys of the LTPS at Black Point was modelled. The chimney had two flues, each of which had diameter 6.6m. The exit velocity and exit temperature are 21.3m/s and 80°C respectively. SO_2 emission rate was 0.14kg/s and the ambient velocity at stack exit was 7.13m/s.

The characteristics of the exhaust are given in Table A2a. Plume rise (i.e. height above the tip of the stack of the point of maximum concentration) and plume centreline concentration were measured at a scale of 1:2000 using the enhanced scaling and at a scale of 1:317.7 using the complete scaling.

Table A2a   Exhaust Characteristics

	FULL SCALE	MODEL SCALE	
		Complete Scaling S = 1:317.7	Enhanced Scaling S = 1:2000
Effective Internal Diameter (m)	9.338	0.02938	0.01101
Exit Velocity (m/s)	21.3	1.195	2.621
Density of exhaust divided by density of ambient air	0.8442	0.8442	0.1518
Exit Temperature (°C)	80	20	20
Exhaust Reynolds Number	9.5×10^6	1962	290

Plume rise and concentration at plume centreline are plotted against downwind distance in Figures A2a and A2b. The solid line in Figure A2a is the full-scale plume rise calculated from Briggs formula:

$$Dh = 1.6\, F^{1/3}\, U^{-1}\, X^{2/3}$$

where $F = g\frac{WD^2}{4}(1 - \rho_e/\rho)$ is Briggs buoyancy flux parameter, U is the ambient velocity measured at stack tip, and X is the downwind distance. Note that $g = 9.805 m/sec^2$ is the acceleration due to gravity, W is exit velocity of effluents, and D is stack's internal diameter.

Figure A2a shows that the plume rise measured under the enhanced and the complete scalings agree very closely with the full-scale value derived from Brigg's formula. The plume centreline concentrations ($\mu g/m^3$) measured under enhanced scaling agree (see Figure A2b) with the complete scaling results. Therefore it is concluded that the plume was properly represented under the enhanced scaling.

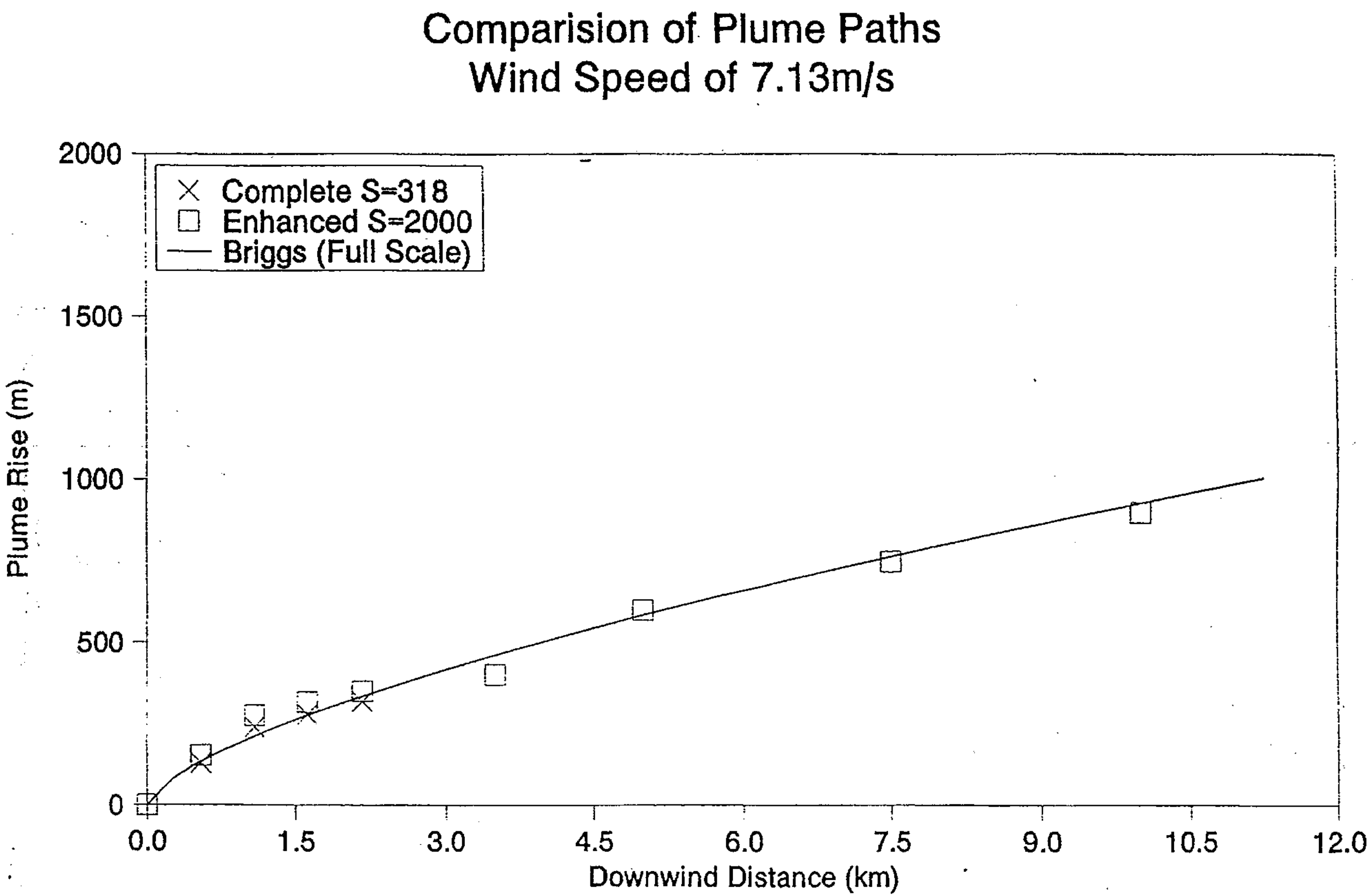


Figure A2a Plume rise versus downwind distance

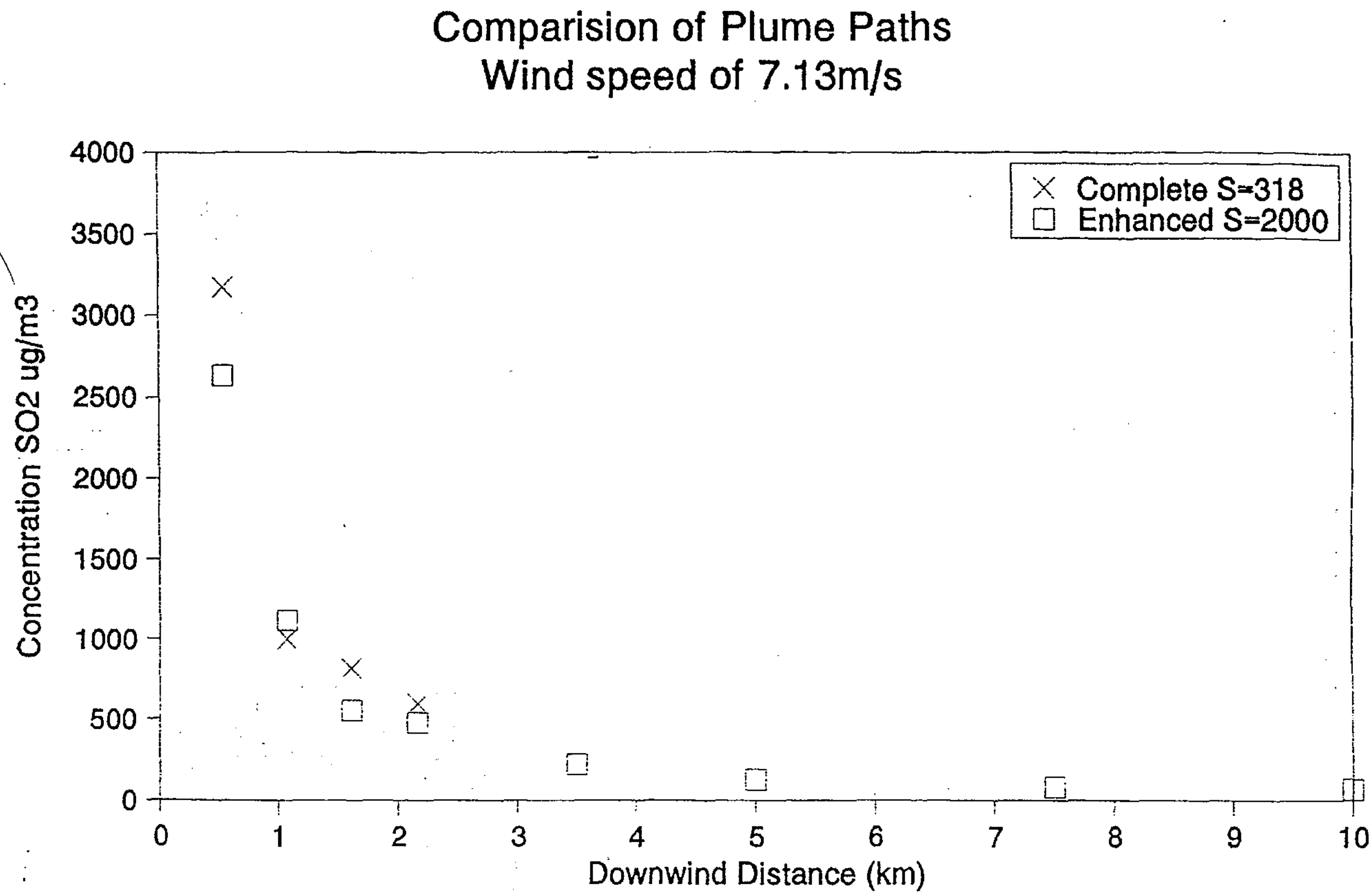


Figure A2b Plume centreline concentration versus downwind distance

It is clear from the above results that the plume was properly modelled under the enhanced scaling.

A3 *GROUND LEVEL CONCENTRATION OF A PLUME INTERACTING WITH A BUILDING*

The purpose of this set of measurements is to confirm that any interaction between a plume and a building will be properly simulated at 1:2000 scale. In particular, the open cycle gas turbines have short chimney and there was some concern that the near field impact of the turbines may not be properly simulated.

A 50m high stack was placed at about 100m upstream of the power station turbine hall. The upstream face of the turbine hall was flat and was 80m high. The top of the turbine hall was 50m deep and the bottom about 118m deep. At the rear, the top of the building was led to the ground by four steps with heights ranging from about 15 to 37m.

The stack exit velocity and temperature were identical to those of the open cycle gas turbines, namely 66m/s and 543°C. The stack diameter was 8.5m. A full-scale 10m height wind of 15m/s was simulated.

Concentration measurements were made at the top of the building, and in the wake. The results obtained at 1:2000 (enhanced scaling) and 1:500 (complete scaling) are presented in Figure A3a.

At the top of the building and beyond about 2km from the stack, there is excellent agreement between the complete and the enhanced scaling. Immediately downstream of the turbine hall, however, somewhat higher ground level concentrations were measured using the enhanced scaling. Since identical sensors were used for both sets of measurements, higher concentration may have occurred at 1:2000 scale not because of inconsistencies in the scaling techniques but because the concentration is increasing with height above ground level.

A4 *REYNOLDS NUMBER INDEPENDENCE TESTS*

A neutrally buoyant plume was used for the tests. The stack height was 250m and the wind direction was 340°. The plume exit velocity, W, and the wind speed, U, were varied whilst keeping W/U constant.

Measured percentage volume concentrations are plotted against "full scale" wind speed in Figure A4a. The full scale wind speed

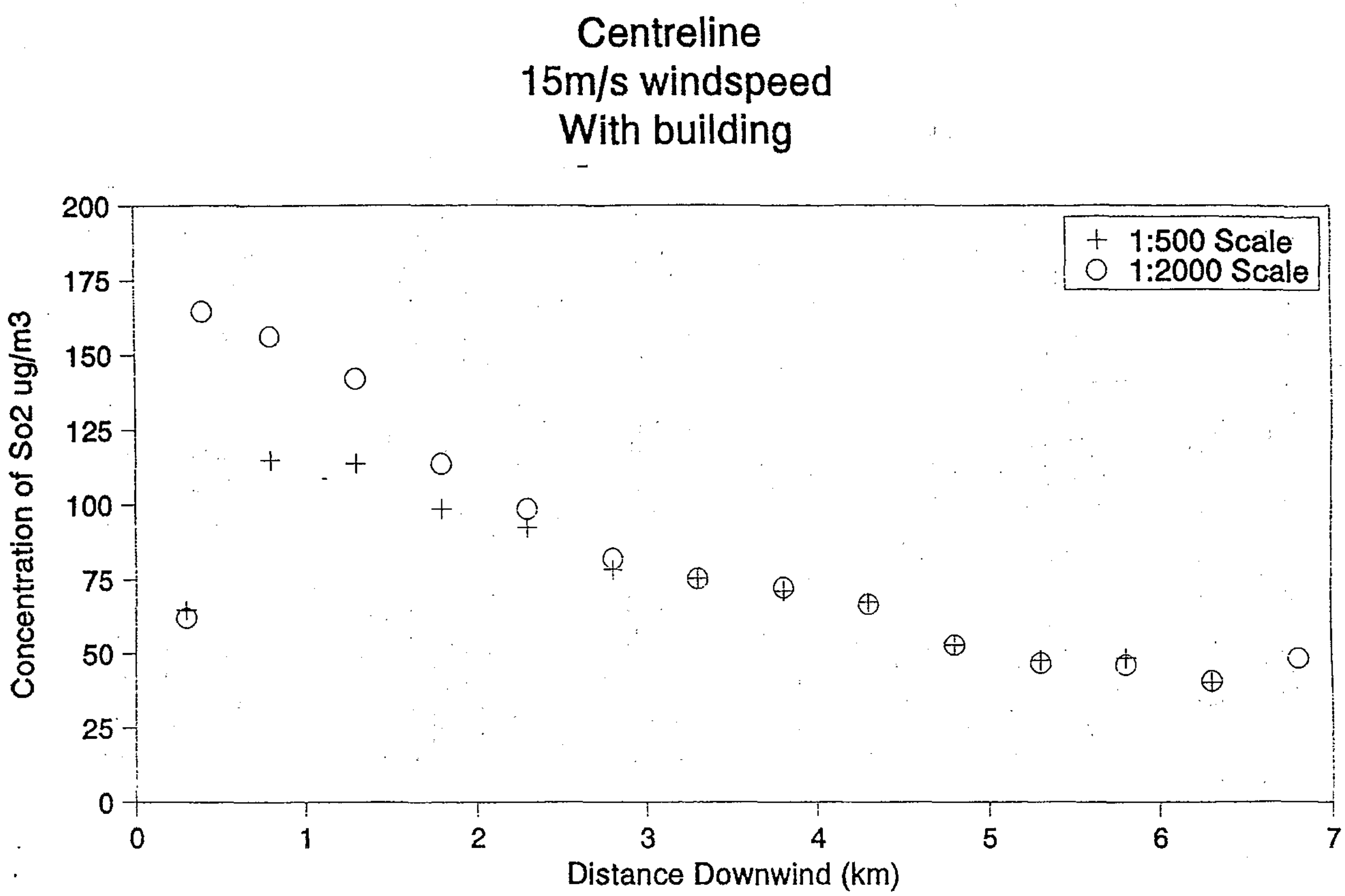


Figure A3a Ground level concentration for a plume interacting with a building

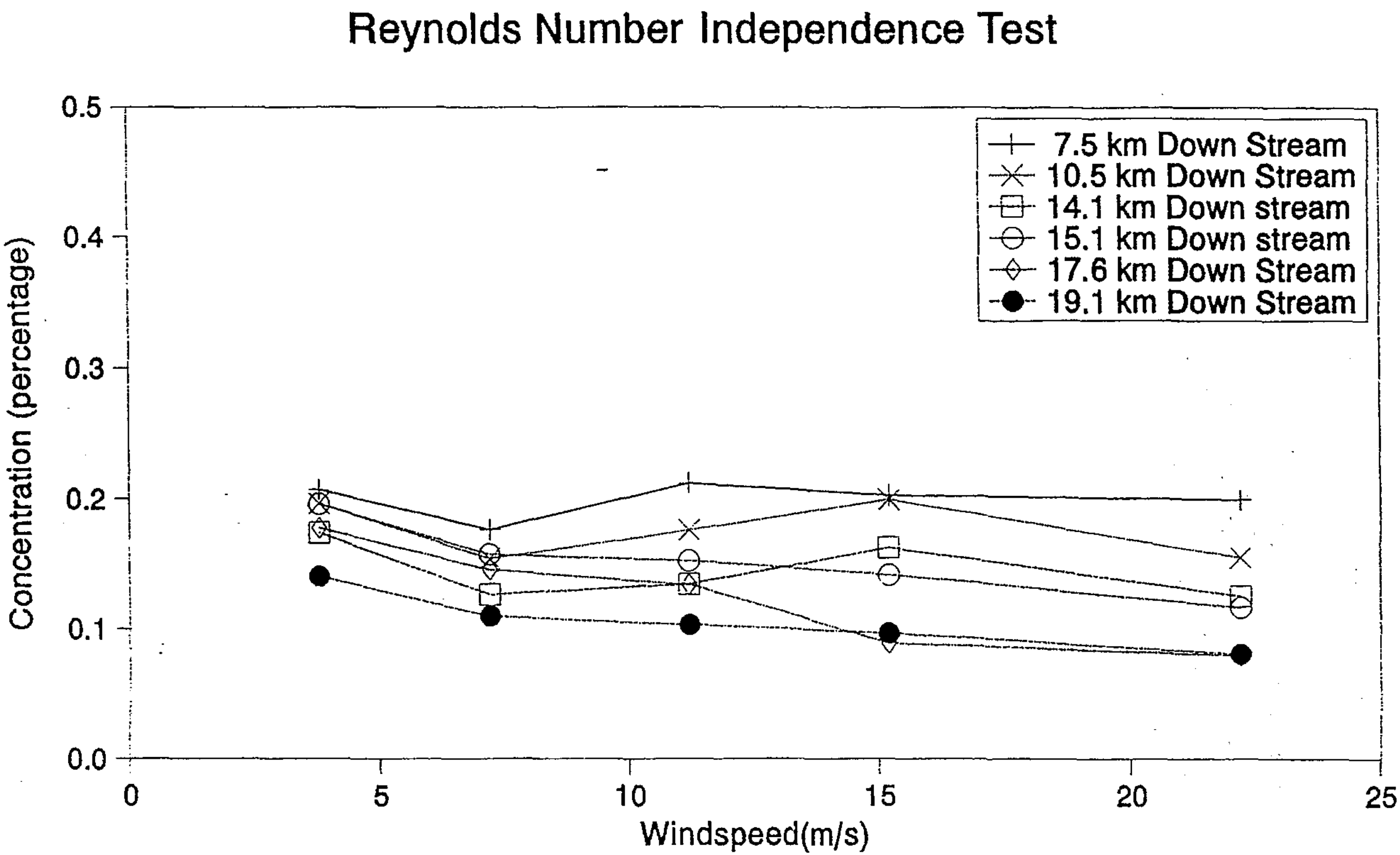


Figure A4a Concentration measured at constant exit velocity ratio with a neutrally buoyant plume versus wind speed was obtained by applying the velocity scale factor for the enhanced scaling to model scale wind speed.

There is a modest scatter in the data but there is no systematic relationship with wind speed and hence Reynolds number. It is therefore concluded that there was no significant influence of Reynolds number. This result suggests that the approach flow and the flow around the topographical model was properly simulated.

Annex B

Source Emissions and Characteristics

Summary of Source Data Used in the Wind Tunnel Tests (Assuming Full Load)

Option	Description	Stack Height (m)	Exit Temp (°C)	Exit Velocity (m s^{-1})	Flow Rate (Actual m^{-3} s^{-1})	Flue diameter (m)	Source NO_x Concentration ($\mu g\ m^{-3}$)	Source SO_2 Concentration ($\mu g\ m^{-3}$)
1	10 OCGT (100MW)	50	543	66	936.3	4.25	53403	85443
2	4 x 2 Coal-Fired (680MW) max FGD of 90%	250	80	21.3	735.2	6.6	595740	190421
3	8 Gas-Fired CCGT (600MW)	100	105	21.6	511.8	5.5	97686	negligible
4	2 x 2 Coal-Fired (680MW) no FGD	250	120	21.3	735.2	6.6	595740	1904210
5	4 Gas-Fired CCGT (600MW)	100	105	21.6	511.8	5.5	97686	negligible
6	4 Oil-Fired CCGT (600MW)	100	140	24.3	581.5	5.5	91719	163948
7	8 Oil-Fired CCGT (600MW)	100	140	24.3	581.5	5.5	91719	163948
8	2 x 2 Coal-Fired max FGD of 90%	250	80	21.3	735.2	6.6	595740	190421
9	2 x 2 Coal-Fired med FGD of 50%	250	100	21.3	735.2	6.6	595740	960596
10	10 OCGT (100MW)	80	543	66.0	936.3	4.25	53403	85443
11	10 OCGT (100MW)	100	543	66.0	936.3	4.25	53403	85443
12	8 Gas-Fired CCGT (100MW)	150	105	21.7	511.8	5.5	97686	negligible
13	4 x 2 Coal-Fired (680MW) max FGD of 90%	200	80	21.3	735.2	6.6	595740	190421
14	4 x 2 Oil-Fired (680MW) max FGD of 90%	250	80	18.8	649.7	6.6	323226	430968
15	2 x 2 Oil-Fired (680MW) max FGD of 90%	250	80	18.8	649.7	6.6	323226	430968
16	2 x 4 Coal-Fired (680MW) max FGD of 90%	250	80	21.3	735.2	6.6	595740	190421
17	2 x 2 Coal-fired max FGD + 4 Gas-fired CCGT's	250	80 & 105	21.3 & 21.7	735.2 & 511.8	6.6 & 5.5	595740 & 97686	190421 & neg
CP A	Castle Peak A Coal fired	215	120	18.6	428.0	5.4	1577066	1635476
CP B	Castle Peak B Coal Fired	250	120	23.7	810.9	6.6	1578512	1726498

Note: The sulphur contents of distillate oil for CCGT fuel oil for coal-fired units as back-up fuels are 0.5% and 3.5% (by weight) respectively.

Summary of the Black Point Emission Characteristics Used to Predict Ground Level Concentrations of NO_2 and SO_2 in the Acidification Assessment

	LTPS Coal Option	LTPS Oil[6] Option	CCGT Gas Option	CCGT Oil[7] Option
Average Annual Load (MW)	2393	2393	2393	2393
Number of Flues	8	8	24	24
Number of Stacks	4	4	8	8
Height of Stacks (m)	250	250	100	100
Volumetric Flow Rate [5] per flue ($m^3\ s^{-1}$)	375	347	256	291
Volumetric Flow Rate [5] per flue ($Nm^3\ s^{-1}$)	290	268	185	192
Exit Velocity ($m\ s^{-1}$)	21	21	22	24
Exit Temperature (K)	353	353	378	413
Effective Stack Diameter (m)	9.4	9.2	9.5	9.6
Total NO_x Emission Rate [5] ($g\ s^{-1}$)	1806 [1] 1204 [2]	880 [3]	610 [4]	633 [4]
Total SO_2 Emission Rate [5] ($g\ s^{-1}$)	400	1180	-	1160

[1] 380 ppm NO_x, [2] 253 ppm NO_x, [3] 220 ppm NO_x, [4] 67 ppm NO_x, [5] For the annual average load
[6] Fuel oil sulphur content is 3.5%
[7] Distillate oil sulphur content is 0.5%.

Summary of the Castle Peak Emission Characteristics Used to Predict Ground Level Concentrations of NO_2 and SO_2 in the Acidification Assessment

	Castle Peak A	Castle Peak B
Average Annual Load (MW)	3138 (A+B combined)	
Number of Flues	4	4
Number of Stacks	1	1
Height of Stacks (m)	215	250
Volumetric Flow Rate [4] per flue ($m^3\ s^{-1}$)	324	628
Volumetric Flow Rate [4] per flue ($Nm^3\ s^{-1}$)	225	436
Exit Velocity ($m\ s^{-1}$)	18	24
Exit Temperature (K)	393	393
Effective Stack Diameter (m)	10.8	13.1
Total NO_x Emission Rate [4] ($g\ s^{-1}$)	2030 [1] 1845 [2]	3933 [1] 2145 [3]
Total SO_2 Emission Rate [4] ($g\ s^{-1}$)	1440	2792

[1] 1100 ppm NO_x, [2] 1000 ppm NO_x, [3] 600 ppm NO_x [4] For the annual average load

Annex C

Wind Tunnel Tests – Analysis of Wind Conditions

C1 *OBJECTIVES*

An analysis of appropriate wind data is essential for determining the worst-case dispersion scenarios and for evaluating the likely frequency with which different levels of impact will occur. Ultimately this information must be considered together with the likely frequency with which different emissions scenarios will occur in coincidence with specific wind conditions. This is discussed in the main text of the report.

C2 *SOURCE DATA*

The source data used for this analysis comes from observations made at the Chek Lap Kok meteorological station run by the Royal Observatory (RO). Statistics were obtained from the RO on the frequency of occurrence of 10 minute mean wind speed and prevailing wind direction for the periods 1980–82 and 1985–90. Chek Lap Kok was selected as the most representative station for conditions affecting Black Point and Castle Peak. Although not sheltered to the east, as the two power stations are by the Castle Peak Range, for the relevant wind directions, from the northwest, west and southwest, it is similarly exposed. Coincident frequencies of wind speed and direction should therefore be representative in these cases.

C3 *MAXIMUM WIND SPEEDS APPLICABLE TO BLACK POINT ALONE*

The human health impact criteria used for the assessment are the Hong Kong 1–hour average Air Quality Objectives which specify a limit value which should not be exceeded on more than three occasions per year. The worst–case wind speed used for the assessment should therefore occur frequency enough to satisfy this criterion for each wind direction considered.

A credible wind speed/direction scenario must therefore occur for at least 0.034% of the time (three hours) over a year, made up, in principle, of three hourly occasions (each representing 0.011% of the time). Table C3a summarises the maximum wind speeds revealed by the Chek Lap Kok statistics on the basis of the 0.034% criterion.

Table C3a *Max Wind Speeds Recorded for Chek Lap Kok*

Wind Direction (°)	Max Wind Speed Range (m/s)[1]
10–50	8.3–11.2
60	11.3–14.2
70–90	14.3–17.2
100	17.3–20.7
110	14.3–17.2
120–130	11.3–14.2
140	8.3–11.2
150	11.3–14.2
160–190	8.3–11.2
200–220	5.3–8.2
230	8.3–11.2
240–290	5.3–8.2
300	11.3–14.2
310	8.3–11.2
320	11.3–14.2
330–360	8.3–11.2

1 Where specified wind speed or greater occurs for >0.03% of the time.

It can be seen that for the wind directions of relevance to this assessment (0–20° and 160–360°) the maximum wind speeds occur mainly within the ranges 5.3–8.2m/s and 8.3–11.2m/s. The exceptions are 300° and 320° where the 11.3–14.2m/s range is just credible. Wind speeds greater than 11.3–14.2m/s only occur for directions between 70° and 110° which will take the power station plumes out to sea.

C4 *MAXIMUM WIND SPEEDS - BLACK POINT AND CASTLE PEAK*

The scenarios where the plumes from Black Point and Castle Peak power stations overlap require specific consideration of the frequencies with which the critical wind directions and speeds will occur. This is because the two power stations will only be operated together at outputs approaching full load for limited periods of time and so the combined frequency of operation and occurrence of relevant wind conditions must be estimated for each dispersion scenario.

The wind directions of concern in this case are 340°, towards Lantau, and 160°, towards Shekou in the PRC. In fact the lateral spread of the plumes from the two power stations will be quite considerable so that it is appropriate to consider the frequencies with which the wind blows in a 20° arc centred on each of these directions, ie 330–350° and 150–170°. The % figure for a 20% direction range was calculated, eg for 150–170° by summing 50% of the 150° and the 170° figures with 100% of the 160° figure as agreed with the RO to be the most valid method of analysis. Table C4a summarises the annual wind-speed frequency data for these ranges. It can be seen that the northeasterly winds are slightly more frequent than those from the southeast, though in neither case is the frequency very high. The cumulative frequency with which the wind blows at a speed equal to or greater than the minimum specified for each range is also given. This is necessary for identifying the appropriate speed to use when estimating concentrations which will occur for a specified minimum amount of time.

The worst-case combined emissions scenario for the two power stations occurs during the summer months and so it is also necessary to estimate the wind speed frequencies associated with the summer months alone. In the calculation, the summer frequency was applied to the annual hours in order to give a worst case. These are summarised in Table C4b. It can be seen that the summer months display a marked difference from the annual average statistics. Northeasterly winds are far less frequent while southeasterly winds, associated with the summer monsoon, are far more frequent.

Table C4a *Annual Wind Speed Frequencies for 330–350° and 150–170°*

Wind Speed (m/s)	Mean Annual Frequency of Occurrence					
	330–350°			150–170°		
	% for range	Cumulative frequency		% for range	Cumulative frequency	
		%	hrs		%	hrs
0.1–1.7	0.55	2.83	248	0.64	2.32	203
1.8–3.2	0.43	2.28	200	0.32	1.68	147
3.3–5.2	0.79	1.85	162	0.65	1.36	119
5.3–8.2	0.86	1.06	93	0.56	0.71	62
8.3–11.2	0.17	0.20	18	0.10	0.15	13
11.3–14.2	0.02	0.03	3	0.04	0.05	4
>14.2	0.01	0.01	1	0.01	0.01	1

Table C4b *Summer[1] Wind Speed Frequencies for 330–350° and 150–170°*

Wind Speed (m/s)	Mean Summer Frequency of Occurrence					
	330–350°			150–170°		
	% for range	Cumulative frequency		% for range	Cumulative frequency	
		%	hrs		%	hrs
0.1–1.7	0.70	1.35	118	1.07	5.07	444
1.8–3.2	0.21	0.65	57	0.78	4.00	350
3.3–5.2	0.2	0.44	39	1.61	3.22	282
5.3–8.2	0.13	0.24	21	1.25	1.61	141
8.3–11.2	0.07	0.11	10	0.21	0.36	32
11.3–14.2	0.03	0.04	4	0.12	0.15	13
>14.2	0.01	0.01	1	0.03	0.03	3

[1] June, July, August

CHEK LAP KOK 1980– 1982, 1985– 1990
June– August (1980– 1990)

SPEED (M/S)	DIRECTION IN TENS OF DEGREES																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0.1– 1.7	0.23	0.24	0.37	0.45	0.54	0.63	0.80	0.68	1.09	0.74	0.67	0.74	0.56	0.45	0.60	0.55	0.44	0.66	0.51
1.8– 3.2	0.13	0.15	0.24	0.29	0.45	0.61	0.74	0.75	0.82	0.71	0.74	0.48	0.28	0.21	0.27	0.31	0.65	0.91	1.07
3.3– 5.2	0.09	0.15	0.13	0.20	0.20	0.33	0.57	1.05	1.43	1.78	1.63	1.08	0.47	0.20	0.38	0.78	1.29	2.06	2.31
5.3– 8.2	0.05	0.04	0.08	0.13	0.11	0.23	0.47	1.14	2.82	3.19	3.33	1.92	0.84	0.30	0.45	0.52	1.00	1.24	0.95
8.3– 11.2	0.02	0.02	0.03	0.08	0.06	0.06	0.34	0.73	1.82	1.46	0.89	0.76	0.25	0.13	0.11	0.09	0.13	0.15	0.12
11.3– 14.2	0.00	0.01	0.01	0.03	0.02	0.05	0.05	0.21	0.62	0.44	0.22	0.14	0.08	0.05	0.07	0.06	0.04	0.02	0.03
>14.2	0.00	0.00	0.00	0.00	0.02	0.02	0.03	0.06	0.09	0.21	0.11	0.07	0.02	0.02	0.01	0.01	0.01	0.01	0.00
Total	0.52	0.61	0.85	1.18	1.41	1.93	3.00	4.62	8.69	8.53	7.59	5.18	2.51	1.35	1.89	2.33	3.56	5.04	4.99

SPEED (M/S)	DIRECTION IN TENS OF DEGREES																		
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	VAR.	TOTAL
0.1– 1.7	0.52	0.32	0.25	0.22	0.20	0.24	0.25	0.30	0.30	0.24	0.38	0.34	0.22	0.18	0.18	0.20	0.16	0.33	18.22
1.8– 3.2	0.99	0.71	0.56	0.34	0.28	0.36	0.43	0.51	0.59	0.33	0.48	0.32	0.14	0.08	0.08	0.08	0.05	0.07	18.12
3.3– 5.2	0.78	0.58	0.60	0.58	0.52	0.41	0.40	0.79	0.46	0.23	0.33	0.19	0.17	0.11	0.04	0.03	0.04	0.01	27.73
5.3– 8.2	0.30	0.27	0.28	0.32	0.44	0.26	0.29	0.20	0.22	0.13	0.25	0.28	0.19	0.15	0.15	0.12	0.12	0.34	23.41
8.3– 11.2	0.30	0.29	0.14	0.19	0.14	0.18	0.15	0.29	0.29	0.29	0.33	0.19	0.15	0.08	0.05	0.03	0.05	0.03	8.09
11.3– 14.2	0.51	0.47	0.28	0.26	0.35	0.30	0.27	0.49	0.23	0.24	0.21	0.19	0.13	0.08	0.03	0.01	0.05	0.01	2.47
>14.2	0.25	0.14	0.12	0.18	0.29	0.14	0.14	0.11	0.02	0.09	0.03	0.06	0.06	0.06	0.02	0.02	0.01	0.00	0.94
Total	3.64	2.77	2.24	2.09	2.22	1.89	1.93	2.70	2.12	1.56	2.00	1.57	1.07	0.74	0.54	0.48	0.47	0.79	98.99

Percentage frequency of clam wind occasions = 1.01

Annex D

Wind Tunnel Tests – Concentration Measurement Results

Key To Development Options

Option	Description	Stack Height (m)
1	10 OCGTs (100MW) stack A	50
2	4 x 2 Coal–Fired (680 MW) max FGD	250
3	8 Gas–Fired CCGTs (600 MW)	100
4	2 x 2 Coal–Fired (680 MW) no FGD	250
5	4 Gas–Fired CCGTs (600 MW)	100
6	4 Oil–Fired CCGTs (600 MW)	100
7	8 Oil–Fired CCGTs (600 MW)	100
8	2 x 2 Coal–Fired (680 MW) max FGD	250
9	2 x 2 Coal–Fired medium FGD	250
10	10 OCGTs (100 MW) stack A	80
11	10 OCGTs (100 MW) stack A	100
12	8 Gas–Fired CCGTs (100 MW) stack A	150
13	4 x 2 Coal–Fired (680 MW) max FGD	200
14	4 x 2 Oil–Fired (680 MW)	250
15	2 x 2 Oil–Fired (680 MW)	250
16	2 x 4 Coal–Fired (680 MW) max FGD	250
(5 + 8)	2 x 2 Coal–Fired with max FGD plus 4 Gas–fired CCGTs	250

Option 1	Wind Direction:	232°	NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			237.0		517.0	573.5
1.2			92.0		301.0	342.9
2.0			51.9		186.9	237.1
2.4			32.9		119.3	174.1
3.2			22.0		90.5	140.9
4.8						
7.5			9.2		36.1	38.1
9.2						
10.0						
10.5	7.8		23.1			28.2
12.0			3.3		14.3	17.7
13.4						
14.0	6.0		14.3			18.1
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			243.0		506.0	560.3
0.8 (120m)			398.0		533.8	494.0
7.5 (40m)			9.2		36.1	38.1

Option 1	Wind Direction:	232°	NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			27.1		79.2	103.6
1.2			15.2		65.5	87.0
2.0			13.2		60.9	88.3
2.4			9.6		44.3	73.2
3.2			8.0		40.5	70.2
4.8						
7.5			5.4		23.7	26.2
9.2						
10.0						
10.5	4.0		15.2			20.3
12.0			2.2		10.3	12.9
13.4						
14.0	3.5		10.0			13.3
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			27.8		77.5	101.3
0.8 (120m)			45.5		81.8	89.3
7.5 (40m)			5.4		23.7	26.2

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction:	232°	SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			379.2		827.2	917.6
1.2			147.2		481.6	548.6
2.0			83.0		299.0	379.4
2.4			52.6		190.9	278.6
3.2			35.2		144.8	225.4
4.8						
7.5			14.7		57.8	61.0
9.2						
10.0						
10.5	12.5		37.0			45.1
12.0			5.3		22.9	28.3
13.4						
14.0	9.6		22.9			29.0
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			388.8		809.6	896.5
0.8 (120m)			636.8		854.1	790.4
7.5 (40m)			14.7		57.8	61.0

Option 1 Wind Direction: 252 ° NO_x						
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
0.8			141.9		455.3	475.0
1.2			53.3		201.6	201.9
2.0			28.8		144.1	149.4
2.4			34.1		135.1	136.0
3.2			33.8		112.8	117.9
4.8						
7.5			10.3		31.5	33.9
9.2						
10.0						
10.5			7.6		23.6	24.2
12.0						
13.4						
14.0			5.6		18.7	18.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			255.3		469.7	462.2
0.8 (120m)			568.1		367.5	327.5
14.0 (40m)			6.5		18.4	17.7
14.0 (80m)			6.2		19.0	18.3

Option 1 Wind Direction: 252 ° NO_2						
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
0.8			16.2		69.8	85.8
1.2			8.8		43.8	51.2
2.0			7.3		46.9	55.7
2.4			10.0		50.1	57.2
3.2			12.2		50.5	58.8
4.8						
7.5			6.0		20.7	23.3
9.2						
10.0						
10.5			5.0		16.6	17.5
12.0						
13.4						
14.0			3.9		13.6	13.6
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			29.2		72.0	83.5
0.8 (120m)			65.0		56.3	59.2
14.0 (40m)			4.6		13.4	13.0
14.0 (80m)			4.3		13.8	13.4

(assumes ozone concentration = 35 ppb)

Option 1 Wind Direction: 252 ° SO_2						
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
0.8			227.0		728.5	760.0
1.2			85.3		322.6	323.0
2.0			46.1		230.6	239.0
2.4			54.6		216.2	217.6
3.2			54.1		180.5	188.6
4.8						
7.5			16.5		50.4	54.2
9.2						
10.0						
10.5			12.2		37.8	38.7
12.0						
13.4						
14.0			9.0		29.9	29.6
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			408.5		751.5	739.5
0.8 (120m)			909.0		588.0	524.0
14.0 (40m)			10.4		29.4	28.3
14.0 (80m)			9.9		30.4	29.3

Option 1	Wind Direction: 270 ° NO$_x$					
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
0.8			74.8		280.3	433.1
1.2			88.2		236.4	292.4
2.0		38.4	75.8		199.9	291.8
2.4			20.6		100.8	145.2
3.2		16.1	47.2	62.9	73.9	115.8
4.8						
7.5		8.6	17.1	25.3	37.6	50.4
9.2						
10.0						
10.5		4.4	10.2	13.2	26.0	31.9
12.0						
13.4						
14.0		3.7	6.9	13.0	13.4	18.2
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			166.0		357.4	416.0
0.8 (120m)			242.6		360.6	330.7
7.5 (40m)		5.6	16.3	25.1	36.1	49.7
7.5 (80m)		5.6	16.3	25.8	34.7	48.6

Option 1	Wind Direction: 270 ° NO$_2$					
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
0.8			8.6		42.9	78.3
1.2			14.5		51.4	74.2
2.0		7.4	19.2		65.1	108.7
2.4			6.0		37.4	61.1
3.2		4.5	17.1	25.6	33.1	57.7
4.8						
7.5		4.3	10.0	15.9	24.7	34.6
9.2						
10.0						
10.5		2.6	6.7	9.1	18.3	23.0
12.0						
13.4						
14.0		2.4	4.8	9.3	9.7	13.4
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			19.0		54.8	75.2
0.8 (120m)			27.8		55.3	59.8
7.5 (40m)		2.8	9.6	15.7	23.7	34.1
7.5 (80m)		2.9	9.7	16.4	23.0	33.6

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction: 270 ° SO$_2$					
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
0.8			119.7		448.5	693.0
1.2			141.1		378.2	467.8
2.0		61.4	121.3		319.8	466.9
2.4			33.0		161.3	232.3
3.2		25.8	75.5	100.6	118.2	185.3
4.8						
7.5		13.8	27.4	40.5	60.2	80.6
9.2						
10.0						
10.5		7.0	16.3	21.1	41.6	51.0
12.0						
13.4						
14.0		5.9	11.0	20.8	21.4	29.1
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			265.6		571.8	665.6
0.8 (120m)			388.2		577.0	529.1
7.5 (40m)		9.0	26.1	40.2	57.8	79.5
7.5 (80m)		9.0	26.1	41.3	55.5	77.8

Option 1	Wind Direction: 290° NO_x					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			153.5		324.2	432.8
1.2			30.4		105.0	148.9
2.0			47.0		108.4	125.3
2.4			25.7		72.4	85.6
3.2			26.1		78.6	97.7
4.8						
7.5			5.9		11.1	14.2
9.2						
10.0						
10.5			4.8		7.5	9.6
12.0						
13.4						
14.0			4.6		6.9	6.7
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			211.9		390.8	482.9
0.8 (120m)			310.5		426.7	408.0
7.5 (60m)			6.0		11.4	14.2
10.5 (60m)			5.8		9.2	9.8

Option 1	Wind Direction: 290° NO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			17.6		49.7	78.2
1.2			5.0		22.8	37.8
2.0			11.9		35.3	46.7
2.4			7.5		26.9	36.0
3.2			9.5		35.2	48.7
4.8						
7.5			3.5		7.3	9.7
9.2						
10.0						
10.5			3.2		5.3	6.9
12.0						
13.4						
14.0			3.2		5.0	4.9
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			24.2		59.9	87.3
0.8 (120m)			35.5		65.4	73.7
7.5 (60m)			3.5		7.5	9.7
10.5 (60m)			3.8		6.5	7.1

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction: 290° SO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			245.6		518.7	692.5
1.2			48.6		168.0	238.2
2.0			75.2		173.4	200.5
2.4			41.1		115.8	137.0
3.2			41.8		125.8	156.3
4.8						
7.5			9.4		17.8	22.7
9.2						
10.0						
10.5			7.7		12.0	15.4
12.0						
13.4						
14.0			7.4		11.0	10.7
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			339.0		625.3	772.6
0.8 (120m)			496.8		682.7	652.8
7.5 (60m)			9.6		18.2	22.7
10.5 (60m)			9.3		14.7	15.7

Option 1	Wind Direction: 310 °		NOₓ			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			82.7		276.2	310.8
1.2			46.4		179.4	224.4
2.0			30.9		129.7	176.6
2.4			30.1		106.9	144.3
3.2			24.3		90.7	67.2
4.8						
7.5			7.9		14.7	16.3
9.2						
10.0						
10.5			6.4		12.7	12.3
12.0						
13.4						
14.0			6.3		5.7	5.3
16.0			5.3		6.7	6.2
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			142.9		384.8	404.6
0.8 (120m)			158.6		302.4	331.1
3.2 (60m)			37.7		117.8	71.6

Option 1	Wind Direction: 310 °		NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			9.5		42.3	56.2
1.2			7.6		39.0	56.9
2.0			7.8		42.2	65.8
2.4			8.8		39.7	60.7
3.2			8.8		40.6	33.5
4.8						
7.5			4.6		9.6	11.2
9.2						
10.0						
10.5			4.2		9.0	8.9
12.0						
13.4						
14.0			4.4		4.1	3.9
16.0			3.8		4.9	4.6
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			16.4		59.0	73.1
0.8 (120m)			18.1		46.3	59.8
3.2 (60m)			13.7		52.7	35.7

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction: 310 °		SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			132.3		441.9	497.3
1.2			74.2		287.0	359.0
2.0			49.4		207.5	282.6
2.4			48.2		171.0	230.9
3.2			38.9		145.1	107.5
4.8						
7.5			12.6		23.5	26.1
9.2						
10.0						
10.5			10.2		20.3	19.7
12.0						
13.4						
14.0			10.1		9.1	8.5
16.0			8.5		10.7	9.9
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			228.6		615.7	647.4
0.8 (120m)			253.8		483.8	529.8
3.2 (60m)			60.3		188.5	114.6

Option 1	Wind Direction: 330 °		NO$_x$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
0.8			31.7		118.5	293.1
1.2			9.9		40.6	112.2
2.0			15.3		51.5	124.4
2.4						
3.2			8.7		29.9	86.0
4.8			6.4		30.5	45.4
7.5						
9.2						
10.0						
10.5			3.5		12.3	21.3
12.0						
13.4						
14.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0			3.1		7.2	11.2
19.1						
0.8 (60m)			23.3		87.8	224.1
0.8 (120m)			12.7		48.2	142.8
4.8 (60m)			7.1		32.1	46.6
18.0 (60m)			2.3		7.6	11.5

Option 1	Wind Direction: 330 °		NO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
0.8			3.6		18.2	53.0
1.2			1.6		8.8	28.5
2.0			3.9		16.8	46.3
2.4						
3.2			3.2		13.4	42.9
4.8			3.0		17.0	27.3
7.5						
9.2						
10.0						
10.5			2.3		8.7	15.4
12.0						
13.4						
14.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0			2.2		5.3	8.3
19.1						
0.8 (60m)			2.7		13.5	40.5
0.8 (120m)			1.5		7.4	25.8
4.8 (60m)			3.3		17.8	28.1
18.0 (60m)			1.7		5.6	8.5

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction: 330 °		SO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
0.8			50.7		189.6	469.0
1.2			15.8		65.0	179.5
2.0			24.5		82.4	199.0
2.4						
3.2			13.9		47.8	137.6
4.8			10.2		48.8	72.6
7.5						
9.2						
10.0						
10.5			5.6		19.7	34.1
12.0						
13.4						
14.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0			5.0		11.5	17.9
19.1						
0.8 (60m)			37.3		140.5	358.6
0.8 (120m)			20.3		77.1	228.5
4.8 (60m)			11.4		51.4	74.6
18.0 (60m)			3.7		12.2	18.4

Option 1	Wind Direction: 340 °		NO_x			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
0.8			13.3		114.8	252.4
1.2			8.6		94.4	203.7
2.0			11.0		64.6	145.6
2.4			11.2		53.5	114.4
3.2		3.4	9.0	31.1	42.3	101.5
4.8						
7.5		2.8	7.7	14.1		
9.2						
10.0						
10.5		3.0	27.3	7.8		
12.0						
13.4						
14.0		0.5	1.8	3.3		
16.0						
16.8						
17.0						
17.6		1.7	3.8	7.1		
17.8						
18.0						
19.1		6.6	3.0	4.4		
2.4 (60m)			10.1		62.8	129.6
2.4 (120m)			11.7		75.0	134.1
10.5 (40m)			18.9	25.2		

Option 1	Wind Direction: 340 °		NO_2			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
0.8			1.5		17.6	45.6
1.2			1.4		20.5	51.7
2.0			2.8		21.0	54.2
2.4						
3.2		1.0	3.3	12.7	18.9	50.6
4.8						
7.5		1.4	4.5	8.8		
9.2						
10.0						
10.5		1.8	18.0	5.4		
12.0						
13.4						
14.0		0.3	1.3	2.4		
16.0						
16.8						
17.0						
17.6		1.2	2.7	5.2		
17.8						
18.0						
19.1		4.6	2.2	3.2		
2.4 (60m)			3.0		23.3	54.5
2.4 (120m)			3.4		27.8	56.4
10.5 (40m)			12.4	17.3		

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction: 340 °		SO_2			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
0.8			21.3		183.7	403.8
1.2			13.8		151.0	325.9
2.0			17.6		103.4	233.0
2.4						
3.2		5.4	14.4	49.8	67.7	162.4
4.8						
7.5		4.5	12.3	22.6		
9.2						
10.0						
10.5		4.8	43.7	12.5		
12.0						
13.4						
14.0		0.8	2.9	5.3		
16.0						
16.8						
17.0						
17.6		2.7	6.1	11.4		
17.8						
18.0						
19.1		10.6	4.8	7.0		
2.4 (60m)			16.2		100.5	207.4
2.4 (120m)			18.7		120.0	214.6
10.5 (40m)			30.2	40.3		

Option 1	Wind Direction: 356 °					NO_x
Height: 0 m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8						
1.2						
2.0			6.0		42.2	83.2
2.4						
3.2			15.5		29.2	55.0
4.8						
7.5						
9.2						
10.0						
10.5			13.3		7.7	13.4
12.0						
13.4			2.3		12.4	17.2
14.0						
16.0						
16.8						
17.0			0.0		4.9	10.0
17.6						
17.8			0.4		6.1	10.1
18.0						
19.1			1.6		7.6	10.3

