Report: Air quality monitoring

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RICHARDS BAY
CLEAN AIR ASSOCIATION
An Association Incorporated under Section 21

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For and on behalf of
ECOSERV (Pty) Ltd.

Approved by : Lisa Guastella

Signed :

Position : Consultant

Date : 14 May 2001

ECOSERV, **PO Box 10299, Meerensee, Richards Bay, 3901, tel: (035) 901-5340, (031) 710-1850, lisa@ecoserv.co.za,**

Executive Summary

This report highlights the activities and monitoring results of the Richards Bay Clean Air Association (RBCAA) for the Year 2000. The meteorological conditions and pollution trends for the Year 2000 are presented in the body of the report.

For the year, there were no exceedances of any of the Department of Environmental Affairs and Tourism (DEAT) guidelines. The annual averages for all stations fell below 30% of DEAT guidelines. There has been no significant variation in the SO_2 annual average concentrations reported for the last four years. In terms of sulphur dioxide (SO_2), the air quality, defined by the British Department of Environment, in the study area is regarded as "very good". SO_2 concentrations were highest at the Hillside station, which is consistent with previous findings. While pollution levels were largely dependent on the station locality relative to sources and prevailing winds, there was generally a slight increase in pollution concentrations during winter mornings as a result of inversion conditions.

The RBCAA achieved all 2000 stated objectives. The monitoring system was ISO Guide 25 accredited in March of 1999. Annual re-accreditation was achieved in August 2000. The Esikhawini and Umhlatuze stations were moved during mid-year to Hillside and Veldenvlei, respectively and the caravan at Hillside was moved to a site adjacent to the Richards Bay Borough office complex. There was a 9% drop in the overall annual data capture rate compared to the previous year, mainly as a result of station moves during mid-year and analyser malfunctions towards the latter part of the year. The overall 85% of data captured for the year is still above quality assurance (80% data capture) for the system.

The HAWK model operated within acceptable model parameters for stations in residential and agricultural areas. Software updates to the original programme were issued during 2000. The HAWK model has become a useful tool in the analysis of peaks and complaints.

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1 Introduction

This is the 4th Annual Report for the Richards Bay Clean Air Association. The report details the annual averages along with monthly and daily average trends of monitored pollutants in the Richards Bay area. Basic statistical analyses are discussed before the meteorological results for the year are laid out. A list of objectives for the coming year and stated objectives for the previous year are also discussed.

The Richards Bay Clean Air Association's (RBCAA) continued monitoring of sulphur dioxide (SO_2) and ozone (O_3) in the Richards Bay area during 2000. The monitoring network consists of five monitoring stations for SO_2, while O_3 is measured at one station (Veldenvlei). While measurements at Arboretum and Wildenweide were continuous throughout the year, several changes were implemented at the other measurement sites. The mobile caravan, which had been located at Alusaf Hillside, was moved on 18 July to a site adjacent to the Transitional Local Council (TLC) building and data from that site was validated from 20 July. The Esikhawini station was decommissioned on 22 June to establish a permanent monitoring station at Hillside. Data from the new Hillside station was validated from 25 July and data capture from the Hillside site was almost continuous for 2000. The Umhlatuze station was decommissioned on 25 May and equipment was moved to a new monitoring site at Veldenvlei, which was validated from 1 June. Particulate matter (PM_{10}) sampling did not resume in 2000 after the analyser malfunctioned during October 1999. Ozone measurements resumed at Veldenvlei during August.

The SO_2 concentrations reported are determined by a United States Environmental Protection Agency (USEPA) equivalent method. At the Arboretum, Wildenweide, Hillside and Esikhawini stations the equivalent method number is EQSA-0193-092, at the Caravan the equivalent method number is EQSA-0495-100 and at Umhlatuze and the Veldenvlei stations the equivalent method number is EQSA-1086-061. The results pertain to instantaneous samples drawn from air passing the above fixed stations, and care should be taken when extrapolating these results to surrounding areas.

All measurements allow for a maximum precision error of 15% of the reported value. A tolerance around the zero point of plus or minus 10 ppb is allowed. All effort is made to reduce the error to a minimum. In terms of quality assurance standards, data collection must be above 80% to be valid for statistical analysis.

In March 1999, after a successful audit in December 1998, the Richards Bay Clean Air Association was awarded SANAS accreditation as a set of chemical-testing laboratories. This provides the Association with a set of guidelines with which it can ensure a high quality of data captured. Accreditation is ongoing and renewed annually after a performance audit.

There were no exceedances of the national guidelines for SO_2 or ozone during the year 2000.

In spite of the various station moves, an overall data capture rate of 85% was achieved.

2 Sulphur Dioxide Monitoring

The SO_2 monitoring results for January to December 2000 are summarised in the following sections. The ambient SO_2 levels are required to comply with the DEAT Guidelines which are:

Period	Maximum SO_2 (ppb)	Maximum O_3 (ppb)	Maximum PM_{10} ($\mu g/m^3$)
Instantaneous	600	260	-
Hourly average	300	120	-
Daily average	100	-	180
Monthly average	50	-	-
Annual average	30	-	60

2.1 Compliance Figures

There were no exceedances of the instantaneous, hourly, daily, monthly or annual average SO_2 guidelines during 2000.

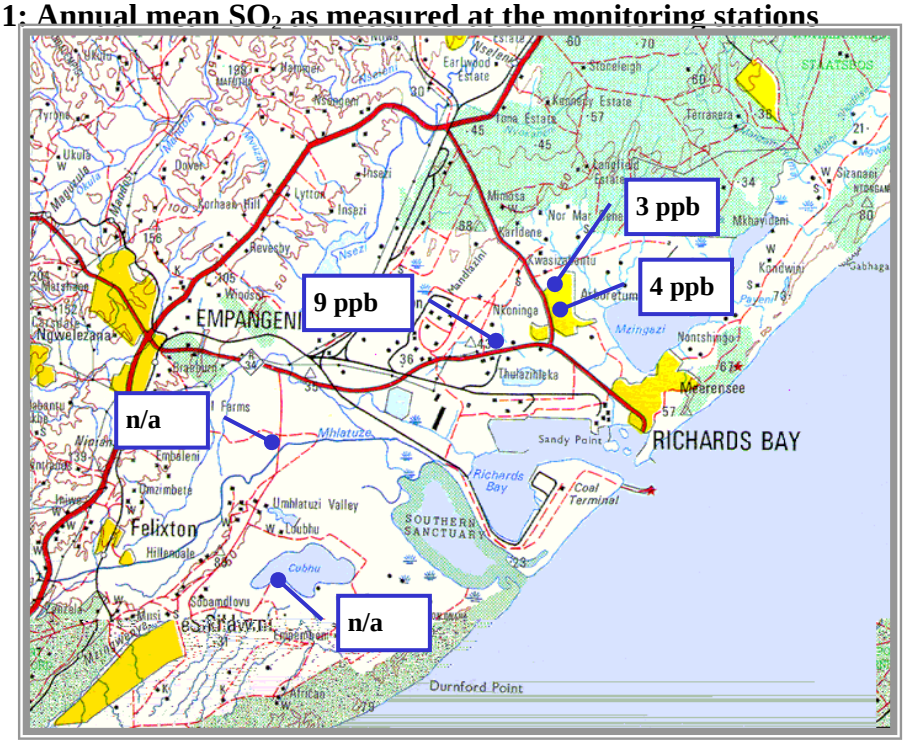
There were no exceedances of the instantaneous or the hourly average O_3 guidelines during 2000

2.2 Trends and Mean Results

The trends of SO_2 in the Richards Bay region are presented in this section. Note that averages are not reflected for those periods where annual data capture is below quality assurance limits (80%). Periods for which data is missing are detailed in Appendix 1.

2.2.1 Annual Mean

Figure 1: Annual mean SO_2 as measured at the monitoring stations



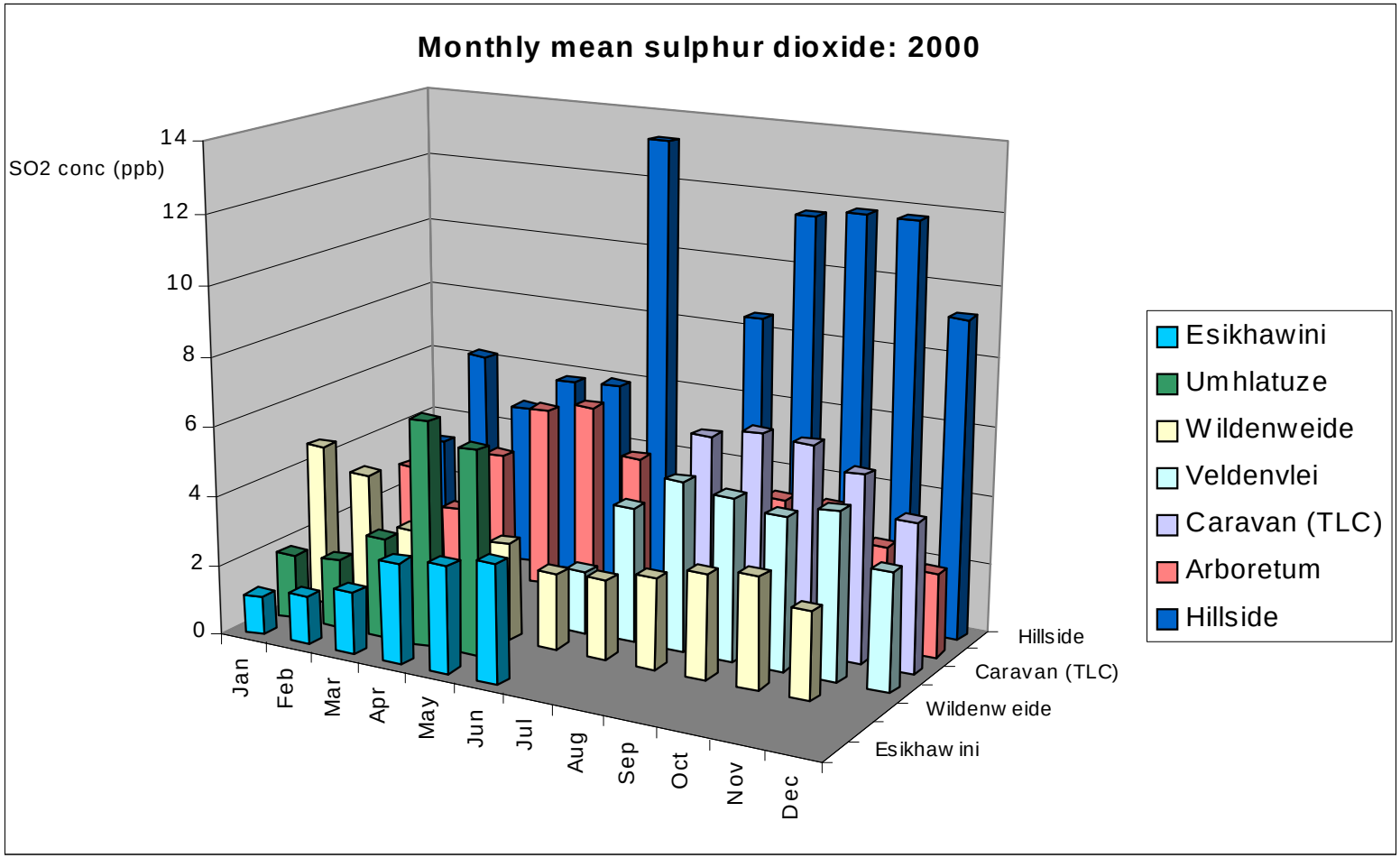
The annual average concentrations for 2000 at all the stations are displayed in Table 1, along with the 1997 to 1999 averages. Annual averages are only reflected for those stations where data capture meets quality assurance limits (80%). The highest annual average SO_2 concentration was measured at Hillside, which was the same as the previous year and was 29.7% of the National guideline. The Arboretum and Wildenweide annual average SO_2 remained relatively consistent compared to the previous couple of years. The average SO_2 at Esikhawini for the period 1 January to 22 June was 2.2 ppb, at Umhlatuze for the period 1 January to 24 May was 3.9 ppb, for Veldenvlei for the period 1 June to 31 December was 3.8 ppb and for the Caravan (TLC offices) for the period 20 July to 31 December was 5.7 ppb. The stations mentioned in the preceding sentence were either decommissioned or initiated during 2000 therefore data capture was below 80% for the year.