Option 1	Wind Direction: 356 °					NO_2
Height: 0 m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8						
1.2						
2.0			1.5		13.7	31.0
2.4						
3.2			5.6		13.1	27.4
4.8						
7.5						
9.2						
10.0						
10.5			8.8		5.4	9.7
12.0						
13.4			1.6		9.0	12.6
14.0						
16.0						
16.8						
17.0					3.6	7.4
17.6						
17.8			0.3		4.5	7.5
18.0						
19.1			1.2		5.6	7.6

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction: 356 °					SO_2
Height: 0 m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8						
1.2						
2.0			9.6		67.5	133.1
2.4						
3.2			24.8		46.7	88.0
4.8						
7.5						
9.2						
10.0						
10.5			21.3		12.3	21.4
12.0						
13.4			3.7		19.8	27.5
14.0						
16.0						
16.8						
17.0					7.8	16.0
17.6						
17.8			0.6		9.8	16.2
18.0						
19.1			2.6		12.2	16.5

Option 1	Wind Direction:	015 °	NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8						
1.2						
2.0			41.8		92.2	153.0
2.4						
3.2			17.6		53.6	101.7
4.8						
7.5			8.4		26.6	40.1
9.2						
10.0						
10.5			4.9		15.4	24.6
12.0						
13.4						
14.0			2.5		8.0	15.6
16.0						
16.8			1.2		4.9	7.9
17.0						
17.6						
17.8						
18.0						
19.1						
16.8 (60 m)			1.1		4.7	6.7

Option 1	Wind Direction:	015 °	NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8						
1.2						
2.0			10.6		30.0	57.0
2.4						
3.2			6.4		24.0	50.7
4.8						
7.5			4.9		17.4	27.5
9.2						
10.0						
10.5			3.2		10.9	17.7
12.0						
13.4						
14.0			1.8		5.8	11.5
16.0						
16.8			0.9		3.6	5.8
17.0						
17.6						
17.8						
18.0						
19.1						
16.8 (60 m)			0.8		3.5	4.9

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction:	015 °	SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8						
1.2						
2.0			66.9		147.5	244.8
2.4						
3.2			28.2		85.8	162.7
4.8						
7.5			13.4		42.6	64.2
9.2						
10.0						
10.5			7.8		24.6	39.4
12.0						
13.4						
14.0			4.0		12.8	25.0
16.0						
16.8			1.9		7.8	12.6
17.0						
17.6						
17.8						
18.0						
19.1						
16.8 (60 m)			1.8		7.5	10.7

Option 1	Wind Direction: 160 °		NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8			0.0		31.9	117.3
1.2			0.0		19.4	121.8
2.0			0.0		13.2	59.4
2.4			0.0		10.2	66.6
3.2			0.0		11.1	41.9
4.8						
7.5			3.2		9.4	22.7
9.2			1.3		2.2	7.9
10.0			1.7		6.3	12.8
10.5						
12.0						
13.4						
14.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)			0.0		83.9	267.9
0.8 (120m)			40.1		303.5	446.3
9.2 (60m)			1.7		3.7	9.8
9.2 (120m)			2.4		6.1	11.4

Option 1	Wind Direction: 160 °		NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8					4.9	21.2
1.2					4.2	30.9
2.0					4.3	22.1
2.4					3.8	28.0
3.2					5.0	20.9
4.8						
7.5			1.9		6.2	15.6
9.2			0.8		1.5	5.6
10.0			1.1		4.4	9.2
10.5						
12.0						
13.4						
14.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)					12.9	48.4
0.8 (120m)			4.6		46.5	80.7
9.2 (60m)			1.1		2.5	7.0
9.2 (120m)			1.5		4.2	8.1

(assumes ozone concentration = 35 ppb)

Option 1	Wind Direction: 160 °		SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
0.8					51.0	187.7
1.2					31.0	194.9
2.0					21.1	95.0
2.4					16.3	106.6
3.2					17.8	67.0
4.8						
7.5			5.1		15.0	36.3
9.2			2.1		3.5	12.6
10.0			2.7		10.1	20.5
10.5						
12.0						
13.4						
14.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
0.8 (60m)					134.2	428.6
0.8 (120m)			64.2		485.6	714.1
9.2 (60m)			2.7		5.9	15.7
9.2 (120m)			3.8		9.8	18.2

Option 2	Wind Direction: 015 ° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	52.2	82.4	398.8	670.9	630.2
3.2	31.0	141.9	536.5	611.1	516.2
4.8					
7.5	33.7	208.8	381.0	330.8	251.3
9.2					
10.0					
10.5	26.6	147.9	287.1	228.2	174.5
12.0					
13.4					
14.0	11.5	97.4	207.1	157.3	127.9
15.0					
16.0					
16.8	12.1	52.6	123.6	83.1	76.0
17.0					
17.8					
18.0					
19.1					
16.8 (60m)	10.9	52.6	123.4	84.4	77.4

Option 2	Wind Direction: 015 ° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	7.6	15.8	101.2	218.5	234.8
3.2	6.8	40.0	194.3	273.4	257.4
4.8					
7.5	14.0	104.3	223.6	217.0	172.5
9.2					
10.0					
10.5	13.5	86.8	189.0	160.8	125.9
12.0					
13.4					
14.0	6.7	63.2	145.2	114.4	93.9
15.0					
16.0					
16.8	7.5	35.8	88.8	61.0	56.1
17.0					
17.8					
18.0					
19.1					
16.8 (60m)	6.8	35.8	88.6	62.0	57.1

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 015 ° SO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	16.6	26.2	126.9	213.5	200.5
3.2	9.9	45.2	170.7	194.5	164.3
4.8					
7.5	10.7	66.4	121.2	105.3	80.0
9.2					
10.0					
10.5	8.5	47.1	91.4	72.6	55.5
12.0					
13.4					
14.0	3.7	31.0	65.9	50.1	40.7
15.0					
16.0					
16.8	3.9	16.7	39.3	26.4	24.2
17.0					
17.8					
18.0					
19.1					
16.8 (60m)	3.5	16.7	39.3	26.9	24.6

Option 2	Wind Direction:	160 °	NO$_x$		
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	11.8	11.5	90.0	285.0	381.0
3.2	16.1	15.9	123.6	323.4	376.6
4.8					
7.5	25.1	26.6	221.2	300.3	275.6
9.2	26.2	28.3	126.5	184.1	176.6
10.0	16.8	38.8	147.7	192.6	93.6
10.5					
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
9.2 (60m)	17.0	26.4	136.0	200.8	184.1
9.2 (120m)	71.1	49.3	172.9	194.5	177.2

Option 2	Wind Direction:	160 °	NO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	1.7	2.2	22.8	92.8	141.9
3.2	3.5	4.5	44.8	144.7	187.8
4.8					
7.5	10.4	13.3	129.8	197.0	189.2
9.2	12.3	15.7	80.0	126.8	125.5
10.0	8.3	22.3	95.9	134.7	67.2
10.5					
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
9.2 (60m)	8.0	14.6	86.1	138.3	130.8
9.2 (120m)	33.5	27.3	109.4	133.9	125.9

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction:	160 °	SO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	3.8	3.7	28.6	90.7	121.2
3.2	5.1	5.1	39.3	102.9	119.8
4.8					
7.5	8.0	8.5	70.4	95.6	87.7
9.2	8.3	9.0	40.3	58.6	56.2
10.0	5.3	12.3	47.0	61.3	29.8
10.5					
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
9.2 (60m)	5.4	8.4	43.3	63.9	58.6
9.2 (120m)	22.6	15.7	55.0	61.9	56.4

Option 2	Wind Direction: 232° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0					
3.2	12.6	27.6	257.9	484.4	483.6
4.8					
7.5	36.2	79.4	295.6	306.8	252.3
9.2					
10.0					
10.5		37.6	209.1	225.4	199.5
12.0	37.3	48.0	184.8	181.9	156.3
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
3.2 (40m)	10.9	35.1	281.3	495.5	489.8
7.5 (40m)	15.5	50.0	317.1	322.9	272.3
12.0 (40m)	37.6	42.7	186.5	184.5	160.7

Option 2	Wind Direction: 232° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0					
3.2	2.8	7.8	93.4	216.7	241.1
4.8					
7.5	15.0	39.7	173.5	201.2	173.2
9.2					
10.0					
10.5		22.1	137.7	158.9	143.9
12.0	20.2	29.6	125.7	130.5	113.9
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
3.2 (40m)	2.4	9.9	101.9	221.7	244.2
7.5 (40m)	6.4	25.0	186.1	211.8	186.9
12.0 (40m)	20.4	26.4	126.9	132.3	117.1

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 232° SO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0					
3.2	4.0	8.8	82.1	154.1	153.9
4.8					
7.5	11.5	25.3	94.1	97.6	80.3
9.2					
10.0					
10.5		12.0	66.5	71.7	63.5
12.0	11.9	15.3	58.8	57.9	49.7
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
3.2 (40m)	3.5	11.2	89.5	157.7	155.9
7.5 (40m)	4.9	15.9	100.9	102.7	86.6
12.0 (40m)	12.0	13.6	59.3	58.7	51.1

Option 2	Wind Direction: 252 ° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	9.2	15.0	107.6	291.5	370.5
3.2	21.7	20.2	177.1	405.2	453.3
4.8					
7.5	60.1	25.6	164.5	213.9	177.8
9.2					
10.0					
10.5	30.9	29.2	153.0	175.9	152.5
12.0					
13.4					
14.0	35.4	26.4	124.9	141.0	116.0
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
14.0 (40m)	56.8	32.9	122.4	135.1	110.5
14.0 (80m)	35.4	32.5	125.9	136.1	111.9

Option 2	Wind Direction: 252 ° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	1.3	2.9	27.3	94.9	138.0
3.2	4.8	5.7	64.1	181.3	226.0
4.8					
7.5	25.0	12.8	96.5	140.3	122.0
9.2					
10.0					
10.5	15.7	17.1	100.7	124.0	110.0
12.0					
13.4					
14.0	20.6	17.1	87.5	102.5	85.2
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
14.0 (40m)	33.0	21.4	85.8	98.2	81.2
14.0 (80m)	20.6	21.1	88.2	99.0	82.2

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 252 ° SO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	2.9	4.8	34.2	92.8	117.9
3.2	6.9	6.4	56.4	128.9	144.2
4.8					
7.5	19.1	8.1	52.3	68.1	56.6
9.2					
10.0					
10.5	9.8	9.3	48.7	56.0	48.5
12.0					
13.4					
14.0	11.3	8.4	39.7	44.9	36.9
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
14.0 (40m)	18.1	10.5	38.9	43.0	35.2
14.0 (80m)	11.3	10.3	40.1	43.3	35.6

Option 2	Wind Direction: 270 ° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	14.6	24.0	31.0	196.3	311.1
3.2	14.5	24.0	30.9	196.2	311.1
4.8					
7.5	9.4	19.7	71.3	185.7	179.7
9.2					
10.0					
10.5	29.6	22.3	89.2	133.3	118.2
12.0					
13.4					
14.0	35.1	19.6	87.0	119.9	102.0
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					

Option 2	Wind Direction: 270 ° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	2.1	4.6	7.9	63.9	115.9
3.2	3.2	6.8	11.2	87.8	155.1
4.8					
7.5	3.9	9.8	41.8	121.8	123.3
9.2					
10.0					
10.5	15.0	13.1	58.7	93.9	85.3
12.0					
13.4					
14.0	20.4	12.7	61.0	87.2	74.9
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 270 ° SO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	4.6	7.6	9.9	62.5	99.0
3.2	4.6	7.6	9.8	62.4	99.0
4.8					
7.5	3.0	6.3	22.7	59.1	57.2
9.2					
10.0					
10.5	9.4	7.1	28.4	42.4	37.6
12.0					
13.4					
14.0	11.2	6.2	27.7	38.2	32.5
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					

Option 2	Wind Direction: 290 °	NO_x			
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	173.5	285.2	368.4	454.6	460.6
3.2	88.0	198.6	325.4	447.8	432.5
4.8					
7.5	30.0	65.7	126.7	149.0	146.1
9.2					
10.0					
10.5	21.2	54.2	102.0	111.0	97.7
12.0					
13.4					
14.0	52.1	76.6	99.5	76.8	73.4
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
7.5 (60m)	30.4	72.0	129.1	150.5	143.1
10.5 (60m)	79.8	74.7	110.8	111.3	96.2

Option 2	Wind Direction: 290 °	NO_2			
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	25.4	54.7	93.5	148.1	171.6
3.2	19.3	56.0	117.8	200.4	215.6
4.8					
7.5	12.5	32.8	74.3	97.7	100.3
9.2					
10.0					
10.5	10.7	31.8	67.2	78.2	70.5
12.0					
13.4					
14.0	30.3	49.7	69.7	55.9	53.9
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
7.5 (60m)	12.6	36.0	75.8	98.7	98.2
10.5 (60m)	40.4	43.8	73.0	78.4	69.4

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 290 °	SO_2			
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	55.2	90.8	117.2	144.7	146.6
3.2	28.0	63.2	103.5	142.5	137.6
4.8					
7.5	9.5	20.9	40.3	47.4	46.5
9.2					
10.0					
10.5	6.7	17.2	32.5	35.3	31.1
12.0					
13.4					
14.0	16.6	24.4	31.7	24.4	23.4
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
7.5 (60m)	9.7	22.9	41.1	47.9	45.5
10.5 (60m)	25.4	23.8	35.3	35.4	30.6

Option 2	Wind Direction: 310 °		NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	2.5	12.8	116.2	313.8	317.6
3.2	4.1	39.6	250.8	336.2	341.7
4.8					
7.5	10.0	98.4	202.5	182.8	152.9
9.2					
10.0					
10.5	7.7	61.2	126.0	113.7	103.1
12.0					
13.4					
14.0	7.5	18.7	117.7	91.5	84.8
15.0	20.6	44.0	102.2	75.5	62.7
16.0	18.7	39.9	92.7	74.7	63.3
16.8					
17.0					
17.8					
18.0					
19.1					
3.2 (60m)	10.7	80.6	332.3	421.8	395.0

Option 2	Wind Direction: 310 °		NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	0.4	2.5	29.5	102.2	118.3
3.2	0.9	11.2	90.8	150.4	170.4
4.8					
7.5	4.2	49.2	118.8	119.9	104.9
9.2					
10.0					
10.5	3.9	35.9	83.0	80.1	74.4
12.0					
13.4					
14.0	4.4	12.1	82.5	66.5	62.3
15.0	12.3	29.1	72.4	55.1	46.2
16.0	11.5	26.8	66.2	54.7	46.7
16.8					
17.0					
17.8					
18.0					
19.1					
3.2 (60m)	2.3	22.7	120.3	188.7	196.9

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 310 °		SO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0	0.8	4.1	37.0	99.9	101.1
3.2	1.3	12.6	79.8	107.0	108.7
4.8					
7.5	3.2	31.3	64.4	58.2	48.7
9.2					
10.0					
10.5	2.5	19.5	40.1	36.2	32.8
12.0					
13.4					
14.0	2.4	6.0	37.5	29.1	27.0
15.0	6.6	14.0	32.5	24.0	20.0
16.0	6.0	12.7	29.5	23.8	20.1
16.8					
17.0					
17.8					
18.0					
19.1					
3.2 (60m)	3.4	25.6	105.7	134.2	125.7

Option 2	Wind Direction: 330 °	NO$_x$			
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	5.5	9.7	108.6	339.3	370.0
3.2	8.9	60.5	139.6	125.4	103.1
4.8	13.4	58.5	237.3	321.7	221.6
7.5					
9.2					
10.0					
10.5	11.4	65.3	186.6	179.3	143.4
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	14.6	46.6	72.6	71.5	58.5
19.1					
4.8 (60m)	23.8	41.4	175.9	259.1	143.4
18.0 (60m)	30.5	40.7	72.3	69.8	60.6

Option 2	Wind Direction: 330 °	NO$_2$			
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	0.8	1.9	27.6	110.5	137.8
3.2	2.0	17.1	50.5	56.1	51.4
4.8	4.1	22.2	111.5	178.9	133.4
7.5					
9.2					
10.0					
10.5	5.8	38.3	122.9	126.4	103.4
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	9.3	32.2	52.5	52.6	43.2
19.1					
4.8 (60m)	7.2	15.7	82.7	144.1	86.3
18.0 (60m)	19.5	28.1	52.3	51.4	44.8

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 330 °	SO$_2$			
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	1.8	3.1	34.6	108.0	117.7
3.2	2.8	19.3	44.4	39.9	32.8
4.8	4.3	18.6	75.5	102.4	70.5
7.5					
9.2					
10.0					
10.5	3.6	20.8	59.4	57.1	45.6
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	4.6	14.8	23.1	22.8	18.6
19.1					
4.8 (60m)	7.6	13.2	56.0	82.4	45.6
18.0 (60m)	9.7	13.0	23.0	22.2	19.3

Option 2	Wind Direction: 340 ° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0					
3.2	5.4	37.1	254.1	393.6	384.9
4.8					
7.5	12.4	65.4	250.6	252.5	221.5
9.2					
10.0					
10.5	10.9	37.7	178.0	169.4	146.1
12.0					
13.4					
14.0	7.2	18.1	113.4	121.2	111.2
15.0					
16.0					
16.8					
17.0					
17.6	21.0	44.9	104.2	82.1	75.9
18.0					
19.1	16.7	27.8	92.8	76.9	70.9
10.5 (40m)	8.8	37.7	184.8	181.3	160.0

Option 2	Wind Direction: 340 ° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0					
3.2	1.2	10.5	92.0	176.1	191.9
4.8					
7.5	5.2	32.7	147.1	165.6	152.0
9.2					
10.0					
10.5	5.5	22.1	117.2	119.4	105.4
12.0					
13.4					
14.0	4.2	11.8	79.5	88.1	81.7
15.0					
16.0					
16.8					
17.0					
17.6	13.3	30.9	75.2	60.4	56.0
18.0					
19.1	10.8	19.4	67.4	56.7	52.4
10.5 (40m)	4.5	22.1	121.7	127.8	115.4

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 340 ° SO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance	3	5	8	12	15
2.0					
3.2	1.7	11.8	80.9	125.2	122.5
4.8					
7.5	3.9	20.8	79.7	80.3	70.5
9.2					
10.0					
10.5	3.5	12.0	56.6	53.9	46.5
12.0					
13.4					
14.0	2.3	5.8	36.1	38.6	35.4
15.0					
16.0					
16.8					
17.0					
17.6	6.7	14.3	33.2	26.1	24.2
18.0					
19.1	5.3	8.8	29.5	24.5	22.6
10.5 (40m)	2.8	12.0	58.8	57.7	50.9

Option 2	Wind Direction: 356 °		NO_x		
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	5.9	40.7	279.0	323.9	288.2
3.2	5.6	38.6	264.7	340.9	285.4
4.8					
7.5					
9.2					
10.0					
10.5	10.1	35.1	165.6	130.8	89.7
12.0					
13.4	10.7	27.0	169.0	126.8	97.6
14.0					
15.0					
16.0					
16.8					
17.0	27.1	58.0	134.6	91.5	76.4
17.8	27.8	59.6	138.3	95.7	66.9
18.0					
19.1	22.7	48.5	112.5	76.5	53.3

Option 2	Wind Direction: 356 °		NO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	0.9	7.8	70.8	105.5	107.4
3.2	1.2	10.9	95.8	152.5	142.3
4.8					
7.5					
9.2					
10.0					
10.5	5.1	20.6	109.0	92.2	64.7
12.0					
13.4	6.1	17.3	117.6	91.9	71.6
14.0					
15.0					
16.0					
16.8					
17.0	17.0	39.6	96.8	67.2	56.4
17.8	17.7	41.0	99.9	70.4	49.4
18.0					
19.1	14.7	33.8	81.7	56.4	39.4

(assumes ozone concentration = 35 ppb)

Option 2	Wind Direction: 356 °		SO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance	3	5	8	12	15
2.0	1.9	13.0	88.8	103.1	91.7
3.2	1.8	12.3	84.2	108.5	90.8
4.8					
7.5					
9.2					
10.0					
10.5	3.2	11.2	52.7	41.6	28.5
12.0					
13.4	3.4	8.6	53.8	40.3	31.1
14.0					
15.0					
16.0					
16.8					
17.0	8.6	18.5	42.8	29.1	24.3
17.8	8.8	19.0	44.0	30.5	21.3
18.0					
19.1	7.2	15.4	35.8	24.3	17.0

Option 3	Wind Direction:	015°		NO_x	
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	22.1	51.7	187.1	256.2	256.2
2.4					
3.2	13.7	38.8	142.9	224.5	189.5
4.8					
7.5	9.2	18.6	70.2	88.4	78.6
9.2					
10.0					
10.5	20.0	111.2	215.9	171.6	131.2
12.0					
13.4					
14.0	2.1	11.4	38.1	52.5	42.0
15.0					
16.0					
16.8	25.3	8.3	23.5	26.2	22.6
17.0					
17.8					
18.0					
19.1					
16.8 (60m)	7.0	9.5	25.7	26.5	23.5

Option 3	Wind Direction:	015°		NO_2	
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	3.2	9.9	47.5	83.4	95.4
2.4					
3.2	3.0	10.9	51.7	100.4	94.5
4.8					
7.5	3.8	9.3	41.2	58.0	53.9
9.2					
10.0					
10.5	10.1	65.3	142.1	120.9	94.6
12.0					
13.4					
14.0	1.2	7.4	26.7	38.2	30.9
15.0					
16.0					
16.8	15.8	5.7	16.9	19.3	16.7
17.0					
17.8					
18.0					
19.1					
16.8 (60m)	4.4	6.4	18.5	19.4	17.3

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 160 °		NO_x		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8	17.7		192.7		332.8
1.2	26.8		300.7		430.6
2.0	9.7	86.6	421.2	574.7	534.2
2.4	5.6		252.1		391.9
3.2	5.9	16.5	214.2	316.4	348.8
4.8					
7.5	4.4	15.0	112.5	127.3	121.1
9.2	4.4	13.2	83.3	96.0	85.3
10.0	10.0	14.2	61.7	79.3	72.0
10.5					
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	33.9		322.6		444.5
0.8 (120m)	162.9		822.7		649.2
9.2 (60m)	3.7	13.6	88.8	92.6	82.1
9.2 (120m)	13.8	19.7	72.1	91.8	81.0

Option 3	Wind Direction: 160 °		NO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8	1.1		22.1		60.1
1.2	2.5		49.6		109.3
2.0	1.4	16.6	106.9	187.2	199.0
2.4	1.0		73.9		164.8
3.2	1.3	4.7	77.6	141.6	173.9
4.8					
7.5	1.8	7.5	66.0	83.5	83.1
9.2	2.1	7.3	52.7	66.1	60.6
10.0	4.9	8.2	40.1	55.4	51.6
10.5					
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	2.1		36.9		80.3
0.8 (120m)	10.2		94.2		117.3
9.2 (60m)	1.7	7.5	56.2	63.8	58.3
9.2 (120m)	6.5	10.9	45.6	63.2	57.5

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 232° NO$_x$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8	0.0		6.4		130.6
1.2	1.5		5.9		106.4
2.0	3.6		39.3		313.3
2.4	0.9		35.9		293.1
3.2	1.1	8.8	33.7	124.7	246.3
4.8					
7.5	16.4	12.3	25.7	58.1	75.0
9.2					
10.0					
10.5	2.6	3.5	15.9	53.4	61.1
12.0	4.5	4.0	11.0	41.8	51.3
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	0.0		76.5		610.8
0.8 (120m)	0.0		304.9		528.9
3.2 (40m)	7.2	10.3	38.6	136.2	267.3
7.5 (40m)	3.8	5.6	25.0	75.2	84.3
12.0 (60m)	3.1	3.5	12.0	43.4	52.3

Option 3	Wind Direction: 232° NO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8			0.7		23.6
1.2	0.1		1.0		27.0
2.0	0.5		10.0		116.7
2.4	0.2		10.5		123.3
3.2	0.2	2.5	12.2	55.8	122.8
4.8					
7.5	6.8	6.2	15.1	38.1	51.5
9.2					
10.0					
10.5	1.3	2.1	10.4	37.6	44.1
12.0	2.4	2.5	7.5	30.0	37.4
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)			8.8		110.4
0.8 (120m)			34.9		95.6
3.2 (40m)	1.6	2.9	14.0	60.9	133.3
7.5 (40m)	1.6	2.8	14.7	49.3	57.9
12.0 (60m)	1.7	2.1	8.1	31.1	38.1

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 270 °		NO$_x$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8	0.1		17.9		52.0
1.2	0.4		115.4		270.0
2.0	39.6	139.2	353.6	588.1	588.9
2.4	1.3		186.6		391.3
3.2	9.2	15.1	159.7	250.8	342.6
4.8					
7.5	16.5	22.6	70.5	93.6	84.4
9.2					
10.0					
10.5	3.7	16.4	61.1	64.9	54.6
12.0					
13.4					
14.0	2.2	9.3	44.0	46.8	38.7
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	1.1		200.6		506.7
0.8 (120m)	97.6		1520.7		1524.7
7.5 (40m)	6.2	18.7	71.4	100.3	90.0
7.5 (80m)	5.9	17.8	67.8	96.4	87.2

Option 3	Wind Direction: 270 °		NO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8			2.0		9.4
1.2	0.0		19.0		68.5
2.0	5.8	26.7	89.8	191.5	219.4
2.4	0.2		54.7		164.6
3.2	2.0	4.3	57.8	112.2	170.8
4.8					
7.5	6.8	11.3	41.4	61.4	57.9
9.2					
10.0					
10.5	1.9	9.6	40.3	45.7	39.4
12.0					
13.4					
14.0	1.3	6.1	30.8	34.0	28.4
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	0.1		23.0		91.6
0.8 (120m)	6.1		174.0		275.5
7.5 (40m)	2.6	9.4	41.9	65.8	61.8
7.5 (80m)	2.4	8.9	39.8	63.2	59.9

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 290°	NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8	6.8		29.3		208.2
1.2	47.1		116.6		340.5
2.0	13.8	35.6	431.2	457.6	524.4
2.4	17.3		288.2		400.6
3.2	11.1	34.5	240.3	264.6	337.6
4.8					
7.5	4.2	23.8	66.1	81.6	72.0
9.2					
10.0					
10.5	4.4	24.5	46.6	52.3	45.7
12.0					
13.4					
14.0	7.4	21.7	37.1	33.8	28.6
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	138.4		231.3		616.2
0.8 (120m)	642.3		1186.5		850.3
7.5 (60m)	4.4	23.9	63.2	78.4	71.6
10.5 (60m)	11.0	26.5	46.2	51.1	44.1

Option 3	Wind Direction: 290°	NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8	0.4		3.4		37.6
1.2	4.3		19.2		86.4
2.0	2.0	6.8	109.4	149.0	195.4
2.4	3.0		84.4		168.5
3.2	2.4	9.7	87.0	118.4	168.3
4.8					
7.5	1.8	11.9	38.8	53.5	49.4
9.2					
10.0					
10.5	2.2	14.4	30.7	36.8	33.0
12.0					
13.4					
14.0	4.3	14.1	26.0	24.6	21.0
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	8.6		26.5		111.4
0.8 (120m)	40.0		135.8		153.7
7.5 (60m)	1.8	12.0	37.1	51.4	49.1
10.5 (60m)	5.6	15.5	30.4	36.0	31.8

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 310 ° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8	78.8		120.3		227.2
1.2	89.3		150.8		238.6
2.0	89.6	109.6	269.1	271.6	292.8
2.4	70.2		259.1		259.0
3.2	4.5	44.7	153.8	204.2	193.9
4.8					
7.5	2.3	14.5	29.4	37.4	33.6
9.2					
10.0					
10.5	1.0	15.2	33.0	33.8	28.3
12.0					
13.4					
14.0	1.9	11.0	22.6	22.0	18.6
15.0					
16.0	1.2	9.9	20.8	20.2	16.8
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	175.6		245.2		330.6
0.8 (120m)	253.0		488.2		399.7
3.2 (60m)	10.8	74.1	219.6	239.9	225.6

Option 3	Wind Direction: 310 ° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8	4.9		13.8		41.1
1.2	8.2		24.9		60.6
2.0	13.1	21.0	68.3	88.5	109.1
2.4	12.0		75.9		108.9
3.2	1.0	12.6	55.7	91.3	96.6
4.8					
7.5	1.0	7.3	17.3	24.6	23.1
9.2					
10.0					
10.5	0.5	8.9	21.7	23.8	20.4
12.0					
13.4					
14.0	1.1	7.1	15.8	16.0	13.6
15.0					
16.0	0.7	6.7	14.8	14.8	12.4
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	10.9		28.1		59.8
0.8 (120m)	15.8		55.9		72.2
3.2 (60m)	2.4	20.9	79.5	107.3	112.5

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 330 ° NO$_x$				
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	12	15
0.8	51.0		165.3		247.6
1.2	31.9		165.7		205.0
2.0	39.7		209.7	212.7	227.8
2.4	32.3		251.4		241.9
3.2	20.5		219.1	248.6	183.7
4.8	8.9		97.1	108.4	87.9
7.5					
9.2					
10.0					
10.5	7.1		53.0	55.1	44.2
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	2.3		22.7	26.7	21.3
19.1	2.3		22.9	27.1	21.8
0.8 (60m)	80.2		196.5		254.8
0.8 (60m)	132.3		310.9		327.6
4.8 (40m)	8.6		98.2	104.7	85.9

Option 3	Wind Direction: 330 ° NO$_2$				
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	12	15
0.8	3.2		18.9		44.7
1.2	2.9		27.3		52.0
2.0	5.8		53.2	69.3	84.8
2.4	5.5		73.6		101.7
3.2	4.5		79.3	111.2	91.6
4.8	2.7		45.6	60.3	52.9
7.5					
9.2					
10.0					
10.5	3.6		34.9	38.8	31.9
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	1.5		16.4	19.6	15.7
19.1	1.5		16.6	20.0	16.1
0.8 (60m)	5.0		22.5		46.1
0.8 (60m)	8.2		35.6		59.2
4.8 (40m)	2.6		46.2	58.2	51.7

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 340 °		NO$_x$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8	3.2		105.2		284.9
1.2	8.6		118.2		263.7
2.0	12.5		175.2		276.5
2.4	10.0		178.4		277.7
3.2	14.4	49.9	191.7	190.8	248.2
4.8					
7.5	6.0	27.9	107.0	105.3	93.0
9.2					
10.0					
10.5	7.4	12.4	55.5	58.5	55.8
12.0					
13.4					
14.0	1.4	8.3	43.9	46.2	42.9
15.0					
16.0					
16.8					
17.0					
17.6	1.6	1.9	15.6	28.3	25.5
18.0					
19.1	2.4	4.1	24.6	28.1	25.9
0.8 (60m)	12.0		177.9		343.6
0.8 (120m)	39.4		436.2		495.6
10.5 (40m)	2.2	12.7	61.7	64.2	59.2

Option 3	Wind Direction: 340 °		NO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8	0.2		12.0		51.5
1.2	0.8		19.5		66.9
2.0	1.8		44.5		103.0
2.4	1.7		52.3		116.8
3.2	3.2	14.1	69.4	85.4	123.8
4.8					
7.5	2.5	13.9	62.8	69.1	63.8
9.2					
10.0					
10.5	3.7	7.3	36.5	41.2	40.2
12.0					
13.4					
14.0	0.8	5.4	30.8	33.6	31.5
15.0					
16.0					
16.8					
17.0					
17.6	1.0	1.3	11.2	20.9	18.8
18.0					
19.1	1.6	2.9	17.9	20.7	19.1
0.8 (60m)	0.7		20.4		62.1
0.8 (120m)	2.5		49.9		89.6
10.5 (40m)	1.1	7.5	40.6	45.3	42.7

(assumes ozone concentration = 35 ppb)

Option 3	Wind Direction: 356 ° NO$_x$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	13.9	24.4	160.0	218.4	201.9
2.4					
3.2	10.2	16.7	116.9	136.2	127.9
4.8					
7.5					
9.2					
10.0					
10.5	5.2	19.9	38.9	39.9	35.6
12.0					
13.4	1.0	5.7	34.0	44.1	42.1
14.0					
15.0					
16.0					
16.8					
17.0	1.5	4.3	36.5	34.4	31.9
17.8	5.3	7.6	28.0	30.8	26.6
18.0					
19.1	1.7	5.6	17.5	19.0	16.2

Option 3	Wind Direction: 356 ° NO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	2.0	4.7	40.6	71.1	75.2
2.4					
3.2	2.2	4.7	42.3	60.9	63.8
4.8					
7.5					
9.2					
10.0					
10.5	2.6	11.6	25.6	28.1	25.7
12.0					
13.4	0.6	3.7	23.6	31.9	30.9
14.0					
15.0					
16.0					
16.8					
17.0	0.9	2.9	26.2	25.2	23.5
17.8	3.3	5.2	20.2	22.6	19.7
18.0					
19.1	1.1	3.9	12.7	14.0	11.9

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 015°		NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	12.8		54.6		278.3
2.4					
3.0					
3.2	11.5		123.3		293.0
4.8					
7.5	11.4		121.8		145.4
9.4					
10.0					
10.5	7.7		82.2		89.0
12.0					
13.4					
14.0	7.0		74.7		74.6
16.0					
16.8	5.4		58.0		52.1
17.0					
17.6					
17.8					
18.0					
19.1					
16.8 (60m)	5.1		54.3		49.2

Option 4	Wind Direction: 015°		NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	2.5		15.9		103.7
2.4					
3.0					
3.2	3.2		50.2		146.1
4.8					
7.5	5.7		76.3		99.8
9.4					
10.0					
10.5	4.5		56.4		64.2
12.0					
13.4					
14.0	4.5		53.6		54.8
16.0					
16.8	3.7		42.3		38.4
17.0					
17.6					
17.8					
18.0					
19.1					
16.8 (60m)	3.5		39.6		36.3

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 015°		SO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	40.7		173.7		885.6
2.4					
3.0					
3.2	36.6		392.3		932.3
4.8					
7.5	36.3		387.6		462.7
9.4					
10.0					
10.5	24.5		261.6		283.2
12.0					
13.4					
14.0	22.3		237.7		237.4
16.0					
16.8	17.2		184.6		165.8
17.0					
17.6					
17.8					
18.0					
19.1					
16.8 (60m)	16.2		172.8		156.6

Option 4	Wind Direction: 160°	NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	0.6		5.4		272.4
2.4					
3.0					
3.2	5.0		45.2		335.1
4.8					
7.5	3.8		34.4		129.6
9.4	9.8		25.3		82.4
10.0	3.2		29		72.1
10.5					
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
9.2 (60m)	6.7		33.8		99.1
9.2 (120m)	34.1		40.9		75.6

Option 4	Wind Direction: 160°	NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	0.1		1.6		101.5
2.4					
3.0					
3.2	1.4		18.4		167.1
4.8					
7.5	1.9		21.6		89.0
9.4	5.5		16.9		58.7
10.0	1.8		19.7		51.7
10.5					
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
9.2 (60m)	3.7		22.5		70.4
9.2 (120m)	18.9		27.2		53.7

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 160°	SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	1.9		17.2		866.8
2.4					
3.0					
3.2	15.9		143.8		1066.3
4.8					
7.5	12.1		109.5		412.4
9.4	31.2		80.5		262.2
10.0	10.2		92.3		229.4
10.5					
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
9.2 (60m)	21.3		107.6		315.3
9.2 (120m)	108.5		130.1		240.6

Option 4	Wind Direction: 232° NO_x				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	4.3		10.6		204.9
2.4					
3.0					
3.2	15.7		26.9		238.6
4.8					
7.5	22.4		61.4		126.1
9.4					
10.0					
10.5	17.5		47.6		105.2
12.0	29.2		49.9		64.2
13.4					
14.0	21.5		48.7		79.8
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	21.9		60.1		145.6

Option 4	Wind Direction: 232° NO_2				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	0.8		3.1		76.3
2.4					
3.0					
3.2	4.4		11.0		119.0
4.8					
7.5	11.2		38.5		86.6
9.4					
10.0					
10.5	10.3		32.7		75.9
12.0	18.0		35.1		46.8
13.4					
14.0	14.0		34.9		58.6
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	10.9		37.7		99.9

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 232° SO_2				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	13.7		33.7		652.0
2.4					
3.0					
3.2	50.0		85.6		759.2
4.8					
7.5	71.3		195.4		401.3
9.4					
10.0					
10.5	55.7		151.5		334.7
12.0	92.9		158.8		204.3
13.4					
14.0	68.4		155.0		253.9
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	69.7		191.2		463.3

Option 4	Wind Direction: 252 °		NO$_x$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	2.5		6.2		123.5
2.4					
3.0					
3.2	7.9		13.5		188.1
4.8					
7.5	36.5		47.5		112.7
9.4					
10.0					
10.5	21.9		44.8		81.2
12.0					
13.4					
14.0	26.1		46.7		71.3
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
14.0 (40m)	42.5		43.3		64.0
14.0 (80m)	27.4		46.1		67.1

Option 4	Wind Direction: 252 °		NO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	0.5		1.8		46.0
2.4					
3.0					
3.2	2.2		5.5		93.8
4.8					
7.5	18.2		29.8		77.4
9.4					
10.0					
10.5	12.9		30.8		58.6
12.0					
13.4					
14.0	16.9		33.5		52.4
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
14.0 (40m)	27.6		31.1		47.0
14.0 (80m)	17.8		33.1		49.3

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 252 °		SO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	8.0		19.7		393.0
2.4					
3.0					
3.2	25.1		43.0		598.5
4.8					
7.5	116.1		151.1		358.6
9.4					
10.0					
10.5	69.7		142.6		258.4
12.0					
13.4					
14.0	83.1		148.6		226.9
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
14.0 (40m)	135.2		137.8		203.6
14.0 (80m)	87.2		146.7		213.5

Option 4	Wind Direction: 270 °	NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	10.8		10.2		203.3
2.4					
3.0					
3.2	8.1		13.9		141.6
4.8					
7.5	3.7		28.0		109.8
9.4					
10.0					
10.5	0.6		52.8		87.8
12.0					
13.4					
14.0	2.0		43.3		62
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	2.3		25.6		110.7
7.5 (80m)	1.2		23.4		109

Option 4	Wind Direction: 270 °	NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	2.1		3.0		75.7
2.4					
3.0					
3.2	2.3		5.7		70.6
4.8					
7.5	1.8		17.5		75.4
9.4					
10.0					
10.5	0.4		36.2		63.3
12.0					
13.4					
14.0	1.3		31.1		45.5
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	1.1		16.0		76.0
7.5 (80m)	0.6		14.7		74.8

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 270 °	SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	34.4		32.5		646.9
2.4					
3.0					
3.2	25.8		44.2		450.6
4.8					
7.5	11.8		89.1		349.4
9.4					
10.0					
10.5	1.9		168.0		279.4
12.0					
13.4					
14.0	6.4		137.8		197.3
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	7.3		81.5		352.2
7.5 (80m)	3.8		74.5		346.8

Option 4	Wind Direction: 290°		NO$_x$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	13.2		12.5		255.4
2.4					
3.0					
3.2	14.7		41.8		255.8
4.8					
7.5	13.1		47.6		86.5
9.4					
10.0					
10.5	9.9		47.1		61.8
12.0					
13.4					
14.0	14.4		63.7		44.2
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (60m)	15.3		48.1		87.2
10.5 (60m)	43.8		43.4		56.2

Option 4	Wind Direction: 290°		NO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	2.5		3.6		95.1
2.4					
3.0					
3.2	4.1		17.0		127.5
4.8					
7.5	6.5		29.8		59.4
9.4					
10.0					
10.5	5.8		32.3		44.6
12.0					
13.4					
14.0	9.4		45.7		32.5
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (60m)	7.6		30.1		59.9
10.5 (60m)	25.7		29.8		40.5

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 290°		SO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	42.0		39.8		812.7
2.4					
3.0					
3.2	46.8		133.0		814.0
4.8					
7.5	41.7		151.5		275.2
9.4					
10.0					
10.5	31.5		149.9		196.6
12.0					
13.4					
14.0	45.8		202.7		140.6
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (60m)	48.7		153.1		277.5
10.5 (60m)	139.4		138.1		178.8

Option 4	Wind Direction: 310 °		NO_x		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0			2.0		128.5
2.4					
3.0					
3.2	1.0		44.9		180.7
4.8					
7.5	2.7		55.4		75.4
9.4					
10.0					
10.5	3.5		56.6		58.9
12.0					
13.4					
14.0	2.2		35.2		34.8
16.0	5.1		31.0		31.5
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	2.6		59.7		202.3

Option 4	Wind Direction: 310 °		NO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0			0.6		47.9
2.4					
3.0					
3.2	0.3		18.3		90.1
4.8					
7.5	1.3		34.7		51.8
9.4					
10.0					
10.5	2.1		38.8		42.5
12.0					
13.4					
14.0	1.4		25.3		25.6
16.0	3.4		22.5		23.2
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	0.7		24.3		100.9

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 310 °		SO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0			6.4		408.9
2.4					
3.0					
3.2	3.2		142.9		575.0
4.8					
7.5	8.6		176.3		239.9
9.4					
10.0					
10.5	11.1		180.1		187.4
12.0					
13.4					
14.0	7.0		112.0		110.7
16.0	16.2		98.6		100.2
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	8.3		190.0		643.7

Option 4	Wind Direction: 330 ° NO$_x$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	0.5		14.1		187.2
2.4					
3.0					
3.2	1.9		29.3		51.5
4.8	5.0		69.4		170.0
7.5					
9.4					
10.0					
10.5	3.9		62.8		83.3
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	5.9		35.4		42.6
19.1	7.2		35.4		42.6
4.8 (40m)	17.5		77.7		162.4

Option 4	Wind Direction: 330 ° NO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	0.1		4.1		69.7
2.4					
3.0					
3.2	0.5		11.9		25.7
4.8	1.9		35.9		102.4
7.5					
9.4					
10.0					
10.5	2.3		43.1		60.1
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	4.1		25.9		31.5
19.1	5.0		26.0		31.5
4.8 (40m)	6.6		40.2		97.8

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 330 ° SO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	1.6		44.9		595.7
2.4					
3.0					
3.2	6.0		93.2		163.9
4.8	15.9		220.8		540.9
7.5					
9.4					
10.0					
10.5	12.4		199.8		265.1
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	18.8		112.6		135.6
19.1	22.9		112.6		135.6
4.8 (40m)	55.7		247.2		516.8

Option 4	Wind Direction: 340 °		NO_x		
Height: 0m	Wind Speed (m s⁻¹)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0					
2.4					
3.0					
3.2	4.5		214.1		289.7
4.8					
7.5	8.8		179.7		136.7
9.4					
10.0					
10.5	7.3		118.4		89.1
12.0					
13.4					
14.0	4.7		73.9		67.1
16.0					
16.8					
17.0					
17.6	8.6		51.8		42.2
17.8					
18.0					
19.1	10.3		50.3		42.3
10.5 (40m)	7.9		128.3		95.4

Option 4	Wind Direction: 340 °		NO_2		
Height: 0m	Wind Speed (m s⁻¹)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0					
2.4					
3.0					
3.2	1.3		87.2		144.4
4.8					
7.5	4.4		112.6		93.8
9.4					
10.0					
10.5	4.3		81.3		64.3
12.0					
13.4					
14.0	3.1		53.0		49.3
16.0					
16.8					
17.0					
17.6	5.9		37.9		31.2
17.8					
18.0					
19.1	7.2		36.9		31.3
10.5 (40m)	4.6		88.1		68.8

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 340 °		SO_2		
Height: 0m	Wind Speed (m s⁻¹)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0					
2.4					
3.0					
3.2	14.3		681.3		921.8
4.8					
7.5	28.0		571.8		435.0
9.4					
10.0					
10.5	23.2		376.7		283.5
12.0					
13.4					
14.0	15.0		235.1		213.5
16.0					
16.8					
17.0					
17.6	27.4		164.8		134.3
17.8					
18.0					
19.1	32.8		160.1		134.6
10.5 (40m)	25.1		408.3		303.6

Option 4	Wind Direction: 356 ° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	1.5		71.2		280.9
2.4					
3.0					
3.2	12.2		130.9		227.8
4.8					
7.5					
9.4					
10.0					
10.5	5.1		83.4		45.2
12.0					
13.4	6.0		94.0		64.7
14.0					
16.0					
16.8					
17.0	10.5		63.0		43.8
17.6					
17.8	11.9		71.8		39.6
18.0					
19.1	9.4		56.5		29.3

Option 4	Wind Direction: 356 ° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	0.3		20.7		104.6
2.4					
3.0					
3.2	3.4		53.3		113.6
4.8					
7.5					
9.4					
10.0					
10.5	3.0		57.2		32.6
12.0					
13.4	3.8		67.1		47.4
14.0					
16.0					
16.8					
17.0	7.2		46.0		32.3
17.6					
17.8	8.2		52.5		29.2
18.0					
19.1	6.6		41.5		21.7

(assumes ozone concentration = 35 ppb)

Option 4	Wind Direction: 356 ° SO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
0.8					
1.2					
2.0	4.8		226.6		893.8
2.4					
3.0					
3.2	38.8		416.5		724.9
4.8					
7.5					
9.4					
10.0					
10.5	16.2		265.4		143.8
12.0					
13.4	19.1		299.1		205.9
14.0					
16.0					
16.8					
17.0	33.4		200.5		139.4
17.6					
17.8	37.9		228.5		126.0
18.0					
19.1	29.9		179.8		93.2

Option 5	Wind Direction:	015°	NO_x		
Height: 0m Distance (km)	Wind Speed ($m\ s^{-1}$) 3	5	8	12	15
2.0	3.6		60.4		102.3
3.2	2.7		52.2		69.1
4.8					
7.5	5.3		40.4		34.8
9.2					
10.0					
10.5	5.3		29.9		24.9
12.0					
13.4					
14.0	6.4		21.3		18.6
16.0					
16.8	5.3		10.2		9.1
17.0					
17.6					
17.8					
18.0					
19.1					
16.8 (60m)	5.3		10.2		9.1

Option 5	Wind Direction:	015°	NO_2		
Height: 0m Distance (km)	Wind Speed ($m\ s^{-1}$) 3	5	8	12	15
2.0	0.5		15.3		38.1
3.2	0.6		18.9		34.5
4.8					
7.5	2.2		23.7		23.9
9.2					
10.0					
10.5	2.7		19.7		18.0
12.0					
13.4					
14.0	3.7		14.9		13.7
16.0					
16.8	3.3		7.3		6.7
17.0					
17.6					
17.8					
18.0					
19.1					
16.8 (60m)	3.3		7.3		6.7

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 160 °		NO_x		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	1.4		64.4		105.0
3.2	4.3		77.1		94.1
4.8					
7.5	2.0		50.5		42.6
9.2	5.8		32.6		25.3
10.0	9.7		19.2		13.3
10.5					
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
9.2 (60m)	6.2		37.7		27.1
9.2 (120m)	11.5		30.4		22.7

Option 5	Wind Direction: 160 °		NO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	0.2		16.3		39.1
3.2	0.9		27.9		46.9
4.8					
7.5	0.8		29.7		29.3
9.2	2.7		20.7		17.9
10.0	4.8		12.5		9.6
10.5					
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
9.2 (60m)	2.9		23.9		19.2
9.2 (120m)	5.4		19.2		16.1

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 232°		NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	2.5		12.3		55.9
3.2	8.6		20.3		55.9
4.8					
7.5	7.7		18.2		82.0
9.2					
10.0					
10.5	4.6		12.4		26.6
12.0	4.6		11.4		26.7
13.4					
14.0	4.7		9.7		17.4
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	7.5		17.8		5.4

Option 5	Wind Direction: 232°		NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	0.4		3.1		20.8
3.2	1.9		7.4		27.9
4.8					
7.5	3.2		10.7		56.3
9.2					
10.0					
10.5	2.3		8.2		19.2
12.0	2.5		7.7		19.5
13.4					
14.0	2.7		6.8		12.8
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	3.1		10.5		3.7

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 252 °	NO$_x$			
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	2.5		20.9		94.3
3.2	1.7		23.5		81.8
4.8					
7.5	3.6		17.7		33.1
9.2					
10.0					
10.5	2.3		24.1		29.9
12.0					
13.4					
14.0	2.0		15.0		22.1
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
14.0 (40m)	2.3		14.2		19.6
14.0 (80m)	2.0		15.6		20.7

Option 5	Wind Direction: 252 °	NO$_2$			
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	0.4		5.3		35.1
3.2	0.4		8.5		40.8
4.8					
7.5	1.5		10.4		22.7
9.2					
10.0					
10.5	1.1		15.9		21.5
12.0					
13.4					
14.0	1.1		10.5		16.2
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
14.0 (40m)	1.4		10.0		14.4
14.0 (80m)	1.1		10.9		15.2