Table 1: Comparison of 1997 to 2000 annual averages

Station Name	Units	'97 Annual Avg.	'98 Annual Avg.	'99 Annual Ave.	'00 Annual Ave.
Arboretum SO_2	ppb	1.9	4.0	3.0	3.5
Wildenweide SO_2	ppb	2.4	2.2	3.7	2.9
Umhlatuze SO_2	ppb	4.2	2.8	2.4	n/a
Esikhawini SO_2	ppb	<0.5	1.6	2.1	n/a
Esikhawini O_3	ppb	-	17.0		n/a
Hillside SO_2	ppb	9.8	5.8	8.9	8.9
Hillside PM_{10}	µg/ m^3	-	30.0	39.9	n/a

2.2.2 Monthly Mean Sulphur Dioxide

Figure 2: Monthly mean SO_2 measured at the five monitoring stations



2.2.3 Daily Mean

Figure 3: Daily mean SO_2 measured at Arboretum

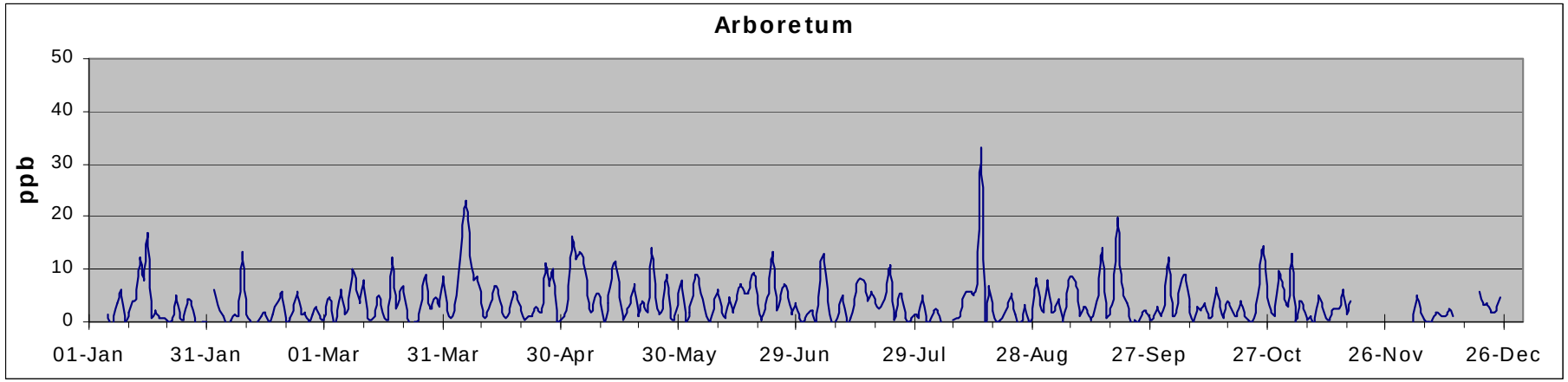


Figure 4: Daily mean SO_2 measured at Wildenweide

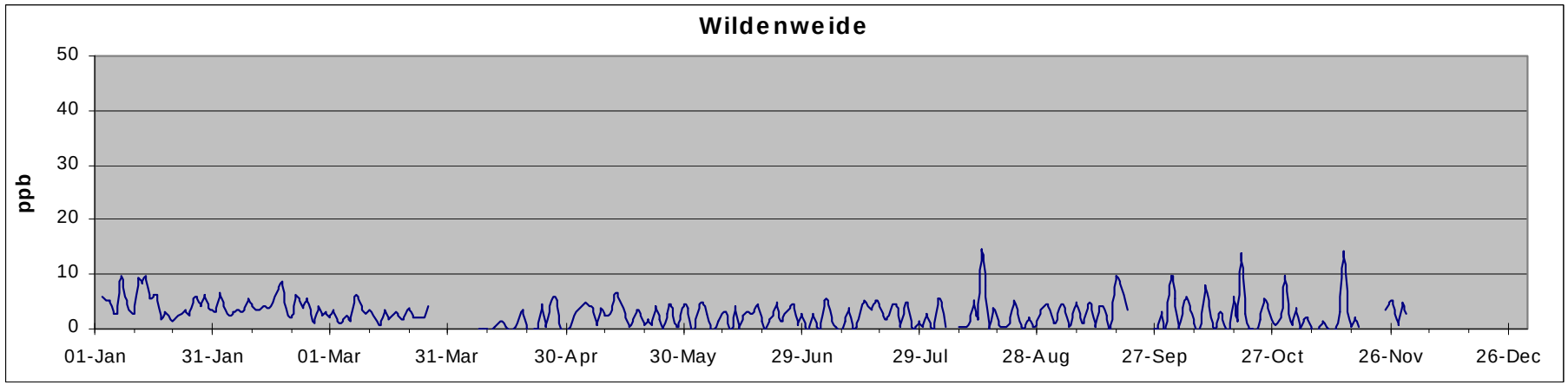


Figure 5: Daily mean SO_2 measured at Esikhawini (Jan-Jun 2000)

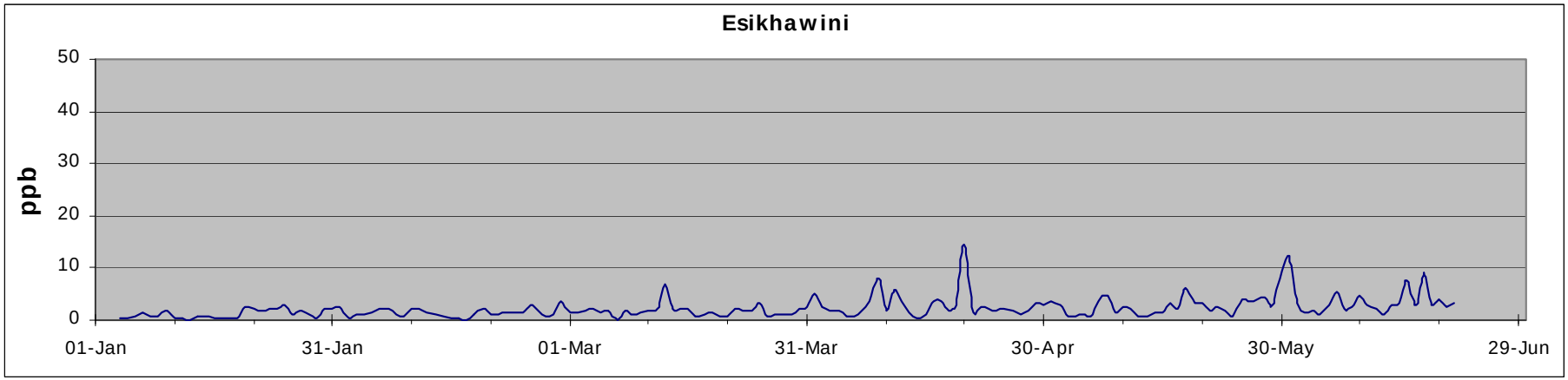


Figure 6: Daily mean SO_2 measured at Umhlatuze (Jan-May 2000)

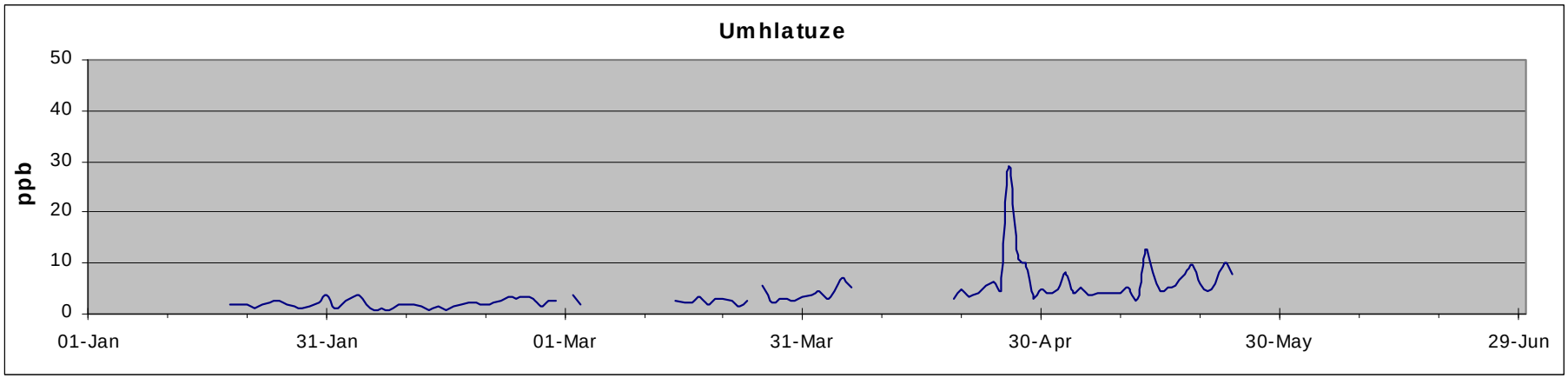


Figure 7: Daily mean SO_2 measured at the Caravan (adjacent to TLC building) (Jul-Dec 2000)

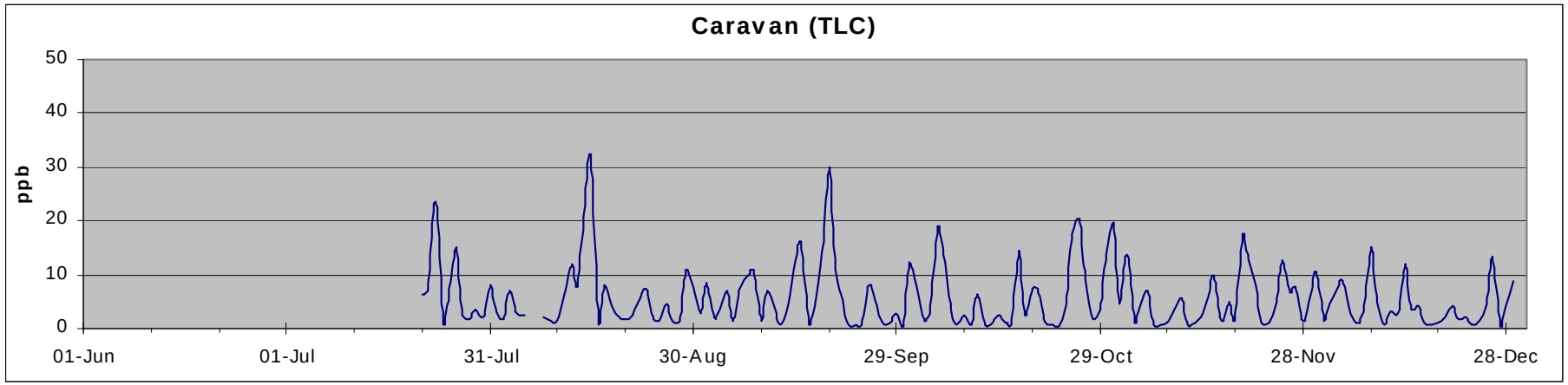


Figure 8: Daily mean SO_2 measured at Veldenvlei (Jun-Dec 2000)