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 270 °	NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	24.7		79.4		94.4
3.2	18.3		84.3		81.9
4.8					
7.5	22.5		33.0		36.1
9.2					
10.0					
10.5	5.5		30.7	19.2	24.4
12.0					
13.4					
14.0	3.7		24.9		18.2
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	6.2		38.9		42.6
7.5 (80m)	6.0		39.4		43.2

Option 5	Wind Direction: 270 °	NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	3.6		20.2		35.2
3.2	4.0		30.5		40.8
4.8					
7.5	9.3		19.4		24.8
9.2					
10.0					
10.5	2.8		20.2	13.5	17.6
12.0					
13.4					
14.0	2.1		17.4		13.4
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	2.6		22.8		29.3
7.5 (80m)	2.5		23.1		29.6

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 290 °	NO_x			
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	24.5		79.0		137.5
3.2	12.6		59.1		91.0
4.8					
7.5	7.7		36.3		35.6
9.2					
10.0					
10.5	8.6		29.6		23.5
12.0					
13.4					
14.0	14.9		19.6		14.4
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (60m)	7.4		36.2		34.7
10.5 (60m)	17.5		27.8		21.6

Option 5	Wind Direction: 290 °	NO_2			
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	3.6		20.0		51.2
3.2	2.8		21.4		45.4
4.8					
7.5	3.2		21.3		24.5
9.2					
10.0					
10.5	4.4		19.5		17.0
12.0					
13.4					
14.0	8.7		13.7		10.6
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (60m)	3.1		21.2		23.8
10.5 (60m)	8.9		18.3		15.6

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 310 ° NO$_x$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	5.9		48.2		50.3
3.2	3.2		9.9		17.7
4.8					
7.5	4.1		13.8		13.1
9.2					
10.0					
10.5	4.4		12.5		11.0
12.0					
13.4					
14.0	1.1		7.1		6.2
16.0	0.8		7.2		6.2
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	6.5		17.8		21.3

Option 5	Wind Direction: 310 ° NO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	0.9		12.2		18.7
3.2	0.7		3.6		8.8
4.8					
7.5	1.7		8.1		9.0
9.2					
10.0					
10.5	2.2		8.2		7.9
12.0					
13.4					
14.0	0.6		5.0		4.5
16.0	0.5		5.2		4.5
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	1.4		6.5		10.6

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 330 °		NO$_x$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	6.5		52.7		80.9
3.2	3.4		22.8		14.3
4.8	6.6		43.9		34.4
7.5					
9.2					
10.0					
10.5	4.8		29.9		18.9
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	1.5		15.2		10.1
19.1					
4.8 (60m)	8.6		44.3		34.4
18.0 (60m)	1.5		14.7		10.2

Option 5	Wind Direction: 330 °		NO$_2$		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	0.9		13.4		30.1
3.2	0.7		8.3		7.1
4.8	2.0		20.6		20.7
7.5					
9.2					
10.0					
10.5	2.4		19.7		13.6
12.0					
13.4					
14.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	1.0		11.0		7.4
19.1					
4.8 (60m)	2.6		20.8		20.7
18.0 (60m)	1.0		10.7		7.6

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 340 °		NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	7.5		61.1		75.8
3.2					
4.8					
7.5	7.7		35.6		34.4
9.2					
10.0					
10.5	5.6		17.2		17.4
12.0					
13.4					
14.0	2.3		15.9		17.8
16.0					
16.8					
17.0					
17.6	0.4		3.8		5.9
17.8					
18.0					
19.1	1.2		8.5		8.7

Option 5	Wind Direction: 340 °		NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	1.1		15.5		28.2
3.2					
4.8					
7.5	3.2		20.9		23.6
9.2					
10.0					
10.5	2.9		11.3		12.5
12.0					
13.4					
14.0	1.4		11.1		13.1
16.0					
16.8					
17.0					
17.6	0.2		2.7		4.3
17.8					
18.0					
19.1	0.8		6.2		6.4

(assumes ozone concentration = 35 ppb)

Option 5	Wind Direction: 356 °	NO$_x$			
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	12	15
2.0	10.7		86.4		69.6
3.2	7.7		62.8		43.9
4.8					
7.5					
9.2					
10.0					
10.5	3.0		9.0		6.7
12.0					
13.4	2.4		18.9		11.1
14.0					
16.0					
16.8					
17.0	4.7		15.4		8.9
17.6					
17.8	1.4		13.5		7.4
18.0					
19.1	0.6		5.7		3.6

Option 5	Wind Direction: 356 °	NO$_2$			
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	12	15
2.0	1.6		21.9		25.9
3.2	1.7		22.7		21.9
4.8					
7.5					
9.2					
10.0					
10.5	1.5		5.9		4.8
12.0					
13.4	1.4		13.1		8.2
14.0					
16.0					
16.8					
17.0	3.0		11.1		6.5
17.6					
17.8	0.9		9.7		5.5
18.0					
19.1	0.4		4.2		2.7

(assumes ozone concentration = 35 ppb)

Option 6 Wind Direction: 270 ° NO_x						
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	3.2		94.1			210.4
3.2	0.2		82.7			156.0
4.8						
7.5	2.3		30.5			42.0
9.2						
10.0						
10.5	0.6		31.1			30.6
12.0						
13.4						
14.0	0.4		25.9			22.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	0.3		37.8			52.1
7.5 (80m)	0.2		38.4			52.1

Option 6 Wind Direction: 270 ° NO_2						
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	0.5		23.9			78.4
3.2	0.0		29.9			77.8
4.8						
7.5	0.9		17.9			28.8
9.2						
10.0						
10.5	0.3		20.5			22.0
12.0						
13.4						
14.0	0.2		18.1			16.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	0.1		22.2			35.8
7.5 (80m)	0.1		22.5			35.8

(assumes ozone concentration = 35 ppb)

Option 6 Wind Direction: 270 ° SO_2						
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	5.7		169.4			378.9
3.2	0.4		148.9			280.8
4.8						
7.5	4.1		54.9			75.6
9.2						
10.0						
10.5	1.1		56.0			55.0
12.0						
13.4						
14.0	0.7		46.6			40.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	0.5		68.1			93.8
7.5 (80m)	0.4		69.1			93.8

Option 7	Wind Direction: 340 °		NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	6.6		123.4			156.9
4.8						
7.5	0.2		73.6			79.8
9.2						
10.0						
10.5	0.3		41.7			50.8
12.0						
13.4						
14.0			31.4			38.7
16.0						
16.8						
17.0						
17.6			11.0			20.3
17.8						
18.0						
19.1			17.2			21.7

Option 7	Wind Direction: 340 °		NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	1.4		44.7			78.2
4.8						
7.5	0.1		43.2			54.8
9.2						
10.0						
10.5	0.2		27.4			36.7
12.0						
13.4						
14.0			22.0			28.4
16.0						
16.8						
17.0						
17.6			7.9			15.0
17.8						
18.0						
19.1			12.5			16.0

(assumes ozone concentration = 35 ppb)

Option 7	Wind Direction: 340 °		SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	11.8		222.1			282.5
4.8						
7.5	0.4		132.5			143.7
9.2						
10.0						
10.5	0.5		75.0			91.5
12.0						
13.4						
14.0			56.5			69.7
16.0						
16.8						
17.0						
17.6			19.7			36.6
17.8						
18.0						
19.1			30.9			39.1

Option 6	Wind Direction: 340 °		NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	1.1		58.1			69.6
4.8						
7.5	1.0		42.8			42.6
9.2						
10.0						
10.5	0.5		21.3			22.5
12.0						
13.4						
14.0	0.4		17.9			21.3
16.0						
16.8						
17.0						
17.6			4.3			7.9
17.8						
18.0						
19.1	0.1		10.2			11.0

Option 6	Wind Direction: 340 °		NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	0.2		21.0			34.7
4.8						
7.5	0.4		25.1			29.2
9.2						
10.0						
10.5	0.3		14.0			16.2
12.0						
13.4						
14.0	0.2		12.5			15.7
16.0						
16.8						
17.0						
17.6			3.1			5.8
17.8						
18.0						
19.1			7.4			8.2

(assumes ozone concentration = 35 ppb)

Option 6	Wind Direction: 340 °		SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	2.0		104.6			125.3
4.8						
7.5	1.8		77.1			76.7
9.2						
10.0						
10.5	1.0		38.3			40.5
12.0						
13.4						
14.0	0.7		32.1			38.4
16.0						
16.8						
17.0						
17.6			7.8			14.2
17.8						
18.0						
19.1			18.4			19.9

Option 7	Wind Direction: 270 ° NO_x					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	6.4		309.2			535.9
3.2	1.7		125.9			245.5
4.8						
7.5	0.7		38.0			66.5
9.2						
10.0						
10.5	0.8		39.6			52.9
12.0						
13.4						
14.0	0.6		26.9			36.8
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	1.1		52.4			87.9
7.5 (80m)	1.1		52.2			87.1

Option 7	Wind Direction: 270 ° NO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	0.9		78.5			199.7
3.2	0.4		45.6			122.4
4.8						
7.5	0.3		22.3			45.6
9.2						
10.0						
10.5	0.4		26.0			38.1
12.0						
13.4						
14.0	0.4		18.9			27.0
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	0.4		30.8			60.3
7.5 (80m)	0.5		30.6			59.8

(assumes ozone concentration = 35 ppb)

Option 7	Wind Direction: 270 ° SO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	11.4		556.8			965.0
3.2	3.0		226.6			442.0
4.8						
7.5	1.2		68.5			119.7
9.2						
10.0						
10.5	1.4		71.2			95.2
12.0						
13.4						
14.0	1.1		48.5			66.2
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	1.9		94.4			158.3
7.5 (80m)	2.0		94.0			156.8

Option 8	Wind Direction: 015 °	NO_x				
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	99.7		127.3			349.8
3.2	68.1		185.0			283.0
4.8						
7.5	28.5		196.7			149.7
9.2						
10.0						
10.5	37.1		153.6			105.1
12.0						
13.4						
14.0	30.8		110.8			61.5
15.0						
16.0						
16.8	19.9		67.5			35.6
17.0						
17.6						
17.8						
18.0						
19.1						
16.8 (40m)	27.6		67.7			38.0

Option 8	Wind Direction: 015 °	NO_2				
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	14.6		32.3			130.3
3.2	15.0		67.0			141.1
4.8						
7.5	11.8		115.4			102.8
9.2						
10.0						
10.5	18.8		101.1			75.8
12.0						
13.4						
14.0	17.9		77.7			45.2
15.0						
16.0						
16.8	12.4		48.5			26.3
17.0						
17.6						
17.8						
18.0						
19.1						
16.8 (40m)	17.2		48.6			28.0

(assumes ozone concentration = 35 ppb)

Option 8	Wind Direction: 015 °	SO_2				
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	31.7		40.5			111.2
3.2	21.7		58.8			90.0
4.8						
7.5	9.1		62.6			47.6
9.2						
10.0						
10.5	11.8		48.8			33.4
12.0						
13.4						
14.0	9.8		35.2			19.6
15.0						
16.0						
16.8	6.3		21.5			11.3
17.0						
17.6						
17.8						
18.0						
19.1						
16.8 (40m)	8.8		21.5			12.1

Option 8	Wind Direction: 310 °		NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	29.2		41.8			227.6
3.2	61.0		110.8			264.2
4.8						
7.5	11.4		86.5			78.5
9.2						
10.0						
10.5						
12.0						
13.4						
14.0			80.2			49.5
15.0	1.8		99.7			61.0
16.0	4.4		102.4			57.2
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
3.2 (60m)	7.2		143.0			305.1

Option 8	Wind Direction: 310 °		NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	4.3		10.6			84.8
3.2	13.4		40.1			131.7
4.8						
7.5	4.7		50.8			53.9
9.2						
10.0						
10.5						
12.0						
13.4						
14.0			56.2			36.4
15.0	1.1		70.6			44.9
16.0	2.7		73.1			42.2
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
3.2 (60m)	1.6		51.8			152.1

Option 8	Wind Direction: 310 °		SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	9.3		13.3			72.4
3.2	19.4		35.2			84.0
4.8						
7.5	3.6		27.5			25.0
9.2						
10.0						
10.5						
12.0						
13.4						
14.0			25.5			15.7
15.0						
16.0	1.4		32.6			18.2
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
3.2 (60m)	2.3		45.5			97.0

Option 8	Wind Direction: 330 °		NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	9.6		78.8			349.6
3.2						
4.8	82.0		91.1			175.5
7.5						
9.2						
10.0						
10.5	81.3		127.3			30.1
12.0						
13.4						
14.0			88.5			74.0
15.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0	12.1		61.2			64.7
19.1						
4.8 (60m)	28.8		119.7			195.3

Option 8	Wind Direction: 330 °		NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	1.4		20.0			130.2
3.2						
4.8	24.9		42.8			105.7
7.5						
9.2						
10.0						
10.5	41.2		83.8			21.7
12.0						
13.4						
14.0			62.0			54.4
15.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0	7.7		44.3			47.8
19.1						
4.8 (60m)	8.7		56.3			117.6

(assumes ozone concentration = 35 ppb)

Option 8	Wind Direction: 330 °		SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	3.1		25.1			111.2
3.2						
4.8	26.1		29.0			55.8
7.5						
9.2						
10.0						
10.5	25.9		40.5			9.6
12.0						
13.4						
14.0			28.1			23.5
15.0						
16.0						
16.8						
17.0						
17.6						
17.8						
18.0	3.8		19.5			20.6
19.1						
4.8 (60m)	9.2		38.1			62.1

Option 8	Wind Direction: 340 °		NO$_x$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	10.4		145.8			276.3
4.8						
7.5	15.0		158.0			130.4
9.2						
10.0						
10.5	20.1		99.5			83.9
12.0						
13.4						
14.0	8.1		78.7			73.7
15.0						
16.0						
16.8						
17.0						
17.6	10.0		46.0			37.0
17.8						
18.0						
19.1	8.3		48.1			39.3
10.5 (40m)	12.5		115.7			97.1

Option 8	Wind Direction: 340 °		NO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	2.3		52.8			137.8
4.8						
7.5	6.2		92.7			89.5
9.2						
10.0						
10.5	10.2		65.5			60.5
12.0						
13.4						
14.0	4.7		55.2			54.1
15.0						
16.0						
16.8						
17.0						
17.6	6.3		33.2			27.3
17.8						
18.0						
19.1	5.4		34.9			29.0
10.5 (40m)	6.3		76.2			70.0

(assumes ozone concentration = 35 ppb)

Option 8	Wind Direction: 340 °		SO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	3.3		46.4			87.9
4.8						
7.5	4.8		50.2			41.5
9.2						
10.0						
10.5	6.4		31.6			26.7
12.0						
13.4						
14.0	2.6		25.0			23.4
15.0						
16.0						
16.8						
17.0						
17.6	3.2		14.6			11.8
17.8						
18.0						
19.1	2.6		15.3			12.5
10.5 (40m)	4.0		36.8			30.9

Option 8	Wind Direction: 356 °					NO_x
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
2.0			7.1			179.2
3.2	39.0		41.6			211.6
4.8						
7.5						
9.2						
10.0						
10.5	16.2		76.7			103.4
12.0	35.8		49.4			71.5
13.4						
14.0	16.0		64.9			71.9
15.0						
16.0						
16.8						
17.0						
17.6						
17.8	22.3		60.5			51.6
18.0						
19.1						
14.0 (40m)	9.1		70.1			73.6

Option 8	Wind Direction: 356 °					NO_2
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
2.0			1.8			66.8
3.2	8.6		15.1			105.5
4.8						
7.5						
9.2						
10.0						
10.5	8.2		50.5			74.6
12.0	19.4		33.6			52.1
13.4						
14.0	9.3		45.5			52.8
15.0						
16.0						
16.8						
17.0						
17.6						
17.8	14.2		43.7			38.1
18.0						
19.1						
14.0 (40m)	5.3		49.1			54.1

(assumes ozone concentration = 35 ppb)

Option 8	Wind Direction: 356 °					SO_2
Height: 0m Distance (km)	Wind Speed (m s^{-1}) 3	5	8	10	12	15
2.0			2.3			57.0
3.2	12.4		13.2			67.3
4.8						
7.5						
9.2						
10.0						
10.5	5.2		24.4			32.9
12.0	11.4		15.7			22.7
13.4						
14.0	5.1		20.6			22.9
15.0						
16.0						
16.8						
17.0						
17.6						
17.8	7.1		19.2			16.4
18.0						
19.1						
14.0 (40m)	2.9		22.3			23.4

Option 9	Wind Direction: 270 ° NO$_x$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	1.1		10.1			238.1
3.2	3.1		32.8			170.2
4.8						
7.5	3.0		31.1			112.7
9.2						
10.0						
10.5	1.7		62.0			90.7
12.0						
13.4						
14.0	3.5		64.1			68.2
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	2.2		36.7			122.8
7.5 (80m)	2.3		38.7			126.4

Option 9	Wind Direction: 270 ° NO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	0.2		2.6			88.7
3.2	0.7		11.9			84.9
4.8						
7.5	1.2		18.2			77.4
9.2						
10.0						
10.5	0.9		40.8			65.4
12.0						
13.4						
14.0	2.0		44.9			50.1
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	0.9		21.5			84.3
7.5 (80m)	1.0		22.7			86.8

(assumes ozone concentration = 35 ppb)

Option 9	Wind Direction: 270 ° SO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	1.8		16.1			378.8
3.2	4.9		52.2			270.8
4.8						
7.5	4.8		49.5			179.3
9.2						
10.0						
10.5	2.7		98.6			144.3
12.0						
13.4						
14.0	5.6		102.0			108.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	3.5		58.4			195.4
7.5 (80m)	3.7		61.6			201.1

Option 9	Wind Direction: 340 °		NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	7.0		97.5			281.3
3.2						
4.8						
7.5	41.7		117.7			136.1
9.2						
10.0						
10.5	17.4		86.3			89.2
12.0						
13.4						
14.0	10.6		69.9			74.8
16.0						
16.8						
17.0						
17.6	8.8		33.4			46.5
17.8						
18.0						
19.1	10		41.2			47.6
10.5 (40m)	16.2		98.6			101.0

Option 9	Wind Direction: 340 °		NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	1.0		24.7			104.8
3.2						
4.8						
7.5	17.3		69.1			93.4
9.2						
10.0						
10.5	8.8		56.8			64.3
12.0						
13.4						
14.0	6.2		49.0			54.9
16.0						
16.8						
17.0						
17.6	5.6		24.1			34.3
17.8						
18.0						
19.1	6.5		29.9			35.2
10.5 (40m)	8.2		64.9			72.8

(assumes ozone concentration = 35 ppb)

Option 9	Wind Direction: 340 °		SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	11.1		155.1			447.5
3.2						
4.8						
7.5	66.3		187.3			216.5
9.2						
10.0						
10.5	27.7		137.3			141.9
12.0						
13.4						
14.0	16.9		111.2			119.0
16.0						
16.8						
17.0						
17.6	14.0		53.1			74.0
17.8						
18.0						
19.1	15.9		65.5			75.7
10.5 (40m)	25.8		156.9			160.7

Option 10	Wind Direction: 270 °	NO_x			
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		49.7		184.6	324.2
1.2		61.8		175.0	247.8
2.0	21.9	86.6	176.4		236.5
2.4		23.6		86.6	138.2
3.0					
3.2	7.0	45.3	51.1	68.1	114.4
4.8					
7.5	3.7	21.9	23.4		
8.0					
10.0					
10.5	3.2	14.3	14.3		
14.0	2.1	13.9	13.1		
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		102.6		267.0	369.7
0.8 (120m)		202.7		317.4	337.8
7.5 (40m)	3.8	20.5	23.2		
7.5 (80m)	3.4	21.1	23.6		

Option 10	Wind Direction: 270 °	NO_2			
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		5.7		28.3	58.6
1.2		10.2		38.1	62.9
2.0	4.2	22.0	51.4		88.1
2.4		6.9		32.1	58.1
3.0					
3.2	2.0	16.4	20.8	30.5	57.0
4.8					
7.5	1.8	12.9	14.7		
8.0					
10.0					
10.5	1.9	9.4	9.8		
14.0	1.4	9.7	9.4		
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		11.7		40.9	66.8
0.8 (120m)		23.2		48.6	61.0
7.5 (40m)	1.9	12.0	14.5		
7.5 (80m)	1.7	12.4	14.8		

(assumes ozone concentration = 35 ppb)

Option 10	Wind Direction: 270 °	SO_2			
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		79.5		295.4	518.7
1.2		98.9		280.0	396.5
2.0	35.0	138.6	282.2		378.4
2.4		37.8		138.6	221.1
3.0					
3.2	11.2	72.5	81.8	109.0	183.0
4.8					
7.5	5.9	35.0	37.4		
8.0					
10.0					
10.5	5.1	22.9	22.9		
14.0	3.4	22.2	21.0		
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		164.2		427.2	591.5
0.8 (120m)		324.3		507.8	540.5
7.5 (40m)	6.1	32.8	37.1		
7.5 (80m)	5.4	33.8	37.8		

Option 10	Wind Direction: 290 ° NO$_x$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		79.4		227.5	323.6
1.2		27.5		95.6	132.7
2.0		58.4		105.9	118.8
2.4		32.3		81.2	94.3
3.0					
3.2		29.0		84.9	103.8
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		126.8		305.1	394.5
0.8 (120m)		239.4		394.7	378.1

Option 10	Wind Direction: 290 ° NO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		9.1		34.9	58.5
1.2		4.5		20.8	33.7
2.0		14.8		34.5	44.3
2.4		9.5		30.1	39.7
3.0					
3.2		10.5		38.0	51.7
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		14.5		46.7	71.3
0.8 (120m)		27.4		60.5	68.3

(assumes ozone concentration = 35 ppb)

Option 10	Wind Direction: 290 ° SO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		127.0		364.0	517.8
1.2		44.0		153.0	212.3
2.0		93.4		169.4	190.1
2.4		51.7		129.9	150.9
3.0					
3.2		46.4		135.8	166.1
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		202.9		488.2	631.2
0.8 (120m)		383.0		631.5	605.0

Option 10	Wind Direction: 310 °		NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	5	8	10	12	15
0.8		37.0		197.4	288.6
1.2		22.1		130.0	206.8
2.0		17.2		83.9	145.4
2.4		20.7		77.2	130.2
3.0					
3.2		22.4		76.2	107.2
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		67.2		250.9	339.0
0.8 (120m)		70.8		203.5	265.9

Option 10	Wind Direction: 310 °		NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	5	8	10	12	15
0.8		4.2		30.2	52.2
1.2		3.6		28.3	52.5
2.0		4.4		27.3	54.2
2.4		6.1		28.6	54.8
3.0					
3.2		8.1		34.1	53.4
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		7.7		38.4	61.3
0.8 (120m)		8.1		31.2	48.1

(assumes ozone concentration = 35 ppb)

Option 10	Wind Direction: 310 °		SO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	5	8	10	12	15
0.8		59.2		315.8	461.8
1.2		35.4		208.0	330.9
2.0		27.5		134.2	232.6
2.4		33.1		123.5	208.3
3.0					
3.2		35.8		121.9	171.5
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		107.5		401.4	542.4
0.8 (120m)		113.3		325.6	425.4

Option 10 Wind Direction: 330 ° NO_x

Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		20.2		90.0	
1.2		8.1		32.3	
2.0		13.7		42.1	
2.4		14.5		53.2	
3.0					
3.2		6.3		25.1	
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		19.0		67.8	
0.8 (120m)		9.4		37.9	

Option 10 Wind Direction: 330 ° NO_2

Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		2.3		13.8	
1.2		1.3		7.0	
2.0		3.5		13.7	
2.4		4.2		19.7	
3.0					
3.2		2.3		11.2	
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		2.2		10.4	
0.8 (120m)		1.1		5.8	

(assumes ozone concentration = 35 ppb)

Option 10 Wind Direction: 330 ° SO_2

Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		32.3		144.0	340.0
1.2		13.0		51.7	139.5
2.0		21.9		67.4	139.0
2.4		23.2		85.1	157.1
3.0					
3.2		10.1		40.2	95.5
4.8					
7.5					
8.0					
10.0					
10.5					
14.0					
16.0					
16.8					
17.0					
17.6					
18.0					
19.1					
0.8 (60m)		30.4		108.5	
0.8 (120m)		15.0		60.6	

Option 10	Wind Direction: 340 ° NO_x				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		0.7		65.1	158.1
1.2		5.8		54.3	131.3
2.0		5.6		46.1	101.6
2.4		5.3		34.4	75.3
3.0					
3.2		3.7		34.1	70.1
4.8					
7.5	0.7	3.9	5.6		
8.0					
10.0					
10.5	1.4	1.3	2.6		
14.0	1.9	0.3	0.7		
16.0					
16.8					
17.0					
17.6	0.8	12.3	3.4		
18.0					
19.1	3.4	1.5	1.8		
2.4 (60m)		5.0		45.2	89.1
2.4 (120m)		7.6		65.5	108.6

Option 10	Wind Direction: 340 ° NO_2				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		0.1		10.0	28.6
1.2		1.0		11.8	33.3
2.0		1.4		15.0	37.8
2.4		1.6		12.8	31.7
3.0					
3.2		1.3		15.3	34.9
4.8					
7.5	0.3	2.3	3.5		
8.0					
10.0					
10.5	0.8	0.9	1.8		
14.0	1.2	0.2	0.5		
16.0					
16.8					
17.0					
17.6	0.5	8.9	2.5		
18.0					
19.1	2.4	1.1	1.3		
2.4 (60m)		1.5		16.8	37.5
2.4 (120m)		2.2		24.3	45.7

(assumes ozone concentration = 35 ppb)

Option 10	Wind Direction: 340 ° SO_2				
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
0.8		1.1		104.2	253.0
1.2		9.3		86.9	210.1
2.0		9.0		73.8	162.6
2.4		8.5		55.0	120.5
3.0					
3.2		5.9		54.6	112.2
4.8					
7.5	1.1	6.2	9.0		
8.0					
10.0					
10.5	2.2	2.1	4.2		
14.0	3.0	0.5	1.1		
16.0					
16.8					
17.0					
17.6	1.3	19.7	5.4		
18.0					
19.1	5.4	2.4	2.9		
2.4 (60m)		8.0		72.3	142.6
2.4 (120m)		12.2		104.8	173.8

Option 11	Wind Direction: 270°	NO_x			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	5	8	10	12	15
2.0	26.1	62.0	103.7		
3.0					
3.2	11.4	34.1	51.0		
4.8					
7.5	6.8	19.1	24.2		
8.0					
10.5	4.7	10.2	15.5		
14.0	3.6	10.6	15.0		
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
7.5 (40m)	4.4	17.5	24.1		
7.5 (80m)	4.4	18.0	24.3		

Option 11	Wind Direction: 270°	NO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	5	8	10	12	15
2.0	5.0	15.7	30.2		
3.0					
3.2	3.2	12.3	20.8		
4.8					
7.5	3.4	11.2	15.2		
8.0					
10.5	2.8	6.7	10.6		
14.0	2.3	7.4	10.8		
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
7.5 (40m)	2.2	10.3	15.1		
7.5 (80m)	2.2	10.6	15.2		

(assumes ozone concentration = 35 ppb)

Option 11	Wind Direction: 270°	SO_2			
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	5	8	10	12	15
2.0	41.8	99.2	165.9		
3.0					
3.2	18.2	54.6	81.6		
4.8					
7.5	10.9	30.6	38.7		
8.0					
10.5	7.5	16.3	24.8		
14.0	5.8	17.0	24.0		
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
7.5 (40m)	7.0	28.0	38.6		
7.5 (80m)	7.0	28.8	38.9		

Option 11	Wind Direction:	340°	NO_x		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
2.0					
3.0					
3.2	0.5	6.1	15.3		112.2
4.8					
7.5	0.8	5.2	7.9		
8.0					
10.5	1.4	1.3	2.6		
14.0	0.4	1.1	1.2		
16.0					
16.8					
17.0					
17.6	1.7	4.3	5.8		
18.0					
19.1	3.0	2.6	3.4		

Option 11	Wind Direction:	340°	NO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
2.0					
3.0					
3.2	0.1	2.2	6.2		55.9
4.8					
7.5	0.4	3.1	4.9		
8.0					
10.5	0.8	0.9	1.8		
14.0	0.3	0.8	0.9		
16.0					
16.8					
17.0					
17.6	1.2	3.1	4.2		
18.0					
19.1	2.1	1.9	2.5		

Option 11	Wind Direction:	340°	SO_2		
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	5	8	10	12	15
2.0					
3.0					
3.2	0.8	9.8	24.5		179.5
4.8					
7.5	1.3	8.3	12.6		
8.0					
10.5	2.2	2.1	4.2		
14.0	0.6	1.8	1.9		
16.0					
16.8					
17.0					
17.6	2.7	6.9	9.3		
18.0					
19.1	4.8	4.2	5.4		

Option 12	Wind Direction: 270 °	NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	21.3		143.5			221.5
3.2	15.9		86.9			189.7
4.8						
7.5	11.2		55.4			78.9
9.2						
10.0						
10.5	3.1		53.4			55.6
12.0						
13.4						
14.0	3.5		40.8			38.7
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	4.8		58.1			84.7
7.5 (80m)	4.9		55.6			81.4

Option 12	Wind Direction: 270 °	NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	3.1		36.4			82.5
3.2	3.5		31.4			94.6
4.8						
7.5	4.7		32.5			54.1
9.2						
10.0						
10.5	1.6		35.2			40.1
12.0						
13.4						
14.0	2.1		28.6			28.4
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	2.0		34.1			58.2
7.5 (80m)	2.0		32.6			55.9

(assumes ozone concentration = 35 ppb)

Option 12	Wind Direction: 340 ° NO$_x$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	4.4		92.9			130.4
4.8						
7.5	6.5		77.8			70.6
9.2						
10.0						
10.5	5.4		39.3			40.8
12.0						
13.4						
14.0	1.4		33.1			34.9
16.0						
16.8						
17.0						
17.6	1.4		18.4			26.6
17.8						
18.0						
19.1	2.0		22.4			23.7
10.5 (40m)	7.2		63.4			95.9

Option 12	Wind Direction: 340 ° NO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	1.0		33.6			65.0
4.8						
7.5	2.7		45.6			48.5
9.2						
10.0						
10.5	2.7		25.9			29.4
12.0						
13.4						
14.0	0.8		23.2			25.6
16.0						
16.8						
17.0						
17.6	0.9		13.3			19.7
17.8						
18.0						
19.1	1.3		16.3			17.5
10.5 (40m)	3.7		41.7			69.1

(assumes ozone concentration = 35 ppb)

Option 13	Wind Direction: 270 ° NO$_x$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	28.0		83.8			456.6
3.2	74.9		73.7			310.6
4.8						
7.5	21.6		76.5			143.6
9.2						
10.0						
10.5	29.1		102.7			132.6
12.0						
13.4						
14.0	48.7		88.7			100.6
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	24.2		100.1			214.2
7.5 (80m)	23.1		103.8			211.7

Option 13	Wind Direction: 270 ° NO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	4.1		21.3			170.1
3.2	16.4		26.7			154.9
4.8						
7.5	9.0		44.9			98.6
9.2						
10.0						
10.5	14.7		67.6			95.6
12.0						
13.4						
14.0	28.3		62.2			73.9
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	10.1		58.7			147.0
7.5 (80m)	9.6		60.9			145.3

(assumes ozone concentration = 35 ppb)

Option 13	Wind Direction: 270 ° SO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	8.9		26.6			145.2
3.2	23.8		23.4			98.8
4.8						
7.5	6.9		24.3			45.7
9.2						
10.0						
10.5	9.3		32.7			42.2
12.0						
13.4						
14.0	15.5		28.2			32.0
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	7.7		31.8			68.1
7.5 (80m)	7.3		33.0			67.3

Option 13	Wind Direction: 340 °		NO$_x$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	53.6		461.3			467.4
4.8						
7.5	58.4		337.6			222.6
9.2						
10.0						
10.5	33.5		214.6			150.0
12.0						
13.4						
14.0	17.7		123.5			101.8
16.0						
16.8						
17.0						
17.6	31.7		94.8			74.4
17.8						
18.0						
19.1	31.5		94.3			68.5
10.5 (40m)	22.9		230.4			154.9

Option 13	Wind Direction: 340 °		NO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	11.8		167.0			233.0
4.8						
7.5	24.3		198.1			152.8
9.2						
10.0						
10.5	17.0		141.3			108.2
12.0						
13.4						
14.0	10.3		86.6			74.8
16.0						
16.8						
17.0						
17.6	20.1		68.4			54.9
17.8						
18.0						
19.1	20.5		68.5			50.6
10.5 (40m)	11.6		151.7			111.7

(assumes ozone concentration = 35 ppb)

Option 13	Wind Direction: 340 °		SO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	17.0		146.7			148.6
4.8						
7.5	18.6		107.4			70.8
9.2						
10.0						
10.5	10.7		68.2			47.7
12.0						
13.4						
14.0	5.6		39.3			32.4
16.0						
16.8						
17.0						
17.6	10.1		30.1			23.7
17.8						
18.0						
19.1	10.0		30.0			21.8
10.5 (40m)	7.3		73.3			49.3

Option 14	Wind Direction: 340 ° NO$_x$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	15.3		152.3			212.5
4.8						
7.5	15.4		145.6			110.9
9.2						
10.0						
10.5	9.7		92.1			70.7
12.0						
13.4						
14.0	9.1		75.8			62.9
16.0						
16.8						
17.0						
17.6	2.1		38.5			31.8
17.8						
18.0						
19.1	5.1		43.5			34.7
10.5 (40m)	7.0		107.0			82.8

Option 14	Wind Direction: 340 ° NO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	3.4		55.1			105.9
4.8						
7.5	6.4		85.4			76.1
9.2						
10.0						
10.5	4.9		60.6			51.0
12.0						
13.4						
14.0	5.3		53.1			46.2
16.0						
16.8						
17.0						
17.6	1.3		27.8			23.5
17.8						
18.0						
19.1	3.3		31.6			25.6
10.5 (40m)	3.5		70.5			59.7

(assumes ozone concentration = 35 ppb)

Option 14	Wind Direction: 340 ° SO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	20.4		203.0			283.3
4.8						
7.5	20.5		194.1			147.8
9.2						
10.0						
10.5	12.9		122.8			94.2
12.0						
13.4						
14.0	12.1		101.0			83.8
16.0						
16.8						
17.0						
17.6	2.8		51.3			42.4
17.8						
18.0						
19.1	6.8		58.0			46.3
10.5 (40m)	9.3		142.6			110.4

Option 14	Wind Direction: 270 °				NO$_x$	
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	8.6		33.0			199.2
3.2	29.9		30.4			147.1
4.8						
7.5	10.9		55.6			104.0
9.2						
10.0						
10.5	12.9		65.8			72.4
12.0						
13.4						
14.0	14.8		55.3			52.4
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	13.7		55.4			99.9
7.5 (80m)	13.7		55.2			99.6

Option 14	Wind Direction: 270 °				NO$_2$	
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	1.3		8.4			74.2
3.2	6.6		11.0			73.3
4.8						
7.5	4.5		32.6			71.4
9.2						
10.0						
10.5	6.5		43.3			52.2
12.0						
13.4						
14.0	8.6		38.8			38.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	5.7		32.5			68.6
7.5 (80m)	5.7		32.4			68.4

(assumes ozone concentration = 35 ppb)

Option 14	Wind Direction: 270 °				SO$_x$	
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	11.5		44.0			265.5
3.2	39.9		40.5			196.1
4.8						
7.5	14.5		74.1			138.6
9.2						
10.0						
10.5	17.2		87.7			96.5
12.0						
13.4						
14.0	19.7		73.7			69.8
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	18.3		73.8			133.2
7.5 (80m)	18.3		73.6			132.8

Option 14 Wind Direction: 340 ° NO_x

Height: 0m Distance (km)	Wind Speed ($m\ s^{-1}$) 3	5	8	10	12	15
2.0						
3.2	15.3		152.3			212.5
4.8						
7.5	15.4		145.6			110.9
9.2						
10.0						
10.5	9.7		92.1			70.7
12.0						
13.4						
14.0	9.1		75.8			62.9
16.0						
16.8						
17.0						
17.6	2.1		38.5			31.8
17.8						
18.0						
19.1	5.1		43.5			34.7
10.5 (40m)	7.0		107.0			82.8

Option 14 Wind Direction: 340 ° NO_2

Height: 0m Distance (km)	Wind Speed ($m\ s^{-1}$) 3	5	8	10	12	15
2.0						
3.2	3.4		55.1			105.9
4.8						
7.5	6.4		85.4			76.1
9.2						
10.0						
10.5	4.9		60.6			51.0
12.0						
13.4						
14.0	5.3		53.1			46.2
16.0						
16.8						
17.0						
17.6	1.3		27.8			23.5
17.8						
18.0						
19.1	3.3		31.6			25.6
10.5 (40m)	3.5		70.5			59.7

(assumes ozone concentration = 35 ppb)

Option 14 Wind Direction: 340 ° SO_x

Height: 0m Distance (km)	Wind Speed ($m\ s^{-1}$) 3	5	8	10	12	15
2.0						
3.2	20.4		203.0			283.3
4.8						
7.5	20.5		194.1			147.8
9.2						
10.0						
10.5	12.9		122.8			94.2
12.0						
13.4						
14.0	12.1		101.0			83.8
16.0						
16.8						
17.0						
17.6	2.8		51.3			42.4
17.8						
18.0						
19.1	6.8		58.0			46.3
10.5 (40m)	9.3		142.6			110.4

Option 14	Wind Direction: 270 ° NO$_x$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	8.6		33.0			199.2
3.2	29.9		30.4			147.1
4.8						
7.5	10.9		55.6			104.0
9.2						
10.0						
10.5	12.9		65.8			72.4
12.0						
13.4						
14.0	14.8		55.3			52.4
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	13.7		55.4			99.9
7.5 (80m)	13.7		55.2			99.6

Option 14	Wind Direction: 270 ° NO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	1.3		8.4			74.2
3.2	6.6		11.0			73.3
4.8						
7.5	4.5		32.6			71.4
9.2						
10.0						
10.5	6.5		43.3			52.2
12.0						
13.4						
14.0	8.6		38.8			38.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	5.7		32.5			68.6
7.5 (80m)	5.7		32.4			68.4

(assumes ozone concentration = 35 ppb)

Option 14	Wind Direction: 270 ° SO$_2$					
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	11.5		44.0			265.5
3.2	39.9		40.5			196.1
4.8						
7.5	14.5		74.1			138.6
9.2						
10.0						
10.5	17.2		87.7			96.5
12.0						
13.4						
14.0	19.7		73.7			69.8
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	18.3		73.8			133.2
7.5 (80m)	18.3		73.6			132.8

Option 15	Wind Direction: 270 °		NO_x			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	6.8		26.2			130.0
3.2	24.2		24.6			89.9
4.8						
7.5	20.1		29.0			32.9
9.2						
10.0						
10.5	8.5		43.3			35.4
12.0						
13.4						
14.0	10.7		39.8			28.4
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	11.3		42.9			61.1
7.5 (80m)	11.9		44.2			61.0

Option 15	Wind Direction: 270 °		NO_2			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	1.0		6.6			48.4
3.2	5.3		8.9			44.8
4.8						
7.5	8.4		17.0			22.6
9.2						
10.0						
10.5	4.3		28.5			25.5
12.0						
13.4						
14.0	6.2		27.9			20.9
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	4.7		25.2			41.9
7.5 (80m)	4.9		25.9			41.9

(assumes ozone concentration = 35 ppb)

Option 15	Wind Direction: 270 °		SO_x			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0	9.1		34.9			173.3
3.2	32.3		32.8			119.8
4.8						
7.5	26.8		38.7			43.9
9.2						
10.0						
10.5	11.3		57.7			47.2
12.0						
13.4						
14.0	14.3		53.1			37.9
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	15.1		57.2			81.4
7.5 (80m)	15.9		58.9			81.3

Option 15	Wind Direction: 340 °		NO_x			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	3.9		97.8			139.0
4.8						
7.5	9.4		88.4			68.7
9.2						
10.0						
10.5	5.8		54.7			41.3
12.0						
13.4						
14.0	3.2		42.5			39.8
16.0						
16.8						
17.0						
17.6	1.5		23.3			21.1
17.8						
18.0						
19.1	3		25.6			22.3
10.5 (40m)	5.0		65.7			49.0

Option 15	Wind Direction: 340 °		NO_2			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	0.9		35.4			69.3
4.8						
7.5	3.9		51.9			47.2
9.2						
10.0						
10.5	2.9		36.0			29.8
12.0						
13.4						
14.0	1.9		29.8			29.2
16.0						
16.8						
17.0						
17.6	0.9		16.8			15.6
17.8						
18.0						
19.1	1.9		18.6			16.5
10.5 (40m)	2.5		43.3			35.3

(assumes ozone concentration = 35 ppb)

Option 15	Wind Direction: 340 °		SO_x			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	5.2		130.4			185.3
4.8						
7.5	12.5		117.8			91.6
9.2						
10.0						
10.5	7.7		72.9			55.1
12.0						
13.4						
14.0	4.3		56.7			53.1
16.0						
16.8						
17.0						
17.6	2.0		31.1			28.1
17.8						
18.0						
19.1	4.0		34.1			29.7
10.5 (40m)	6.7		87.6			65.3

Option 16	Wind Direction: 270 ° NO_x					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	11.8		17.9			265.4
3.2	9.1		19.4			206.3
4.8						
7.5	85.9		49.0			112.5
9.2						
10.0						
10.5	32.0		74.6			114.5
12.0						
13.4						
14.0	35.1		70.6			90.6
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	27.2		60.9			173.3
7.5 (80m)	26.6		70.5			173.1

Option 16	Wind Direction: 270 ° NO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	1.7		4.5			98.9
3.2	2.0		7.0			102.9
4.8						
7.5	35.7		28.8			77.2
9.2						
10.0						
10.5	16.2		49.1			82.6
12.0						
13.4						
14.0	20.4		49.5			66.5
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	11.3		35.7			119.0
7.5 (80m)	11.1		41.4			118.8

(assumes ozone concentration = 35 ppb)

Option 16	Wind Direction: 270 ° SO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)					
Distance (km)	3	5	8	10	12	15
2.0	3.8		5.7			84.4
3.2	2.9		6.2			65.6
4.8						
7.5	27.3		15.6			35.8
9.2						
10.0						
10.5	10.2		23.7			36.4
12.0						
13.4						
14.0	11.2		22.5			28.8
16.0						
16.8						
17.0						
17.6						
17.8						
18.0						
19.1						
7.5 (40m)	8.6		19.4			55.1
7.5 (80m)	8.5		22.4			55.0

Option 16	Wind Direction: 340 °		NO$_x$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	1.9		88.2			391.7
4.8						
7.5	6.7		134.9			230.7
9.2						
10.0						
10.5	5.9		96.3			157.1
12.0						
13.4						
14.0	4.1		64.0			113.4
16.0						
16.8						
17.0						
17.6	8.2		53.1			71.4
17.8						
18.0						
19.1	9.7		54.1			72.2
10.5 (40m)	5.1		106.8			165.7

Option 16	Wind Direction: 340 °		NO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	0.4		31.9			195.3
4.8						
7.5	2.8		79.2			158.4
9.2						
10.0						
10.5	3.0		63.4			113.3
12.0						
13.4						
14.0	2.4		44.9			83.3
16.0						
16.8						
17.0						
17.6	5.2		38.3			52.7
17.8						
18.0						
19.1	6.3		39.3			53.4
10.5 (40m)	2.6		70.3			119.5

(assumes ozone concentration = 35 ppb)

Option 16	Wind Direction: 340 °		SO$_2$			
Height: 0m	Wind Speed (m s^{-1})					
Distance (km)	3	5	8	10	12	15
2.0						
3.2	0.6		28.0			124.6
4.8						
7.5	2.1		42.9			73.4
9.2						
10.0						
10.5	1.9		30.6			50.0
12.0						
13.4						
14.0	1.3		20.4			36.1
16.0						
16.8						
17.0						
17.6	2.6		16.9			22.7
17.8						
18.0						
19.1	3.1		17.2			23.0
10.5 (40m)	1.6		34.0			52.7

Options 5+8 Wind Direction: 015 ° NO_x					
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	103.3		187.7		452.1
3.2	70.8		237.2		352.1
4.8					
7.5	33.8		237.1		184.5
9.2					
10.0					
10.5	42.4		183.5		130.0
12.0					
13.4					
14.0	37.2		132.1		80.1
15.0					
16.0					
16.8	25.2		77.7		44.7
17.0					
17.6					
17.8					
18.0					
19.1					

Options 5+8 Wind Direction: 015 ° NO_2					
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	15.1		47.6		168.4
3.2	15.5		85.9		175.5
4.8					
7.5	14.0		139.1		126.7
9.2					
10.0					
10.5	21.5		120.8		93.8
12.0					
13.4					
14.0	21.6		92.6		58.9
15.0					
16.0					
16.8	15.7		55.8		33.0
17.0					
17.6					
17.8					
18.0					
19.1					

(assumes ozone concentration = 35 ppb)

Options 5+8 Wind Direction: 015 ° SO_2					
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	31.7		40.5		111.2
3.2	21.7		58.8		90.0
4.8					
7.5	9.1		62.6		47.6
9.2					
10.0					
10.5	11.8		48.8		33.4
12.0					
13.4					
14.0	9.8		35.2		19.6
15.0					
16.0					
16.8	6.3		21.5		11.3
17.0					
17.6					
17.8					
18.0					
19.1					

Options 5+8 Wind Direction: 270 ° NO_x					
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	37.4		114.7		369.3
3.2	42.7		127.0		253.1
4.8					
7.5	72.4		84.9		115.4
9.2					
10.0					
10.5	29.7		109.4		98.1
12.0					
13.4					
14.0	33.0		95.0		75.2
15.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	29.1		114.2		169.7
7.5 (80m)	28.6		115.6		170.0

Options 5+8 Wind Direction: 270 ° NO_2					
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	5.5		29.1		137.6
3.2	9.4		46.0		126.2
4.8					
7.5	30.1		49.8		79.2
9.2					
10.0					
10.5	15.0		72.0		70.8
12.0					
13.4					
14.0	19.2		66.6		55.2
15.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	12.1		67.0		116.5
7.5 (80m)	11.9		67.8		116.7

(assumes ozone concentration = 35 ppb)

Options 5+8 Wind Direction: 270 ° SO_2					
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	4.0		11.2		87.4
3.2	7.8		13.6		54.4
4.8					
7.5	15.9		16.5		25.2
9.2					
10.0					
10.5	7.7		25.0		23.4
12.0					
13.4					
14.0	9.3		22.3		18.1
15.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
7.5 (40m)	7.3		23.9		40.4
7.5 (80m)	7.2		24.2		40.3

Options 5+8 Wind Direction: 310 ° NO$_x$					
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	35.1		90.0		277.9
3.2	64.2		120.7		281.9
4.8					
7.5	15.5		100.3		91.6
9.2					
10.0					
10.5					
12.0					
13.4					
14.0					
15.0					
16.0	5.2		109.6		63.4
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	13.7		160.8		326.4

Options 5+8 Wind Direction: 310 ° NO$_2$					
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	5.1		22.8		103.5
3.2	14.1		43.7		140.5
4.8					
7.5	6.5		58.9		62.9
9.2					
10.0					
10.5					
12.0					
13.4					
14.0					
15.0					
16.0	3.2		78.3		46.7
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	3.0		58.2		162.7

Options 5+8 Wind Direction: 310 ° SO$_2$					
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0	9.3		13.3		72.4
3.2	19.4		35.2		84.0
4.8					
7.5	3.6		27.5		25.0
9.2					
10.0					
10.5					
12.0					
13.4					
14.0					
15.0					
16.0	1.4		32.6		18.2
16.8					
17.0					
17.6					
17.8					
18.0					
19.1					
3.2 (60m)	2.3		45.5		97.0

Options 5+8 Wind Direction: 330 °					NO_x
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	16.1		131.5		430.5
3.2					
4.8	88.6		135.0		209.9
7.5					
9.2					
10.0					
10.5	86.1		157.2		113.4
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	13.6		76.4		74.8
19.1					
4.8 (60m)	37.4		164.0		229.7

Options 5+8 Wind Direction: 330 °					NO_2
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	2.3		33.4		160.4
3.2					
4.8	26.9		63.4		126.4
7.5					
9.2					
10.0					
10.5	43.6		103.5		81.8
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	8.7		55.2		55.2
19.1					
4.8 (60m)	11.3		77.1		138.3

(assumes ozone concentration = 35 ppb)

Options 5+8 Wind Direction: 330 °					SO_2
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0	3.1		25.1		111.2
3.2					
4.8	26.1		29.0		55.8
7.5					
9.2					
10.0					
10.5	25.9		40.5		30.1
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.6					
17.8					
18.0	3.8		19.5		20.6
19.1					
4.8 (60m)	9.2		38.1		62.1