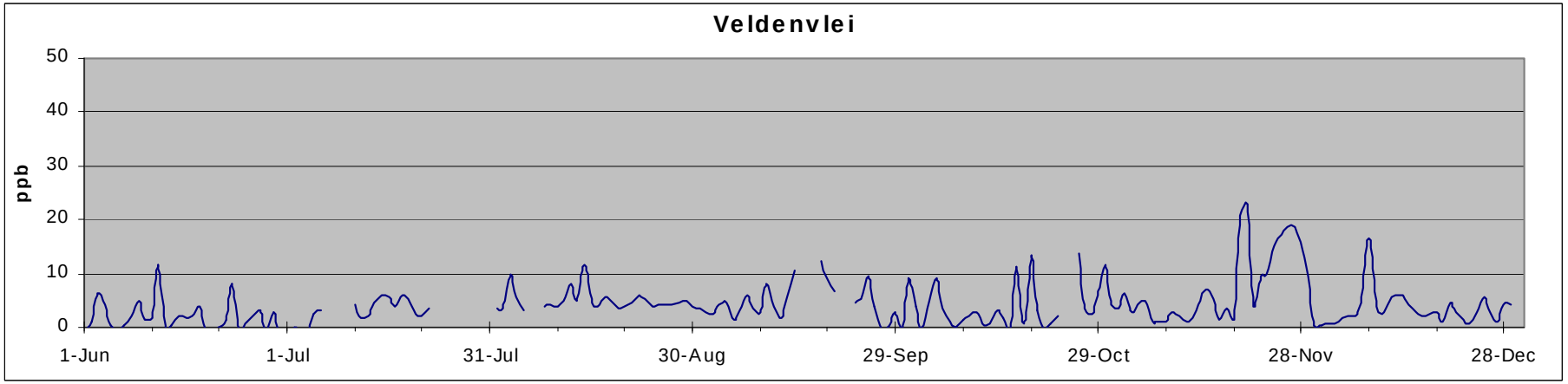


Figure 9: Daily mean SO_2 measured at Hillside

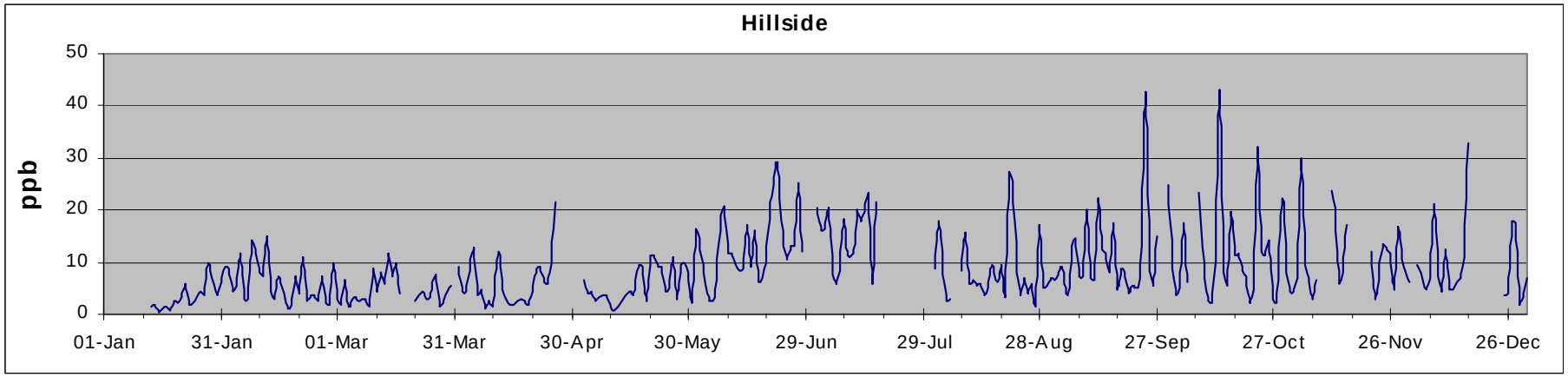
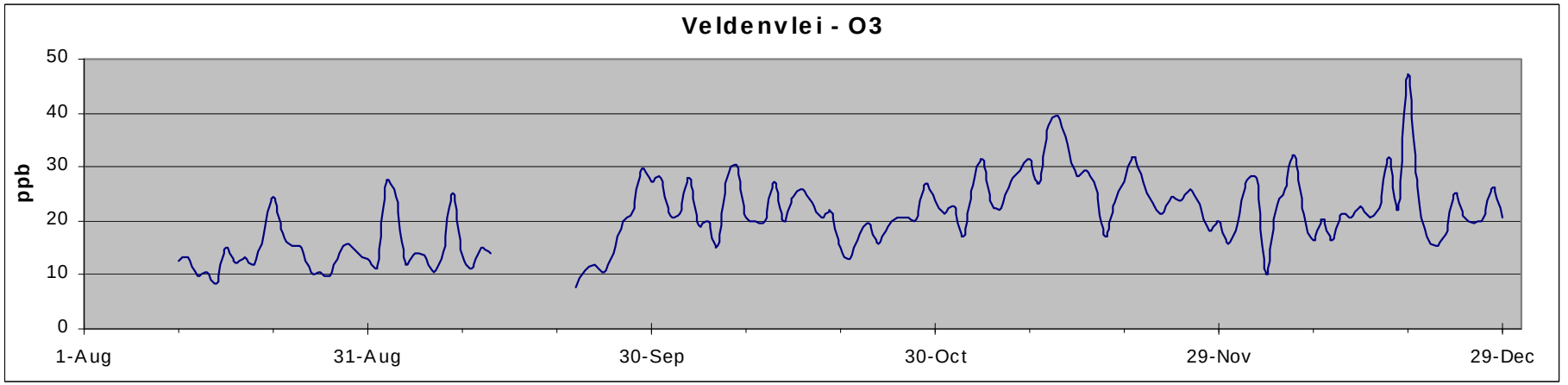