Options 5+8 Wind Direction: 340 ° NO_x					
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0					
3.2					
4.8					
7.5	22.7		193.6		164.8
9.2					
10.0					
10.5	25.7		116.7		101.3
12.0					
13.4					
14.0	10.4		94.6		91.5
15.0					
16.0					
16.8					
17.0					
17.6	10.4		49.8		42.9
17.8					
18.0					
19.1	9.5		56.6		48.0

Options 5+8 Wind Direction: 340 ° NO_2					
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0					
3.2					
4.8					
7.5	9.4		113.6		113.1
9.2					
10.0					
10.5	13.0		76.9		73.0
12.0					
13.4					
14.0	6.1		66.3		67.2
15.0					
16.0					
16.8					
17.0					
17.6	6.6		35.9		31.7
17.8					
18.0					
19.1	6.2		41.1		35.5

(assumes ozone concentration = 35 ppb)

Options 5+8 Wind Direction: 340 ° SO_2					
Height: 0m	Wind Speed (m s^{-1})				
Distance (km)	3	5	8	12	15
2.0					
3.2					
4.8					
7.5	4.8		50.2		41.5
9.2					
10.0					
10.5	6.4		31.6		26.7
12.0					
13.4					
14.0	2.6		25.0		23.4
15.0					
16.0					
16.8					
17.0					
17.6	3.2		14.6		11.8
17.8					
18.0					
19.1	2.6		15.3		12.5

Options 5+8 Wind Direction: 356 °					NO_x
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0			93.5		248.8
3.2	46.7		104.4		255.5
4.8					
7.5					
9.2					
10.0					
10.5	19.2		85.7		110.1
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.6					
17.8	23.7		74.0		59.0
18.0					
19.1					

Options 5+8 Wind Direction: 356 °					NO_2
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0			23.7		92.7
3.2	10.3		37.8		127.4
4.8					
7.5					
9.2					
10.0					
10.5	9.7		56.4		79.4
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.6					
17.8	15.0		53.4		43.6
18.0					
19.1					

(assumes ozone concentration = 35 ppb)

Options 5+8 Wind Direction: 356 °					SO_2
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance (km)	3	5	8	12	15
2.0			2.3		57.0
3.2	12.4		13.2		67.3
4.8					
7.5					
9.2					
10.0					
10.5	5.2		24.4		32.9
12.0					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.6					
17.8	7.1		19.2		16.4
18.0					
19.1					

Castle Peak A	Wind Direction:	015°	NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	0.0	0.0	143.9	184.6	214.7
9.2					
10.0					
10.5	3.2	11.2	252.0	177.3	218.9
13.4					
14.0	31.0	55.7	162.0	157.2	145.9
15.0					
16.0					
16.8	0.0	18.9	125.8	100.0	110.4
17.0					
17.8					
18.0					
19.1	25.8	51.2	117.3	98.8	81.2
16.8 (60m)	0.0	11.7	101.9	98.3	98.8

Castle Peak A	Wind Direction:	015°	NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5			67.7	102.8	129.3
9.2					
10.0					
10.5	1.3	5.7	148.5	116.7	150.6
13.4					
14.0	16.8	34.3	110.1	112.7	106.3
15.0					
16.0					
16.8		12.2	87.9	72.6	81.0
17.0					
17.8					
18.0					
19.1	15.8	34.4	83.8	72.4	59.9
16.8 (60m)		7.5	71.2	71.4	72.5

Castle Peak A	Wind Direction:	015°	SO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	0.0	0.0	149.1	191.3	222.5
9.2					
10.0					
10.5	3.3	11.7	261.1	183.8	226.9
13.4					
14.0	32.1	57.7	167.9	162.9	151.2
15.0					
16.0					
16.8		19.6	130.3	103.6	114.4
17.0					
17.8					
18.0					
19.1	26.7	53.0	121.5	102.3	84.2
16.8 (60m)		12.1	105.6	101.9	102.3

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak A Wind Direction: 160 ° NO_x					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0	0.0		5.2		32.9
−2.5	0.0		6.4		288.0
−2.0	0.0		21.4		554.3
−1.5	0.0		36.1		484.4
−1.0	0.1		59.8		551.2
−0.5	7.4		71.3		561.7
0.0	7.3		102.2		577.6
0.8	0.0		80.4		397.2
1.2	0.0		100.1		387.2
2.0	0.0		115.1		401.6
2.4	0.0		123.2		378.8
3.2	0.0		95.9		319.9
4.8					
7.5	44.7		111.2		167.3
9.2	26.1		77.4		122.3
10.0	6.0		73.8		106.6
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	0.0		118.6		492.5
0.8 (120m)	0.0		117.1		430.8
9.2 (60m)	4.1		90.7		104.4

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak A Wind Direction: 160 ° NO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0			0.7		7.2
−2.5			1.3		87.1
−2.0			5.4		206.5
−1.5			10.9		209.0
−1.0	0.0		20.7		265.2
−0.5	1.8		27.5		293.5
0.0	1.9		43.0		322.0
0.8			37.8		239.2
1.2			49.2		240.1
2.0			61.0		260.8
2.4			67.4		250.5
3.2			55.3		217.6
4.8					
7.5	23.7		75.0		121.6
9.2	14.8		53.7		89.6
10.0	3.5		51.7		78.3
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)			55.8		296.5
0.8 (120m)			55.0		259.4
9.2 (60m)	2.3		62.9		76.5

Castle Peak A Wind Direction: 160 ° SO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0			5.4		34.1
−2.5			6.7		298.5
−2.0			22.2		574.4
−1.5			37.4		502.1
−1.0			62.0		571.3
−0.5	7.7		73.9		582.1
0.0	7.5		105.9		598.6
0.8			83.3		411.7
1.2			103.8		401.3
2.0			119.3		416.2
2.4			127.6		392.6
3.2			99.4		331.5
4.8					
7.5	46.3		115.3		173.4
9.2	27.0		80.2		126.8
10.0	6.3		76.5		110.4
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)			123.0		510.4
0.8 (120m)			121.4		446.5
9.2 (60m)	4.3		94.0		108.2

Castle Peak A Wind Direction: 310° NO_x					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					171.3
7.5	6.9		46.8		248.3
9.2					
10.0					
10.5	0.0		59.7		173.4
13.4					
14.0	0.0		4.8		62.4
15.0	0.0		9.3		67.8
16.0			28.7		49.9
16.8					
17.0	7.1		17.3		60.1
17.8					
18.0					
19.1					

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak A Wind Direction: 310° NO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					72.2
7.5	2.0		21.2		145.7
9.2					
10.0					
10.5			34.6		118.4
13.4					
14.0			3.2		45.1
15.0			6.3		49.3
16.0			19.7		36.5
16.8					
17.0	4.1		12.1		44.1
17.8					
18.0					
19.1					

Castle Peak A Wind Direction: 310° SO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					177.5
7.5	7.1		48.5		257.3
9.2					
10.0					
10.5			61.8		179.7
13.4					
14.0			5.0		64.7
15.0			9.7		70.2
16.0			29.7		51.7
16.8					
17.0	7.4		17.9		62.3
17.8					
18.0					
19.1					

Castle Peak A	Wind Direction: 330 °		NO_x		
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8	0.0	0.0	0.0	90.3	192.3
7.5	0.0	0.0	90.7	393.4	399.8
9.2					
10.0					
10.5	0.0	0.0	83.9	245.9	224.3
13.4					
14.0	0.0	0.0	52.8	125.8	116.0
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	28.7	27.8	55.7	103.1	93.5
19.1					
4.8 (60m)	0.0	0.0	0.0	468.4	635.2
18.0 (60m)	23.3	28.3	56.4	95.5	95.2

Castle Peak A	Wind Direction: 330 °		NO_2		
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8				18.4	45.8
7.5			35.8	189.5	212.8
9.2					
10.0					
10.5			46.6	155.1	149.5
13.4					
14.0			34.4	88.1	83.3
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	16.7	18.1	39.1	75.0	68.7
19.1					
4.8 (60m)				95.4	151.3
18.0 (60m)	13.6	18.4	39.5	69.5	69.9

Castle Peak A	Wind Direction: 330 °		SO_2		
Height: 0m	Wind Speed ($m s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8				93.5	199.3
7.5			94.0	407.7	414.4
9.2					
10.0					
10.5			87.0	254.9	232.4
13.4					
14.0			54.7	130.3	120.3
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	29.7	28.9	57.7	106.9	96.9
19.1					
4.8 (60m)				485.4	658.3
18.0 (60m)	24.2	29.3	58.4	98.9	98.6

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak A	Wind Direction: 340 °		NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [(1)]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	1.2	28.8	245.2	370.1	410.8
9.2					
10.0					
10.5	10.4	29.2	168.0	235.0	221.0
13.4					
14.0	25.4	19.6	106.8	133.6	123.2
15.0					
16.0					
16.8					
17.0					
17.8	3.8	46.1	100.1	94.9	80.6
18.0					
19.1	13.9	31.4	83.4	431.2	197.2

[(1)] Distances are specified as downwind of Black Point in kilometers

Castle Peak A	Wind Direction: 340 °		NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [(1)]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	0.3	8.7	94.5	174.6	214.7
9.2					
10.0					
10.5	3.9	13.5	92.6	147.5	146.7
13.4					
14.0	12.5	11.3	69.4	93.4	88.4
15.0					
16.0					
16.8					
17.0					
17.8	2.2	29.8	70.0	69.0	59.2
18.0					
19.1	8.3	20.8	59.1	315.1	145.2

Castle Peak A	Wind Direction: 340 °		SO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [(1)]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	1.3	29.9	254.2	383.5	425.7
9.2					
10.0					
10.5	10.8	30.3	174.1	243.5	229.0
13.4					
14.0	26.3	20.3	110.7	138.5	127.6
15.0					
16.0					
16.8					
17.0					
17.8	4.0	47.8	103.8	98.4	83.6
18.0					
19.1	14.4	32.6	86.4	446.9	204.4

Castle Peak A	Wind Direction: 356 °		NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	0.0	0.0	94.4	368.0	417.9
9.2					
10.0					
10.5	0.3	2.5	113.3	189.4	202.3
13.4	4.3	33.1	297.9	144.7	116.9
14.0	2.5	18.9	103.1	155.9	147.2
15.0					
16.0					
16.8					
17.0	27.7	36.2	88.7	144.7	124.1
17.8	36.2	47.2	54.5	99.6	80.2
18.0					
19.1	28.4	37.0	18.9	47.2	37.4

Castle Peak A	Wind Direction: 356 °		NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5			38.5	182.4	228.0
9.2					
10.0					
10.5	0.1	1.2	63.5	120.4	135.6
13.4	2.1	18.7	191.2	100.5	83.5
14.0	1.2	11.0	67.4	109.4	105.9
15.0					
16.0					
16.8					
17.0	15.7	23.1	61.6	104.8	90.9
17.8	21.1	30.6	38.2	72.4	58.9
18.0					
19.1	17.1	24.6	13.4	34.5	27.6

Castle Peak A	Wind Direction: 356 °		SO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5			97.8	381.4	433.1
9.2					
10.0					
10.5	0.3	2.6	117.4	196.3	209.7
13.4	4.4	34.3	308.7	150.0	121.1
14.0	2.6	19.6	106.9	161.6	152.5
15.0					
16.0					
16.8					
17.0	28.7	37.5	92.0	150.0	128.6
17.8	37.5	48.9	56.4	103.2	83.2
18.0					
19.1	29.4	38.4	19.6	48.9	38.8

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak B	Wind Direction:	015°	NO_x		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	14.9	114.6	273.5	497.1	544.7
9.2					
10.0					
10.5	21.0	75.8	314.7	400.2	362.5
13.4					
14.0	25.4	27.0	92.3	116.2	116.5
15.0					
16.0					
16.8	0.0	60.5	199.3	206.6	175.0
17.0					
17.8					
18.0					
19.1	34.5	53.6	122.1	107.3	76.7
16.8 (60m)	67.4	80.7	180.4	179.6	131.8

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak B	Wind Direction:	015°	NO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	4.5	43.6	128.7	276.7	328.2
9.2					
10.0					
10.5	8.8	38.1	185.4	263.3	249.3
13.4					
14.0	13.8	16.7	62.8	83.3	84.9
15.0					
16.0					
16.8		39.0	139.2	150.0	128.4
17.0					
17.8					
18.0					
19.1	21.1	36.0	87.2	78.6	56.6
16.8 (60m)	38.8	52.1	126.0	130.4	96.7

Castle Peak B	Wind Direction:	015°	SO_2		
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	16.3	125.3	299.1	543.5	595.5
9.2					
10.0					
10.5	23.0	82.9	344.0	437.6	396.3
13.4					
14.0	27.8	29.5	101.0	127.0	127.4
15.0					
16.0					
16.8		66.1	217.9	225.9	191.3
17.0					
17.8					
18.0					
19.1	37.7	58.6	133.5	117.3	83.9
16.8 (60m)	73.7	88.2	197.2	196.4	144.1

Castle Peak B	Wind Direction: 160 °		NO_x		
Height: 0m Distance [1]	Wind Speed ($m\ s^{-1}$) 3	5	8	12	15
−3.0	0.0		1.2		110.8
−2.5	4.7		6.9		374.8
−2.0	11.3		13.2		516.7
−1.5	17.9		33.3		606.3
−1.0	38.7		38.5		669.6
−0.5	40.5		73.0		684.8
0.0	69.6		83.1		670.3
0.8	8.0		51.9		465.8
1.2	24.2		69.4		460.3
2.0	4.1		97.4		503.3
2.4	4.4		102.1		484.4
3.2	6.9		89.5		428.1
4.8					
7.5	0.8		116.2		252.6
9.2	0.0		96.4		187.8
10.0	7.2		89.4		147.0
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	5.2		96.6		554.9
0.8 (120m)	16.5		103.6		502.3
9.2 (60m)	4.9		108.2		159.9

Castle Peak B	Wind Direction: 160 °		NO_2		
Height: 0m Distance [1]	Wind Speed ($m\ s^{-1}$) 3	5	8	12	15
−3.0			0.2		24.2
−2.5	0.5		1.4		113.3
−2.0	1.7		3.4		192.5
−1.5	3.2		10.1		261.6
−1.0	8.0		13.3		322.1
−0.5	9.6		28.1		357.9
0.0	18.3		34.9		373.7
0.8	2.4		24.4		280.4
1.2	7.8		34.1		285.5
2.0	1.5		51.6		326.8
2.4	1.6		55.8		320.3
3.2	2.8		51.6		291.3
4.8					
7.5	0.4		78.3		183.6
9.2			66.9		137.6
10.0	4.2		62.7		108.0
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	1.6		45.4		334.1
0.8 (120m)	5.0		48.7		302.4
9.2 (60m)	2.8		75.0		117.2

Castle Peak B	Wind Direction: 160 °		SO_2		
Height: 0m Distance [1]	Wind Speed ($m\ s^{-1}$) 3	5	8	12	15
−3.0	0.0		1.4		121.1
−2.5	5.2		7.5		409.8
−2.0	12.4		14.5		565.0
−1.5	19.5		36.5		662.9
−1.0	42.3		42.1		732.1
−0.5	44.2		79.8		748.8
0.0	76.1		90.8		732.9
0.8	8.8		56.7		509.3
1.2	26.4		75.9		503.3
2.0	4.4		106.5		550.3
2.4	4.8		111.6		529.7
3.2	7.5		97.9		468.1
4.8					
7.5	0.9		127.0		276.2
9.2			105.4		205.4
10.0	7.9		97.8		160.8
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	5.7		105.7		606.8
0.8 (120m)	18.0		113.3		549.2
9.2 (60m)	5.3		118.3		174.9

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak B	Wind Direction: 310° NO_x				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.4	0.0		0.0		35.5
7.5	0.0		7.2		179.6
9.2					
10.0					
10.5	0.0		31.1		192.5
13.4					
14.0	0.0		6.1		66.1
15.0	0.0		5.2		67.0
16.0			7.2		57.3
16.8					
17.0	5.2		21.4		64.5
17.8					
18.0					
19.1					

Castle Peak B	Wind Direction: 310° NO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					15.0
7.5			3.3		105.4
9.2					
10.0					
10.5			18.0		131.4
13.4					
14.0			4.0		47.8
15.0			3.5		48.8
16.0			5.0		41.9
16.8					
17.0	3.0		14.9		47.4
17.8					
18.0					
19.1					

Castle Peak B	Wind Direction: 310° SO_2				
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					38.8
7.5			7.9		196.4
9.2					
10.0					
10.5			34.0		210.5
13.4					
14.0			6.7		72.3
15.0			5.7		73.3
16.0			7.9		62.7
16.8					
17.0	5.7		23.4		70.6
17.8					
18.0					
19.1					

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak B	Wind Direction: 330 °		NO_x		
Height: 0m Distance [1]	Wind Speed ($m s^{-1}$) 3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8	0.0		0.0		16.2
7.5	0.0		0.0		612.5
9.2					
10.0					
10.5	0.0		64.5		401.9
13.4					
14.0	0.8		61.4		175.5
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	38.3		74.6		135.9
19.1					
4.8 (60m)	0.0		0.0		56.9
18.0 (60m)	18.2		74.6		141.2

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak B	Wind Direction: 330 °		NO_2		
Height: 0m Distance [1]	Wind Speed ($m s^{-1}$) 3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					3.9
7.5					326.0
9.2					
10.0					
10.5			35.8		267.9
13.4					
14.0	0.4		39.9		126.1
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	22.3		52.3		99.8
19.1					
4.8 (60m)					13.5
18.0 (60m)	10.6		52.3		103.7

Castle Peak B	Wind Direction: 330 °		SO_2		
Height: 0m Distance [1]	Wind Speed ($m s^{-1}$) 3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					17.7
7.5					669.7
9.2					
10.0					
10.5			70.6		439.4
13.4					
14.0	0.9		67.1		191.9
15.0					
16.0					
16.8					
17.0					
17.8					
18.0	41.9		81.6		148.5
19.1					
4.8 (60m)					62.2
18.0 (60m)	19.9		81.6		154.4

Castle Peak B	Wind Direction: 340 °			NO_x	
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	0.0	30.0	41.6	293.3	524.1
9.2					
10.0					
10.5	19.1	33.0	126.1	288.5	328.0
13.4					
14.0	8.3	25.7	112.6	226.5	181.0
15.0					
16.0					
16.8					
17.0					
17.6	2.4	22.2	110.3	152.4	108.3
18.0					
19.1	1.6		25.7		103.1

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak B	Wind Direction: 340 °			NO_2	
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5		9.1	16.0	138.4	273.9
9.2					
10.0					
10.5	7.2	15.2	69.5	181.1	217.8
13.4					
14.0	4.1	14.7	73.1	158.4	129.9
15.0					
16.0					
16.8					
17.0					
17.8	1.4	14.3	77.1	110.7	79.5
18.0					
19.1	0.9		18.2		75.9

Castle Peak B	Wind Direction: 340 °			SO_2	
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5		32.7	45.5	320.7	573.0
9.2					
10.0					
10.5	20.9	36.1	137.9	315.5	358.6
13.4					
14.0	9.0	28.1	123.1	247.7	197.9
15.0					
16.0					
16.8					
17.0					
17.8	2.6	24.2	120.6	166.6	118.4
18.0					
19.1	1.7		28.1		112.7

Castle Peak B	Wind Direction: 356 ° NO$_x$				
Height: 0m	Wind Speed (m s^{-1})				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	0.0	3.6	81.2	313.8	465.2
9.2					
10.0					
10.5	4.3	33.1	117.0	250.1	273.5
13.4	3.8	29.5	197.3	207.4	137.2
14.0	3.6	27.5	142.4	211.0	196.7
15.0					
16.0					
16.8					
17.0	18.5	24.2	112.6	199.3	185.2
17.8	18.5	24.2	68.6	154.2	140.6
18.0					
19.1	35.8	46.8	38.3	75.5	65.8

Castle Peak B	Wind Direction: 356 ° NO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5		1.2	33.1	155.5	253.8
9.2					
10.0					
10.5	1.7	15.6	65.6	159.0	183.3
13.4	1.9	16.7	126.7	144.0	98.0
14.0	1.8	15.9	93.0	148.1	141.4
15.0					
16.0					
16.8					
17.0	10.5	15.4	78.1	144.2	135.7
17.8	10.8	15.7	48.1	112.1	103.3
18.0					
19.1	21.6	31.1	27.2	55.2	48.4

Castle Peak B	Wind Direction: 356 ° SO$_2$				
Height: 0m	Wind Speed (m s^{-1})				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5		4.0	88.7	343.1	508.7
9.2					
10.0					
10.5	4.7	36.2	127.9	273.5	299.1
13.4	4.2	32.3	215.8	226.8	150.0
14.0	4.0	30.0	155.7	230.7	215.0
15.0					
16.0					
16.8					
17.0	20.3	26.4	123.1	217.9	202.5
17.8	20.3	26.4	75.0	168.6	153.7
18.0					
19.1	39.2	51.2	41.9	82.6	71.9

[1] Distances are specified as downwind of Black Point in kilometers

Castle Peak A&B Wind Direction: 340 ° NO_x					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	1.2	58.8	286.8	663.3	934.9
9.2					
10.0					
10.5	29.5	62.2	294.2	523.5	549.0
13.4					
14.0	33.6	45.3	219.4	360.1	304.1
15.0					
16.0					
16.8					
17.0					
17.8	6.2	68.2	210.4	247.3	188.9
18.0					
19.1	15.4		109.0		300.3

Castle Peak A&B Wind Direction: 340 ° NO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	0.3	17.8	110.5	313.0	488.6
9.2					
10.0					
10.5	11.2	28.7	162.1	328.6	364.5
13.4					
14.0	16.6	26.0	142.5	251.8	218.3
15.0					
16.0					
16.8					
17.0					
17.8	3.6	44.1	147.1	179.6	138.7
18.0					
19.1	9.3		77.3		221.1

Castle Peak A&B Wind Direction: 340 ° SO_2					
Height: 0m	Wind Speed ($m\ s^{-1}$)				
Distance [1]	3	5	8	12	15
−3.0					
−2.5					
−2.0					
−1.5					
−1.0					
−0.5					
0.0					
0.8					
1.2					
2.0					
2.4					
3.2					
4.8					
7.5	1.3	62.6	299.6	704.2	998.8
9.2					
10.0					
10.5	31.7	66.4	312.0	559.0	587.6
13.4					
14.0	35.3	48.4	233.8	386.1	325.5
15.0					
16.0					
16.8					
17.0					
17.8	6.6	72.0	224.4	264.9	202.0
18.0					
19.1	16.1		114.5		317.1

[1] Distances are specified as downwind of Black Point in kilometers, summation of concentrations resulting from Castle Peak A and B emissions, modelled separately in the wind tunnel.

Castle Peak A&B Wind Direction: 160 ° NO_x					
Height: 0m	Wind Speed (m s^{-1})				
Distance [1]	3	5	8	12	15
−3.0	0.0		6.5		143.7
−2.5	4.7		13.3		662.8
−2.0	11.3		34.6		1071.0
−1.5	17.9		69.4		1090.7
−1.0	38.8		98.3		1220.8
−0.5	47.9		144.3		1246.5
0.0	76.9		185.3		1247.9
0.8	8.0		132.3		863.0
1.2	24.2		169.5		847.5
2.0	4.1		212.5		904.9
2.4	4.4		225.2		863.2
3.2	6.9		185.4		748.0
4.8					
7.5	45.5		227.4	0.0	419.9
9.2	26.1		173.8	0.0	310.2
10.0	13.3		163.2	0.0	253.6
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	5.2		215.3		1047.5
0.8 (120m)	16.5		220.8		933.1
9.2 (60m)	9.0		198.8		264.3

Castle Peak A&B Wind Direction: 160 ° NO_2					
Height: 0m	Wind Speed (m s^{-1})				
Distance [1]	3	5	8	12	15
−3.0	0.0		0.9		31.4
−2.5	0.5		2.7		200.3
−2.0	1.7		8.8		399.0
−1.5	3.2		21.0		470.7
−1.0	8.1		34.0		587.3
−0.5	11.3		55.6		651.4
0.0	20.3		77.9		695.7
0.8	2.4		62.2		519.6
1.2	7.8		83.4		525.6
2.0	1.5		112.6		587.6
2.4	1.6		123.2		570.8
3.2	2.8		106.9		509.0
4.8					
7.5	24.2		153.3		305.2
9.2	14.8		120.5		227.3
10.0	7.7		114.4		186.3
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	1.6		101.2		630.7
0.8 (120m)	5.0		103.8		561.8
9.2 (60m)	5.1		137.9		193.7

Castle Peak A&B Wind Direction: 160 ° SO_2					
Height: 0m	Wind Speed (m s^{-1})				
Distance [1]	3	5	8	12	15
−3.0	0.0		6.8		155.2
−2.5	5.2		14.2		708.3
−2.0	12.4		36.6		1139.4
−1.5	19.5		73.8		1164.9
−1.0	42.3		104.1		1303.4
−0.5	51.9		153.7		1330.9
0.0	83.7		196.7		1331.5
0.8	8.8		140.0		920.9
1.2	26.4		179.6		904.6
2.0	4.4		225.8		966.5
2.4	4.8		239.2		922.3
3.2	7.5		197.2		799.6
4.8					
7.5	47.2		242.3		449.6
9.2	27.0		185.6		332.2
10.0	14.2		174.2		271.2
10.5					
13.4					
14.0					
15.0					
16.0					
16.8					
17.0					
17.8					
18.0					
19.1					
0.8 (60m)	5.7		228.6		1117.2
0.8 (120m)	18.0		234.7		995.7
9.2 (60m)	9.6		212.2		283.0

[1] Distances are specified as downwind of Black Point in kilometers, summation of concentrations resulting from Castle Peak A and B emissions, modelled separately in the wind tunnel.

WIND SPEED m/s	HEIGHT (m)	OPTIONS															
		OPTION 1		OPTION 2		OPTION 3		OPTION 4		OPTION 5		OPTION 6		OPTION 7		OPTION 8	
		NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x
3	0			20.0	6.4	4.4	—	7.9	25.3	7.9	—					11.4	3.6
	60			20.3	6.5	4.6	—	9.3	29.4	7.6	—						
5	0			82.1	26.1	25.6											
	60			90.0	28.6	25.8											
8	0	6.9	11.0	164.5	52.3	63.5	—	51.5	163.8	33.4	—					86.5	27.5
	60	7.0	11.1	167.6	53.3	60.7	—	52.1	165.6	33.3							
12	0	12.9	20.7	165.9	52.8	79.2	—										
	60																
15	0	15.3	24.5	149.5	47.8	70.3	—	81.0	257.8	32.4	—					78.4	24.9
	60	15.2	24.4	146.4	46.8	92.2	—	81.6	259.7	31.5	—						

ESTIMATES OF CONCENTRATION (SO_x and NO_x in $\mu g/m^3$)
AT THE BUTTERFLY ESTATE

WIND SPEED m/s	HEIGHT (m)	OPTIONS															
		OPTION 1		OPTION 2		OPTION 3		OPTION 4		OPTION 5		OPTION 6		OPTION 7		OPTION 8	
		NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2
3	0			8.3	6.4	1.8	—	3.3	25.3	3.3	—					4.7	3.6
	60			8.4	6.5	1.9	—	3.9	29.4	3.2	—						
5	0			41.0	26.1	12.8											
	60			45.0	28.6	12.9											
8	0	4.0	11.0	96.5	52.3	37.3	—	30.2	163.8	19.6	—					50.8	27.5
	60	4.1	11.1	98.3	53.3	35.6	—	30.6	165.6	19.5							
12	0	8.5	20.7	108.8	52.8	51.9	—										
	60																
15	0	10.5	24.5	102.6	47.8	48.3	—	55.6	257.8	22.2	—					53.8	24.9
	60	10.4	24.4	100.5	46.8	63.2	—	56.0	259.7	21.6	—						

ESTIMATES OF CONCENTRATION (SO_2 and NO_2 in $\mu g/m^3$)
AT THE BUTTERFLY ESTATE

WIND SPEED m/s	HEIGHT (m)	OPTIONS															
		OPTION 1		OPTION 2		OPTION 3		OPTION 4		OPTION 5		OPTION 6		OPTION 7		OPTION 8	
		NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x
3	0			37.3	11.9	6.0	—	21.5	68.3	6.2	—						
	40			37.6	12.0	4.1	—										
5	0			48.0	15.3	5.3	—										
	40			42.7	13.6	4.6	—										
8	0	3.3	5.3	184.8	58.8	14.6	—	48.7	155.0	12.9	—						
	40			186.5	59.3	15.9	—										
12	0	14.3	22.9	181.9	57.9	55.6	—										
	40			184.5	58.7	57.7	—										
15	0	18.1	29.0	156.3	49.7	68.2	—	79.8	254.0	23.1	—						
	40			160.2	51.1	69.5	—										

ESTIMATES OF CONCENTRATION (SO_x and NO_x in $\mu g/m^3$)
AT MAI PO

WIND SPEED m/s	HEIGHT (m)	OPTIONS															
		OPTION 1		OPTION 2		OPTION 3		OPTION 4		OPTION 5		OPTION 6		OPTION 7		OPTION 8	
		NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2
3	0			15.5	11.9	2.5	—	8.9	68.3	2.6	—						
	40			15.6	12.0	1.7	—										
5	0			24.0	15.3	2.6	—										
	40			21.3	13.6	2.3	—										
8	0	1.9	5.3	108.4	58.8	8.6	—	28.6	155.0	7.6	—						
	40			109.4	59.3	9.3	—										
12	0	9.4	22.9	119.3	57.9	36.5	—										
	40			121.0	58.7	37.8	—										
15	0	12.4	29.0	107.3	49.7	46.8	—	54.8	254.0	15.9	—						
	40			110.0	51.1	47.7	—										

ESTIMATES OF CONCENTRATION (SO_2 and NO_2 in $\mu g/m^3$)
AT MAI PO

Options (1+5+8) + Castle Peak A&B Wind Direction 160° NO_x					
Height 0m Distance	Wind Speed (m/s)				
	3	5	8	12	15
2.0	6.1		226.3		1127.
3.2	9.0		257.2		993.4
7.5	49.2		358.3		701.7
9.2	29.2		272.1		471.4
10.0	22.0		249.7		466.4

Options (1+5+8) + Castle Peak A&B Wind Direction 160° NO_2					
Height 0m Distance	Wind Speed (m/s)				
	3	5	8	12	15
2.0	1.8		116.1		670.3
3.2	3.3		119.8		631.4
7.5	25.7		230.1		498.7
9.2	16.3		182.7		341.8
10.0	12.0		170.6		339.0

Options (1+5+8) + Castle Peak A&B Wind Direction 160° SO_2					
Height 0m Distance	Wind Speed (m/s)				
	3	5	8	12	15
2.0	4.9		240.6		1103.5
3.2	8.0		214.3		919.1
7.5	48.2		280.3		552.7
9.2	27.8		212.7		384.3
10.0	16.4		198.8		343.3

Combined Impacts of Options 1, 5 and 8 plus Castle Peak A&B for Wind Direction of 160°

Annex E

Wind Tunnel Tests – Determination of NO to NO_2 Conversion Rate

1 *INTRODUCTION*

From combustion processes such as the LTPS, nitrogen oxides (NO_x) are emitted as approximately 90 to 95% nitric oxide (NO). The remaining 5 to 10% consists principally of nitrogen dioxide NO_2. However, NO is rapidly oxidised to NO_2 in the atmosphere by photochemical oxidants, mainly ozone (O_3), as follows:

$$NO + O_3 \text{ -------> } NO_2 + O_2$$

Principally, the rate of oxidation is dependent on the ambient O_3 concentration and wind speed. An increased O_3 concentration forces the reaction to the right and leads to increased NO_2 formation. At higher wind speeds, mixing of the plume with background air, containing O_3, is enhanced. Therefore, O_3 which has been depleted during the oxidation reaction is renewed.

With regard to human health effects, the concentration of NO_2 is of much more importance than NO. Therefore, the ratio NO_2/NO_x is significant in assessing the impact of the LTPS on potential sensitive receptors.

This annex reviews several scientific studies which have attempted to determine the rate of oxidation of NO to NO_2, by O_3, within power station plumes, and describes the methodology which has been adopted in order to determine ground level concentrations of NO_2 from the proposed LTPS.

2 *DETERMINATION OF THE NO TO NO_2 CONVERSION RATE*

2.1 *Introduction*

The determination of the NO to NO_2 conversion rate for this assessment has been based on work carried out by Janssen *et al* [1]. The specific objective of this study was to calculate conversion rates under various meteorological conditions, for each season of the year. Janssen's calculations were based on the observations of sixty measurement flights through the plumes from several power plants. From the large data base produced, Janssen was able to formulate an equation to describe the conversion of NO to NO_2, where the input parameters are dependent on the O_3 concentration, wind speed and season of the year.

[1] Atmospheric Environment, Volume 22, No 1, pages 43-53

Another study by Joos *et al* [1] was reviewed in order to evaluate it's application to this assessment. However, this study was considered to be inferior, with respect to Janssen's paper for this particular application, for the following reasons:

- The study was based on only two pollution episodes obtained during October, 1985.

- Measurements were only available for autumn; summer conversion rates are likely to be higher due to an increase in solar irradiation.

- The paper is a general physio-chemical study, whereas Janssens's study was specifically aimed at assessing the conversion rate of NO to NO_2 and, consequently, assessed this in more detail.

- Measurements were made on the plume of one power plant only.

Therefore, the work carried out by Janssen *et al*, which is discussed in more detail in *Section* 2.2, will be used to determine NO to NO_2 conversion rates.

2.2 *Methodology*

Janssen's study described the ratio of NO_2/NO_x, as a function of distance from the source from measurements obtained within stack plumes from Dutch power stations over a period of ten years, between 1975 and 1985. In this period a large data base was built up, consisting of sixty measuring flights carried out under widely varying atmospheric conditions. Janssen proposed that the total (cross-wind integrated) NO oxidation rate in power plant plumes can be described approximately by the phenomenological relation:

$$NO_2 \,/\, NO_x = A(1 - \exp(-\alpha x))$$

In this equation, x is the distance from the source and A and α are constants. This equation was formulated from information regarding the reaction rate of NO and O_3 to form NO_2 and the destruction of NO_2 by photodissociation. Using the data base, the numerical values for A and α were classified according to atmospheric conditions. Ozone concentrations, wind speed and season of the year are the most important parameters in determining A and α.

The parameter A determines the equilibrium ratio of NO_2/NO_x, whereas the parameter α determines the rate at which this equilibrium is reached. Both A and α increase with increasing O_3 concentration and solar irradiation. The parameter α also increases with increasing wind speed.

[1] Atmospheric Environment, Volume 24A, No 3, pages 703-710

2.3 *Calculation of the NO_2/NO_x Ratio*

Information concerning O_3 concentrations in Hong Kong is available from the High Island Reservoir over a three month period, these are summarised in *Table 2.3a*.

Table 2.3a *Summary of Ozone Concentrations (ppb) Obtained from the High Island Reservoir Site, June to August, 1985*

	June	July	August
Daily Minimum	14	8	10
Daily Maximum	51	20	39
Daily Average	32	15	20
Hourly Maximum	81	45	67

The concentration of ozone can be classified as low, high and episodic. Low concentrations of O_3 are of the order of 10 ppb, high concentrations, 35 ppb and episodic concentrations are represented by concentrations as high as 80 ppb. Since the oxidation rate is greater at higher O_3 concentrations, the episodic O_3 concentration should represent the 'worst–case'. Ozone episodes may occur for several days, however, these events will be fairly infrequent. Therefore, in order to determine the NO_2 concentration within the plume, high O_3 concentrations of 35 ppb were assumed.

Values of A and α were selected given regard to the O_3 concentration of 35 ppb and wind speeds of 3, 5, 8, 10, 12 and 15 m s^{-1}. Summer values were chosen since the oxidation rate is increased with increasing solar irradiation, therefore, this should represent the worst–case. Janssen quotes values for α for three wind speed ranges, therefore, in order to obtain values for α for the above wind speeds, a linear relationship between wind speed and α was assumed. In addition, since Janssen's study was carried out in Holland, where solar irradiation is likely to be less than Hong Kong, values of α representative of 50 ppb O_3 were selected.

The value of A used in calculating the NO_2/NO_x ratio was 0.74. The values of α used are summarised in *Table 2.3b*.

Table 2.3b *The Values of α Used for Determining the NO_2/NO_x Ratio*

Wind Speed (m s^{-1})	α
3	0.11
5	0.15
8	0.21
10	0.25
12	0.29
15	0.35

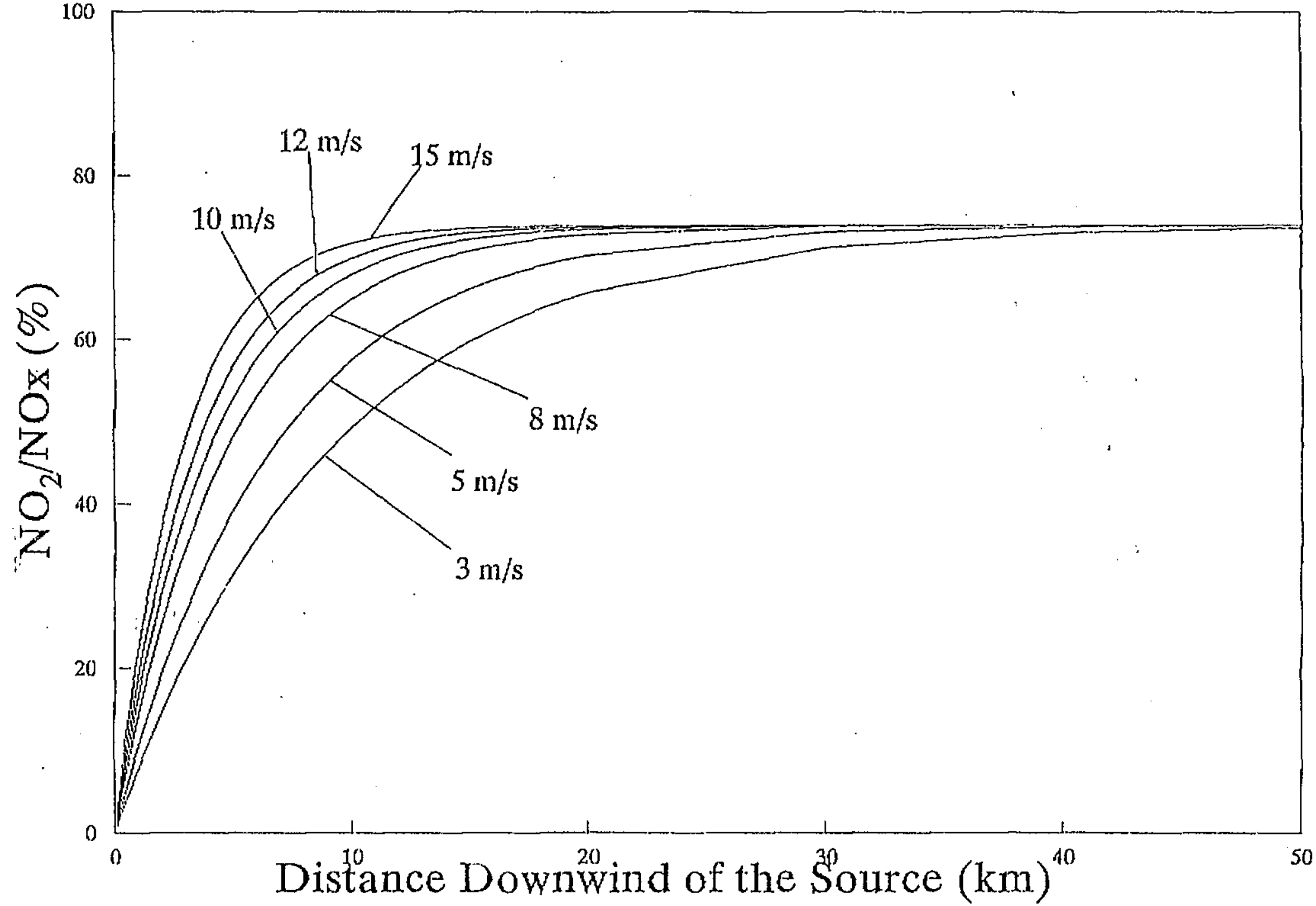
Using Janssen's equation and the values of α given in *Table 2.3b*, the ratio of NO_2/NO_x at various distances downwind of the LTPS can be determined. These are given in *Table 2.3c* and illustrated in *Figure 2.3a*. The concentration of NO_x downwind of the LTPS has been predicted using dispersion models and wind tunnel experiments. Therefore, these predictions, and the calculated NO_2/NO_x ratio, can be used to determine the concentration of NO_2 downwind of the LTPS.

Table 2.3c *Ratio of NO_2 to NO_x Downwind of the Source at Various Wind Speeds*

Distance (km)	NO_2/NO_x (%)					
	3 m s^{-1}	5 m s^{-1}	8 m s^{-1}	10 m s^{-1}	12 m s^{-1}	15 m s^{-1}
0.1	0.8	1.1	1.5	1.8	2.1	2.5
0.2	1.6	2.2	3.0	3.6	4.2	5.0
0.3	2.4	3.3	4.5	5.3	6.2	7.4
0.4	3.2	4.3	6.0	7.0	8.1	9.7
0.5	4.0	5.3	7.4	8.7	10.0	11.9
0.6	4.7	6.4	8.8	10.3	11.8	14.0
0.7	5.5	7.4	10.1	11.9	13.6	16.1
0.8	6.2	8.4	11.4	13.4	15.3	18.1
0.9	7.0	9.3	12.7	14.9	17.0	20.0
1.0	7.7	10.3	14.0	16.4	18.6	21.9
1.2	9.2	12.2	16.5	19.2	21.7	25.4
1.4	10.6	14.0	18.8	21.9	24.7	28.7
1.6	11.9	15.8	21.1	24.4	27.5	31.7
1.8	13.3	17.5	23.3	26.8	30.1	34.6
2.0	14.6	19.2	25.4	29.1	32.6	37.3
2.2	15.9	20.8	27.4	31.3	34.9	39.7
2.4	17.2	22.4	29.3	33.4	37.1	42.1
2.6	18.4	23.9	31.1	35.4	39.2	44.2
2.8	19.6	25.4	32.9	37.3	41.1	46.2
3.0	20.8	26.8	34.6	39.0	43.0	48.1
3.5	23.6	30.2	38.5	43.2	47.2	52.3
4.0	26.3	33.4	42.1	46.8	50.8	55.8
4.5	28.9	36.3	45.2	50.0	53.9	58.7
5.0	31.3	39.0	48.1	52.8	56.6	61.1
5.5	33.6	41.6	50.7	55.3	59.0	63.2
6.0	35.8	43.9	53.0	57.5	61.0	64.9
6.5	37.8	46.1	55.1	59.4	62.8	66.4
7.0	39.7	48.1	57.0	61.1	64.3	67.6
7.5	41.6	50.0	58.7	62.7	65.6	68.6
8.0	43.3	51.7	60.2	64.0	66.7	69.5
8.5	44.9	53.3	61.6	65.2	67.7	70.2
9.0	46.5	54.8	62.8	66.2	68.6	70.8
9.5	48.0	56.2	63.9	67.1	69.3	71.3
10.0	49.4	57.5	64.9	67.9	69.9	71.8
11.0	51.9	59.8	66.7	69.3	71.0	72.4
12.0	54.2	61.8	68.0	70.3	71.7	72.9
13.0	56.3	63.5	69.2	71.1	72.3	73.2
14.0	58.1	64.9	70.1	71.8	72.7	73.4
15.0	59.8	66.2	70.8	72.3	73.0	73.6
16.0	61.3	67.3	71.4	72.6	73.3	73.7
17.0	62.6	68.2	71.9	72.9	73.5	73.8
18.0	63.8	69.0	72.3	73.2	73.6	73.9
19.0	64.8	69.7	72.6	73.4	73.7	73.9
20.0	65.8	70.3	72.9	73.5	73.8	73.9
30.0	71.3	73.2	73.9	74.0	74.0	74.0
40.0	73.1	73.8	74.0	74.0	74.0	74.0
50.0	73.7	74.0	74.0	74.0	74.0	74.0

Summer conversion rates, 35 ppb (70 $\mu g\ m_{-3}$) Ozone.

Figure 2.3a
Ratio of NO_2 to NO_x Downwind of the Source at Various Wind Speeds



Annex F

Rigorous Frequency Analysis - Detailed Results (with NO_x mitigation at Castle Peak)

Table F.1a *Hourly Statistics of Sulphur Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
20/8/86	23:00	9.7	345	4107	1134	143.0	205.1	3.3	351.4
28/11/87	21:00	10.3	15	3364	2081	125.6	178.9	11.1	315.6
14/12/85	22:00	13.3	3	3313	1104	128.9	183.5	2.1	314.5
14/12/85	21:00	11.9	359	3313	2156	118.3	169.7	11.1	299.1
30/11/90	18:00	11.0	355	3364	3976	107.5	155.0	34.2	296.7
14/12/85	23:00	13.9	8	3280	533	120.7	171.4	0.0	292.1
13/11/87	11:00	8.7	360	3364	4246	103.6	149.6	32.9	286.1
29/3/88	20:00	8.9	353	3707	2373	108.8	157.4	19.4	285.6
4/1/86	22:00	11.1	5	3313	1104	115.8	166.2	3.0	285.0
19/10/89	18:00	9.3	358.7	3364	3976	97.4	141.1	36.3	274.8
25/10/88	18:00	8.9	353	3364	3976	97.2	140.8	36.3	274.3
27/2/86	11:00	9.6	354	3313	3128	100.5	145.3	27.4	273.2
30/11/90	17:00	9.5	356.8	3364	4075	104.0	150.1	18.2	272.3
26/10/88	8:00	9.2	355	3224	343	107.9	155.3	9.0	272.2
19/12/86	9:00	9.0	350	3313	1049	105.2	151.6	14.3	271.1
26/10/88	10:00	7.5	344	3364	3661	93.2	135.3	37.5	266.0
29/3/88	21:00	5.9	353	3707	1661	102.7	149.0	13.8	265.5
18/11/89	10:00	6.5	18.8	3364	3661	96.1	139.1	29.5	264.7
18/11/89	12:00	10.4	0.1	3364	4246	92.7	134.1	36.7	263.5
25/10/88	19:00	7.7	359.0	3364	3676	94.3	136.8	31.6	262.7

Sulphur Dioxide (SO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	292.1 (85)	36.5%
Limit on Daily Concentration	76	21.8%
Limit on Mean Concentration	3	4.1%

Table F.1b *Hourly Statistics of Nitrogen Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
30/11/90	18:00	11.0	355	3364	3976	64	52.5	75.5	192.0
13/11/87	11:00	8.7	360	3364	4246	61.2	50.3	72.5	184.0
19/10/89	18:00	9.3	358.7	3364	3976	56.9	46.9	79.6	183.4
25/10/88	18:00	8.9	53	3364	3976	56.8	46.8	79.6	183.2
26/10/88	10:00	7.5	344	3364	3661	54	44.6	81.8	180.4
18/11/89	12:00	10.4	0.1	3364	4478	54.4	44.7	80.6	179.7
25/10/88	17:00	8.8	355	3364	4075	53.4	44.1	81.5	179.0
19/10/89	17:00	8.6	348.2	3364	4075	50.2	41.5	82.9	174.6
30/10/88	17:00	7.4	349	3364	4075	49.5	41	82.8	173.3
25/10/88	19:00	7.7	359	3364	3676	54.9	45.3	69.2	169.4
27/2/86	11:00	9.6	354	3313	2899	59.3	48.7	60.3	168.3
18/11/89	10:00	6.5	18.8	3364	3661	56.3	46.4	64.6	167.3
7/10/89	16:00	7.2	357.7	3364	4115	51.5	42.6	71.8	165.9
28/11/87	21:00	10.3	15	3364	2081	77.6	62.8	25.2	165.6
30/11/90	19:00	7.4	5.8	3364	3676	54.5	44.9	65.2	164.6
20/8/86	23:00	9.7	345	4107	1134	86.4	70.5	7.3	164.2
26/10/88	11:00	7.7	352	3364	4246	43.7	36.2	80.9	160.8
26/10/88	15:00	7.3	346	3364	4105	42	34.8	83.7	160.5
20/2/86	17:00	6.7	352	3313	2758	56.6	46.6	56.7	159.9
29/3/88	20:00	8.9	353	3707	2373	63.8	52.4	42.7	158.9

Nitrogen Dioxide (NO_2) measured at Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	179 (88)	59.7%
Limit on Daily Concentration	40	26.8%
Limit on Mean Concentration	1.8	2.2%

Table F.1c Hourly Statistics of Sulphur Dioxide at Mai Po

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
25/6/86	19:00	12.2	213	4107	3402	127.3	185.0	5.3	317.6
25/6/86	18:00	14.7	224	4107	3886	122.7	177.7	5.8	06.2
19/7/88	21:00	11.9	219	4107	2308	116.9	165.8	10.6	293.3
19/7/88	23:00	14.6	203	4107	1134	113.1	164.3	0.0	277.4
25/6/86	20:00	12.4	209	4107	2946	111.4	161.9	0.0	273.3
28/5/85	11:00	10.6	230	3707	3727	97.4	140.0	34.4	271.8
19/7/88	22:00	16.8	217	4107	3402	108.6	157.9	2.9	269.4
28/5/85	10:00	11.2	228	3707	3109	96.6	133.9	29.9	260.4
22/5/87	9:00	11.0	215	3707	1489	94.4	130.4	0.0	224.8
30/7/87	20:00	6.7	229	4107	2946	93.1	130.3	0.0	223.4
23/6/88	13:00	8.0	212	4107	4211	92.6	124.5	0.0	217.1
22/5/87	10:00	8.7	213	3707	3109	90.2	123.3	0.0	213.5
27/5/85	15:00	9.0	213	3707	3582	78.4	108.2	25.7	212.2
22/5/88	10:00	7.5	230	3707	3109	77.3	101.7	30.7	209.7
28/5/85	9:00	10.3	225	3707	1489	69.6	93.8	23.0	186.4
22/2/87	8:00	9.8	215	3406	134	79.3	106.4	0.0	185.7
27/5/85	8:00	8.2	234.3	3406	134	74.9	103.5	6.9	185.3
20/4/88	15:00	9.3	218	3707	3582	74.9	98.5	11.5	184.9
27/2/85	14:00	9.8	229	3707	3094	75.2	98.5	11.3	184.8
20/4/88	16:00	7.0	206	3707	3583	78.8	104.8	0.0	183.6

Sulphur Dioxide (SO_2) measured at Mai Po

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	273.3 (86)	34.2%
Limit on Daily Concentration	46	13.2%
Limit on Mean Concentration	1	1.3%

Table F.1d *Hourly Statistics of Nitrogen Dioxide at Mai Po*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
28/5/85	11:00	10.6	230	3707	3727	62.4	51.1	77.9	191.4
28/5/85	10:00	11.2	228	3707	3109	61.1	48.3	66.9	176.3
25/6/86	19:00	12.2	213	4107	3402	81.9	67.8	12.1	161.8
19/7/88	21:00	11.9	219	4107	2308	74.6	60.2	24	158.8
25/6/86	18:00	14.7	224	4107	886	78.8	65	13.3	157.1
11/4/90	12:00	7.1	221.2	3707	4002	37.8	28.1	89.4	155.3
22/5/88	10:00	7.5	230	3707	3109	48	36	67.5	151.5
27/5/85	15:00	9.0	213	3707	3582	49.5	38.9	57.4	145.8
28/5/85	12:00	12.4	292.5	3707	4002	30.1	23.8	91.8	145.7
19/7/88	22:00	16.8	217	4107	1770	69.9	57.8	6.7	134.4
19/7/88	23:00	14.6	203	4107	1134	72.7	60.2	0.0	132.9
25/6/86	20:00	12.4	209	4107	2946	71.7	59.3	0.0	131.0
27/5/85	11:00	8.0	228	3707	3727	22.7	17	89	128.7
28/5/85	9:00	10.3	225	3707	1489	43.6	33.5	50.9	128.0
2/9/88	13:00	7.1	222	3364	4087	31.8	23.1	70	124.9
24/8/85	14:00	8.1	227	4107	3857	16	11.6	97.8	122.4
24/8/85	15:00	7.0	223	4107	4224	14.6	10.7	92.2	117.5
27/5/85	10:00	9.3	236	3707	3109	18.9	14.7	80.6	114.2
22/6/88	11:00	6.0	226	4107	4337	13.8	10.1	90.1	114.0
10/9/90	15:00	7.3	227.3	3364	4105	9.6	7.7	96.2	113.5

Nitrogen Dioxide (NO_2) measured at Mai Po

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	145.8 (85)	48.6%
Limit on Daily Concentration	28	18.8%
Limit on Mean Concentration	0.7	0.9%

Table F.1e *Hourly Statistics of Sulphur Dioxide at Lung Kwu Tan*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
29/7/87	10:00	10.6	195	4107	3802	522.5	410.1	0.0	932.6
29/7/87	9:00	13.3	192	4107	2204	531.6	391.7	0.0	923.3
20/7/88	0:00	8.9	262	4026	215	343.7	273.2	0.0	616.9
29/7/87	11:00	10.2	197	4107	4337	357.9	218.9	0.0	576.8
25/6/86	21:00	11.7	208	4107	2308	343.9	210.2	0.0	554.1
29/7/87	12:00	9.2	191	4107	4453	339.4	207.7	0.0	547.1
31/7/87	7:00	12.0	187	3350	0	307.0	195.7	0.0	502.7
29/7/87	8:00	13.0	187	4026	297	260.2	161.6	0.0	421.8
31/7/87	22:00	9.5	204	4107	1770	246.1	150.5	0.0	396.6
29/7/87	8:00	11.1	187	4026	297	169.0	105.6	0.0	274.6
25/6/86	4:00	15.0	202	2776	0	159.1	114.0	0.0	273.1
31/7/87	8:00	13.3	231.8	3406	134	153.2	117.0	0.0	270.2
20/7/88	23:00	8.9	187	4107	1134	154.1	94.8	0.0	248.9
11/4/90	9:00	11.8	202.6	3707	1489	154.2	94.3	0.0	248.5
21/7/87	17:00	9.4	184	4107	4136	141.0	86.8	0.0	227.8
21/5/87	13:00	7.7	202	3707	3565	138.1	85.1	0.0	223.2
20/7/88	8:00	7.0	165.5	4026	297	127.1	79.7	0.0	206.8
31/7/87	9:00	10.6	174.0	4107	2204	122.0	74.6	0.0	196.6
20/7/88	3:00	10.7	221	2885	0	111.8	68.6	0.0	180.4
20/7/88	7:00	6.9	202	3350	0	103.9	65.4	0.0	169.3

Sulphur Dioxide (SO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	576.8 (87)	72.1%
Limit on Daily Concentration	31	8.9%
Limit on Mean Concentration	0.8	1%

Table F.1f Hourly Statistics of Nitrogen Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
29/7/87	10:00	10.6	195	4107	3802	159.1	72.2	0	231.3
29/7/87	9:00	13.3	192	4107	2204	159.1	67.7	0	226.8
20/7/88	0:00	8.9	262	3501	0	105.1	48.3	0	153.4
29/7/87	11:00	10.2	197	4107	4337	101.7	35.4	0	137.1
25/6/86	21:00	11.7	208	4107	2308	97.9	34.1	0	132.0
29/7/87	12:00	9.2	191	4107	4453	96.3	33.6	0	129.9
31/7/87	7:00	12.0	187	3350	0	88	32.1	0	120.1
29/7/87	8:00	13.0	187	4026	297	74	26.2	0	100.2
25/6/86	22:00	9.5	204	4107	1770	69.9	24.4	0	94.3
24/10/87	12:00	12.8	335	3364	4478	0	0	88.6	88.6
26/4/85	15:00	13.2	330	3707	3582	0	0	77.6	77.6
24/10/87	15:00	10.3	341	3364	4105	0	0	75.1	75.1
23/10/87	19:00	12.9	320	3364	3676	0	0	69.4	69.4
21/9/88	16:00	10.9	340	3364	4115	0	0	67	67.0
24/10/87	11:00	12.5	322	3364	4246	0	0	66.9	66.9
11/4/90	8:00	13.3	231.8	3406	134	46.3	20.4	0	66.7
24/10/87	13:00	12.0	324	3364	4087	0	0	66.7	66.7
20/7/87	4:00	15.0	202	2776	0	47.2	19.5	0	66.7
31/7/87	8:00	11.1	187	4026	297	48.5	17.3	0	65.8
26/4/85	14:00	13.9	324	3707	3094	0	0	65.2	65.2

Nitrogen Dioxide (NO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	137.1 (87)	45.7%
Limit on Daily Concentration	15.2	10.1%
Limit on Mean Concentration	0.2	0.3%

Table F.1g   Hourly Statistics of Sulphur Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
29/7/87	10:00	10.6	195	4107	3802	326.7	418.7	0.0	745.4
29/7/87	9:00	13.3	192	4107	2204	321.4	413.8	0.0	735.2
29/7/87	11:00	10.2	197	4107	4337	238.2	288.5	0.0	526.7
29/7/87	12:00	9.2	191	4107	4453	231.9	278.2	0.0	510.1
20/7/88	0:00	8.9	262	4026	215	213.2	274.7	0.2	488.1
25/6/86	21:00	11.7	208	4107	2308	214.1	265.9	0.0	480.0
31/7/87	7:00	12.0	187	3350	0	210.3	253.2	0.0	463.5
29/7/87	8:00	13.0	187	4026	297	185.3	219.3	0.0	404.6
25/6/86	22:00	9.5	204	4107	1770	161.4	196.5	0.0	357.9
25/6/86	23:00	8.9	187	4107	1134	167.6	173.8	0.0	341.4
31/7/87	17:00	9.4	184	4107	4136	164.1	167.3	0.0	331.4
21/5/87	13:00	7.7	202	3707	3565	150.1	155.9	0.0	306.0
20/7/88	8:00	7.0	165.5	4026	297	137.2	144.7	0.0	281.9
21/5/87	14:00	7.1	192	3707	3094	123.5	120.7	0.0	244.2
20/7/88	7:00	6.9	202	3350	0	119.3	124.0	0.0	243.3
11/4/90	9:00	11.8	202.6	3707	1489	105.0	126.1	7.1	238.2
29/7/87	7:00	10.0	194.0	3350	0	120.3	115.3	0.0	235.6
20/7/88	4:00	15.0	202	2776	0	99.1	125.6	0.0	224.7
11/4/90	8:00	13.3	231.8	3406	134	93.6	120.7	9.6	223.9
31/7/87	8:00	11.1	187.8	4026	297	96.6	124.5	0.0	221.1

Sulphur Dioxide (SO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	526.7 (87)	65.8%
Limit on Daily Concentration	47	13.5%
Limit on Mean Concentration	1	1.7%

Table F.1h Hourly Statistics of Nitrogen Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
29/7/87	10:00	10.6	195	4107	3802	174.7	127.5	0.0	302.2
29/7/87	9:00	13.3	192	4107	2204	170.7	125	0.0	295.7
29/7/87	11:00	10.1	197	4107	4337	120.3	83.5	0.0	203.8
20/7/88	0:00	8.9	262	4026	215	114.5	83.9	0.2	198.6
29/7/87	12:00	9.2	191	4107	4453	116.7	80.4	0.0	197.1
25/6/86	21:00	11.7	208	4107	2308	109.2	77.5	0.0	186.7
31/7/87	7:00	12.0	187	3350	0	106.5	73.6	0.0	180.1
19/7/88	17:00	13.2	233	4107	4136	0.0	0.0	168.9	168.9
19/7/88	16:00	13.3	231	4107	4232	0.0	0.0	157.6	157.6
29/7/87	8:00	13.0	187	4026	297	93	63.3	0.0	156.3
25/6/86	22:00	9.5	204	4107	1770	81.7	57.0	0.0	138.7
25/6/86	23:00	8.9	187	4107	1134	80.1	48.1	0.0	128.2
31/7/87	17:00	9.4	184	4107	4136	78	16.1	0.0	124.1
28/5/85	11:00	10.6	230	3707	3727	0.0	0.0	117.4	117.4
21/5/87	13:00	7.7	202	3707	3565	71.8	43.2	0.0	115.0
20/7/88	8:00	7.0	165.5	4026	297	65.5	39.9	0.0	105.4
19/7/88	18:00	12.9	247	4107	3886	0.0	0.0	104.5	104.5
28/5/85	12:00	12.4	292.5	3707	4002	0.0	0.0	103.9	103.9
11/4/90	8:00	13.3	231.8	3406	134	50	36.6	13.9	100.5
11/4/90	9:00	11.8	202.6	3707	1489	52.9	36.4	10.4	99.7

Nitrogen Dioxide (NO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	203.8 (87)	67.9%
Limit on Daily Concentration	24	16.1%
Limit on Mean Concentration	0.5	0.7%

Table F.1i Hourly Statistics of Sulphur Dioxide at Butterfly Estate

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
11/7/86	16:00	20.3	280	4107	4232	436.9	598.9	0.0	1035.8
11/7/86	17:00	18.3	278	4107	4136	436.9	598.9	0.0	1035.8
11/7/86	19:00	21.7	273	4107	3402	436.9	598.9	0.0	1035.8
11/7/86	20:00	20.2	271	4107	2946	436.9	598.9	0.0	1035.8
11/7/86	21:00	17.7	281	4107	2308	436.9	598.9	0.0	1035.8
11/7/86	22:00	17.2	280	4107	1770	436.9	598.9	0.0	1035.8
11/7/86	23:00	15.4	275	4107	1134	433.3	594.0	0.0	1027.3
12/7/86	0:00	13.1	270	4026	215	401.5	515.9	0.0	917.4
31/7/90	10:00	9.7	276.1	4107	3802	394.9	404.1	0.0	799.0
31/7/90	9:00	11.4	275.1	4107	2204	343.0	369.5	0.0	712.5
11/7/86	18:00	18.0	270	4107	3886	218.5	299.4	0.0	517.9
31/7/90	11:00	7.8	272.2	4107	4337	276.4	231.3	0.0	507.7
24/6/85	20:00	12.4	284	4107	2946	215.6	267.5	7.6	490.7
11/7/86	15:00	18.2	271	4107	4224	145.6	199.6	12.4	357.6
23/6/88	14:00	10.7	253	4107	3857	145.6	199.6	0.0	345.2
25/6/85	2:00	9.7	265	3105	0.0	148.7	152.8	0.0	301.5
31/7/90	7:00	12.6	284.5	3350	0.0	121.9	157.4	0.0	279.3
12/7/86	1:00	9.1	245	3501	0.0	119.5	135.8	0.0	255.3
21/8/86	8:00	6.3	254	4026	297	176.4	58.8	0.0	235.2
21/8/86	20:00	2.0	109	4107	2946	106.6	120.1	6.3	233.0

Sulphur Dioxide (SO_2) measured at Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	507.7 (90)	63.5%
Limit on Daily Concentration	30	8.7%
Limit on Mean Concentration	1	1.6%

Table F.1j Hourly Statistics of Nitrogen Dioxide at Butterfly Estate

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,coal	Total
11/7/86	16:00	20.3	280	4107	4232	213.6	166.5	0	380.1
11/7/86	17:00	18.3	278	4107	4136	213.6	166.5	0	380.1
11/7/86	19:00	21.7	273	4107	3402	213.6	166.5	0	380.1
11/7/86	20:00	20.2	271	4107	2946	213.6	166.5	0	380.1
11/7/86	21:00	17.7	281	4107	2308	213.6	166.5	0	380.1
11/7/86	22:00	17.2	280	4107	1770	213.6	166.5	0	380.1
11/7/86	23:00	15.4	275	4107	1134	211.8	165.1	0	376.9
12/7/86	0:00	13.1	270	4026	215	191	140.2	0	331.2
31/7/90	10:00	9.7	276.1	4107	3802	173.5	102.1	0	275.6
31/7/90	9:00	11.4	275.1	4107	2204	152.8	94.3	0	247.1
11/7/86	18:00	18.0	270	4107	3886	106.8	83.2	0	190.0
24/6/85	20:00	12.4	284	4007	2946	101.1	71.7	15.9	188.7
31/7/90	11:00	7.8	272.2	4107	4337	116.5	57.5	0	174.0
11/7/86	15:00	18.2	271	4107	4224	71.2	55.5	26.6	153.3
23/6/88	14:00	10.7	253	4107	3857	71.2	55.5	0	126.7
25/6/85	2:00	9.7	265	3105	0	65.4	38.6	0	104.0
31/7/90	7:00	12.6	284.5	3350	0	58.1	42.8	0	100.9
8/9/90	16:00	7.9	0.9	3364	4115	48.4	24	26.7	99.1
21/8/86	20:00	2.0	109	4107	2946	48.1	30.9	13.4	92.4
12/7/86	1:00	9.1	245	3501	0	54.2	35.2	0	89.4

Nitrogen Dioxide (NO_2) measured Butterfly Estate

	Pollution Concentration	% of AQ Standard
Limit on Hourly Concentration	174 (90)	58.0%
Limit on Daily Concentration	26.8	17.9%
Limit on Mean Concentration	1	1.2%

Table F.2a *Hourly Statistics of Sulphur Dioxide at Mai Po*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
25/6/86	19:00	12.2	213	4107	3402	127.3	185.0	0	312.3
25/6/86	18:00	14.7	224	4107	3886	122.7	177.7	0	300.4
19/7/88	21:00	11.9	219	4107	2308	116.9	165.8	0	282.7
19/7/88	23:00	14.6	203	4107	1134	113.1	164.3	0	277.3
25/6/86	20:00	12.4	209	4107	2946	111.4	161.9	0	273.3
28/5/85	22:00	16.8	217	3707	1193	97.4	140.0	0	266.5
19/7/88	11:00	10.6	230	4107	4337	108.6	157.9	0	237.4
28/5/85	10:00	11.2	228	3707	3109	96.6	133.9	0	230.5
22/5/87	9:00	11.0	215	3707	1489	94.4	130.4	0	224.8
30/7/87	20:0	6.7	229	4107	2946	93.1	130.3	0	223.3
26/6/88	13:00	8:0	212	4107	4211	92.6	124.5	0	217.1
22/5/87	10:00	8.7	213	3707	3109	90.2	123.3	0	213.6
27/5/85	15:00	9.0	213	3707	3582	78.4	108.1	0	186.5
22/5/88	8:00	9.8	215	3406	134	79.3	106.4	0	185.7
28/5/85	16:00	7.0	206	3707	3583	78.8	104.8	0	183.7
22/5/87	0:00	7.5	230	3707	3109	77.3	101.7	0	179.0
27/5/85	8:00	8.2	234.3	3406	134	74.9	103.5	0	178.4
20/4/88	14:00	9.8	229	3707	3094	75.2	98.3	0	173.5
27/5/85	15:00	9.3	218	3707	3582	74.9	98.5	0	173.4
20/4/88	1:00	11.9	274	2582	0	69.3	100.8	0	170.1

Sulphur Dioxide (SO_2) measured Mai Po

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	273.3 (86)	34.2%
Limit on Daily Concentration	43.89	12.54%
Limit on Mean Concentration	0.90	1.12%

Table F.2b *Hourly Statistics of Nitrogen Dioxide at Mai Po*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
28/5/85	19:00	12.2	213	3707	2995	81.9	67.8	5.8	155.5
28/5/85	18:00	14.7	224	3707	3294	78.8	65.0	6.1	149.9
25/6/86	21:00	11.9	219	4107	2308	74.6	60.2	7.7	142.5
19/7/88	11:00	10.6	230	4107	4337	62.4	51.1	24.1	137.6
25/6/86	23:00	14.6	203	4107	1134	72.7	60.2	0	132.9
11/4/90	20:00	12.4	209	3707	2373	71.7	59.3	0	131.0
22/5/88	22:00	16.8	217	3707	1193	69.9	57.8	2.4	130.1
27/5/85	10:00	11.2	228	3707	3109	61.1	48.3	14.5	123.9
28/5/85	9:00	11.0	215	3707	1489	59.7	46.9	0	106.6
19/7/88	20:00	6.7	229	4107	2946	59.1	47.1	0	106.2
19/7/88	13:00	8.0	212	4107	4211	57.9	44.4	0	102.3
25/6/86	10:00	8.7	213	4107	3802	56.8	44.2	0	101.0
27/5/85	15:00	9.0	213	3707	3582	49.5	38.9	12.4	100.8
28/5/85	10:00	7.5	230	3707	3109	48.0	36.0	7.5	91.5
2/9/88	8:00	8.2	234.3	3224	343	47.3	37.3	3.1	87.7
24/8/85	8:00	9.8	215	4026	297	49.6	37.9	0	87.5
24/8/85	16:00	7.0	206	4107	4232	49.1	37.2	0	86.3
27/5/85	9:00	10.3	225	3707	1489	43.6	33.5	8.2	85.3
22/6/88	14:00	9.8	229	4107	3857	46.6	34.7	2.6	83.9
10/9/90	15:00	9.3	218	3364	4105	46.5	34.8	2.4	83.7

Nitrogen Dioxide (NO_2) measured Mai Po

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	123.9 (85)	41.3%
Limit on Daily Concentration	21.90	14.60%
Limit on Mean Concentration	0.45	0.56%

Table F.2c Hourly Statistics of Sulphur Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
29/7/87	10:00	10.6	195	4107	3802	522.5	410.1	0	932.6
29/7/87	9:00	13.3	192	4107	2204	531.6	391.7	0	923.3
20/7/88	0:00	8.9	262	4026	215	343.7	273.2	0	616.9
29/7/87	11:00	10.2	197	4107	4337	357.9	218.9	0	576.8
25/6/86	21:00	11.7	208	4107	308	343.9	210.2	0	554.1
29/7/87	12:00	9.2	191	4107	4453	339.4	207.7	0	547.1
31/7/87	7:00	12.0	187	3350	0	307.0	195.7	0	502.7
29/7/87	8:00	13.0	187	4026	297	260.2	161.6	0	421.8
25/6/86	22:00	9.5	204	4107	1770	246.1	150.5	0	396.6
31/7/87	8:00	11.1	187	4026	297	169.0	105.6	0	274.6
20/7/88	4:00	15.0	202	2776	0	159.1	114.0	0	273.1
11/4/90	8:00	13.3	231.8	3406	134	153.2	117.0	0	270.2
25/6/86	23:00	8.9	187	4107	1134	154.1	94.8	0	248.9
11/4/90	9:00	11.8	202.6	3707	1489	154.2	94.3	0	248.5
31/7/87	17:00	9.4	184	4107	4136	141.0	86.8	0	227.8
21/5/87	13:00	7.7	202	3707	3565	138.1	85.1	0	223.2
20/7/88	8:00	7.0	165.5	4026	297	127.1	79.7	0	206.8
31/7/87	9:00	10.6	174	4107	2204	122.0	74.6	0	196.6
20/7/88	3:00	10.7	221	2885	0	111.8	68.6	0	180.4
20/7/88	7:00	6.9	202	3350	0	103.9	65.4	0	169.3

Sulphur Dioxide (SO_2) measured Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	576.8 (87)	72.1%
Limit on Daily Concentration	30.0	8.6%
Limit on Mean Concentration	1.0	0.8%

Table F.2d Hourly Statistics of Nitrogen Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
29/7/87	10:00	10.6	195	4107	3802	159.1	72.2	0.0	231.3
29/7/87	9:00	13.3	192	4107	2204	159.1	67.7	0.0	226.8
20/7/88	0:00	8.9	262	4026	215	105.1	48.3	0.0	153.4
29/7/87	11:00	10.2	197	4107	4337	101.7	35.4	0.0	137.1
25/6/86	21:00	11.7	208	4107	2308	97.9	34.1	0.0	132.0
29/7/87	12:00	9.2	191	4107	4453	96.3	33.6	0.0	129.9
31/7/87	7:00	12	187	3350	0	88.0	32.1	0.0	120.1
29/7/87	8:00	13	187	4026	297	74.0	26.2	0.0	100.2
25/6/86	22:00	9.5	204	4107	1770	69.9	24.4	0.0	94.3
24/10/87	12:00	12.8	335	3364	4478	0.0	0.0	74.9	74.9
24/10/87	11:00	12.5	322	3364	4246	0.0	0.0	67.2	67.2
24/10/87	15:00	10.3	341	3364	4105	0.0	0.0	66.9	66.9
11/4/90	8:00	13.3	231.8	3406	134	46.3	20.4	0.0	66.7
20/7/88	4:00	15.0	202	2776	0	47.2	19.5	0.0	66.7
26/4/85	15:00	13.2	330	3707	3582	0.0	0.0	66.0	66.0
31/7/87	8:00	11.1	187	4026	297	48.5	17.3	0.0	65.8
21/9/88	16:00	10.9	340	3364	4115	0.0	0.0	64.0	64.0
24/10/87	13:00	12.0	324	3364	4087	0.0	0.0	62.8	62.8
21/9/88	17:00	9.8	334	3364	4075	0.0	0.0	62.1	62.1
24/10/90	17:00	8.1	336.1	3364	4075	0.0	0.0	62.0	62.0

Nitrogen Dioxide (NO_2) measured Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	137.1 (87)	45.7%
Limit on Daily Concentration	18.0	12.1%
Limit on Mean Concentration	1.0	0.6%

Table F.2e Hourly Statistics of Sulphur Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
29/7/87	10:00	10.6	195	4107	3802	326.7	418.7	0.0	745.4
29/7/87	9:00	13.3	192	4107	2204	321.4	413.8	0.0	735.2
29/7/87	11:00	10.2	197	4107	4337	238.2	288.5	0.0	526.7
29/7/87	12:00	9.2	191	4107	4453	231.9	278.2	0.0	510.1
20/7/88	0:00	8.9	262	4026	215	213.2	274.7	0.0	487.9
25/6/86	21:00	11.7	208	4107	2308	214.1	265.9	0.0	480.0
31/7/87	7:00	12.0	187	3350	0	210.3	253.2	0.0	463.5
29/7/87	8:00	13.0	187	4026	297	185.3	219.3	0.0	404.6
25/6/86	2:00	9.5	204	4107	1770	161.4	196.5	0.0	357.9
25/6/86	23:00	8.9	187	4107	1134	167.6	173.8	0.0	341.4
31/7/87	17:00	9.4	184	4107	4136	164.1	167.3	0.0	331.4
21/5/87	13:00	7.7	202	3707	3565	150.1	155.9	0.0	306.0
20/7/88	8:00	7.0	165.5	4026	297	137.2	144.7	0.0	281.9
21/5/87	14:00	7.1	192	3707	3094	123.5	120.7	0.0	244.2
20/7/88	7:00	6.9	202	3350	0	119.3	124.0	0.0	243.3
29/7/87	7:00	10.0	194	3350	0	120.3	115.3	0.0	235.6
11/4/90	9:00	11.8	202.6	3707	1489	105.0	126.1	0.0	231.1
20/7/88	4:00	15.0	202	2776	0	99.1	125.6	0.0	224.7
31/7/87	8:00	11.1	187	4026	297	96.6	124.5	0.0	221.1
20/7/88	3:00	10.7	221	2885	0	105.2	113.6	0.0	218.8

Sulphur Dioxide (SO_2) measured Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	526.7 (87)	65.8%
Limit on Daily Concentration	47.0	13.3%
Limit on Mean Concentration	1.0	1.5%

Table F.2f Hourly Statistics of Nitrogen Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
29/7/87	10:00	10.6	195	4107	3802	174.7	127.5	0.0	302.2
29/7/87	9:00	13.3	192	4107	2204	170.7	125.0	0.0	295.7
29/7/87	11:00	10.2	197	4107	4337	120.3	83.5	0.0	203.8
20/7/88	0:00	8.9	262	4026	215	114.5	83.9	0.1	198.5
29/7/87	12:00	9.2	191	4107	4453	116.7	80.4	0.0	197.1
25/6/86	21:00	11.7	208	4107	2308	109.2	77.5	0.0	186.7
31/7/87	7:00	12.0	187	3350	0	106.5	73.6	0.0	180.1
29/7/87	8:00	13.0	187	4026	297	93.0	63.3	0.0	156.3
25/6/86	22:00	9.5	204	4107	1770	81.7	57.0	0.0	138.7
25/6/86	23:00	8.9	187	4107	1134	80.1	48.1	0.0	128.2
31/7/87	17:00	9.4	184	4107	4136	78.0	46.1	0.0	124.1
21/5/87	13:00	7.7	202	3707	3565	71.8	43.2	0.0	115.0
20/7/88	8:00	7.0	165.5	4026	297	65.5	39.9	0.0	105.4
11/4/90	9:00	11.8	202.6	3707	1489	52.9	36.4	4.4	93.7
11/4/90	8:00	13.3	231.8	3406	134	50.0	36.6	6.0	92.6
20/7/88	7:00	6.9	202	3350	0	56.7	34.0	0.0	90.7
21/5/87	14:00	7.1	192	3707	3094	57.7	32.6	0.0	90.3
20/7/88	4:00	15.0	202	2776	0	52.0	37.6	0.0	89.6
31/7/87	8:00	11.1	187	4026	297	50.1	36.7	0.0	86.8
29/7/87	7:00	10.0	194	3350	0	55.9	30.9	0.0	86.8

Nitrogen Dioxide (NO_2) measured Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	203.8 (87)	67.9%
Limit on Daily Concentration	17.0	11.3%
Limit on Mean Concentration	0.0	0.5%

Table F.2g *Hourly Statistics of Sulphur Dioxide at Butterfly Estate*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
11/7/86	16:00	20.3	280	4107	4232	436.9	598.9	0.0	1035.8
11/7/86	17:00	18.3	278	4107	4136	436.9	598.9	0.0	1035.8
11/7/86	19:00	21.7	273	4107	3402	436.9	598.9	0.0	1035.8
11/7/86	20:00	20.2	271	4107	2946	436.9	598.9	0.0	1035.8
11/7/86	21:00	17.7	281	4107	2308	436.9	598.9	0.0	1035.8
11/7/86	2:00	17.2	20	4107	1770	436.9	598.9	0.0	1035.8
11/7/86	23:00	15.4	275	4107	1134	433.3	594.0	0.0	1027.3
12/7/86	0:00	13.1	270	4026	15	401.5	515.9	0.0	917.4
31/7/90	10:00	9.7	276.1	4107	3802	394.9	404.1	0.0	799.0
31/7/90	9:00	11.4	275.1	4107	2204	343.0	369.5	0.0	712.5
11/7/86	18:00	18.0	270	4107	3886	218.5	299.4	0.0	517.9
31/7/90	11:00	7.8	272.2	4107	4337	276.4	231.3	0.0	507.7
24/6/85	20:00	12.4	284	4107	2946	215.6	267.5	0.0	483.1
11/7/86	15:00	18.2	271	4107	4224	145.6	199.6	0.0	345.2
23/6/88	14:00	10.7	253	4107	3857	145.6	199.6	0.0	345.2
25/6/85	2:00	9.7	265	3105	0	148.7	152.8	0.0	301.5
31/7/90	7:00	12.6	284.5	3350	0	121.9	157.4	0.0	279.3
12/7/86	1:00	9.1	245	3501	0	119.5	135.8	0.0	255.3
21/8/86	8:00	6.3	254	4026	297	176.4	58.8	0.0	235.2
21/8/86	20:00	2.0	109	4107	2946	106.6	120.1	0.0	226.7

Sulphur Dioxide (SO_2) measured Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	507.7 (90)	63.5%
Limit on Daily Concentration	26.0	7.6%
Limit on Mean Concentration	1.0	1.0%

Table F.2h Hourly Statistics of Nitrogen Dioxide at Butterfly Estate

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
11/7/86	16:00	20.3	280	4107	4232	213.6	166.5	0.0	380.1
11/7/86	17:00	18.3	278	4107	4136	213.6	166.5	0.0	380.1
11/7/86	19:00	21.7	273	4107	3402	213.6	166.5	0.0	380.1
11/7/86	20:00	20.2	271	4107	2946	213.6	166.5	0.0	380.1
11/7/86	21:00	17.7	281	4107	2308	213.6	166.5	0.0	380.1
11/7/86	22:00	17.2	280	4107	1770	213.6	166.5	0.0	380.1
11/7/86	23:00	15.4	275	4107	1134	211.8	165.1	0.0	376.9
12/7/86	0:00	13.1	270	4026	215	191.0	140.2	0.0	331.2
31/7/90	10:00	9.7	276.1	4107	3802	173.5	102.1	0.0	275.6
31/7/90	9:00	11.4	275.1	4107	2204	152.8	94.3	0.0	247.1
11/7/86	18:00	18.0	270	4107	3886	106.8	83.2	0.0	190.0
24/6/85	20:00	12.4	284	4107	2946	101.1	71.7	8.6	181.4
31/7/90	11:00	7.8	272.2	4107	4337	116.5	57.5	0.0	174.0
11/7/86	15:00	18.2	271	4107	4224	71.2	55.5	14.2	140.9
23/6/88	14:00	10.7	253	4107	3857	71.2	55.5	0.0	126.7
25/6/85	2:00	9.7	265	3105	0	65.4	38.6	0.0	104.0
31/7/90	7:00	12.6	284.5	3350	0	58.1	42.8	0.0	100.9
12/7/86	1:00	9.1	245	3501	0	54.2	35.2	0.0	89.4
8/9/90	16:00	7.9	0.9	3364	4115	48.4	24.0	14.4	86.8
21/8/86	20:00	2.0	109	4107	2946	48.1	30.9	7.2	86.2

Nitrogen Dioxide (NO_2) measured Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	174 (90)	58.0%
Limit on Daily Concentration	14.0	9.2%
Limit on Mean Concentration	1.0	0.7%

Table F.2i *Hourly Statistics of Sulphur Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
20/8/86	23:00	9.7	345	4107	1134	143.0	205.1	0.0	348.1
14/12/85	22:00	13.3	3	3313	2342	128.9	184.5	0.0	313.4
28/11/87	21:00	10.3	15	3364	2081	125.6	178.9	0.0	304.5
14/12/85	23:00	13.9	8	3280	533	120.7	171.4	0.0	292.1
14/12/85	21:00	11.9	359	3313	2156	169.7	118.3	0.0	288.0
4/1/86	22:00	11.1	5	3313	1104	115.8	166.2	0.0	282.0
29/3/88	20:00	8.9	353	3707	2373	108.8	157.4	0.0	266.2
26/10/88	8:00	9.2	355	3224	343	10739	155.3	0.0	263.2
31/11/90	18:0	11.0	355	3364	3976	107.5	155.0	0.0	262.5
28/11/87	23:00	6.1	353.2	3346	854	106.1	152.8	0.0	258.9
19/12/86	9:00	9.0	350	3313	1046	105.2	151.6	0.0	256.8
30/11/90	17:00	9.5	356.8	3364	4075	104.0	150.1	0.0	254.1
13/11/87	11:00	8.7	360	3364	4246	103.6	149.6	0.0	253.2
29/3/88	21:00	5.9	353	3707	1661	102.7	149.0	0.0	251.7
15/12/85	23:00	11.1	358	3280	533	102.4	147.4	0.0	249.8
24/11/85	21:00	8.9	358	3364	2081	102.1	147.5	0.0	249.6
27/2/86	11:00	9.6	354	3313	2899	100.5	145.3	0.0	245.8
24/11/85	22:00	8.5	355	3364	1532	100.4	145.2	0.0	245.6
11/3/85	9:00	10.1	358.3	3707	1489	98.8	142.3	0.0	241.1
20/8/86	22:00	9.5	4.0	4107	1770	97.7	141.6	0.0	239.3

Sulphur Dioxide (SO_2) measured Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	288 (85)	36%
Limit on Daily Concentration	73.0	20.8%
Limit on Mean Concentration	3.0	3.9%

Table F.2j Hourly Statistics of Nitrogen Dioxide at Tung Chung

Date	Time	Wind Speed	Wind Dir	MW		Concentration			
				CPPS	LTPS	CPA	CPB	BP,gas	Total
20/8/86	23:00	9.7	345	4107	1134	86.4	70.5	2.7	159.6
28/11/87	21:00	10.3	15	3364	2081	77.6	62.8	10.4	150.8
14/12/85	22:00	13.3	3	3313	1104	79.7	64.6	2.0	146.3
30/11/90	18:00	11.0	355	3364	3976	64.0	52.5	25.7	142.2
14/12/85	21:00	11.9	359	3313	2156	71.7	58.5	9.2	139.4
14/12/85	23:00	13.9	8	3280	533	75.1	60.6	0.0	135.7
13/11/87	11:00	8.7	360	3364	4246	61.2	50.3	24.1	135.6
29/3/88	20:00	8.9	353	3707	2373	63.8	52.4	13.6	129.8
4/1/86	22:00	11.1	5	3313	1104	70.0	57.1	2.4	129.5
19/10/89	18:00	9.3	358.7	3364	3976	56.9	46.9	5.2	129.0
25/10/88	18:00	8.9	353	3364	3976	56.8	46.8	25.2	128.8
27/2/86	11:00	9.6	354	3313	2899	59.3	48.7	19.8	127.8
30/11/90	17:00	9.5	356.8	3364	4075	61.5	50.5	13.4	125.4
18/11/89	12:00	10.4	0.1	3364	4478	54.4	44.7	26.1	125.2
19/12/86	9:00	9.0	350	3313	1049	62.5	51.3	10.6	124.4
26/10/88	8:00	9.2	355	3224	343	64.5	52.8	7.0	124.3
26/10/88	0:00	7.5	344	3364	3661	54.0	44.6	25.2	123.8
18/11/89	10:00	6.5	18.8	3364	3661	56.3	46.4	20.7	123.4
25/10/88	17:00	8.8	355	3364	4075	53.4	44.1	25.4	122.9
25/3/87	13:00	6.6	359	3707	3565	57.3	46.9	17.8	122.0

Nitrogen Dioxide (NO_2) measured Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	135.7 (85)	45.2%
Limit on Daily Concentration	35.0	23.1%
Limit on Mean Concentration	1.0	1.8%

Table F.3a *Hourly Statistics of Sulphur Dioxide at Mai Po*

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
25/6/86	19:00	12.2	213	4107	2720	643	127.2	185.0	4.0	0.0	316.2
25/6/86	18:00	14.7	224	4107	2720	1097	122.7	177.7	4.1	0.0	304.5
19/7/88	21:00	11.9	219	4107	2308	0	116.9	165.8	10.8	0.0	293.5
19/7/88	23:00	14.6	203	4107	1134	0	113.0	164.3	0.0	0.0	277.3
25/6/86	20:00	12.4	209	4107	2662	267	111.4	161.9	0.0	0.0	273.3
19/7/88	22:00	16.8	217	4107	1770	0	108.6	157.9	2.9	0.0	269.4
28/5/85	1:00	10.6	230	3707	2297	1345	97.4	140.0	20.9	0.0	258.3
28/5/85	10:00	11.2	228	3707	2297	763	96.6	133.9	22.6	0.0	253.1
22/5/87	9:00	11.0	215	3707	1489	0	94.4	130.4	0.0	0.0	224.8
30/7/87	20:00	6.7	229	4107	2662	267	93.1	130.3	0.0	0.0	223.4
23/6/88	13:00	8.0	212	4107	2720	1403	92.6	124.5	0.0	0.0	217.1
22/2/87	10:00	8.7	213	3707	2297	763	90.2	123.3	0.0	0.0	213.5
22/5/85	15:00	9.0	213	3707	2297	1208	78.4	108.1	18.1	0.0	204.6
22/5/88	10:00	7.5	230	3707	2297	763	77.3	101.7	24.5	0.0	203.5
27/5/85	8:00	8.2	234.3	3406	134	0	74.9	103.5	7.6	0.0	186.0
28/5/85	9:00	10.3	225	3707	1489	0	69.6	93.8	22.4	0.0	185.8
22/5/87	8:00	9.8	215	3406	134	0	79.3	106.4	0.0	0.0	185.7
20/4/88	16:00	7.0	206	3707	2297	1210	78.8	104.8	0.0	0.0	183.6
27/5/85	14:00	9.8	229	3707	2297	753	75.2	98.3	9.9	0.0	183.4
20/4/88	15:00	9.3	218	3707	2297	1208	74.9	98.5	9.3	0.0	182.7

Sulphur Dioxide (SO_2) measured Mai Po

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	273.3 (86)	34.2%
Limit on Daily Concentration	46.0	13.2%
Limit on Mean Concentration	1.0	1.3%

Table F.3b Hourly Statistics of Nitrogen Dioxide at Mai Po

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
28/5/85	11:00	10.6	230	3707	2297	1345	62.4	51.1	46.7	7.8	168.0
28/5/85	10:00	11.2	228	3707	2297	763	61.1	48.3	50.1	4.4	163.9
25/6/86	19:00	12.2	213	4107	2720	643	81.9	67.8	9.2	0.8	159.7
19/7/88	21:00	11.9	219	4107	2308	0	74.6	60.2	24.1	0.0	158.9
25/6/86	18:00	14.7	224	4107	2720	1097	78.8	65.0	9.5	1.0	154.3
22/5/88	10:00	7.5	230	3707	2297	763	48.0	36.0	53.9	3.5	141.4
11/4/90	12:00	7.1	221.2	3707	2297	1551	37.8	28.1	63.4	5.8	135.1
19/7/88	22:00	16.8	217	4107	1770	0	69.9	57.8	6.5	0.0	134.2
19/7/88	23:00	14.6	203	4107	1134	0	72.7	60.2	0.0	0.0	132.9
27/5/85	15:00	9.0	213	3707	2297	1208	49.5	38.9	40.1	4.3	132.8
25/6/86	20:00	12.4	209	4107	2662	267	71.7	59.3	0.0	0.0	131.0
28/5/85	9:00	10.3	225	3707	1489	0	43.6	33.5	49.3	1.6	128.0
28/5/85	12:00	12.4	292.5	3707	2297	1551	30.1	23.8	60.7	7.3	121.9
2/9/88	13:00	7.1	222	3364	2297	1684	31.8	23.1	55.8	5.0	115.7
24/8/85	14:00	8.1	227	4107	2720	1071	16.0	11.6	76.5	4.8	108.9
27/5/85	1:00	8.0	228	3707	2297	1345	22.7	17.0	62.4	6.1	108.2
7/6/87	16:00	7.2	233	4107	2720	1423	36.0	26.2	42.0	2.9	107.1
22/5/87	9:00	11.0	215	3707	1489	0	59.7	46.9	0.0	0.0	106.6
30/7/87	20:00	6.7	229	4107	2662	267	59.1	47.1	0.0	0.0	106.2
27/5/85	14:00	9.8	229	3707	2297	753	46.6	34.7	21.6	1.0	103.9

Nitrogen Dioxide (NO_2) measured Mai Po

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	134.2	44.7%
Limit on Daily Concentration	28.0	18.7%
Limit on Mean Concentration	0.8	1.0%

Table F.3c Hourly Statistics of Sulphur Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
29/7/87	10:00	10.6	195	4107	2720	1019	522.5	410.1	0.0	0.0	932.6
29/7/87	9:00	13.3	192	4107	2204	0	531.6	391.7	0.0	0.0	923.3
20/7/88	0:00	8.9	262	4026	215	0	343.7	273.2	0.0	0.0	617.0
29/7/87	11:00	10.2	197	4107	2720	1522	357.9	218.9	0.0	0.0	576.7
25/6/86	21:00	11.7	208	4107	2308	0	343.9	210.2	0.0	0.0	554.1
29/7/87	12:00	9.2	191	4107	2720	1644	339.4	207.7	0.0	0.0	547.1
31/7/87	7:00	12.0	187	3350	0	0	307.0	195.7	0.0	0.0	502.8
29/7/87	8:00	13.0	187	4026	297	0	260.2	161.6	0.0	0.0	421.8
25/6/86	22:00	9.5	204	4107	1770	0	246.1	150.5	0.0	0.0	396.5
31/7/87	8:00	11.1	187	4026	297	0	0.0	0.0	114.0	216.5	330.5
20/7/88	4:00	15.0	202	2768	0	0	0.0	0.0	101.5	198.0	299.5
11/4/90	8:00	13.3	231.8	3406	134	0	0.0	0.0	73.8	216.5	290.4
25/6/86	23:00	8.9	187	4107	1134	0	0.0	0.0	61.1	215.3	276.4
11/4/90	9:00	11.8	202.6	3707	1489	0	0.0	0.0	98.1	178.0	276.1
31/7/87	17:00	9.4	184	4107	2720	1332	169.0	105.6	0.0	0.0	274.6
21/5/87	13:00	7.7	02	3707	2297	1193	159.1	114.0	0.0	0.0	273.0
20/7/88	8:00	7.0	165.5	4026	297	0	0.0	0.0	108.1	164.4	272.5
31/7/87	9:00	10.6	174	4107	2204	0	153.2	117.0	0.0	0.0	270.2
20/7/88	3:00	10.7	221	2885	0	0	0.0	0.0	88.7	180.8	269.5
20/7/88	7:00	6.9	202	3350	0	0	0.0	0.0	57.2	211.3	268.6

Sulphur Dioxide (SO_2) measured Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	576.7 (87)	72.1%
Limit on Daily Concentration	32.0	9.1%
Limit on Mean Concentration	0.9	1.1%

Table F.3d Hourly Statistics of Nitrogen Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
29/7/87	10:00	10.6	195	4107	2720	1019	159.1	72.2	0.0	0.0	231.3
29/7/87	9:00	13.3	192	4107	2204	0	159.1	67.7	0.0	0.0	226.8
20/7/88	0:00	8.9	262	4026	215	0	105.1	48.3	0.0	0.0	153.3
29/7/87	11:00	10.2	197	4107	2720	1522	101.7	35.4	0.0	0.0	137.1
25/6/86	21:00	11.7	208	4107	2308	0	97.9	34.1	0.0	0.0	132.0
29/7/87	12:00	9.2	191	4107	2720	1644	96.3	33.6	0.0	0.0	129.9
31/7/87	7:00	12.0	187	3350	0	0	88.0	32.1	0.0	0.0	120.2
29/7/87	8:00	13	187	4026	297	0	74.0	26.2	0.0	0.0	100.2
24/10/87	12:00	12.8	335	3364	2297	1997	69.9	24.4	0.0	0.0	94.3
26/4/85	15:00	13.2	330	3707	2297	1208	0.0	0.0	21.5	54.8	76.3
25/6/86	22:00	9.5	204	4107	1770	0	0.0	0.0	14.5	57.0	71.5
23/10/87	19:00	12.9	320	3364	2297	1298	0.0	0.0	18.3	48.7	67.0
24/10/87	15:00	10.3	341	3364	2297	1700	46.3	20.4	0.0	0.0	66.7
26/4/85	14:00	13.9	324	3707	2297	753	47.2	19.5	0.0	0.0	66.7
24/10/87	13:00	12	324	3364	2297	1684	0.0	0.0	11.6	54.8	66.5
21/9/88	16:00	10.9	340	3364	2297	1710	48.5	17.3	0.0	0.0	65.8
24/10/87	11:00	12.5	322	3364	2297	1833	0.0	0.0	10.6	52.8	63.4
21/9/88	17:00	9.8	334	3364	2297	1672	0.0	0.0	15.8	44.4	60.3
9/11/90	13:00	10.9	335.4	3364	2297	1684	0.0	0.0	17.2	43.0	60.5
24/10/87	14:00	11.9	320	3364	2297	1288	43.8	15.2	0.0	0.0	59.0

Nitrogen Dioxide (NO_2) measured Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	137.1 (87)	45.7%
Limit on Daily Concentration	17.0	11.3%
Limit on Mean Concentration	0.4	0.5%

Table F.3e Hourly Statistics of Sulphur Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
29/7/87	10:00	10.6	195	4107	2720	1019	326.7	418.7	0.0	0.0	745.5
29/7/87	9:00	13.3	192	4107	2204	0	621.4	413.8	0.0	0.0	735.1
29/7/87	11:00	10.2	197	4107	2720	1522	238.2	288.5	0.0	0.0	526.7
29/7/87	12:00	9.2	191	4107	2720	1644	231.9	278.2	0.0	0.0	510.1
20/7/88	0:00	8.9	262	4026	215	0	213.2	274.7	0.0	0.5	488.4
25/6/86	21:00	11.7	208	4107	2308	0	214.1	265.9	0.0	0.0	480.1
31/7/87	7:00	12	187	3350	0	0	210.3	253.2	0.0	0.0	463.4
29/7/87	8:00	13	187	4026	297	0	185.3	219.3	0.0	0.0	404.6
25/6/86	2:00	9.5	204	4107	1770	0	161.4	196.5	0.0	0.0	357.9
25/6/86	23:00	8.9	187	4107	1134	0	167.6	173.8	0.0	0.0	341.4
31/7/87	17:00	9.4	184	4107	2720	1332	164.1	167.3	0.0	0.0	331.3
21/5/87	13:00	7.7	202	3707	2297	1193	0.0	0.0	64.2	251.7	315.9
20/7/88	8:00	7.0	165.5	4026	297	0	0.0	0.0	67.5	242.9	310.4
21/5/87	14:00	7.1	192	3707	2297	753	150.1	155.9	0.0	0.0	306.0
20/7/88	7:00	6.9	202	350	0	0	137.2	144.7	0.0	0.0	281.9
11/4/90	9:00	11.8	202.6	3707	1489	0	105.0	126.1	0.0	23.0	254.0
29/11/87	7:00	10	194	3350	0	0	93.6	120.7	0.0	32.4	246.7
11/4/90	8:00	13.3	231.8	3406	134	0	123.5	120.7	0.0	0.0	244.2
20/7/88	4:00	15	202	2768	0	0	119.3	124.0	0.0	0.0	243.2
31/7/87	8:00	11.1	187	4026	297	0	120.3	115.3	0.0	0.0	235.6