Figure 10: Daily mean Ozone (O_3) concentration measured at Veldenvlei (Aug-Dec 2000)



The annual and monthly averages were highest at the Hillside station (formerly the Caravan). This is considered to be due to the location of the station relative to Hillside, Bayside and Indian Ocean Fertilisers (IOF) plants. The monthly and annual averages were however below the national guidelines. The highest monthly average of 13.3 ppb during June was 26.6% of the national guideline. The trends in monthly average SO_2 at Wildenweide, Veldenvlei and the Caravan (TLC building) were similar during the latter half of the year, for which data is comparable. This is considered to be due to the stations' locations, north-east of the major industries, and thus all measure increased SO_2 during winds from the south-west sector. Averages at the Caravan were generally higher than at the other two stations due to its closer proximity to industry. Likewise trends in monthly average SO_2 at Umhlatuze and Esikhawini, both situated west-southwest to southwest of the main industrial area, were also similar.

Arboretum

SO_2 peaks at Arboretum were generally recorded on moderate west-southwest to south-westerly winds, between 220º and 260º, with the highest monthly averages recorded between April and June (Fig. 2). Peaks associated with this wind field generally originate from the Hillside site or the IOF acid plant stack. Some higher episodes were recorded on a westerly wind, most likely a result of plumes from Mondi Kraft. The maximum SO_2 levels recorded on the morning of 15 August (Table 3) were also reflected earlier at the Caravan and at the Veldenvlei and Wildenweide stations (late on 14 August) and were all related to the same incident. Light westerly to northwesterly winds and stable conditions suggested a source west-northwesterly of Richards Bay, possibly a fire. An extended period of elevated SO_2 was measured at Arboretum from 5 to 7 April. This was a result of a consistent fresh winds (> 5 m/s) from the south-west combined with emissions from Alusaf Hillside, Bayside and IOF.

Wildenweide

Peaks were generally recorded on a more southerly to south-westerly wind direction (approximately 180º to 200º) to that of the Arboretum station. The station location was positioned for the purpose of recording emissions from the Mondi Kraft mill, but the concentrations are not as high as would be expected, and can generally be linked to plumes from IOF and Hillside. Apart from the peak levels late on the 14th (see above), peaks in daily average SO_2 on 19 October occurred during fresh to strong south-westerly winds, which would suggest Mondi as the source. On the other hand, the peak on 14 November was recorded during fresh southerly to SSW winds, which suggests the SO_2 may have been derived from Alusaf Hillside, Bayside or IOF.

Esikhawini

Lowest SO_2 averages were recorded at the Esikhawini station, which can be regarded as representative of background SO_2 concentrations. The maximum SO_2 concentrations on the early morning of 20 April (Table 3) and 31 May (Fig. 5) were both associated with light north-westerly to WNW winds and stable conditions. The source was either from the Felixton Mondi or Tongaat-Hulett plants or local sugar cane burning.

Umhlatuze

Data capture at the Umhlatuze station was rather erratic for the period of operation due to an unreliable power supply to the station. Peak SO_2 levels were generally associated with moderate to fresh south-westerly winds and unstable conditions, which suggests the source to be either from Felixton's Mondi or Tongaat-Hulett or local sugar cane burning. A startup was in process at Tongaat-Hulett when peak SO_2 levels were measured on 26 April, although no problems were apparently experienced. Sugar cane burning was reported when the smaller peak was measured on 13 May.

Caravan (TLC building)

SO_2 averages were generally second highest at the Caravan site (Fig. 2), which is to be expected considering it's relative proximity to the main industrial sources compared to the other stations (excluding Hillside) during west-southwesterly to south-westerly winds. Circumstances surrounding the maximum daily average on the early morning of 15 August are discussed above. Elevated SO_2 on the morning of 19 September (Fig. 7) was also evident at Arboretum (Fig. 3) and was related to moderate west-southwesterly winds. The Hawk dispersion model predicted the source of SO_2 to be from Mondi and Alusaf Hillside.

Veldenvlei

Elevated average SO_2 at Veldenvlei was also generally correlated with moderate to fresh south-westerly to west-southwesterly winds, the main sources from this vector being Mondi and Hillside. The maximum daily average of 23 ppb on 20 November (Table 3) was associated with such a wind field.