Sulphur Dioxide (SO_2) measured Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	526.7 (87)	65.8%
Limit on Daily Concentration	47.0	13.5%
Limit on Mean Concentration	1.5	1.9%

Table F.3f *Hourly Statistics of Nitrogen Dioxide at Ha Pak Nai*

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
29/7/87	10:00	10.6	195	4107	2720	1019	174.7	127.5	0.0	0.0	302.3
29/7/87	9:00	13.3	192	4107	2204	0	170.7	125.0	0.0	0.0	295.7
29/7/87	11:00	10.2	197	4107	2720	1522	120.3	83.5	0.0	0.0	203.9
20/7/88	0:00	8.9	262	4026	215	0	114.5	83.9	0.0	0.2	198.6
29/7/87	12:00	9.2	191	4107	2720	1644	116.7	80.4	0.0	0.0	197.1
25/6/86	21:00	11.7	208	4107	2308	0	109.2	77.5	0.0	0.0	186.7
31/7/87	7:00	12	187	3350	0	0	106.5	73.6	0.0	0.0	180.1
29/7/87	8:00	13	187	4026	297	0	93.0	63.3	0.0	0.0	156.2
19/7/88	17:00	13.2	233	4107	2720	1332	81.7	57.0	0.0	0.0	138.7
25/6/86	22:00	9.5	204	4107	1770	0	80.1	48.1	0.0	0.0	128.3
19/7/88	16:00	13.3	231	4107	2720	1423	78.0	46.1	0.0	0.0	124.1
25/6/86	23:00	8.9	187	4107	1134	0	71.8	43.2	0.0	0.0	114.9
31/7/87	17:00	9.4	184	4107	2720	1332	0.0	0.0	16.9	88.8	105.8
21/5/87	13:00	7.7	202	3707	2297	1193	65.5	39.9	0.0	0.0	105.4
20/7/88	8:00	7.0	165.5	4026	297	0	50.0	36.6	0.0	11.1	97.8
11/4/90	8:00	13.3	231.8	3406	134	0	52.9	36.4	0.0	8.1	97.4
11/4/90	9:00	11.8	202.6	3707	1489	0	0.0	0.0	16.8	80.5	97.3
19/7/88	18:00	12.9	247	4107	2720	1097	56.7	34.0	0.0	0.0	90.7
28/5/85	11:00	10.6	230	3707	2297	1345	57.7	32.6	0.0	0.0	90.3
20/7/88	7:00	6.9	202	3350	0	0	52.0	37.6	0.0	0.0	89.7

Nitrogen Dioxide (NO_2) measured Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	203.9 (87)	67.9%
Limit on Daily Concentration	24.0	16.0%
Limit on Mean Concentration	0.7	0.9%

Table F.3g *Hourly Statistics of Sulphur Dioxide at Butterfly Estate*

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
11/7/86	16:00	20.3	280	4107	2720	1423	436.9	598.9	0.0	0.0	1035.8
11/7/86	17:00	18.3	278	4107	2720	1332	436.9	598.9	0.0	0.0	1035.8
11/7/86	19:00	21.7	273	4107	2720	643	436.9	598.9	0.0	0.0	1035.8
11/7/86	20:00	20.2	271	4107	2662	267	436.9	598.9	0.0	0.0	1035.8
11/7/86	21:00	17.7	281	4107	2308	0	436.9	598.9	0.0	0.0	1035.8
11/7/86	22:00	17.2	280	4107	1770	0	436.9	598.9	0.0	0.0	1035.8
11/7/86	23:00	15.4	275	4107	1134	0	433.3	594.0	0.0	0.0	1027.3
12/7/86	0:00	13.1	270	4026	215	0	401.5	515.9	0.0	0.0	917.5
31/7/90	10:00	9.7	276.1	4107	2720	1019	394.9	404.1	0.0	0.0	799.0
31/7/90	9:00	11.4	275.1	4107	2204	0	343.0	369.5	0.0	0.0	712.5
11/7/86	18:00	18	270	4107	2720	1097	218.5	299.4	0.0	0.0	517.9
31/7/90	11:00	7.8	272.2	4107	2720	1522	276.4	231.3	0.0	0.0	507.7
24/6/85	20:00	12.4	284	4107	2662	267	215.6	267.5	0.4	11.3	494.8
11/7/86	15:00	18.2	271	4107	2720	1416	145.6	199.6	14.3	23.3	382.8
23/6/88	14:00	10.7	253	4107	2720	1071	145.6	199.6	0.0	0.0	345.3
25/6/85	2:00	9.7	265	3105	0	0	148.7	152.8	0.0	0.0	301.5
31/7/90	7:00	12.6	284.5	3350	0	0	121.9	157.4	0.0	0.0	279.2
12/7/86	1:00	9.1	245	3501	0	0	119.5	135.8	0.0	0.0	255.3
21/8/86	8:00	6.3	254	4026	297	0	106.6	120.1	1.6	16.1	244.5
21/8/86	20:00	2.0	109	4107	2662	267	176.4	58.8	0.0	0.0	235.1

Sulphur Dioxide (SO_2) measured Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	507.7	63.5%
Limit on Daily Concentration	30.0	8.7%
Limit on Mean Concentration	1.0	1.4%

Table F.3h Hourly Statistics of Nitrogen Dioxide at Butterfly Estate

Date	Time	Wind Speed	Wind Dir	MW CPPS	BP,coal	BP,gas	Concentration CPA	CPB	BP,coal	BP,gas	Total
11/7/86	16:00	20.3	280	4107	2720	1423	213.6	166.5	0.0	0.0	380.1
11/7/86	17:00	18.3	278	4107	2720	1332	213.6	166.5	0.0	0.0	380.1
11/7/86	19:00	21.7	273	4107	2720	643	213.6	166.5	0.0	0.0	380.1
11/7/86	20:00	20.2	271	4107	2662	267	213.6	166.5	0.0	0.0	380.1
11/7/86	21:00	17.7	281	4107	2308	0	213.6	166.5	0.0	0.0	380.1
11/7/86	22:00	17.2	280	4107	1770	0	213.6	166.5	0.0	0.0	380.1
11/7/86	23:00	15.4	275	4107	1134	0	211.8	165.1	0.0	0.0	377.0
12/7/86	0:00	13.1	270	4026	215	0	191.0	140.2	0.0	0.0	331.2
31/7/90	10:00	9.7	276.1	4107	2720	1019	173.5	102.1	0.0	0.0	275.7
31/7/90	9:00	11.4	275.1	4107	2204	0	152.8	94.3	0.0	0.0	247.1
11/7/86	18:00	18.0	270	4107	2720	1097	106.8	83.2	0.0	0.0	190.0
24/6/85	20:00	12.4	284	4107	2662	267	101.1	71.7	0.1	5.8	178.8
31/7/90	11:00	7.8	272.2	4107	2720	1522	116.5	57.5	0.0	0.0	174.0
11/7/89	15:00	18.2	271	4107	2720	1416	71.2	55.5	5.5	12.0	144.1
23/6/88	14:00	10.7	253	4107	2720	1071	71.2	55.5	0.0	0.0	126.7
25/6/85	2:00	9.7	265	3105	0	0	65.4	38.6	0.0	0.0	104.0
31/7/90	7:00	12.6	284.5	3350	0	0	58.1	42.8	0.0	0.0	100.9
21/8/86	20:00	2	109	4107	2662	267	54.2	35.2	0.0	0.0	89.3
8/9/90	16:00	7.9	0.9	3364	2297	1710	48.1	30.9	0.6	8.3	88.0
12/7/86	1:00	9.1	245	3501	0	0	48.4	24.0	3.0	4.5	79.8

Nitrogen Dioxide (NO_2) measured Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	174 (90)	58.0%
Limit on Daily Concentration	22.0	15.0
Limit on Mean Concentration	1.0	1.2%

Table F.3i *Hourly Statistics of Sulphur Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
20/8/86	23:00	9.7	345	4107	1134	0	143.0	205.1	0.0	2.9	351.1
28/11/87	21:00	10.3	15	3364	1985	90	125.6	178.9	0.4	18.0	323.0
14/12/85	22:00	13.3	3	3313	1105	0	128.9	183.5	0.0	0.7	313.1
14/12/85	21:00	11.9	359	3313	1527	0	107.5	155.0	14.8	33.7	311.0
14/12/85	23:00	13.9	8	3280	533	0	108.8	157.4	2.1	37.9	306.2
4/1/86	22:00	11.1	5	3313	1105	0	97.4	141.1	20.5	46.9	305.9
29/3/88	20:00	8.9	353	3707	2101	256	97.2	140.8	20.6	47.2	305.7
30/11/90	18:00	11	355	3364	2297	1579	93.2	135.3	23.5	51.5	303.5
26/10/88	8:00	9.2	355	3224	343	0	103.6	149.6	18.0	31.7	302.9
19/12/86	9:00	9.0	350	3313	1049	0	118.3	169.7	0.0	11.1	299.1
13/11/87	11:00	8.7	360	3364	2297	1833	92.0	133.4	23.4	48.1	296.8
27/2/86	11:00	9.6	354	3313	2548	331	100.5	145.3	4.6	45.5	296.0
29/3/88	21:00	5.9	353	3707	1661	0	94.3	136.8	14.4	48.9	294.4
30/11/90	17:00	9.5	356.8	3364	2297	1672	87.2	126.9	26.0	53.4	293.5
28/11/87	23:00	6.1	353.2	3346	854	0	120.7	171.4	0.0	0.0	292.1
24/11/85	21:00	8.9	358	3364	1985	90	86.3	125.6	26.2	53.8	291.8
19/10/89	18:00	9.3	358.7	3364	2297	1579	96.6	139.8	3.5	48.5	288.4
20/2/86	17:00	6.7	352	3313	2485	256	89.4	130.0	23.1	45.7	288.2
25/10/88	18:00	8.9	353	3364	2297	1579	96.1	139.1	16.6	35.5	287.3
19/12/86	10:00	8.7	355	3313	2310	47	92.7	134.1	21.6	38.7	287.1

Sulphur Dioxide (SO_2) measured Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	306.2 (85)	38.3%
Limit on Daily Concentration	77.0	21.9%
Limit on Mean Concentration	3.0	4.2%

Table F.3j Hourly Statistics of Nitrogen Dioxide at Tung Chung

Date	Time	Wind Speed	Wind Dir	MW			Concentration				
				CPPS	BP,coal	BP,gas	CPA	CPB	BP,coal	BP,gas	Total
30/11/90	18:00	11	355	3364	2297	1579	86.4	70.5	0.0	1.6	158.5
28/11/87	21:00	10.3	15	3364	1985	90	77.6	62.8	0.2	9.9	150.4
20/8/86	23:00	9.7	35	4026	297	0	79.7	64.6	0.0	0.4	144.7
27/2/86	11:00	9.6	354	3313	2548	331	64.0	52.5	5.8	17.8	140.0
13/11/87	11:00	8.7	360	3364	2297	1833	63.8	52.4	0.8	20.0	137.0
19/10/89	18:00	9.3	358.7	3364	2297	1579	56.9	46.9	8.0	24.8	136.6
25/10/88	18:00	8.9	353	3364	2297	1579	56.8	46.8	8.1	24.9	136.5
14/12/85	21:00	11.9	359	3313	1527	0	71.7	58.5	0.0	5.9	136.0
29/3/88	20:00	8.9	353	3707	2101	256	75.1	60.6	0.0	0.0	135.7
20/2/86	17:00	6.7	352	3313	2485	256	61.2	50.3	7.1	16.7	135.3
26/10/88	10:00	7.5	344	3364	2297	1283	54.0	44.6	9.2	27.2	135.0
18/11/89	12:00	10.4	0.1	3364	2297	1997	59.3	48.7	1.8	24.0	133.8
25/10/88	17:00	8.8	355	3264	2297	1672	53.4	44.1	9.2	25.4	132.0
25/10/88	19:00	7.7	359	3364	2297	1298	54.9	45.3	5.6	25.8	131.5
19/12/86	10:00	8.7	355	3313	2310	47	56.6	46.6	1.4	25.6	130.2
14/12/85	22:00	13.3	3	3313	1105	0	50.2	41.5	10.2	28.2	130.0
30/11/90	19:00	7.4	5.8	3364	2297	1298	49.5	41.0	10.3	28.4	129.2
25/10/88	20:00	9.6	358	3364	2265	585	70.0	57.1	0.0	2.0	129.1
18/11/89	10:00	6.5	18.8	3364	2297	1283	54.4	44.7	8.5	20.4	128.0
26/10/88	9:00	6.4	356	3364	1963	60	56.3	46.4	6.5	18.8	127.9

Nitrogen Dioxide (NO_2) measured Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	135.3 (86)	45.1%
Limit on Daily Concentration	42.0	28.1%
Limit on Mean Concentration	2.0	2.3%

Table F.4a *Hourly Statistics of Sulphur Dioxide at Mai Po Nature Reserve*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
28/5/85	11:00	10.6	230.0	333.0	97.4	140.0	95.7
25/6/86	19:00	12.2	213.0	237.1	127.3	185.0	14.7
25/6/86	18:00	14.7	224.0	316.6	122.7	177.7	16.1
28/5/85	10:00	11.2	228.0	313.7	96.6	133.9	83.2
19/7/88	21:00	11.9	219.0	312.3	116.9	165.8	29.5
19/7/88	23:00	14.6	203.0	277.4	113.1	164.3	0.0
19/7/88	22:00	16.8	217.0	274.6	108.6	157.9	8.1
25/6/86	20:00	12.4	209.0	273.3	111.4	161.9	0.0
22/5/88	10:00	7.5	230.0	264.4	77.3	101.7	85.3
27/5/85	15:00	9.0	213.0	258.1	78.4	108.1	71.5
11/4/90	12:00	7.1	221.2	253.6	61.1	79.7	112.8
28/5/85	12:00	12.4	292.5	228.2	47.7	66.0	114.5
28/5/85	9:00	10.3	225.0	227.4	69.6	93.8	63.9
22/5/87	9:00	11.0	215.0	224.8	94.4	130.4	0.0
30/7/87	20:00	6.7	229.0	223.3	93.1	130.3	0.0
23/6/88	13:00	8.0	212.0	217.1	92.6	124.5	0.0
22/5/87	10:00	8.7	213.0	213.6	90.2	123.3	0.0
2/9/88	13:00	7.1	222.0	207.7	51.9	66.3	89.5
20/4/88	15:00	9.3	218.0	205.5	74.9	98.5	32.0
27/5/85	14:00	9.8	229.0	205.1	75.2	98.3	31.5

Sulphur Dioxide (SO_2) measured at Mai Po Nature Reserve

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	274.6	34.3%
Limit on Dailly Concentration	52.23	14.92%
Limit on Mean Concentration	1.29	1.62%

Table F.4b Hourly Statistics of Nitrogen Dioxide at Mai Po Nature Reserve

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
28/5/85	11:00	10.6	230.0	165.4	62.4	51.1	51.9
25/6/86	19:00	12.2	213.0	157.8	81.9	67.8	8.1
28/5/86	10:00	11.2	228.0	154.0	61.1	48.3	44.6
25/6/86	18:00	14.7	224.0	152.7	78.8	65.0	8.9
19/7/88	21:00	11.9	219.0	150.8	74.6	60.3	16.0
19/7/88	23:00	14.6	203.0	132.9	72.7	60.2	0.0
19/7/88	22:00	16.8	217.0	132.1	69.9	57.8	4.4
25/6/86	20:00	12.4	209.0	131.0	71.7	59.3	0.0
22/5/88	10:00	7.5	230.0	129.0	48.0	36.0	45.0
27/5/85	15:00	9.0	213.0	126.7	49.5	38.9	38.3
11/4/90	12:00	7.1	221.2	125.5	37.8	28.1	59.5
28/5/85	12:00	12.4	292.5	115.1	30.1	23.8	61.2
28/5/85	9:00	10.3	225.0	111.0	43.6	33.5	34.0
22/5/87	9:00	11.0	215.0	106.6	59.7	46.9	0.0
30/7/87	20:00	6.7	229.0	106.2	59.1	47.1	0.0
23/6/88	13:00	8.0	212.0	102.3	57.9	44.4	0.0
2/9/88	13:00	7.1	222.0	101.5	31.8	23.1	46.7
22/5/87	10:00	8.7	213.0	101.0	56.8	44.2	0.0
27/5/85	11:00	8.0	228.0	99.0	22.7	17.0	59.3
20/4/88	15:00	9.3	218.0	98.1	46.5	34.8	16.8

Nitrogen Dioxide (NO_2) measured at Mai Po Nature Reserve

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	152.7 (86)	50.9%
Limit on Dailly Concentration	24.97	16.65%
Limit on Mean Concentration	0.61	0.76%

Table F.4c *Hourly Statistics of Sulphur Dioxide at Lung Kwu Tan*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
29/7/87	10:00	10.6	195.0	932.6	522.5	410.1	0.0
29/7/87	9:00	13.3	192.0	923.3	531.6	391.7	0.0
20/7/88	0:00	8.9	262.0	617.0	343.7	273.2	0.0
29/7/87	11:00	10.2	197.0	576.7	347.9	218.9	0.0
25/7/86	21:00	11.7	208.0	554.1	343.9	210.2	0.0
29/7/87	12:00	9.2	191.0	547.1	339.4	207.7	0.0
31/7/87	7:00	12.0	187.0	502.8	307.0	195.7	0.0
29/7/87	8:00	13.0	187.0	421.8	260.2	161.6	0.0
25/6/86	22:00	9.5	204.0	396.5	246.1	150.5	0.0
31/7/87	8:00	11.1	187.0	274.6	169.0	105.6	0.0
20/7/88	4:00	15.0	202.0	273.0	159.1	114.0	0.0
11/4/90	8:00	13.3	231.8	270.2	153.2	117.0	0.0
25/6/86	23:00	8.9	187.0	248.8	154.1	94.8	0.0
11/4/90	9:00	11.8	202.6	248.4	154.2	94.3	0.0
24/10/87	12:00	12.8	335.0	233.3	0.0	0.0	233.3
31/7/87	17:00	9.4	184.0	227.9	141.0	86.8	0.0
21/5/87	13:00	7.7	202.0	223.2	138.1	85.1	0.0
20/7/88	8:00	7.0	165.5	206.8	127.1	79.7	0.0
24/10/87	15:00	10.3	341.0	204.6	0.0	0.0	204.6
31/7/87	9:00	10.6	174.0	196.6	122.0	74.6	0.0

Sulphur Dioxide (SO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	576.7 (87)	72.1%
Limit on Dailly Concentration	49.68	14.19%
Limit on Mean Concentration	1.17	1.46%

Table F.4d   Hourly Statistics of Nitrogen Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
29/7/87	10:00	10.6	195.0	231.3	159.1	72.2	0.0
29/7/87	9:00	13.3	192.0	226.8	159.1	67.7	0.0
20/7/88	0:00	8.9	262.0	153.3	105.1	48.3	0.0
29/7/87	11:00	10.2	197.0	137.1	101.7	35.4	0.0
25/6/86	21:00	11.7	208.0	132.0	97.9	34.1	0.0
29/7/87	12:00	9.2	191.0	129.9	96.3	33.6	0.0
31/7/87	7:00	12.0	187.0	120.2	88.0	32.1	0.0
29/7/87	8:00	13.0	187.0	100.2	74.0	26.2	0.0
25/6/86	22:00	9.5	204.0	94.3	69.9	24.4	0.0
11/4/90	8:00	13.3	231.8	66.7	46.3	20.4	0.0
20/7/88	4:00	15.0	202.0	66.7	47.2	19.5	0.0
31/7/87	8:00	11.1	187.0	65.8	48.5	7.3	0.0
11/4/90	9:00	11.8	202.6	59.0	43.8	15.2	0.0
24/10/87	12:00	12.8	335.0	58.9	0.0	0.0	58.9
25/6/86	23:00	8.9	187.0	57.9	42.9	15.0	0.0
31/7/87	17:00	9.4	184.0	52.8	39.1	13.7	0.0
21/5/87	13:00	7.7	202.0	51.9	38.4	13.5	0.0
26/4/85	15:00	13.2	330.0	51.7	0.0	0.0	51.7
24/10/87	15:00	10.3	341.0	50.0	0.0	0.0	50.0
20/7/88	8:00	7.0	165.5	47.9	35.3	12.5	0.0

Nitrogen Dioxide (NO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	137.1 (87)	45.7%
Limit on Dailly Concentration	11.22	7.48%
Limit on Mean Concentration	0.21	0.27%

Table F.4e Hourly Statistics of Sulphur Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
29/7/87	10:00	10.6	195.0	745.5	326.7	418.7	0.0
29/7/87	9:00	13.3	192.0	735.1	321.4	413.8	0.0
29/7/87	11:00	10.2	197.0	526.7	238.1	288.5	0.0
29/7/87	12:00	9.2	191.0	51.01	231.9	278.2	0.0
20/7/88	0:00	8.9	262.0	488.3	213.2	274.7	0.4
25/6/86	21:00	11.7	208.0	480.1	214.1	265.9	0.0
31/7/87	7:00	12.0	187.0	163.4	210.3	253.2	0.0
29/7/87	8:00	13.0	187.0	404.6	185.3	219.3	0.0
25/6/86	22:00	9.5	204.0	357.9	161.4	196.5	0.0
25/6/86	23:00	8.9	187.0	341.4	167.6	173.8	0.0
31/7/87	17:00	9.4	184.0	331.3	164.1	167.3	0.0
19/7/88	17:00	13.2	233.0	318.8	0.0	0.0	318.8
19/7/88	16:00	13.3	231.0	316.2	0.0	0.0	316.2
21/5/87	13:00	7.7	202.0	306.0	150.1	155.9	0.0
20/7/88	8:00	7.0	165.5	281.9	137.2	144.7	0.0
11/4/90	9:00	11.8	202.6	250.7	105.0	126.1	19.6
21/5/87	14:00	7.1	192.0	244.2	123.5	120.7	0.0
20/7/88	7:00	6.9	202.0	243.2	119.3	124.0	0.0
11/4/90	8:00	13.3	231.8	241.1	93.6	120.7	26.8
28/5/85	11:00	10.6	230.0	237.1	0.0	0.0	237.1

Sulphur Dioxide (SO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	526.7 (87)	65.8%
Limit on Dailly Concentration	60.13	17.18%
Limit on Mean Concentration	1.59	1.99%

Table F.4f   Hourly Statistics of Nitrogen Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
29/7/87	10:00	10.6	195.0	302.3	174.7	127.5	0.0
29/7/87	9:00	13.3	192.0	295.7	170.7	125.0	0.0
29/7/87	11:00	10.2	197.0	203.9	120.3	83.5	0.0
20/7/88	0:00	8.9	262.0	198.6	114.5	83.9	0.1
29/7/87	12:00	9.2	191.0	197.1	116.7	80.4	0.0
25/6/86	21:00	11.7	208.0	186.7	109.2	77.5	0.0
31/7/87	7:00	12.0	187.0	180.1	106.5	73.6	0.0
29/7/87	8:00	13.0	187.0	156.2	93.0	63.3	0.0
25/6/86	22:00	9.5	204.0	138.7	81.7	57.0	0.0
25/6/86	23:00	8.9	187.0	128.3	80.1	48.1	0.0
31/7/87	17:00	9.4	184.0	124.1	78.0	46.1	0.0
21/5/87	13:00	7.7	202.0	114.9	71.8	43.2	0.0
19/7/87	17:00	13.2	233.0	112.6	0.0	0.0	112.6
20/7/88	8:00	7.0	165.5	05.4	65.5	39.9	0.0
19/7/88	16:00	13.3	231.0	05.1	0.0	0.0	105.1
11/4/90	9:00	11.8	202.6	96.2	52.9	36.4	6.9
11/4/90	8:00	13.3	231.8	95.9	50.0	36.6	9.3
20/7/88	7:00	6.9	202.0	90.7	56.7	34.0	0.0
21/5/87	14:00	7.1	192.0	90.3	57.7	32.6	0.0
20/7/88	4:00	15.0	202.0	89.7	52.0	37.6	0.0

Nitrogen Dioxide (NO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	203.9 (87)	67.9%
Limit on Dailly Concentration	21.61	14.41%
Limit on Mean Concentration	0.48	0.60%

Table F.4g Hourly Statistics of Sulphur Dioxide at Butterfly Estate

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
11/7/86	16:00	20.3	280.0	1035.8	436.9	598.9	0.0
11/7/86	17:00	18.3	278.0	1035.8	436.9	598.9	0.0
11/7/86	19:00	21.7	273.0	1035.8	436.9	598.9	0.0
11/7/86	20:00	20.2	271.0	1035.8	436.9	598.9	0.0
11/7/86	21:00	17.7	281.0	1035.8	436.9	598.9	0.0
11/7/86	22:00	17.2	280.0	1035.8	436.9	598.9	0.0
11/7/86	23:00	15.4	275.0	1027.3	433.3	594.0	0.0
12/7/86	0:00	13.1	270.0	917.5	401.5	515.9	0.0
31/7/90	10:00	9.7	276.1	799.0	394.9	404.1	0.0
31/7/90	9:00	11.4	275.1	712.5	343.0	369.5	0.0
11/7/86	18:00	18.0	270.0	517.9	218.5	299.4	0.0
31/7/90	11:00	7.8	272.2	507.7	276.4	231.3	0.0
24/6/85	20:00	12.4	284.0	504.2	215.6	267.5	21.1
11/7/86	15:00	18.2	271.0	379.6	145.6	199.6	34.4
23/6/88	14:00	10.7	253.0	345.3	145.6	199.6	0.0
25/6/85	2:00	9.7	265.0	301.5	148.7	152.8	0.0
31/7/90	7:00	12.6	284.5	279.2	121.9	157.4	0.0
12/7/86	1:00	9.1	245.0	255.3	119.5	135.8	0.0
8/9/90	16:00	7.9	0.9	245.8	115.0	95.3	35.5
21/8/86	20:00	2.0	109.0	244.1	106.6	120.1	17.4

Sulphur Dioxide (SO_2) measured at Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	507.7 (90)	63.5%
Limit on Dailly Concentration	45.94	13.13%
Limit on Mean Concentration	2.05	2.56%

Table F.4h Hourly Statistics of Nitrogen Dioxide at Butterfly Estate

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
11/7/86	16:00	20.3	280.0	380.1	213.6	166.5	0.0
11/7/86	17:00	18.3	278.0	380.1	213.6	166.5	0.0
11/7/86	19:00	21.7	273.0	380.1	213.6	166.5	0.0
11/7/86	20:00	20.2	271.0	380.1	213.6	166.5	0.0
11/7/86	21:00	17.7	281.0	380.1	213.6	166.5	0.0
11/7/86	2:00	17.2	280.0	380.1	213.6	166.5	0.0
11/7/86	23:00	15.4	275.0	377.0	211.8	165.1	0.0
12/7/86	0:00	13.1	270.0	331.2	191.0	140.2	0.0
31/7/90	10:00	9.7	276.1	275.7	173.5	102.1	0.0
31/7/90	9:00	11.4	275.1	247.1	152.8	94.3	0.0
11/7/86	18:00	18.0	270.0	190.0	106.8	83.2	0.0
24/6/85	20:00	12.4	284.0	183.4	101.1	71.7	10.6
31/7/90	11:00	7.8	272.2	174.0	116.5	57.5	0.0
11/7/86	15:00	18.2	271.0	144.4	71.2	55.5	17.7
23/6/88	14:00	10.7	253.0	126.7	71.2	55.5	0.0
25/6/85	2:00	9.7	265.0	104.0	65.4	38.6	0.0
31/7/90	7:00	2.6	284.5	100.9	58.1	42.8	0.0
8/9/90	16:00	7.9	0.9	90.1	48.4	24.0	17.8
12/7/86	1:00	9.1	245.0	89.3	54.2	35.2	0.0
21/8/86	20:00	2.0	109.0	88.0	48.1	30.9	9.0

Nitrogen Dioxide (NO_2) measured at Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	174 (90)	58.0%
Limit on Daily Concentration	18.63	12.42%
Limit on Mean Concentration	0.75	0.93%

Table F.4i *Hourly Statistics of Sulphur Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
30/11/90	18:00	11.0	355.0	357.6	107.5	155.0	95.0
20/8/86	23:00	9.7	345.0	357.2	143.0	205.1	9.0
13/11/87	11:00	8.7	360.0	344.6	103.6	149.6	91.5
19/10/89	18:00	9.3	358.7	339.6	97.4	141.1	101.0
25/10/88	18:00	8.9	353.0	339.1	97.2	140.8	101.1
28/11/87	21:00	10.3	15.0	335.4	125.6	178.9	30.8
26/10/88	10:00	7.5	344.0	332.8	93.2	135.3	104.3
25/10/88	17:00	8.8	355.0	329.1	92.0	133.4	103.8
18/11/89	12:00	10.4	0.1	329.0	92.7	134.1	102.2
27/2/86	11:00	9.6	354.0	322.1	100.5	145.3	76.3
29/3/88	20:00	8.9	353.0	320.3	108.8	157.4	54.1
19/10/89	17:00	8.6	348.2	320.1	87.2	126.9	106.0
25/10/88	19:00	7.7	359.0	319.1	94.3	136.8	88.0
14/12/85	21:00	11.9	359.0	318.9	118.3	169.7	30.9
14/12/85	22:00	13.3	3.0	318.4	128.9	183.5	5.9
30/10/88	17:00	7.4	349.0	317.6	86.3	125.6	105.8
18/11/89	10:00	6.5	18.8	317.2	96.1	139.1	82.0
7/10/89	16:00	7.2	357.7	311.2	89.4	130.0	91.7
30/11/90	19:00	7.4	5.8	311.0	93.2	135.0	82.8
20/2/86	17:00	6.7	352.0	308.3	96.6	139.8	71.9

Sulphur Dioxide (SO_2) measured at Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	329.1 (88)	41.1%
Limit on Dailly Concentration	85.10	24.31%
Limit on Mean Concentration	3.70	4.63%

Table F.4j *Hourly Statistics of Nitrogen Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, HFO
30/11/90	18:00	11.0	355.0	167.0	64.0	52.5	50.6
20/8/86	23:00	9.7	345.0	161.8	86.4	70.5	4.9
13/11/87	11:00	8.7	360.0	160.1	61.2	50.3	48.5
28/11/87	21:00	10.3	15.0	157.2	77.6	62.8	16.8
19/10/89	18:00	9.3	358.7	157.1	56.9	46.9	53.3
25/10/88	18:00	8.9	353.0	156.9	56.8	46.8	53.4
26/10/88	10:00	7.5	344.0	153.5	54.0	44.6	54.9
18/11/89	12:00	10.4	0.1	153.1	54.4	44.7	54.0
25/10/88	17:00	8.8	355.0	152.2	53.4	44.1	54.6
27/2/86	11:00	9.6	354.0	148.4	59.3	48.7	40.4
14/12/85	22:00	13.3	3.0	147.5	79.7	64.6	3.2
19/10/89	17:00	8.6	348.2	147.3	50.2	41.5	55.6
14/12/85	21:00	11.9	359.0	146.8	71.7	58.5	16.6
25/10/88	19:00	7.7	359.0	146.5	54.9	45.3	46.4
30/10/88	17:00	7.4	349.0	146.1	49.5	41.0	55.5
18/11/89	10:00	6.5	18.8	146.0	56.3	46.4	43.3
29/3/88	20:00	8.9	353.0	144.8	63.8	52.4	28.6
30/11/90	19:00	7.4	5.8	143.1	54.5	44.9	43.7
7/10/89	16:00	7.2	357.7	142.2	51.5	42.6	48.2
20/2/86	17:00	6.7	352.0	141.2	56.6	46.6	38.0

Nitrogen Dioxide (NO_2) measured at Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	152.2 (88)	50.7%
Limit on Dailly Concentration	37.53	25.02%
Limit on Mean Concentration	1.59	1.99%

Table F.5a *Hourly Statistics of Sulphur Dioxide at Mai Po*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
25/6/86	19:00	12.2	213.0	327.6	127.3	185.0	15.2
28/5/85	11:00	10.6	230.0	318.2	97.4	140.0	80.8
25/6/86	18:00	4.7	224.0	316.8	122.7	177.7	16.3
19/7/88	21:00	11.9	219.0	308.0	116.9	165.8	25.2
28/5/85	10:00	11.2	228.0	288.4	96.6	133.9	57.9
19/7/88	23:00	14.6	203.0	277.4	113.1	164.3	0.0
19/7/88	22:00	6.8	217.0	274.0	108.6	157.9	7.5
25/6/86	20:00	12.4	209.0	273.3	111.4	161.9	0.0
27/5/85	15:00	9.0	213.0	236.2	78.4	108.1	49.7
22/5/87	9:00	11.0	215.0	224.8	94.4	130.4	0.0
22/5/88	10:00	7.5	230.0	224.3	77.3	101.7	45.3
30/7/87	20:00	6.7	229.0	223.3	93.1	130.3	0.0
23/6/88	13:00	8.0	212.0	217.1	92.6	124.5	0.0
22/5/87	10:00	8.7	213.0	213.6	90.2	123.3	0.0
11/4/90	12:00	7.1	221.2	202.1	61.1	79.7	61.3
28/5/85	9:00	10.3	225.0	202.1	69.6	93.8	38.7
27/5/85	8:00	8.2	234.3	191.3	74.9	103.5	12.9
28/5/85	12:00	12.4	292.5	191.1	47.7	66.0	77.4
27/5/85	14:00	9.8	229.0	189.8	75.2	98.3	16.3
20/4/88	15:00	9.3	218.0	188.8	74.9	98.5	15.4

Sulphur Dioxide (SO_2) measured at Mai Po Nature Reserve

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	274.0 (88)	34.3%
Limit on Dailly Concentration	46.64	13.33%
Limit on Mean Concentration	1.10	1.38%

Table F.5b Hourly Statistics of Nitrogen Dioxide at Mai Po

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
25/6/86	19:00	12.2	213.0	155.9	81.9	67.8	6.3
25/6/86	18:00	14.7	224.0	150.6	78.8	65.0	6.7
28/5/85	11:00	10.6	230.0	146.3	62.4	51.1	32.8
19/7/88	21:00	11.9	219.0	145.0	74.6	60.2	10.2
19/7/88	23:00	14.6	203.0	132.9	72.7	60.2	0.0
28/5/85	10:00	11.2	228.0	132.7	61.1	48.3	23.3
25/6/86	20:00	12.4	209.0	131.0	71.7	59.3	0.0
19/7/88	22:00	16.8	217.0	130.7	69.9	57.8	3.0
27/5/85	15:00	9.0	213.0	108.4	49.5	38.9	19.9
22/5/87	9:00	11.0	215.0	106.6	59.7	46.9	0.0
30/7/87	20:00	6.7	229.0	106.2	59.1	47.1	0.0
23/6/88	13:00	8.0	212.0	102.3	57.9	44.4	0.0
22/5/88	10:00	7.5	230.0	101.9	48.0	36.0	17.9
22/5/87	10:00	8.7	213.0	101.0	56.8	44.2	0.0
28/5/85	9:00	10.3	225.0	92.5	43.6	33.5	15.4
11/4/90	12:00	7.1	221.2	90.2	37.8	28.1	24.2
27/5/85	8:00	8.2	234.3	89.8	47.3	37.3	5.2
27/5/85	14:00	9.8	229.0	87.7	46.6	34.7	6.4
22/5/87	8:00	9.8	215.0	87.5	49.6	37.9	0.0
20/4/88	15:00	9.3	218.0	87.4	46.5	34.8	6.0

Nitrogen Dioxide (NO_2) measured at Mai Po Nature Reserve

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	131 (86)	43.7%
Limit on Dailly Concentration	22.12	14.74%
Limit on Mean Concentration	0.48	0.60%

Table F.5c   Hourly Statistics of Sulphur Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
29/7/87	10:00	10.6	195.0	932.6	522.5	410.1	0.0
29/7/87	9:00	13.3	192.0	923.3	531.6	391.7	0.0
20/7/88	0:00	8.9	262.0	617.0	343.7	273.2	0.0
29/7/87	11:00	10.2	197.0	576.7	357.9	218.9	0.0
25/6/86	21:00	11.7	208.0	554.1	343.9	210.2	0.0
29/7/87	12:00	9.2	191.0	547.1	339.4	207.7	0.0
31/7/87	7:00	12.0	187.0	502.8	307.0	195.7	0.0
29/7/87	8:00	13.0	187.0	421.8	260.2	161.6	0.0
25/6/86	22:00	9.5	204.0	396.5	246.1	150.5	0.0
24/10/87	12:00	12.8	335.0	330.1	0.0	0.0	330.1
24/10/87	11:00	12.5	322.0	309.0	0.0	0.0	309.0
24/10/87	15:00	10.3	341.0	306.5	0.0	0.0	306.5
21/9/88	16:00	10.9	340.0	297.2	0.0	0.0	297.2
21/9/88	17:00	9.8	334.0	288.7	0.0	0.0	288.7
24/10/90	17:00	8.1	336.1	286.7	0.0	0.0	286.7
24/10/87	13:00	12.0	324.0	285.3	0.0	0.0	285.3
9/11/90	13:00	10.9	335.4	279.7	0.0	0.0	279.7
25/10/88	15:00	10.9	343.0	275.2	0.0	0.0	275.2
31/7/87	8:00	11.1	187.0	274.6	169.0	105.6	0.0
26/4/85	15:00	13.2	330.0	274.1	0.0	0.0	274.1

Sulphur Dioxide (SO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	576.7 (87)	72.1%
Limit on Dailly Concentration	85.41	24.40%
Limit on Mean Concentration	2.55	3.19%

Table F.5d Hourly Statistics of Nitrogen Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
29/7/87	10:00	10.6	195.0	231.3	159.1	72.2	0.0
29/7/87	9:00	13.3	192.0	226.8	159.1	67.7	0.0
20/7/88	0:00	8.9	262.0	153.3	105.1	48.3	0.0
29/7/87	11:00	10.2	197.0	137.1	101.7	35.4	0.0
25/6/86	21:00	11.7	208.0	132.0	97.9	34.1	0.0
29/7/87	12:00	9.2	191.0	129.9	96.3	33.6	0.0
31/7/87	7:00	12.0	187.0	120.2	88.0	32.1	0.0
29/7/87	8:00	13.0	187.0	100.2	74.0	26.2	0.0
25/6/86	22:00	9.5	204.0	94.3	69.9	24.4	0.0
11/4/90	8:00	13.3	231.8	66.7	46.3	20.4	0.0
20/7/88	4:00	15.0	202.0	66.7	47.2	19.5	0.0
31/7/87	8:00	11.1	187.0	65.8	48.5	17.3	0.0
24/10/87	12:00	12.8	335.0	62.1	0.0	0.0	62.1
11/4/90	9:00	11.8	202.6	59.0	43.8	15.2	0.0
25/6/86	23:00	8.9	187.0	57.9	42.9	15.0	0.0
24/10/87	15:00	10.3	341.0	55.2	0.0	0.0	55.2
26/4/85	15:00	13.2	330.0	53.6	0.0	0.0	53.6
24/10/87	11:00	12.5	322.0	53.5	0.0	0.0	53.5
31/7/87	17:00	9.4	184.0	52.8	39.1	13.7	0.0
21/9/88	16:00	10.9	340.0	51.9	0.0	0.0	51.9

Nitrogen Dioxide (NO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	137.1 (87)	45.7%
Limit on Dailly Concentration	14.76	9.84%
Limit on Mean Concentration	0.36	0.45%

Table F.5e *Hourly Statistics of Sulphur Dioxide at Ha Pak Nai*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
29/7/87	10:00	10.6	195.0	745.5	326.7	418.7	0.0
29/7/87	9:00	13.3	192.0	735.1	321.4	413.8	0.0
29/7/87	11:00	10.2	197.0	526.7	238.2	288.5	0.0
29/7/87	12:00	9.2	191.0	510.1	231.9	278.2	0.0
20/7/88	0:00	8.9	262.0	488.2	213.2	274.7	0.4
25/6/86	21:00	11.7	208.0	480.1	214.1	265.9	0.0
31/7/87	7:00	12.0	187.0	463.4	210.3	253.2	0.0
29/7/87	8:00	13.0	187.0	404.6	185.3	219.3	0.0
25/6/86	22:00	9.5	204.0	357.9	161.4	196.5	0.0
25/6/86	23:00	8.9	187.0	341.4	167.6	173.8	0.0
31/7/87	17:00	9.4	184.0	331.3	164.1	167.3	0.0
21/5/87	3:00	7.7	202.0	306.0	150.1	155.9	0.0
20/7/88	8:00	7.0	165.5	281.9	137.2	144.7	0.0
19/7/88	17:00	13.2	233.0	261.7	0.0	0.0	261.7
19/7/88	16:00	13.3	231.0	254.7	0.0	0.0	254.7
11/4/90	9:00	11.8	202.6	247.2	105.0	126.1	16.1
21/5/87	4:00	7.1	192.0	244.2	123.5	120.7	0.0
20/7/88	7:00	6.9	202.0	243.2	119.5	124.0	0.0
29/7/88	7:00	10.0	194.0	235.6	120.3	115.3	0.0
11/4/90	8:00	13.3	231.8	235.3	93.6	120.7	21.0

Sulphur Dioxide (SO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	526.7 (87)	65.8%
Limit on Dailly Concentration	52.31	14.95%
Limit on Mean Concentration	1.50	1.88%

Table F.5f Hourly Statistics of Nitrogen Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
29/7/87	10:00	10.6	195.0	302.3	174.7	127.5	0.0
29/7/87	9:00	13.3	192.0	295.7	170.7	125.0	0.0
29/7/87	11:00	10.2	197.0	203.9	120.3	83.5	0.0
20/7/88	0:00	8.9	262.0	198.5	114.5	83.9	0.1
29/7/87	12:00	9.2	191.0	197.1	116.7	80.4	0.0
25/6/86	21:00	11.7	208.0	186.7	109.2	77.5	0.0
31/7/87	7:00	12.0	187.0	180.1	106.5	73.6	0.0
29/7/87	8:00	13.0	187.0	156.2	93.0	63.3	0.0
25/6/86	22:00	9.5	204.0	138.7	81.7	57.0	0.0
25/6/86	23:00	8.9	187.0	128.3	80.1	48.1	0.0
31/7/87	17:00	9.4	184.0	124.1	78.0	46.1	0.0
21/5/87	13:00	7.7	202.0	114.9	71.8	43.2	0.0
20/7/88	8:00	7.0	165.5	105.4	65.5	39.9	0.0
11/4/90	9:00	11.8	202.6	93.5	52.9	36.4	4.2
11/4/90	8:00	13.3	231.8	92.1	50.0	36.6	5.5
20/7/88	7:00	6.9	202.0	90.7	56.7	34.0	0.0
21/5/87	14:00	7.1	192.0	90.3	57.7	32.6	0.0
20/7/88	4:00	15.0	202.0	89.7	52.0	37.6	0.0
31/7/87	8:00	11.1	187.0	86.8	50.1	36.7	0.0
29/7/87	7:00	10.0	194.0	86.8	55.9	30.9	0.0

Nitrogen Dioxide (NO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	203.9 (87)	68.0%
Limit on Dailly Concentration	16.91	11.27%
Limit on Mean Concentration	0.43	0.53%

Table F.5g *Hourly Statistics of Sulphur Dioxide at Butterfly Estate*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
11/7/86	16:00	20.3	280.0	1035.8	436.9	598.9	0.0
11/7/86	17:00	18.3	278.0	1035.8	436.9	598.9	0.0
11/7/86	19:00	21.7	273.0	1035.8	436.9	598.9	0.0
11/7/86	20:00	20.2	271.0	1035.8	436.9	598.9	0.0
11/7/86	21:00	17.7	281.0	1035.8	436.9	598.9	0.0
11/7/86	22:00	17.2	280.0	1035.8	436.9	598.9	0.0
11/7/86	23:00	15.4	275.0	1027.3	433.3	594.0	0.0
12/7/86	0:00	13.1	270.0	917.5	401.5	515.9	0.0
31/7/90	10:00	9.7	276.1	799.0	394.9	404.1	0.0
31/7/90	9:00	11.4	275.1	712.5	343.0	369.5	0.0
11/7/86	18:00	18.0	270.0	517.9	218.0	299.4	0.0
31/7/90	11:00	7.8	272.2	507.7	276.4	231.3	0.0
24/6/85	20:00	12.4	284.0	500.2	215.6	267.5	17.0
11/7/86	15:00	18.2	271.0	398.2	145.6	199.6	52.9
23/6/88	14:00	10.7	253.0	345.3	145.6	199.6	0.0
25/6/85	2:00	9.7	265.0	301.5	148.7	152.8	0.0
31/7/90	7:00	12.6	284.5	279.2	121.9	157.4	0.0
12/7/86	1:00	9.1	245.0	255.3	119.5	135.8	0.0
21/8/86	20:00	2.0	109.0	252.5	106.6	120.1	25.8
21/8/86	8:00	6.3	254.0	235.1	176.4	58.8	0.0

Sulphur Dioxide (SO_2) measured at Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	507.7 (90)	63.5%
Limit on Dailly Concentration	48.61	13.89%
Limit on Mean Concentration	2.01	2.51%

Table F.5h *Hourly Statistics of Nitrogen Dioxide at Butterfly Estate*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
11/7/86	16:00	20.3	280.0	380.1	213.6	166.5	0.0
11/7/86	17:00	18.3	278.0	380.1	213.6	166.5	0.0
11/7/86	19:00	21.7	273.0	380.1	213.6	166.5	0.0
11/7/86	20:00	20.2	271.0	380.1	213.6	166.5	0.0
11/7/86	21:00	17.7	281.0	380.1	213.6	166.5	0.0
11/7/86	22:00	17.2	280.0	380.1	213.6	166.5	0.0
11/7/86	23:00	15.4	275.0	377.0	211.8	165.1	0.0
12/7/86	0:00	13.1	270.0	331.2	191.0	140.2	0.0
31/7/90	10:00	9.7	276.1	275.7	173.5	102.1	0.0
31/7/90	9:00	11.4	275.1	247.1	152.8	94.3	0.0
11/7/86	18:00	18.0	270.0	190.0	106.8	83.2	0.0
24/6/85	20:00	12.4	284.0	179.4	101.1	71.7	6.6
31/7/90	11:00	7.8	272.2	174.0	116.5	57.5	0.0
11/7/86	15:00	18.2	271.0	147.1	71.2	55.5	20.4
23/6/88	14:00	10.7	253.0	126.7	71.2	55.5	0.0
25/6/85	2:00	9.7	265.0	104.0	65.4	38.6	0.0
31/7/90	7:00	12.6	284.5	100.9	58.1	42.8	0.0
12/7/86	1:00	9.1	245.0	89.3	54.2	35.2	0.0
21/8/86	20:00	2.0	109.0	89.0	48.1	30.9	9.9
8/9/90	16:00	7.9	0.9	81.2	48.4	24.0	8.9

Nitrogen Dioxide (NO_2) measured at Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	174.0 (90)	58.0%
Limit on Dailly Concentration	16.28	10.86%
Limit on Mean Concentration	0.59	0.74%

Table F.5i *Hourly Statistics of Sulphur Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
20/8/86	23:00	9.7	345.0	350.6	143.0	205.1	2.5
28/11/87	21:00	10.3	15.0	320.6	125.6	178.9	16.0
14/12/85	2:00	13.3	3.0	313.0	128.9	183.5	0.6
30/11/90	18:00	11.0	355.0	311.1	107.5	155.0	48.5
19/10/89	18:00	9.3	358.7	306.0	97.4	141.1	67.5
25/10/88	18:00	8.9	353.0	305.8	97.2	140.8	67.8
13/11/87	11:00	8.7	360.0	304.6	103.6	149.6	51.5
26/10/88	10:00	7.5	344.0	304.0	93.2	135.3	75.4
29/3/88	20:00	8.9	353.0	301.5	108.8	157.4	35.3
25/10/88	17:00	8.8	355.0	297.7	92.0	133.4	72.4
14/12/85	21:00	11.9	359.0	297.5	118.3	169.7	9.5
19/10/89	17:00	8.6	348.2	294.5	87.2	126.9	80.4
30/10/88	17:00	7.4	349.0	292.8	86.3	125.6	81.0
25/10/88	19:00	7.7	359.0	292.2	94.3	136.8	61.0
14/12/85	23:00	13.9	8.0	292.1	120.7	171.4	0.0
27/2/86	11:00	9.6	354.0	291.1	100.5	145.3	45.3
7/10/89	16:00	7.1	357.7	289.4	89.4	130.0	69.9
18/11/89	12:00	10.4	0.1	289.3	92.7	134.1	62.5
18/11/89	10:00	6.5	18.8	287.8	96.1	139.1	52.6
4/1/86	22:00	11.1	5.0	285.3	115.8	166.2	3.3

Sulphur Dioxide (SO_2) measured at Tung Chung

	Pollution Concentration	% of AQO Standard
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Limit on Hourly Concentration	301.5 (88)	37.7%
Limit on Dailly Concentration	81.69	23.34%
Limit on Mean Concentration	3.48	4.35%

Table F.5j   Hourly Statistics of Nitrogen Dioxide at Tung Chung

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration		
					CPA	CPB	BP, DistO
20/8/86	23:00	9.7	345.0	157.9	86.4	70.5	1.0
28/11/87	21:00	10.3	15.0	146.9	77.6	62.8	6.5
14/12/85	22:00	13.3	3.0	144.5	79.7	64.6	0.2
14/12/85	23:00	13.9	8.0	135.7	75.1	60.6	0.0
30/11/90	18:00	11.0	355.0	135.5	64.0	52.5	19.1
14/12/85	21:00	11.9	359.0	133.9	71.7	58.5	3.7
13/11/87	11:00	8.7	360.0	131.7	61.2	50.3	20.2
19/10/89	18:00	9.3	358.7	130.3	56.9	46.9	26.5
25/10/88	18:00	8.9	353.0	130.2	56.8	46.8	26.6
29/3/88	20:00	8.9	353.0	130.0	63.8	52.4	13.9
4/1/86	22:00	11.1	5.0	128.4	70.0	57.1	1.3
26/10/88	10:00	7.5	344.0	128.3	54.0	44.6	29.6
25/10/88	17:00	8.8	355.0	125.9	53.4	44.1	28.4
27/2/86	11:00	9.6	354.0	125.8	59.3	48.7	17.8
25/10/88	19:00	7.7	359.0	124.1	54.9	45.3	24.0
18/11/89	12:00	10.4	0.1	123.6	54.4	44.7	24.5
18/11/89	10:00	6.5	18.8	123.3	56.3	46.4	20.6
19/10/89	17:00	8.6	348.2	123.2	50.2	41.5	31.6
30/11/90	17:00	9.5	356.8	123.2	61.5	50.5	11.2
30/10/88	17:00	7.4	349.0	123.2	49.5	41.0	31.8

Nitrogen Dioxide (NO_2) measured at Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	133.9 (85)	44.6%
Limit on Dailly Concentration	34.77	23.18%
Limit on Mean Concentration	1.43	1.79%

Table F.6a Hourly Statistics of Sulphur Dioxide at Mai Po

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
25/6/86	19:00	12.2	213.0	324.6	127.3	185.0	2.3	9.9
25/6/86	18:00	14.7	224.0	312.0	122.7	177.7	3.1	8.4
19/7/88	21:00	11.9	219.0	290.7	116.9	165.8	0.0	7.9
28/5/85	10:00	11.2	228.0	279.5	96.6	133.9	13.6	35.4
19/7/88	23:00	14.	203.0	277.4	113.1	164.3	0.0	0.0
25/6/86	20:00	12.4	209.0	273.3	111.4	161.9	0.0	0.0
28/5/85	11:00	10.6	230.0	271.6	97.4	140.0	24.2	10.1
19/7/88	22:00	16.8	217.0	267.2	108.6	157.9	0.0	0.7
22/5/88	10:00	7.5	230.0	253.6	77.3	101.7	11.0	63.5
11/4/90	12:00	7.1	221.2	229.9	61.1	79.7	18.1	71.0
27/5/85	15:00	9.0	213.0	228.4	78.4	108.1	13.4	28.5
22/5/87	9:00	11.0	215.0	224.8	94.4	130.4	0.0	0.0
30/7/87	20:00	6.7	229.0	223.3	93.1	130.3	0.0	0.0
23/6/88	13:00	8.0	212.0	217.1	92.6	124.5	0.0	0.0
28/5/85	9:00	10.3	225.0	216.1	69.6	93.8	4.9	47.8
22/5/87	10:00	8.7	213.0	213.6	90.2	123.3	0.0	0.0
27/5/85	14:00	9.8	229.0	203.1	75.2	98.3	3.3	26.4
20/4/88	15:00	9.3	218.0	200.9	74.9	98.5	4.2	23.3
27/5/85	17:00	7.7	221.0	194.2	72.2	94.3	4.3	23.5
27/5/85	8:00	8.2	234.3	191.3	74.9	103.5	0.0	12.9

Sulphur Dioxide (SO_2) measured at Mai Po Nature Reserve

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	273.3 (86)	34.2%
Limit on Dailly Concentration	48.26	13.79%
Limit on Mean Concentration	1.19	1.48%

Table F.6b Hourly Statistics of Nitrogen Dioxide at Mai Po

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
25/6/86	19:00	12.2	213.0	156.0	81.9	67.8	0.9	5.4
25/6/86	18:00	14.7	224.0	149.8	78.8	65.0	1.3	4.6
19/7/88	21:00	11.9	219.0	139.0	74.6	60.2	0.0	4.2
28/5/85	10:00	11.2	228.0	133.4	61.1	48.3	5.5	18.6
19/7/88	23:00	14.6	203.0	132.9	72.7	60.2	0.0	0.0
25/6/86	20:00	12.4	209.0	131.0	71.7	59.3	0.0	0.0
28/5/85	11:00	10.6	230.0	128.6	62.4	51.1	9.8	5.3
19/7/88	22:00	16.8	217.0	128.1	69.9	57.8	0.0	0.4
22/5/88	10:00	7.5	230.0	121.6	48.0	36.0	4.3	33.3
11/4/90	12:00	7.1	221.2	110.2	37.8	28.1	7.1	37.2
27/5/85	15:00	9.0	213.0	108.7	49.5	38.9	5.4	14.9
22/5/87	9:00	11.0	215.0	106.6	59.7	46.9	0.0	0.0
30/7/87	20:00	6.7	229.0	106.2	59.1	47.1	0.0	0.0
28/5/85	9:00	10.3	225.0	104.1	43.6	33.5	1.9	25.1
23/6/86	13:00	8.0	212.0	102.3	57.9	44.4	0.0	0.0
22/5/87	10:00	8.7	213.0	101.0	56.8	44.2	0.0	0.0
27/5/85	14:00	9.8	229.0	96.4	46.6	34.7	1.3	13.8
20/4/88	15:00	9.3	218.0	95.1	46.5	34.8	1.6	12.2
27/5/85	17:00	7.7	221.0	91.9	44.7	33.2	1.7	12.3
27/5/85	8:00	8.2	234.3	91.4	47.3	37.3	0.0	6.8

Nitrogen Dioxide (NO_2) measured at Mai Po Nature Reserve

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	131 (86)	43.7%
Limit on Dailly Concentration	23.07	15.38%
Limit on Mean Concentration	0.55	0.68%

Table F.6c Hourly Statistics of Sulphur Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
29/7/87	10:00	10.6	195.0	932.6	522.5	410.1	0.0	0.0
29/7/87	9:00	13.3	192.0	923.3	531.6	391.7	0.0	0.0
20/7/88	0:00	8.9	262.0	617.0	343.7	273.3	0.0	0.0
29/7/87	11:00	10.2	197.0	576.7	357.9	218.9	0.0	.0
25/6/86	21:00	11.7	208.0	554.1	343.9	210.2	0.0	0.0
29/7/87	12:00	9.2	191.0	547.1	339.4	207.7	0.0	0.0
31/7/87	7:00	12.0	187.0	502.8	307.0	195.7	0.0	0.0
29/7/87	8:00	13.0	187.0	421.8	260.2	161.6	0.0	0.0
25/6/86	22:00	9.5	204.0	396.5	246.1	150.5	0.0	0.0
24/10/87	12:00	12.8	335.0	330.5	0.0	0.0	114.0	216.5
24/10/87	15:00	10.3	341.0	299.5	0.0	0.0	101.5	198.0
26/4/85	15:00	13.2	330.0	290.4	0.0	0.0	73.8	216.5
23/10/87	19:00	12.9	320.0	276.4	0.0	0.0	61.1	215.3
21/9/88	16:00	10.9	340.0	276.1	0.0	0.0	98.1	178.0
31/7/87	8:00	11.1	187.0	274.6	169.0	105.6	0.0	0.0
20/7/88	4:00	15.0	202.0	273.0	159.1	114.0	0.0	0.0
24/10/87	11:00	12.5	322.0	272.5	0.0	0.0	108.1	164.4
11/4/90	8:00	13.3	231.8	270.2	153.2	117.0	0.0	0.0
24/10/87	13:00	12.0	324.0	269.5	0.0	0.0	88.7	180.8
26/4/85	14:00	13.9	324.0	268.6	0.0	0.0	57.2	211.3

Sulphur Dioxide (SO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	576.7 (87)	72.1%
Limit on Dailly Concentration	68.06	19.45%
Limit on Mean Concentration	1.79	2.24%

Table F.6d Hourly Statistics of Nitrogen Dioxide at Lung Kwu Tan

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
29/7/87	10:00	10.6	195.0	231.3	159.1	72.2	0.0	0.0
29/7/87	9:00	13.3	192.0	226.8	159.1	67.7	0.0	0.0
20/7/88	0:00	8.9	262.0	153.3	105.1	48.3	0.0	0.0
29/7/87	11:00	10.2	197.0	137.1	101.7	35.4	0.0	0.0
25/6/86	21:00	11.7	208.0	132.0	97.9	34.1	0.0	0.0
29/7/87	12:00	9.2	191.0	129.9	96.3	33.6	0.0	0.0
31/7/87	7:00	12.0	187.0	120.2	88.0	32.1	0.0	0.0
29/7/87	8:00	13.0	187.0	100.2	74.0	26.2	0.0	0.0
25/6/86	22:00	9.5	204.0	94.3	69.9	24.4	0.0	0.0
24/10/87	12:00	12.8	335.0	76.3	0.0	0.0	21.5	54.8
26/4/85	15:00	13.2	330.0	71.5	0.0	0.0	14.5	57.0
24/10/87	15:00	10.3	341.0	67.0	0.0	0.0	18.3	48.7
11/4/90	8:00	13.3	231.8	66.7	46.3	20.4	0.0	0.0
20/7/88	4:00	15.0	202.0	66.7	47.2	19.5	0.0	0.0
23/10/87	19:00	12.9	320.0	66.5	0.0	0.0	11.6	54.8
31/7/87	8:00	11.1	187.0	65.8	48.5	17.3	0.0	0.0
26/4/85	14:00	13.9	324.0	63.4	0.0	0.0	10.6	52.8
24/10/87	13:00	12.0	324.0	60.3	0.0	0.0	15.8	44.4
21/9/88	16:00	10.9	340.0	60.2	0.0	0.0	17.2	43.0
11/4/90	9:00	11.8	202.6	59.0	43.8	15.2	0.0	0.0

Nitrogen Dioxide (NO_2) measured at Lung Kwu Tan

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	137.1 (87)	45.7%
Limit on Dailly Concentration	14.14	9.43%
Limit on Mean Concentration	0.30	0.37%

Table F.6e *Hourly Statistics of Sulphur Dioxide at Ha Pak Nai*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
29/7/87	10:00	10.6	195.0	745.5	326.7	418.7	0.0	0.0
29/7/87	9:00	13.3	192.0	735.1	321.4	413.8	0.0	0.0
29/7/87	11:00	10.2	197.0	526.7	238.2	288.5	0.0	0.0
29/7/87	12:00	9.2	191.0	510.1	231.9	278.2	0.0	0.0
20/7/88	0:00	8.9	262.0	488.4	213.2	274.7	0.0	0.0
25/6/86	21:00	11.7	208.0	480.1	214.1	265.9	0.0	0.0
31/7/87	7:00	12.0	187.0	463.4	210.3	253.2	0.0	0.0
29/7/87	8:00	13.0	187.0	404.6	185.3	219.3	0.0	0.0
25/6/86	22:00	9.5	204.0	357.9	161.4	196.5	0.0	0.0
25/6/86	23:00	8.9	187.0	341.4	167.6	173.8	0.0	0.0
31/7/87	17:00	9.4	184.0	331.3	164.1	167.3	0.0	0.0
19/7/88	17:00	13.2	233.0	315.9	0.0	0.0	64.2	251.7
19/7/88	16:00	13.3	231.0	310.4	0.0	0.0	67.5	242.9
21/5/87	13:00	7.7	202.0	306.0	150.1	155.9	0.0	0.0
20/7/88	8:00	7.0	165.5	281.9	137.2	144.7	0.0	0.0
11/4/90	9:00	11.8	202.6	254.0	105.0	126.1	0.0	23.0
11/4/90	8:00	13.3	231.8	246.7	93.6	120.7	0.0	32.4
21/5/87	14:00	7.1	192.0	244.2	123.5	120.7	0.0	0.0
20/7/88	7:00	6.9	202.0	243.2	119.3	124.0	0.0	0.0
29/7/87	7:00	10.0	194.0	235.6	120.3	115.3	0.0	0.0

Sulphur Dioxide (SO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	526.7 (87)	65.8%
Limit on Dailly Concentration	61.20	17.49%
Limit on Mean Concentration	1.76	2.20%

Table F.6f Hourly Statistics of Nitrogen Dioxide at Ha Pak Nai

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
29/7/87	10:00	10.6	195.0	302.3	174.7	127.5	0.0	0.0
29/7/87	9:00	13.3	192.0	295.7	170.7	125.0	0.0	0.0
29/7/87	11:00	10.2	197.0	203.9	120.3	83.5	0.0	0.0
20/7/88	0:00	8.9	262.0	198.6	114.5	83.9	0.0	0.2
29/7/87	12:00	9.2	191.0	197.1	116.7	80.4	0.0	0.0
25/6/86	21:00	11.7	208.0	186.7	109.2	77.5	0.0	0.0
31/7/87	7:00	12.0	187.0	180.1	106.5	73.6	0.0	0.0
29/7/87	8:00	13.0	187.0	156.2	93.0	63.3	0.0	0.0
25/6/86	22:00	9.5	204.0	138.7	81.7	57.0	0.0	0.0
25/6/86	23:00	8.9	187.0	128.3	80.1	48.1	0.0	0.0
31/7/87	17:00	9.4	184.0	124.1	78.0	46.1	0.0	0.0
21/5/87	13:00	7.7	202.0	114.9	71.8	43.2	0.0	0.0
19/7/88	17:00	13.2	233.0	105.8	0.0	0.0	16.9	88.8
20/7/88	8:00	7.0	165.5	105.4	65.5	39.9	0.0	0.0
11/4/90	8:00	13.3	231.8	97.8	50.0	36.6	0.0	11.1
11/4/90	9:00	11.8	202.6	97.4	52.9	36.4	0.0	8.1
19/7/88	16:00	13.3	231.0	97.3	0.0	0.0	16.8	80.5
20/7/88	7:00	6.9	202.0	90.7	56.7	34.0	0.0	0.0
21/5/87	14:00	7.1	192.0	90.3	57.7	32.6	0.0	0.0
20/7/88	4:00	15.0	202.0	89.7	52.0	37.6	0.0	0.0

Nitrogen Dioxide (NO_2) measured at Ha Pak Nai

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	203.9 (87)	68.0%
Limit on Dailly Concentration	21.61	14.41%
Limit on Mean Concentration	0.50	0.63%

Table F.6g *Hourly Statistics of Sulphur Dioxide at Butterfly Estate*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
11/7/86	16:00	20.3	280.0	1035.8	436.9	598.9	0.0	0.0
11/7/86	17:00	18.3	278.0	1035.8	436.9	598.9	0.0	0.0
11/7/86	19:00	21.7	273.0	1035.8	436.9	598.9	0.0	0.0
11/7/86	20:00	20.2	271.0	1035.8	436.9	598.9	0.0	0.0
11/7/86	21:00	17.7	281.0	1035.8	436.9	598.9	0.0	0.0
11/7/86	2:00	17.2	280.0	1035.8	436.9	598.9	0.0	0.0
11/7/86	23:00	15.4	275.0	1027.3	433.3	594.0	0.0	0.0
12/7/86	0:00	13.1	270.0	917.5	401.5	515.9	0.0	0.0
31/7/90	10:00	9.7	276.1	799.0	394.9	404.1	0.0	0.0
31/7/90	9:00	11.4	275.1	712.5	343.0	369.5	0.0	0.0
11/7/86	18:00	18.0	270.0	517.9	218.5	299.4	0.0	0.0
31/7/90	11:00	7.8	272.2	507.7	276.4	231.3	0.0	0.0
24/6/85	20:00	12.4	284.0	494.8	215.6	267.5	0.4	11.3
11/7/86	15:00	18.2	271.0	382.8	145.6	199.6	14.3	23.3
23/6/88	14:00	10.7	253.0	345.3	145.6	199.6	0.0	0.0
25/6/85	2:00	9.7	265.0	301.5	148.7	152.8	0.0	0.0
31/7/90	7:00	12.6	284.5	279.2	121.9	157.4	0.0	0.0
12/7/86	1:00	9.1	245.0	255.3	119.5	135.8	0.0	0.0
21/8/86	20:00	2.0	109.0	244.5	106.6	120.1	1.6	16.1
21/8/86	8:00	6.3	254.0	235.1	176.4	58.8	0.0	0.0

Sulphur Dioxide (SO_2) measured at Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	507.7 (90)	63.5%
Limit on Dailly Concentration	36.61	10.46%
Limit on Mean Concentration	1.55	1.94%

Table F.6h Hourly Statistics of Nitrogen Dioxide at Butterfly Estate

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
11/7/86	16:00	20.3	280.0	380.1	213.6	166.5	0.0	0.0
11/7/86	17:00	18.3	278.0	380.1	213.6	166.5	0.0	0.0
11/7/86	19:00	21.7	273.0	380.1	213.6	166.5	0.0	0.0
11/7/86	20:00	20.2	271.0	380.1	213.6	166.5	0.0	0.0
11/7/86	21:00	17.7	281.0	380.1	213.6	166.5	0.0	0.0
11/7/86	22:00	17.2	280.0	380.1	213.6	166.5	0.0	0.0
11/7/86	23:00	15.4	275.0	377.0	211.8	165.1	0.0	0.0
12/7/86	0:00	13.1	270.0	331.2	191.0	140.2	0.0	0.0
31/7/90	10:00	9.7	276.1	275.7	173.5	102.1	0.0	0.0
31/7/90	9:00	11.4	275.1	247.1	152.8	94.3	0.0	0.0
11/7/86	18:00	18.0	270.0	190.0	106.8	83.2	0.0	0.0
24/6/85	20:00	12.4	284.0	179.4	101.1	71.7	0.1	5.8
31/7/90	11:00	7.8	272.2	174.0	116.5	57.5	0.0	0.0
11/7/86	15:00	18.2	271.0	147.1	71.2	55.5	5.5	12.0
23/6/88	14:00	10.7	253.0	126.7	71.2	55.5	0.0	0.0
25/6/85	2:00	9.7	265.0	104.0	65.4	38.6	0.0	0.0
31/7/90	7:00	12.6	284.5	100.9	58.1	42.8	0.0	0.0
12/7/86	1:00	9.1	245.0	89.3	54.2	35.2	0.0	0.0
21/8/86	20:00	2.0	109.0	88.0	48.1	30.9	0.6	8.3
8/9/90	16:00	7.9	0.9	79.8	48.4	24.0	3.0	4.5

Nitrogen Dioxide (NO_2) measured at Butterfly Estate

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	174 (90)	58.0%
Limit on Dailly Concentration	15.36	10.24%
Limit on Mean Concentration	0.52	0.65%

Table F.6i *Hourly Statistics of Sulphur Dioxide at Tung Chung*

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
20/8/86	23:00	9.7	345.0	351.1	143.0	205.1	0.0	2.9
28/11/87	21:00	10.3	15.0	323.0	125.6	178.9	0.4	18.0
14/12/85	22:00	13.3	3.0	313.1	128.9	183.5	0.0	0.7
30/11/90	18:00	11.0	355.0	311.0	107.5	155.0	14.8	33.7
29/3/88	20:00	8.9	353.0	306.2	108.8	157.4	2.1	37.9
19/10/89	18:00	9.3	358.7	305.9	97.4	141.4	20.5	46.9
25/10/88	18:00	8.9	353.0	305.7	97.2	140.8	20.6	47.2
26/10/88	10:00	7.5	344.0	303.5	93.2	135.3	23.5	51.5
13/11/87	11:00	8.7	360.0	302.9	103.6	149.6	18.0	31.7
14/12/85	21:00	11.9	359.0	299.1	118.3	169.7	0.0	11.1
25/10/88	17:00	8.8	355.0	296.8	92.0	133.4	23.4	48.1
27/2/86	11:00	9.6	354.0	296.0	100.5	145.3	4.6	45.5
25/10/88	19:00	7.7	359.0	294.4	94.3	136.8	1404	48.9
19/10/89	17:00	8.6	348.2	293.5	87.2	126.9	26.0	53.4
14/12/85	23:00	13.9	8.0	292.1	120.7	171.4	0.0	0.0
30/10/88	17:00	7.4	349.0	291.8	86.3	125.6	26.2	53.8
20/2/86	17:00	6.7	352.0	288.4	96.6	139.8	3.5	48.5
7/10/89	16:00	7.2	357.7	288.2	89.4	130.0	23.1	45.7
18/11/89	10:00	6.5	18.8	287.3	96.1	139.1	16.6	35.5
18/11/89	12:00	10.4	0.1	287.1	92.7	134.1	21.6	38.7

Sulphur Dioxide (SO_2) measured at Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	303.5 (88)	37.9%
Limit on Dailly Concentration	81.76	23.36%
Limit on Mean Concentration	3.54	4.42%

Table F.6j Hourly Statistics of Nitrogen Dioxide at Tung Chung

Date	Time	Wind Speed	Wind Dir	Total	Compounds of Concentration			
					CPA	CPB	BP, DistO	BP, HFO
20/8/86	23:00	9.7	345.0	158.5	86.4	70.5	0.0	1.6
28/11/87	21:00	10.3	15.0	150.4	77.6	62.8	0.2	9.9
14/12/85	22:00	13.3	3.0	144.7	79.7	64.6	0.0	0.4
30/11/90	18:00	11.0	355.0	140.0	64.0	52.5	5.8	17.8
29/3/88	20:00	8.9	353.0	137.0	63.8	52.4	0.8	20.0
19/10/89	18:00	9.3	358.7	136.6	56.9	46.9	8.0	24.8
25/10/88	18:00	8.9	353.0	136.5	56.8	46.8	8.1	24.9
14/12/85	21:00	11.9	359.0	136.0	71.7	58.5	0.0	5.9
14/12/85	23:00	13.9	8.0	135.7	75.1	60.6	0.0	0.0
13/11/87	11:00	8.7	360.0	135.3	61.2	50.3	7.1	16.7
26/10/88	10:00	7.5	344.0	135.0	54.0	44.6	9.2	27.2
27/2/86	11:00	9.6	354.0	133.8	59.3	48.7	1.8	24.0
25/10/88	17:00	8.8	355.0	132.0	53.4	44.1	9.2	25.4
25/10/88	19:00	7.7	359.0	131.5	54.9	45.3	5.6	25.8
20/2/86	17:00	6.7	352.0	130.2	56.6	46.6	1.4	25.6
19/10/89	17:00	8.6	348.2	130.0	50.2	41.5	10.2	28.2
30/10/88	17:00	7.4	349.0	129.2	49.5	41.0	10.3	28.4
4/1/86	22:00	11.1	5.0	129.1	70.0	57.1	0.0	2.0
18/11/89	12:00	10.4	0.1	128.0	54.4	44.7	8.5	20.4
18/11/89	10:00	6.5	18.8	127.9	56.3	46.4	6.5	18.8

Nitrogen Dioxide (NO_2) measured at Tung Chung

	Pollution Concentration	% of AQO Standard
Limit on Hourly Concentration	135.7 (85)	45.2%
Limit on Dailly Concentration	35.64	23.76%
Limit on Mean Concentration	1.50	1.87%

Annex G

Rigorous Frequency Analysis - Summary Statistics of Concentration and AQO Exceedance

Table G.1a Summary Statistics (Primary Fuels)

Scenarios	LTPS - 8x680 MW coal					LTPS - 8x600 MW gas CCGT					LTPS : 50% coal/50% gas				
	LTPS + CPPS			Total		LTPS + CPPS			Total		LTPS + CPPS			Total	
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Lung Kwu Tan															
NO_2	1	102	58.9	2	0.3	1	102	58.9	2	0.3	1	102	58.9	2	0.3
NO_2 mitigated	0	77	45.7	0	0.0	0	77	45.7	0	0.0	0	77	45.7	0	0.0
SO_2	2	117	72.1	2	0.3	2	117	72.1	2	0.3	2	117	72.1	2	0.3
Ha Pak Nai															
NO_2	2	142	95.0	2	0.3	2	142	95.0	2	0.3	2	142	95.0	2	0.3
NO_2 mitigated	0	101	67.9	2	0.3	1	101	67.9	2	0.3	1	101	67.9	2	0.3
SO_2	0	93	65.8	0	0.0	0	93	65.8	0	0.0	0	93	65.8	0	0.0
Mai Po															
NO_2	0	80	63.2	2	0.5	0	73	62.5	1	0.2	0	75	63.1	1	0.2
NO_2 mitigated	0	64	48.6	0	0.0	0	52	41.3	0	0.0	0	56	44.7	0	0.0
SO_2	0	40	34.2	0	0.0	0	39	34.2	0	0.0	0	40	34.2	0	0.0
Butterfly Estate															
NO_2	2	156	77.8	2	0.8	2	156	77.8	2	0.8	2	156	77.8	2	0.8
NO_2 mitigated	1	110	58.0	2	0.5	1	110	58.0	2	0.5	1	110	58.0	2	0.5
SO_2	1	115	63.5	1	0.3	1	115	63.5	1	0.3	1	115	63.5	1	0.3
Tung Chung															
NO_2	0	81	73.7	2	1.0	0	76	64.6	1	0.2	0	77	66.6	1	0.3
NO_2 mitigated	0	64	59.7	0	0.0	0	53	45.2	0	0.0	0	57	45.1	0	0.0
SO_2	0	44	36.5	0	0.0	0	44	36.0	0	0.0	0	44	38.3	0	0.0

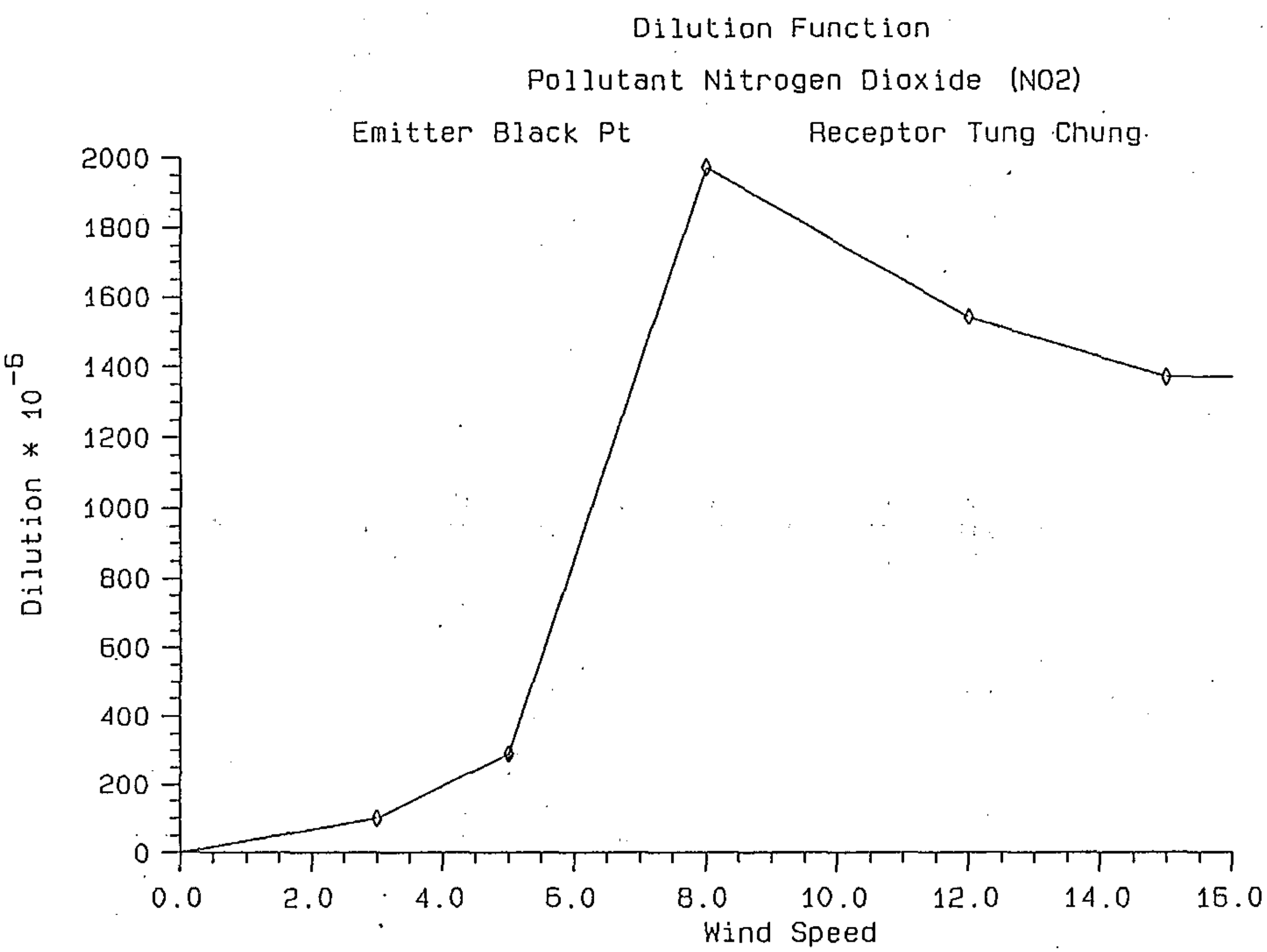
Note (1) A : maximum number of AQO exceedance (over 6 years data) in any one year;
B : maximum glc expressed as % AQO;
C : worst glc at AQO frequency (not more than 3 hourly AQO exceedance) expressed as % AQO;
D : maximum number of AQO exceedance (over 6 years data) in any one year with inclusion of background;
E : average number of AQO exceedance (over 6 years data) in any one year with inclusion of background.
(2) Occasions of typhoon are excluded.

Table G.1b Summary Statistics (Oils Substitution)

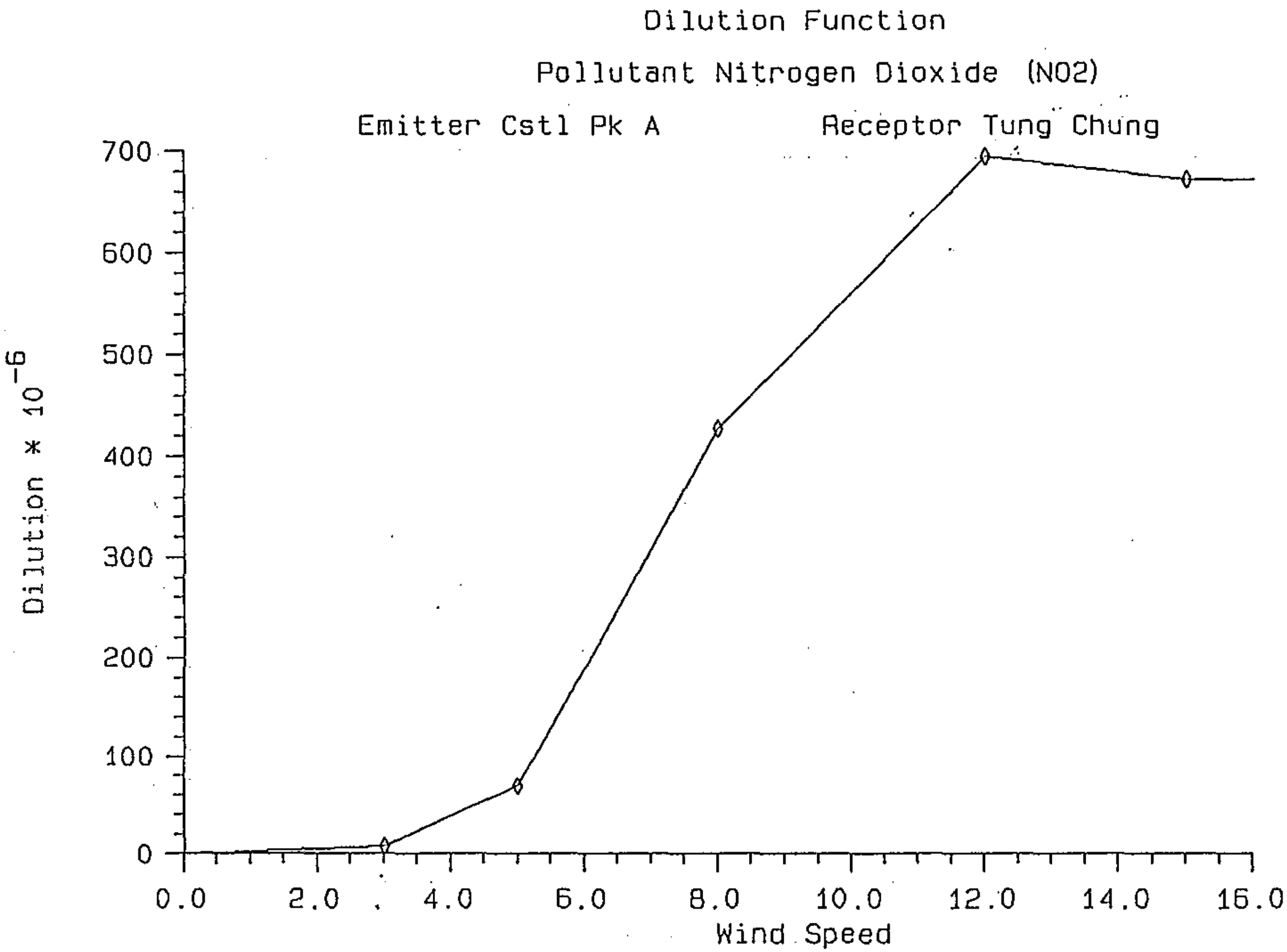
	LTPS – 8x600 MW DistO					LTPS – 50% HFO/50% DistO					LTPS : 8x680 MW HFO				
	LTPS + CPPS			Total		LTPS + CPPS			Total		LTPS + CPPS			Total	
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Lung Kwu Tan															
NO_2	1	102	58.9	2	0.3	1	102	58.9	2	0.3	1	102	58.9	2	0.3
NO_2 mitigated	0	77	45.7	0	0.0	0	77	45.7	0	0.0	0	77	45.7	0	0.0
SO_2	2	117	72.1	2	0.3	2	117	72.1	2	0.3	2	117	72.1	2	0.3
Ha Pak Nai															
NO_2	2	142	95.0	2	0.3	2	142	95.0	2	0.3	2	142	95.0	2	0.3
NO_2 mitigated	1	101	68.0	2	0.3	1	101	68.0	2	0.3	1	101	68.0	2	0.3
SO_2	0	93	65.8	0	0.0	0	93	65.8	0	0.0	0	93	65.8	0	0.0
Mai Po															
NO_2	0	74	62.5	0	0.0	0	74	62.5	1	0.2	0	74	62.5	1	0.2
NO_2 mitigated	0	52	43.7	0	0.0	0	52	43.7	0	0.0	0	55	50.9	0	0.0
SO_2	0	41	34.3	0	0.0	0	41	34.2	0	0.0	0	42	34.3	0	0.0
Butterfly Estate															
NO_2	2	156	77.8	2	0.8	2	156	77.8	2	0.8	2	156	77.8	2	0.8
NO_2 mitigated	1	110	58.0	2	0.5	1	110	58.0	2	0.5	1	110	58.0	2	0.5
SO_2	1	115	63.5	1	0.3	1	115	63.5	1	0.3	1	115	63.5	1	0.3
Tung Chung															
NO_2	0	75	63.2	1	0.2	0	75	64.0	1	0.2	0	76	65.0	1	0.2
NO_2 mitigated	0	53	44.6	0	0.0	0	53	45.2	0	0.0	0	56	50.7	0	0.0
SO_2	0	44	37.7	0	0.0	0	44	37.9	0	0.0	0	45	41.1	0	0.0

Note (1) A : maximum number of AQO exceedance (over 6 years data) in any one year;
B : maximum glc expressed as % AQO;
C : worst glc at AQO frequency (not more than 3 hourly AQO exceedance) expressed as % AQO;
D : maximum number of AQO exceedance (over 6 years data) in any one year with inclusion of background;
E : average number of AQO exceedance (over 6 years data) in any one year with inclusion of background.

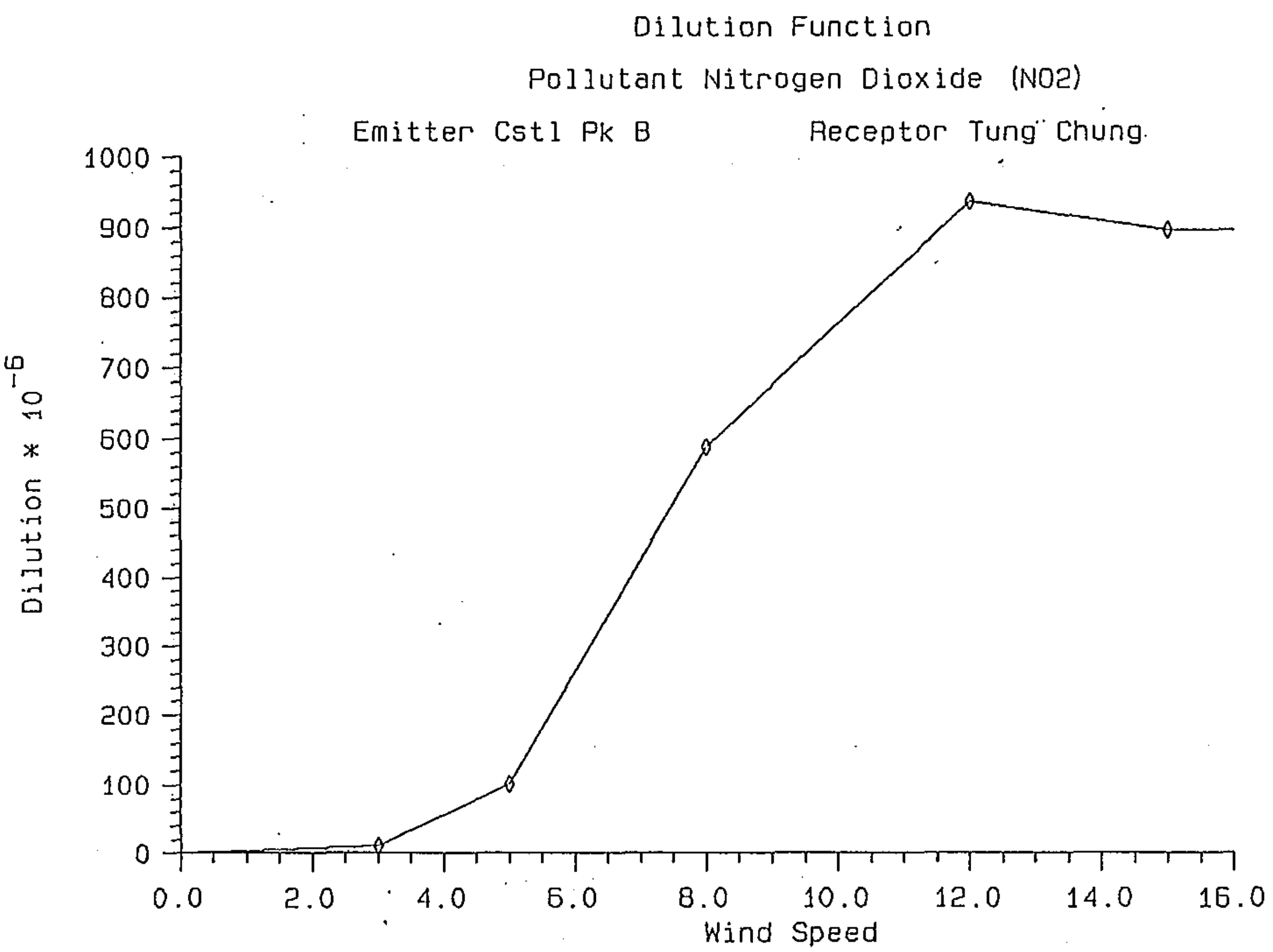
(2) Occasions of typhoon are excluded.

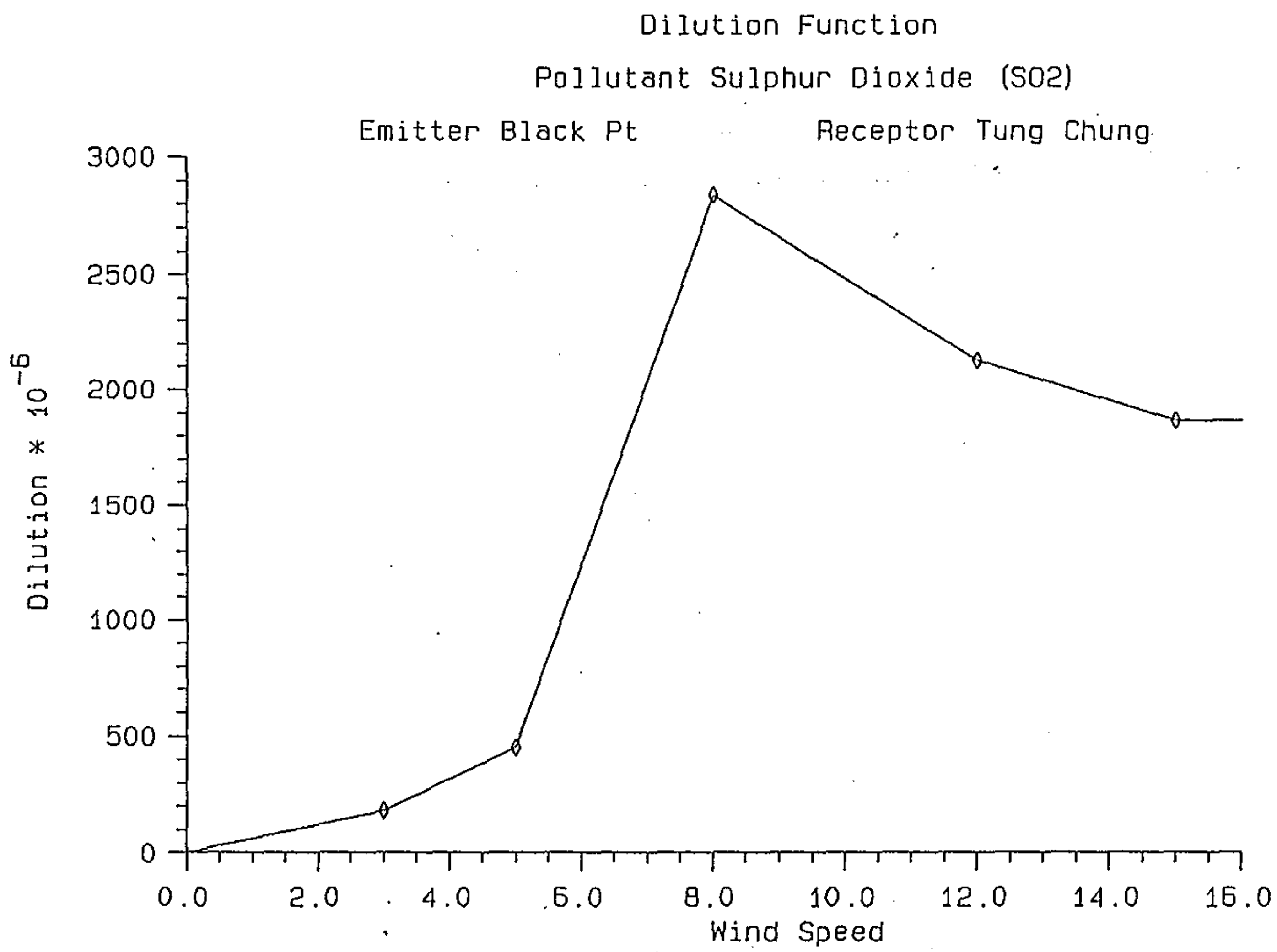


Dilution Function
Pollutant Nitrogen Dioxide (NO2)
Emitter Black Pt
Receptor Tung Chung
Dilution * 10^-6
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Wind Speed

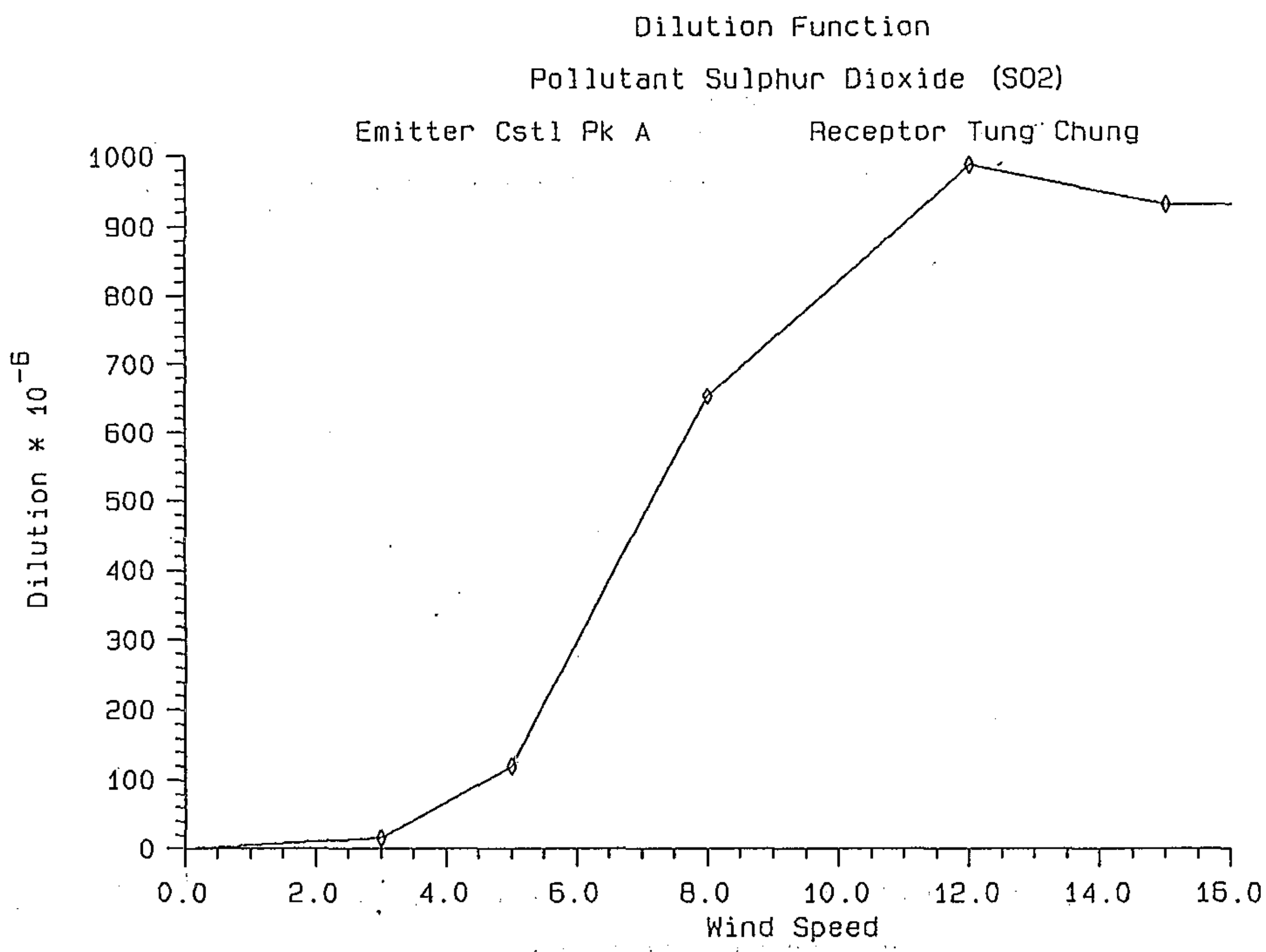


Dilution Function
Pollutant Nitrogen Dioxide (NO2)
Emitter Cstl Pk A
Receptor Tung Chung
Dilution * 10^-6
700
600
500
400
300
200
100
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Wind Speed

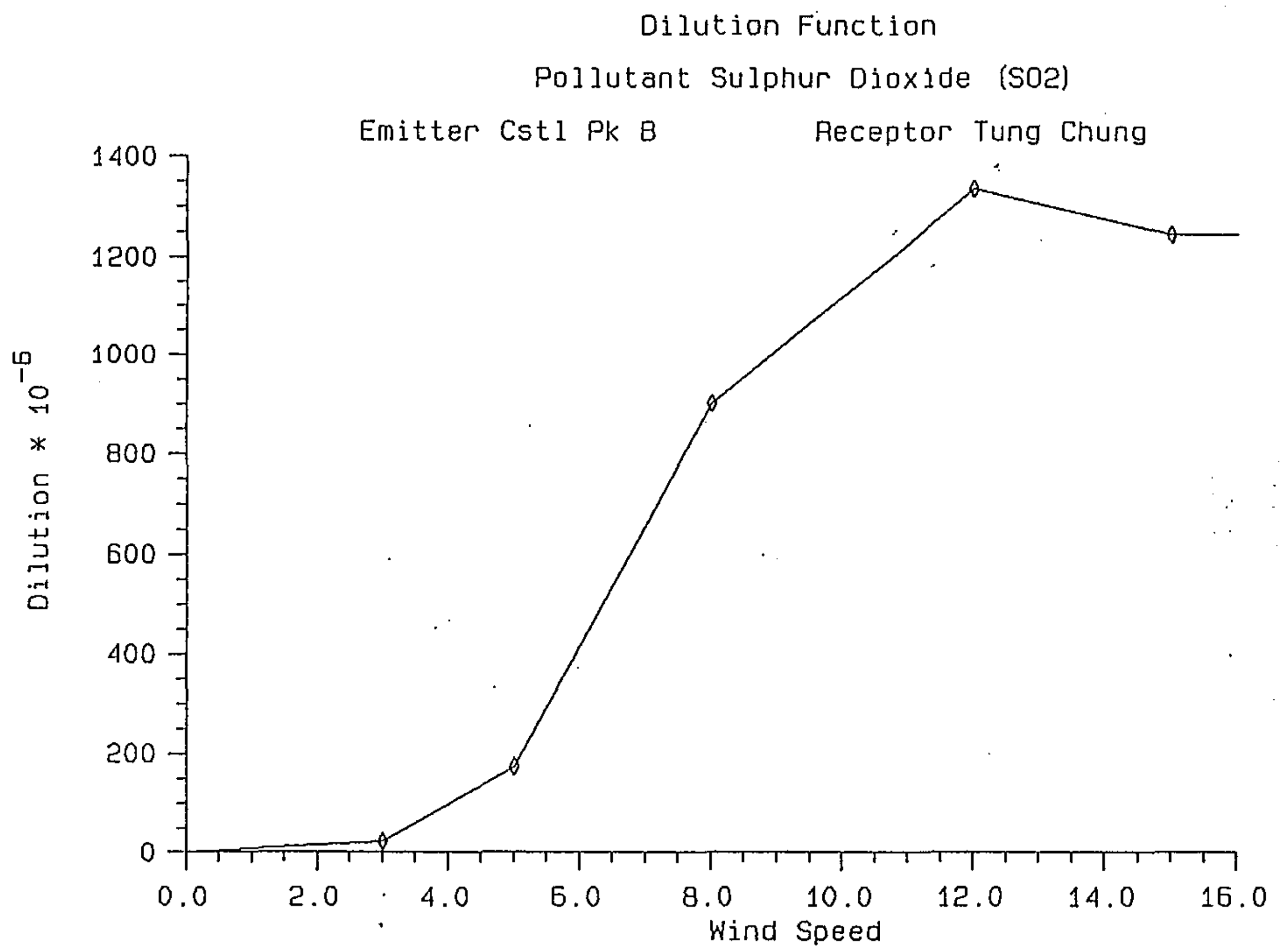

Dilution Function
Pollutant Nitrogen Dioxide (NO2)
Emitter Cstl Pk B
Receptor Tung Chung
Dilution * 10^-6
1000
900
800
700
600
500
400
300
200
100
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Wind Speed



Dilution Function
Pollutant Sulphur Dioxide (SO2)
Emitter Black Pt
Receptor Tung Chung
Dilution * 10^-6
3000
2500
2000
1500
1000
500
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Wind Speed



Dilution Function
Pollutant Sulphur Dioxide (SO2)
Emitter Cstl Pk A
Receptor Tung Chung
Dilution * 10^-6
0
100
200
300
400
500
600
700
800
900
1000
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Wind Speed


Dilution Function
Pollutant Sulphur Dioxide (SO2)
Emitter Cstl Pk B
Receptor Tung Chung
Dilution * 10^-6
1400
1200
1000
800
600
400
200
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Wind Speed

Annex H

Rigorous Frequency Analysis – Derivation of Concentration Functions

Although the Castle Peak Power Station was only modelled for directions to Lantau in this study, directly modelled results were available from previous work by the UK Central Electricity Research Laboratories (CERL, 1981) [1].