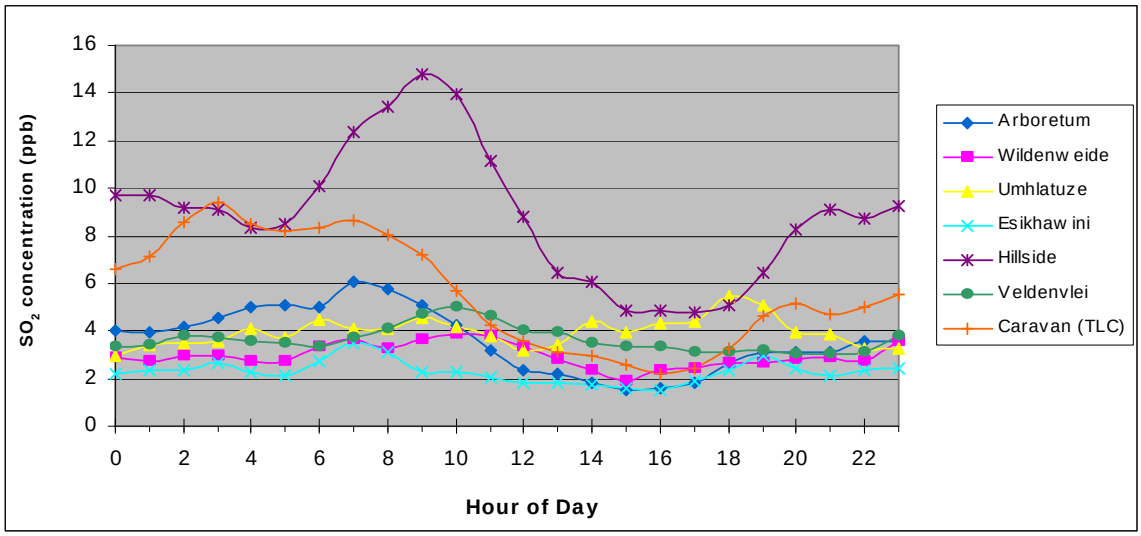
Hillside

The SO_2 averages recorded at this station were generally higher than the averages recorded at the other stations. Elevated daily and hourly average SO_2 at Hillside is mainly associated with the predominant north-easterly winds and is a result of Hillside emissions. The maximum daily average of 43 ppb on 13 October and the peak on 24 September were associated with such conditions. Elevated levels are also possible during land breeze circulation, e.g. the maximum instantaneous concentration of 286 ppb on 12 February (Table 3). This was generally more evident during the winter months and the most likely source is the Hillside GTC4. . Short-term peaks were noted during SSE winds, usually associated with an anticlockwise turning of the winds from south-west, through south to south-east and eventually north-east as low pressure systems move eastwards and are replaced by high pressure systems. The most likely source during these wind shifts is from IOF or Bayside.

2.2.4 Diurnal Trends

Diurnal trends indicate the variation in SO_2 concentration with time of the day. The diurnal trend for each station for 2000 is shown in Figure 11**.**

Figure 11: Diurnal trend for the period January to December 2000



The diurnal trends were similar to those observed for 1998 and 1999. The station at Hillside showed the strongest diurnal trend, with a morning peak in SO_2 concentrations between 09h00 and 10h00 and minimum values during late afternoon when dispersion is at its best. The morning peak is mostly a function of the onset of diurnal north-easterly winds, which transport SO_2 from the direction of the Hillside FTC. The elevated evening and early morning concentrations coincide mainly with the land breeze circulation (north-westerly), which transports SO_2 mainly from the Hillside GTC4.

Early morning peaks and minimum afternoon levels are observed at both the Caravan (TLC building) and Arboretum, although the trend at Arboretum is weaker than that at the Caravan. Both these stations tend to measure increased SO_2 during west-southwesterly to south-westerly winds. Afternoon levels tend to be lower as dispersion, particularly during summer, is improved. The effect of inclement weather events on the diurnal winds is to tend to rotate them anticlockwise to southerly during daytime and south-easterly by afternoon. This is off the vector to the main sources relative to the stations.

The trends at Veldenvlei and Wildenweide were fairly similar, with both measuring peak SO_2 concentrations between 10h00 and 11h00, usually associated with southerly to south-westerly winds. Minimum concentrations were generally measured during mid afternoon at Wildenweide, while at Veldenvlei the minimum was towards late afternoon and evening.

At Umhlatuze maximum SO_2 was recorded during the evening, between 18h00 and 19h00, while Esikhawini showed a slight increase in concentrations during early morning and the evening.

2.2.5 Frequency Distribution of Results

Daily averages

A frequency analysis of environmental data is customarily performed in order to classify the air pollution for a region. It is also useful when working with large data sets. A frequency distribution of the data reveals the predominant SO_2 concentrations (as categories) over a period of time. The frequency distribution (histogram graph) and cumulative percent (line graph) of daily mean data for those stations where data capture for the year exceeded quality assurance (80%) is given in Figures 12-14. The mode (most frequently occurring category) was 2 ppb (i.e. 0-2 ppb) at Arboretum and Wildenweide and 88% and 96%, respectively, of daily averages were below 8 ppb. The trend at Hillside (Fig. 14) differs somewhat in that the cumulative percentage distribution is more even than for the other stations. Only 62% of Hillside daily averages were less than 8 ppb and a greater proportion of daily averages occurred in the 10 to 20 ppb categories compared to the aforementioned two stations.

Figure 12: Frequency distribution of daily mean data at Arboretum for the period January to December 2000

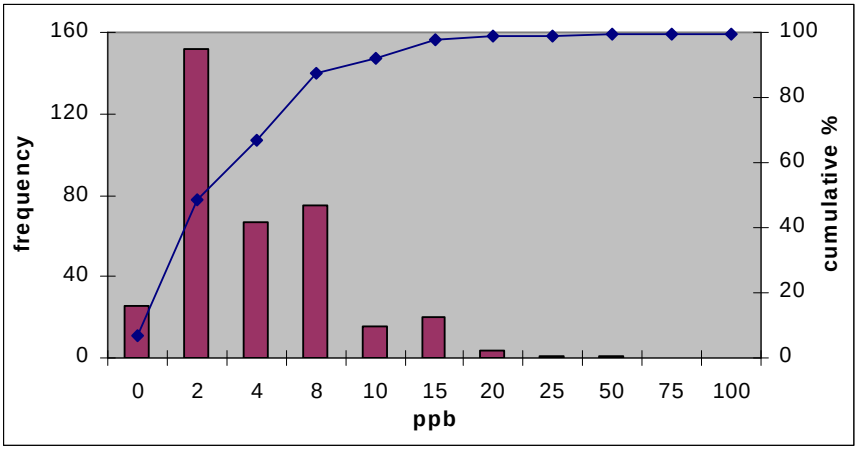


Figure 13: Frequency distribution of daily mean data at Wildenweide for the period January to December 2000