For Tung Chung, Lung Kwu Tan and Butterfly Estate, direct measurements existed. For Mai Po wind direction from Castle Peak, CERL measurements were available, but extrapolation was required to reach Mai Po itself. The further dilution with distance was estimated on the basis of measured dilution with distance at other angles. For Ha Pak Nai cross plots of concentration with wind angle (incorporating BMT and CERL results) were used to interpolate an estimate at each wind speed.

Receptors at Lung Kwu Tan

Lung Kwu Tan was determined to be at 320° from Black Point and 178° from Castle Peak. Measurements were available (Annex D, AKIA report) at 310° and 330° were taken, and for Castle Peak the 160° measurements were used unmodified.

The Black Point data set was essentially complete, but interpolation for Castle Peak at 12 m s^{-1} was undertaken. From other angular measurements, the near field ratio of concentration at 12 m s^{-1} and 15 m s^{-1} was used for the purpose. This produces the physical behaviour of higher wind speeds being necessary to bring down the plume in the near field by comparison with the far field.

Receptor at Ha Pak Nai

Comprehensive measurements from emissions at Black Point were made, but no measurements over the New Territories were within the scope of work for Castle Peak emissions.

The influence of CPA and CPB at Ha Pak Nai (195° from CP) was judged by interpolating the results measured at 160° (BMT measurements) and those measured at 232°, 252° and 272° by CERL in 1981.

Receptor at Mai Po

Data along 232° from Black Point at 12 km was used. The concentration at these locations was relatively low and no further reduction for the extension to 14 km or so was judged to be relevant.

No BMT or CERL measurements were directly relevant for Castle Peak, so numerical values were taken from available angles at this distance and checked for high speed concentration reduction (due to distance from source).

Further refinement was not possible for this location without further measurements, but in view of the low impact at this location, the results are regarded as satisfactory and robust.

(1) Scriven, R.A., Robins, A.G., Wind Tunnel Tests for Castle Peak 'A' and 'B' Station. Part 1: Determination of 'B' Station Stack Height, Central Electricity Research Laboratories, 1981.

Receptor at Butterfly Estate

The required receptor location is at 300° from Black Point. Data at the required distance was available at 290° and 310°. Average values were taken, as both angles produced very similar concentrations. From Castle Peak the bearing to Butterfly Estate is 270°, and the full wind speed range of data from the CERL results for 272° were used.

Receptor at Tung Chung

Tung Chung at 14 km along 350° relative to Black Point. Detailed measurements were available within 6° and 0.6 km of this location and the data was used without modification.

Full wind speed measurements (3 m s^{-1}, 5 m s^{-1}, 8 m s^{-1}, 12 m s^{-1}, 15 m s^{-1}) for Castle Peak emissions were available at the precise location, as recorded in the Annex D of this AKIA report.

The NO_x and NO_2 data used in the Part B AKIA Report are shown in *Tables H.1a* to *H.1e*. NO_x is converted to NO_2 using the formula shown in *Annex E*. Since the ratios of SO_2/NO_x are known, SO_2 concentrations can easily be calculated from the tables. Examples of interpolation curves for Tung Chung are also provided.

Table H.1a *Lung Kwu Tan, N.T.*

Receptor Location	BP Option	3 m/s	5 m/s	8 m/s	12 m/s	15 m/s	
320°, 2 km	2	4.0	11.3	112.4	326.6	343.8	NO_x
	2	0.6	2.2	28.4	106.4	128.1	NO_2
320°, 2 km	3	64.5	97.5	239.4	424.2	260.3	NO_x
	3	9.5	18.7	60.8	78.9	97.0	NO_2
320°, 2 km	5	6.2	20.6	50.5	65.6	65.6	NO_x
	5	0.9	3.0	12.8	21.4	24.4	NO_2
320°, 2 km	8	19.4	39.9	60.3	288.6	288.6	NO_x
	8	2.8	7.7	15.3	94.0	107.5	NO_2
178°, 2 km	CPA	0	2.5	21.4	491.7	554.3	NO_x
	CPA	0	0.5	5.4	160.1	206.4	NO_2
178°, 2 KM	CPB	11.4	9.5	13.3	284.8	516.6	NO_x
	CPB	1.7	1.7	3.3	92.8	192.3	NO_2

Table H.1b *Ha Pak Nai, N.T.*

Receptor Location	BP Option	3 m/s	5 m/s	8 m/s	12 m/s	15 m/s	
232°, 3.2 km	2	12.6	27.6	257.9	484.4	483.6	NO_x
	2	2.8	7.8	93.4	216.7	241.1	NO_2
232°, 3.2 km	3	1.1	8.8	33.7	124.7	246.3	NO_x
	3	0.2	2.5	12.2	55.8	122.8	NO_2
232°, 3.2 km	5	8.6		20.3	55.9	55.9	NO_x
	5	1.9		7.4	25.0	27.9	NO_2
232°, 3.2 km	8	68.1		185.0	283.0	283.0	NO_x
	8	15.0		67.0	126.6	141.0	NO_2
195°, 5.5 km	CPA	0	5.0	118.3	279.1	373.6	NO_x
	CPA	0	2.1	59.9	164.6	236.2	NO_2
195°, 5.5 km	CPB	14.2	15.0	91.7	341.0	456.3	NO_x
	CPB	4.7	6.2	46.6	201.1	288.6	NO_2

Table H.1c *Mai Po Nature Reserve, N.T.*

Receptor Location	BP Option	3 m/s	5 m/s	8 m/s	12 m/s	15 m/s	
232°, 14 km	2	37.3	48.0	184.8	181.9	156.3	NO_x
	2	21.6	31.2	129.5	132.3	114.8	NO_2
232°, 14 km	3	6.0	5.3	14.6	55.6	68.2	NO_x
	3	3.5	3.4	10.2	40.4	50.1	NO_2
232°, 14 km	5	6.2		12.9	23.1	23.1	NO_x
	5	3.6		9.0	16.8	17.0	NO_2
232°, 14 km	8	30.8		110.8		74.0	NO_x
	8	17.9		77.7		54.4	NO_2
218°, 15.7 km	CPA	6.0		73.8	133.6	106.6	NO_x
	CPA	3.5		51.7	98.1	78.2	NO_2
218°, 15.7 km	CPB	7.3		89.3	184.2	147.0	NO_x
	CPB	4.3		62.7	135.3	108.0	NO_2

Table H.1d *Butterfly Estate, N.T.*

Receptor Location	BP Option	3 m/s	5 m/s	8 m/s	12 m/s	15 m/s	
300°, 7.5 km	2	20.0	82.1	164.5	165.9	149.5	NO_x
	2	8.3	41.0	96.5	108.8	102.6	NO_2
300°, 7.5 km	3	4.4	25.6	63.5	79.2	70.3	NO_x
	3	1.8	12.8	37.3	51.9	48.3	NO_2
300°, 7.5 km	5	7.9		33.4		32.4	NO_x
	5	3.3		19.6		22.2	NO_2
300°, 7.5 km	8	11.4		86.5		78.4	NO_x
	8	4.7		50.8		53.8	NO_2
270°, 4 km	CPA		9.6	215.1	406.9	418.6	NO_x
	CPA		3.2	90.5	206.8	233.4	NO_2
270°, 4 km	CPB		4.6	59.4	419.7	544.0	NO_x
	CPB		1.5	24.9	213.3	303.0	NO_2

Table H.1e *Tung Chung, Lantau*

Receptor Location	BP Option	3 m/s	5 m/s	8 m/s	12 m/s	15 m/s	
350°, 14 km	2	10.7	27.0	169.0	126.8	111.2	NO_x
	2	6.1	17.3	117.6	91.9	81.7	NO_2
350°, 14 km	3	1.4	8.3	43.9	46.2	42.9	NO_x
	3	0.8	5.4	30.8	33.6	31.5	NO_2
350°, 14 km	5	2.4		18.9		17.8	NO_x
	5	1.4		13.1		13.1	NO_2
350°, 14 km	8	16.0		78.7		73.7	NO_x
	8	9.3		55.2		54.1	NO_2
354°, 10 km	CPA	2.5	18.9	103.1	156.0	147.1	NO_x
	CPA	1.3	11.0	67.3	109.4	106.0	NO_2
354°, 10 km	CPB	3.6	27.5	142.4	211.0	196.7	NO_x
	CPB	1.7	15.9	93.0	148.1	141.4	NO_2

Annex I

Rigorous Frequency Analysis – Daily System Demand Curves

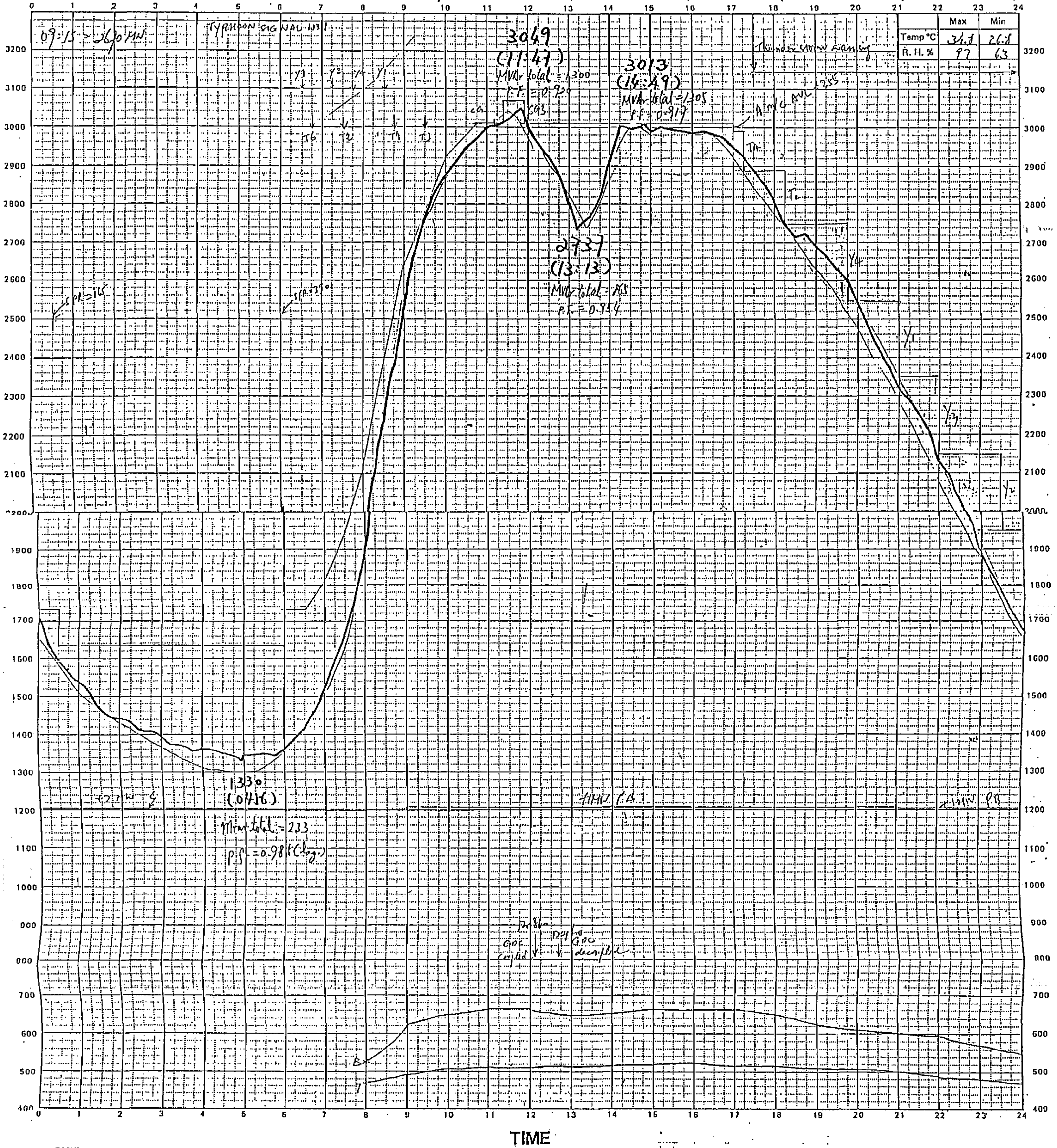
TYPICAL DEMAND CURVE (10th July 1986)

China Light & Power Co., Ltd.: Daily System Demand Curve

DAY & DATE 10/7/06 (7th

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
°C	[illegible]	28	28	28	28	28	27	28	28	27	30	30	31	33	33	33	33	33	32	31	31	27	28	28	27
%	80	81	83	84	88	88	88	85	84	90	76	80	75	67	63	66	63	64	69	71	71	97	84	87	84

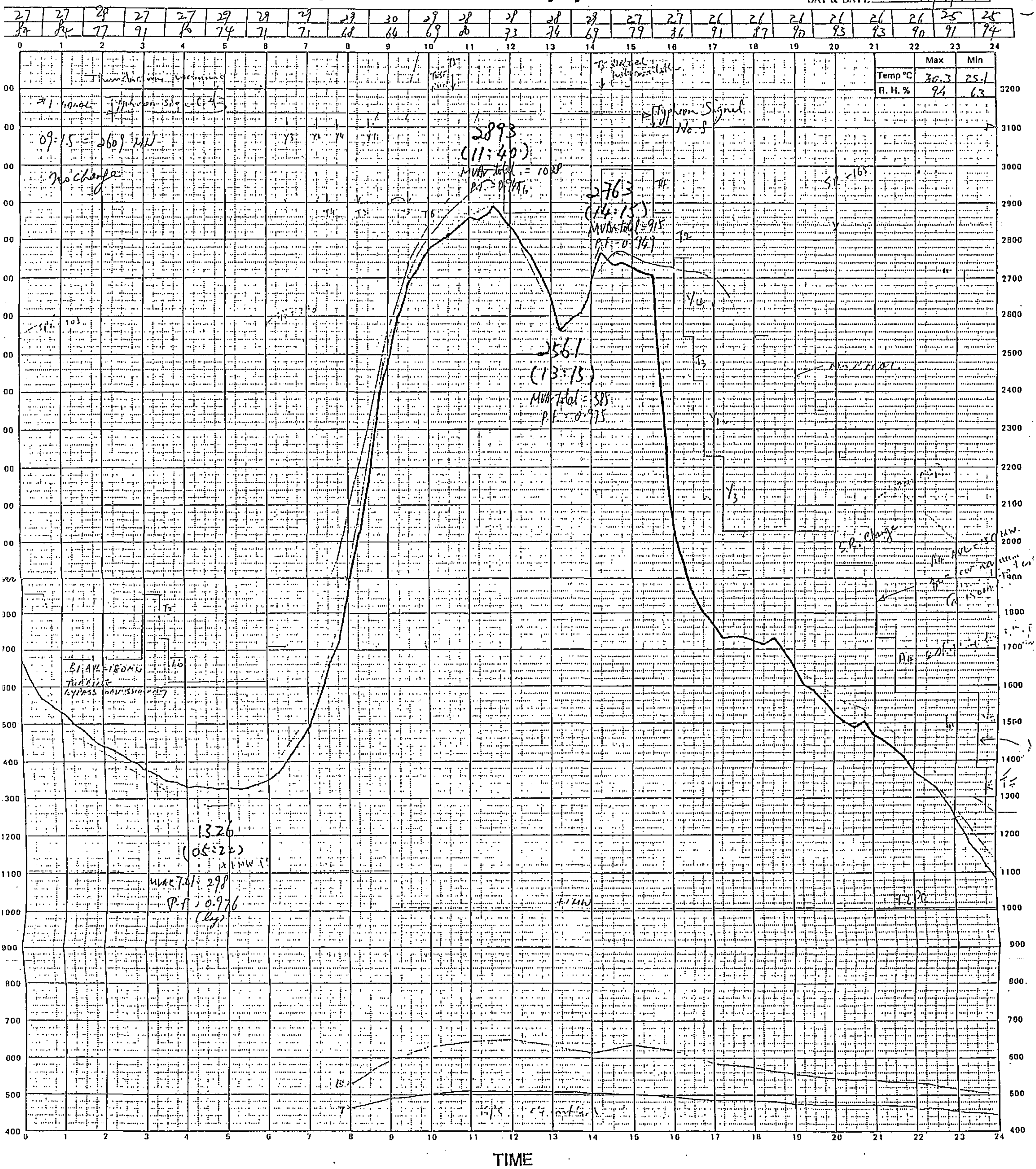
	Max	Min
Temp °C	34.8	26.8
R. H. %	97	63



DEMAND CURVE UNDER INFLUENCE OF TYPHOON (11th July 1986)

China Light & Power Co., Ltd.: Daily System Demand Curve

DAY & DATE 11/7/86 Friday



RESPONSE TO GOVERNMENT COMMENTS

Annex J

Responses to EPD's Consolidated Comments

CHINA LIGHT AND POWER CO LTD

EIA of the Proposed 6000MW Thermal Power Station at Black Point

Key Issue Assessment of Stack Emissions Complex Terrain Wind Tunnel Tests Report

Response To Government Comments

May 1992

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ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
OC1		EPD	**Overall Comments** 1. The complex terrain wind tunnel tests are overall of good quality. We have noticed, however, the omission of some important receptors and some wind speeds for certain receptors which should also be tested. They are detailed in the specific comments	Noted. Please see responses to the specific comments concerned.
OC2		EPD	2. Please note that FGD is considered to be a BPM requirement for new conventional coal-fired power plants in order to reduce the emission of sulphur dioxide to a minimum. This is irrespective of whether the power plant will cause an air impact breaching the air quality objectives. Whether the AQOs are breached is essentially a consideration for whether the existing units should be retrofitted.	Noted.
OC3		EPD	3. The assessment of impacts on the natural environment has been confined mainly to the effects of acidification. The effects of gaseous air pollutants and particulates should also be considered in detail.	These aspects are addressed in Vol 3 Section 8.2 of the Draft Initial Assessment Report (April 1991).
OC4		EPD	4. We have assumed that oil-firing will only be a back-up option which is required only for emergency, flame stabilisation and/or other ad-hoc and transient purposes. If oil is to be used as the primary fuel, it is necessary to extend the scope of the study to address other related environment concerns. In particular, the required controls on sulphur dioxide, nitrogen oxides and particulates will have to be evaluated for oil-fired CCGTs. Therefore if CLP wants to seriously consider the use of oil as primary fuel, please approach EPD for the required scope of work and the relevant BPMs.	Noted. It is understood that oil is not intended to be used as the primary fuel at LTPS. However, from time to time it may be used under certain operational and economic circumstances.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
	Chapter 2		Wind Tunnel Tests Programme	
1.	S.2.3.3		a. Please provide the estimates of the air quality impacts at the Butterfly Estate and its vicinity, which have major residential developments.	Estimate of concentration levels at the Butterfly Estate have been made from adjacent sensors. An updated map of sensor locations is provided and the concentration estimates are provided in Annex A.
2.	Annex A		Boundary Layer and Preparatory Tests a. The following test results were not presented in the Annex:– i. Test No. 7 and 8 in Table ALa; ii. The measurements of Reynolds stresses for wind speed of 15 m/s.	These tests were calibration runs to establish the relationship between the model 10m wind speed and a more convenient tunnel reference. They are not relevant to the quality of the flow or any aspect of dispersion. Reynolds Stress measaurements were not part of the agreed programme of work. However, as an extra check on modelling at small scale and low speed a set of data was collected. Measurements at higher speeds were not made on this occasion.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
3.	Annex B		Source Emissions and Characteristics	
			a. Summary of Source Data used in the Wind Tunnel Tests (assuming Full Load)	
			i. Please clarify the following:-	
			– if the fuel used in option 13 is coal (rather than oil as stated in the Table);	Fuel used in Option 13 is coal. (Table corrected)
			– the fuel sulphur content and FGD status of options 14 and 15;	Orimulsion sulphur content 2.7%, fuel oil sulphur content 3.5%, FGD 90% for Options 14 and 15.
			– the concentration of NO_x emission is 67 ppm or 75 ppm;	NO_x concn confirmed as 67ppm, actual (equivalent to 75ppm at standard conditions).
			– the number of chimneys per unit for the OCGT and CCGT.	The OCGT units were modelled with one chimney per unit. Each 600 MW CCGT unit has one chimney.
			b. Summary of the Emission Characteristics used to predict GLC of NO_2 and SO_2 in the Acidification Assessment.	
			i. The average annual load of LTPS quoted is 2393 MW or about 59% of the full capacity. This appears to be lower than an average base load unit. Would the Consultants clarify if adjustment is necessary?	The figure of 2393 MW for LTPS reflects the greater loading preference placed on CPPS, which was adopted in order to give a "worst case" loading scenario between the two stations.
			ii. The average annual loads of Castle Peak A and B are much higher than the respective maximum loads of these 2 plants. Please clarify and check if the NO_x and SO_2 emission figures are correct.	The figure provided of 3138 is the combined loading for A+B, not individually; the table will be amended.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
4.	Annex C		Analysis of Wind Conditions a. C2 and Table C3a i. Under wind direction 160°, Chek Lap Kok meteorological station is prone to the sheltering effect of Lantau Island. In comparison, Cheung Chau meteorological station ,may be more representative for the estimation of the credible wind speed along this wind direction. b. Table C4a, Table C4b and the summary of wind speed/wind direction statistics following Table C4b.	It is unlikely that Cheung Chau would provide appropriate data for analysis of dispersion of plumes from Castle Peak and Black Point. In both cases the Lantau peaks will provide some sheltering which will not be evident in Cheung Chau data; the latter will also show an unlikely higher frequency of high winds. Wind statistics for Chek Lap Kok and Cheung Chau have been compared for the 160° wind angle. The differences are small and no evidence of shelter is found in the CLK data. Wind Speed / Cheung Chau / Chek Lap Kok <8.3 m/s / 2.72 / 2.17 8.3 - 11.2 m/s / 0.09 / 0.09 11.3 - 14.2 m/s / 0.05 / 0.06 >14.2 m/s / 0.01 / 0.01 **Percentage frequencies of winds during June to August.**

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
			i. The following anomalies are observed:–	
			– Most of the percentages figures in Table C4b are different from those tabulated in the subsequent summary following the Table.	Please note that the % figure for a 20° direction range is calculated, for example, for 150° – 170° by summing 50% of the 150° and the 170° figures with 100% of the 160° figure, as agreed with the RO to be the most valid method of analysis.
			– In the conversion of cumulative frequencies in terms of % to those in hours, the number of hours in a year seems to have been used instead of the number of hours in the summer months (i.e. June, July and August).	In the calculation, the summer frequency was applied to the annual hours in order to give a worst case, this is perhaps unclear and will be amended.
			The summer month statistics in Table C4b have been used to identify the credible worst case wind speeds for the estimation of the impacts of the study options. The anomalies above may lead to an underestimation of the air quality impacts. Clarification needs to be made together with a review of the estimated air quality impacts of the study options.	Chek Lap Kok summary data given do not match the statistics which were used. The data which were used, however, also reveal some mistakes in Table C4b; for 330°–350°, frequencies for 3.3–5.2 m/s and 5.3–8.2 m/s should be 0.2% and 0.13% respectively, not 0.49% and 0.31% as shown. It should also be noted that the 0.01% shown for >14.2 m/s is in fact rounded up from 0.005%. Overall, these errors do not mean that the conclusions need to be changed but that the selection of credible worst-case wind scenarios was in fact pessimistic.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
	Chapter 3		Assessment of Human Health Impacts and Options for Mitigation	
5.	S.3.2		4 x 2 680 MW Coal-fired Units (Base Case)	
			a. Table 3.2a	
			i. Mai Po seems to have been left out for from the measurements. The air quality impacts there should also be estimated.	Please see Annex B.
			b. Table 3.2c	
			i. No measurement has been made for 12m/s for the potential impacts of Castle Peak Power Station on Shekou. However, based on the measurements in Test 2, the impacts from Black Point on to Shekou peak at 12 m/s. The prediction at 8 m/s and 15m/s may underestimate the impacts at Shekou.	As discussed at the EPD/CLP/Consultants meeting on 3.3.92, interpolation of the concentration trend with wind speed has been made for the Castle Peak impact on Shekou. On the basis of wind directions other than 160°, the impact of the Castle Peak stations has been assessed as a function of wind speed. Average relationships between concentrations at 12 m/s and 15 m/s at different distances have been used to create interpolated 12 m/s values. This is an update to the original 160° data in Annex D. It is presented for Shekou alone. These interpolated results for the 12 m/s^{-1} scenario will be utilised in the Frequency Analysis currently underway. Table 3.2c in the report should now read as shown in Annex C.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
			c. Pg. 17 Frequency Consideration – Black Point plus Castle Peak.	
			i. The frequency considerations in this section are affected by comment b on Annex C and should also be included in the review.	See reply to Comment B on Annex C.
			ii. We have the following observations on the methodology for the estimation of the credible worst wind speed:–	As discussed at the EPD meeting of 3.3.92, the frequency assessment presented in the report was a method to allow a first screening of all cases. A re–examination of the frequency assessment based on the more rigorous method discussed is to be undertaken and will be reported separately.
			– For each operating regime/scenario, 3 times of exceedence have been assumed in the estimation of the credible worst wind speed. When all the operating scenarios are considered, more than 3 times of exceedence in total have been assumed.	For individual wind speeds and directions, cumulative frequencies were used to obviate this potential problem. For situations where the 2 power stations can act independently upon a single receptor, further exceedences cannot occur, since LTPS on its own does not cause exceedence of the AQO under any conditions measured. It is therefore not credible for such a scenario to arise.
			– High operating loading is likely to occur during daytime. If high wind speed scenarios also happen during daytime, the probability of occurrence of high wind speed and high operating loadings will be greater than the estimates based on even distribution on high wind speed and operating loading.	We are not aware of any meterological evidence to suggest that high wind speeds occur preferentially during the day and the approach adopted is considered appropriate.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
			– In the estimation of the credible wind speed, the percentage of the peak operating loading based on the number of hours in a year have been used together with the summer wind speed statistics. It appears more reasonable to adopt the number of hours in the summer months. Otherwise, the credible wind speed will be underestimated.	The summer wind speeds have been used, as they represent the worst case; in statistical terms this approach is identical to the one proposed.
			– The credible wind speeds for scenarios with lower operating loadings from both power stations are higher than those with higher operating loadings. It may be possible that an operating loadings less than 80% may justify a higher credible wind speed, which may give the worst air quality impacts.	70% operational loading was assessed – it resulted in less severe impacts than the 80% loading.
			– We have reservation on CLP occupying all the allowable AQO exceedences.	The assessment has been targetted towards a solution which leads to zero exceedance.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
			To avoid the uncertainties associated with the estimation of frequency of the combinations of credible worst wind speed and operating loading. It is worthwhile to consider the approach of using the almost 10 years of sequential hourly data at Chek Lap Kok and the seasonal/monthly load curves for the peak operating year of the power stations to determine the number of hours of exceedence for the critical receptors and the study options short-listed by the findings of this report.	The proposed method of combining 10 years of sequential data from Chek Lap Kok with load curves from CLP would in theory provide a comprehensive set of more *precise* frequency based results. However, it should not be expected that this would necessarily provide a more *accurate* answer to the problem since many of the uncertainties present in the current analysis would still be present and other uncertainties would be introduced, e.g. from the need to interpolate between and extrapolate wind-tunnel results based on the peak load source scenario modelled. Such an analysis will be performed however, as a separate exercise to this KIA.
			iii. If low-NO_x burners cannot reduce the NOx impacts of the plant to acceptable levels, mitigation measures such as SCR should also be explored.	The results of the KIA indicate that adequate mitigation will be provided by the fitting of low NO_x burners to CPB station.
			e. Table 3.21 i. If there is any revision to the credible worst wind speed, the Table should also be reviewed.	 Noted.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
6.	S.3.3.3		Mitigation Options	
			a. The 42 ppm limit is regarded as the BPM for new gas–fired power stations. Experience in other countries has proved that this limit could be achieved with or without water injection. Unless CLP can show that this limit cannot be achieved technically and economically, relaxation of the limit would not be made.	This study was carried out on the basis of a 75ppm emission factor in order to ensure conservatism. It is anticipated that the plant installed will be able to achieve considerably lower emissions than this.
			b. In the assessment, 2 figures, VIZ., 67ppm and 75ppm, have been quoted for the stack NO_x emissions. Please clarify which one has been used in compiling the tables in Annex B.	67 ppm (based on the actual operating conditions and equivalent to 75 ppm under standard conditions).

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
7.	S.3.5		Oil-substitution Options	
			a. We presume that the oil-firing mode would only be used for emergency, flame stabilization or standby purpose. If CLP decides to use oil as the primary fuel, please approach us for the BPM requirements.	Noted. It is understood that oil is not intended to be used as the primary fuel at LTPS. However, from time to time, it may be used under certain operational and economic circumstances.
			b. It appears that the oil sulphur content for 680 MW conventional boiler units is 3.5%. However, according to the APC (Fuel Restriction)Regs., all new units, including those to be used for electricity generation, are required to use liquid fuel with less than 0.5% sulphur and 6 cst (at 40°C).	The Consultants are aware of the APC requirements specifying the burning of distillate oil in new facilities. However, it is recognised that these regulations were drafted to control emissions from the many small industrial plant in Hong Kong, whereas CLP's facilities are specifically designed to efficiently burn residual oils, and will be equipped with FGD and high stacks which are not fitted to small plant. The APC regulations, whilst achieving their aim for the many small scale industrial emitters, would therefore appear inappropriate for large scale, purpose designed Specified Processes such as the LTPS, since their imposition would increase the cost of electricity generation with no significant environmental benefit.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
8.	S.3.6		FGD Considerations	
			a. The modeling data indicates that the "no FGD" option would pose unacceptable impacts to areas such as Shekou and North Lantau Coast under high wind speed scenarios. In view of the uncertainties in the identification of the credible worst wind speed, it is premature to conclude that the 4 combined cycle/4 coal-fired unit scenario without FGD is a viable option. Moreover , the use of FGD is considered by the Authority as BPM for new coal-fired units.	The previous responses are considered to address any uncertainities regarding the credible worst wind speed, and the conclusion regarding the 4 CCGT/4 coal option is considered valid.
			b. The conclusion in Table 3.6a is sensitive to the credible wind speed for the maximum impacts. It should also be reviewed along with the review on the credible worst wind speeds.	Noted. No alteration necessary.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
9.	S.3.7		<u>Open-cycle Gas Turbine Units</u>	
			a. In view of the impacts of the OCGT with 50 m stack to nearby receptors, 80 m appears to be the minimum acceptable stack height of the OCGT units.	50m seems acceptable if infrequency of worst-case wind conditions and the fact that unacceptable impacts are limited to within the site boundary are taken into account.
			b. The Consultants should comment on the combined impacts of the OCGT and the main plant.	The table in Annex D attached combines the impact for 10 OCGTs and 4 coal and 4 CCGTs at Black Point, together with Castle Peak A and B. The combined near field impact of all units can be assessed along 160° or 340°; the table shows 160°. The major near field impacts during these conditions occur over the sea but are in any event well within the AQO's; results for the 140° direction can be estimated from Annex D in the main report, and are similarly within the AQO's.
	Chapter 4		<u>Assessment of Acidification Impacts on the Natural Environment</u>	
10.	S.4.3.1		a. It should be stated that the acid rain results were obtained from HKEPD and appropriate reference should be quoted.	Noted.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
11.	S.4.3.2		Monitoring Results a. Judging from the previous monitoring results, it is evident that Hong Kong is suffering from acid deposition problem. This is further confirmed by comparing the monitoring results with the Canadian target loading for wet SO_4 deposition of 20 kg/ha/y which is designed to protect moderately sensitive aquatic ecosystem. It would be desirable if the Consultants would explore whether further mitigation measures could be implemented economically to achieve this target. b. In view of the enforcement of the APC (Fuel Restriction) Regs. in 1990, the data of 1986–1987 used for derivation of the background deposition may not be appropriate to reflect the present situation. The Consultants may need to used more up-to-date monitoring results for this study.	We are not aware of *any* evidence that Hong Kong is *suffering* from the acid deposition problem, i.e. soil/natural water acidification, diminished nutrient levels in soils, natural vegetation damage. The monitored pollution levels give an indication that recent acid deposition levels could well be higher than the ideal critical load which may be set to protect the natural environment in the long term. The Canadian target is similar to the lower end (i.e. most stringent) of the range of critical loads considered appropriate to the UK. Hong Kong's natural environmental is considered to be relatively sensitive and thus would warrant consideration of a relatively low target would need to include control of all emissions across the territory and is not in the scope of this study. The aim is to determine the impact of the new power station – further comments below. More up-to-date monitoring data would possibly provide a more accurate estimate of the background level. This will be done if EPD could provide the latest available data but it is unlikely to affect the conclusions.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
			c. Since Junk Bay is not free of major heavy industrial activities, the use of its monitoring data from estimation of the background deposition may lead to positive error. This seems to be supported by the 1990 monitoring results of Hong Kong South in which the total acid deposition was found to be about 55 keq/km^2/y.	Noted. However, the Hong Kong South monitoring station only operated for a 9 month period from November 1989 to July 1990. The Junk Bay station has been operating since March 1985. Junk Bay was therefore considered a more robust data set on which to base background estimates, and its easterly location is considered to minimise exposure to industrial emissions.
			d. The total wet and dry deposition of Junk Bay reported in Table 4.3c are less than the sum of the breakdowns appeared in Table 4.3a and 4.3b. For example, for 1986, the sum should be 131.5 but the reported figure in Table 4.3c is only 108.2. Please clarify.	This calculation error has been corrected and the text amended accordingly, e.g. background deposition rate is approx. 110 keq km^{-2} yr^{-1}, not 90 as previously stated.
12.	S.4.4		Assessment Methodolody	
			a. The prediction methodology for estimating the wet deposition from the ambient pollutant predictions should be presented.	P.39 provides a summary of the methodology. If further information is required on specific issues we will be glad to respond.
			b. Please clarify whether max. FGD has been assumed for the coal-fired option scenario for the Black Point Power Station in the assessment of the acidification impacts.	Max FGD has been assumed.
			c. Please provide contours of total deposition in the report.	Please see Annex E attached.
13.	S.4.5		Acidification Impacts of the LTPS	
			a. It is unlikely that the location of maximum in Table 4.5a at (–20,–50) can be associated with southeasterly maximum.	Typing error; table corrected.

ITEM	REFERENCE	ORIGINATOR	COMMENTS	CONSULTANT'S REPLY
14.	Chapter 5		<u>Conclusions</u> a. The validity of the conclusions on the impacts of the power station hinges on the credibility of the identified worst wind speed. The re–assessment of the worst wind speeds and the re–estimation of the frequency of AQO exceedence may affect some of the conclusions.	 Noted but as indicated above, the revised frequency data do not change the conclusions.
15.	Annex D		<u>Concentration Measurement Results</u> a. It appears that the emission of NO_2 and SO_2 of the Castle Peak A and B stations may cause a threat to the attainment of the relevant AQOs at Lung Kwu Tan area. Would the Consultants advise if any mitigation measures would be necessary?	 Mitigation of Castle Peak emissions to date have only been considered in the context of mitigating impacts associated with the Black Point development.

EIA for Phase 1 Development of the Proposed LTPS at Black Point
Air Quality Key Issue Assessment
Response to EPD's Comments dated 9 August 1993

No.	Department	Reference	Comments	Consultant's Response
1	EPD	Section 5, Part A	Add a suitable paragraph to provide a linkage between Part A and Part B.	Noted and text will be added to Section 5 of Part A.
2		Section 8, Part B	Add a new section to state the EPD's position and the way forward.	Noted and text will be added as Section 8 of Part B. A copy of the text is enclosed as Annex B of this response-to-comments for easy reference.
3			*Overall Comments* a. The report does confirm our position on the proposed development that: i) the air quality impacts of the proposed Phase I development of the Power Station (ie 4x 600 MW CCGT units with light industrial diesel oil as back up fuel together with the recommended measures for its design, construction and operation) are acceptable; ii) mitigation measures are available to reduce the air quality impacts of the power station, if coal-fired with heavy fuel oil as back up, to levels that are acceptable by the present air quality standards, on the basis of the current sensitivity of environment and the assumed operation scenarios in this study.	 Noted. Noted.

No.	Department	Reference	Comments	Consultant's Response
4			As we commented in our facsimile message of 12.5.93, we cannot agree to the Consultants' rationale of interpreting the results of the rigorous frequency analysis based on "*on average,* no more than three exceedence of the hourly AQO limits per year". This approach is not in line with the current legislative provision, which requires the hourly AQO limits not to be breached more than thrice a year.	See response to comments numbered 7.
			We have noted that the consultants have taken our request for the maximum number of annual exceedance of the hourly AQO limits in the 6 candidate years. It is these numbers that allow conclusion be drawn on the acceptability of the air quality impacts of the proposed development, based on current legislative standards.	Noted.
5			*Specific Comments*	
		Summary	a. Regarding the position of EPD in the penultimate paragraph of the second page of the Summary, "no unacceptable impacts" is more precise than "no significant impacts", which may lead one to interpret as "no impacts at all".	Noted and reworded.
6			*Part A: Complex Terrain Wind Tunnel Tests*	
		Item 3.a.i	The fuel used in option 13 is "coal" not "oil". The Source Data Summary Table in Annex B has not been amended.	Noted and corrected.
			Please specify the fuel oil sulphur content and assumed SO_2 removal efficiency of the FGD for options 14 & 15 in the Source Data Summary Table in Annex B, the key to Development Options on Pg 45 and in Annex D.	Fuel oil sulphur content of 3.5% and max FGD of 90% SO_2 efficiency for Options 14 and 15.
		Item 3.b.ii	"3138 MW" still appears in the Summary Table in Annex B as individual loadings of Castle Peak A + B.	The figure 3138 MW is the combined loading of Castle Peak A + B. The Table will be amended.

No.	Department	Reference	Comments	Consultant's Response
		Item 4.b.i	Table C4b has not been amended.	Noted and amended. (See Consultant's responses-to-comments dated 18th May 1992.)
		Item 11.d	The total wet and dry deposition of Junk Bay reported in Table 4.3c are still less than the sum of the breakdowns appeared in Tables 4.3a and 4.3b	Noted and amended. (See Consultant's response-to-comments dated 18th May 1993. There are some mistakes in the footnotes of the Summary Table in Annex B for the acidification assessment and will be corrected.
			This comment had been further elaborated in our comments on response to comments (EPD's facsimile message of reference EP 2/G/39 X dated 1.7.92). Could the consultants please include in the report the mathematical relation that has been used for the estimation of the wet deposition.	Noted and the mathematical relation used for the estimation of the wet deposition will be provided.
		Item 13.a	The typing error in Table 4.5a has not been corrected.	Noted and figures corrected.
			The estimates of concentration at the Butterfly Estate and Mai Po as well as the combined impacts of Option 1, 5 and 8 plus Castle Peak A & B for wind direction 160° have been provided in the Annexes of the Consultants' response to comments (Annexes A, B and D). Please incorporate them into the report.	Noted and results incorporated.
			Please incorporate the total deposition contours in Annex E of the response to comments into the report.	Note and figures incorporated.
			Please specify the fuel oil sulphur content.	The fuel oil and distillate oil sulphur contents are 3.5% and 0.5% respectively. These will be specified in the relevant sections.
7			*Part B: Rigorous Frequency Analysis*	
		S.3.4.2	"Table 4.3c" should be "Table 3.4c".	Noted and corrected.

No.	Department	Reference	Comments	Consultant's Response
		S.2.2.2	For the sake of clarity, please elaborate on the NO_x mitigation measures at the Castle Park Power Station.	Noted. The assumed NO_x mitigation measures are about 90% of current levels at Castle Peak A (1000 ppm v/v from 1100 ppm source NO_x) and 55% of current levels at Castle Peak B (600 ppm from 1100 ppm).
		S.3.3.3, S.4.2 and Table 7.1a	i. We cannot agree to the Consultant's rationale of working on the 99.966 percentile values of the whole six years. This approach is not in accordance with the legislative provision, which requires the hourly AQO limits not to be breached more than three times in a year. As such, the 99.966 percentile concentration values given in Table 4.2a – 4.2j, Table 6.1a,b – Table 6.4a,b tend to be smaller than what they otherwise will be. Table 6.6a and 6.6b are not just "useful", as in the words of the Consultants. They are imperative for providing the basis for assessing the acceptability of the air quality impacts of the proposed development by the current legislative standards.	The figures in the referenced Tables will be revised to indicate the maximum 99.966 percentile values in any one year of the six candidate years. Nevertheless, the overall picture that there are no more than 3 hourly AQO exceedance in any year for all receptors is clear. The enclosed Annex A contains the revised Tables 4.2a–4.2j and Table 7.1a that help illustrate these. Noted.
			ii. Please clarify whether the "2.7" in Table 4.2c for the % of 1 day AQO for NO_2 for all coal case should be "20.7".	"2.7" should read "20.7".
		S.6.4	Please provide the emission data for the two oil–substitution options including, at least, the fuel oil sulphur content and SO_2 removal efficiency of the FGD (applicable to the heavy fuel oil option).	The fuel oil sulphur contents and FGD efficiency will be included. For full load emission data, Annex B refers.
		S.7 – the last sentence of the 4th Para	Please clarify whether the hourly AQO NO_2 limits will be breached for all receptors more than three times at any one of the 6 candidate years should the Castle Peak Power Stations not be retrofitted with low NO_x burners.	It is confirmed that even without NO_x mitigation by retrofitting low NO_x burners at Castle Peak, the hourly NO_2 AQO will not be breached at all receptors more than 3 times in any one of the 6 years of meteorological data.

No.	Department	Reference	Comments	Consultant's Response
			Annex B: Wind Tunnel Tests – Source Emissions and Characteristics a. Please include in the Summary Table of Source Data used in the Wind Tunnel Tests the emission limits for NO_x and SO_2 that have been used to derive the source emission concentrations.	One can easily re-calculate these from the source NO_x (as NO_2) and SO_2 concentrations, exit temperatures and the respective molecular mass. Dispersion of the flue gases depends on the actual source characteristics and it is considered unnecessary to include emission limits based on reference conditions in the Table.
			As to the Summary Table for the emission characteristics for Black Point for acidification assessment, please clarify whether there are "3 flues) in the chimney of each CCGT unit. Furthermore, please specify the fuel oil content and FGD efficiency in the table for the oil options.	It is clarified that there are 3 flues per stack of the CCGT units.
			c. The "CGGT" in Option 6 in Summary of Source Data should be "CCGT"	Noted and amended.
			Annex H: Rigorous Frequency Analysis – Derivation of Concentration Functions a. Please provide in the report all the concentration data which are interpolated from the wind tunnel measurements in this assessment and/or the CERL measurements for the Castle Peak Power Station in this report for the supplementary assessment of the Phase II development.	All wind tunnel data originated from this study have been included in Annex B. The CERL measurements used for Part B of the AKIA will be summarized in Tables in Annex H.

No.	Department	Reference	Comments	Consultant's Response
			Others	
			a. The report has not included the agreed comparison on the SO_2 impacts for light industrial diesel oil (IDO) with sulphur contents of 0.5% and 0.2% (Ref: EPD's letter of reference EP 2/G/39 dated 29.1.93). Please be reminded once again that the fuel sulphur content of IDO should be 0.2% by weight in order to comply with the emission standards of our BPM requirements.	The sulphur contents of the industrial diesel oil (IDO), named as distillate oil in the report, is 0.5% throughout the original AKIA. We understand that the Government and the oil companies are discussing the opportunity of reducing the sulphur contents of the IDO and the proposed change will depend on the availability of such fuel in Hong Kong. The proposed reduction in sulphur contents of the IDO to 0.2% as required by the latest BPM will effectively reduce the SO_2 concentration by 60%. The comparison of SO_2 impacts will be made in Section 6.4 of Part B AKIA Report.
			b. Please comment in an appropriate report of this study on the land use implications of this proposal.	Noted. Land use implications have been address in various sections of the Final Site Search Report.
			c. For easy reference, please provide a summary of the proposed mitigation measures in an appropriate report of this summary.	Proposed mitigation measures will be elaborated in the Summary Section of the AKIA Report