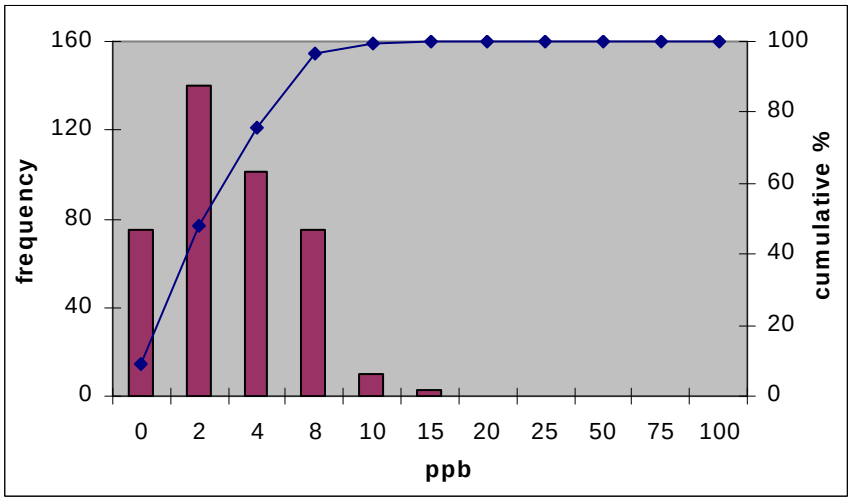
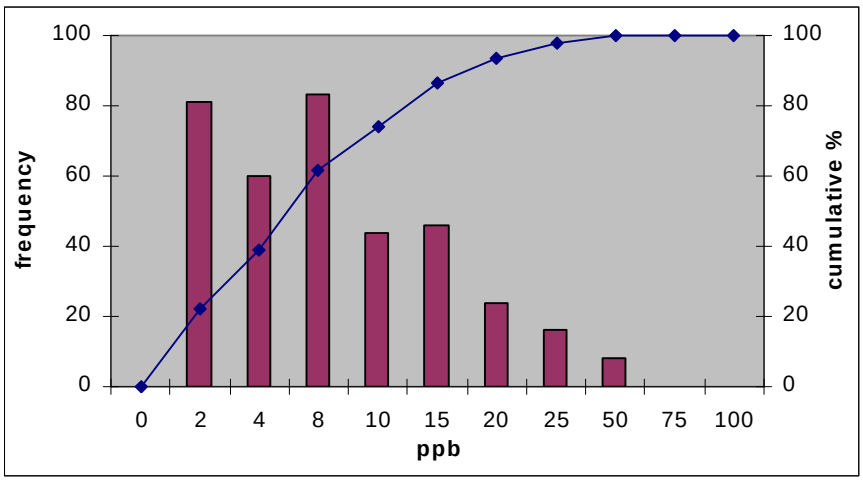


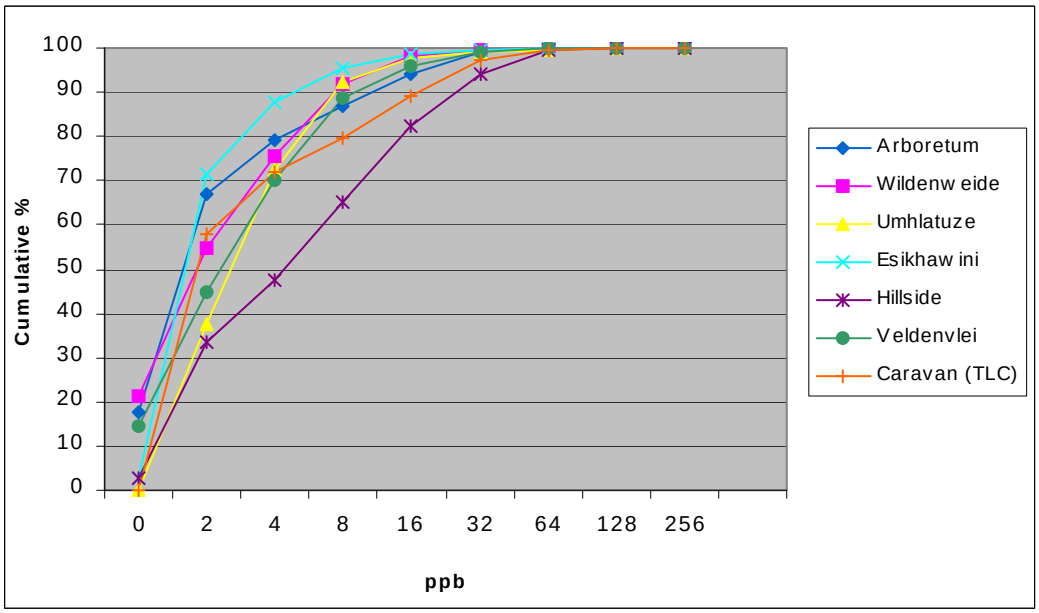
Figure 14: Frequency distribution of daily mean data at Hillside for the period January to December 2000



Hourly averages

The cumulative percentage of hourly mean data at all stations is provided in Figure 15. The results indicate a tendency for higher hourly averages over the 4 to 32 ppb frequency classes.

Figure 15: Cumulative percent of Hourly Mean data for the period January to December 2000



Note: Umhlatuze, Esikhawini, Veldenvlei and Caravan graphs are based on data capture for the year of less than 80%.

Percentiles

Percentiles also provide an indication of the spread of the data by giving an indication of the concentration below which the specified percentage of the data occurs. Percentiles of the hourly mean data from all the monitoring stations are shown in Table 2.

Table 2: Percentiles for the hourly mean SO_2 at each station

Percentile	SO_2 (ppb)						
	Arboretum	Wildenweide	Hillside	Esikhawini	Umhlatuze	V'vlei	Caravan
95th	17.7	10.5	34.1	7.7	10.0	14.3	24.5
75th	3.0	3.9	11.9	2.3	4.3	4.4	5.2
50th	1.0	1.6	4.5	1.1	2.5	2.3	1.6

Note: statistics for the latter four stations are based on annual data capture rates of less than 80%.

The British Department of Environment's classification scheme suggests that, for SO_2, a 95th hourly average percentile less than 60 ppb is classified as *Very Good*, between 60 and 124 ppb is classified as *Good*, between 125 and 399 ppb is classified as *Poor* and greater than or equal to 400 ppb is classified as *Very Poor*. According to this scheme, the air quality, in terms of SO_2, at all the stations may be regarded as *Very Good*. The air quality was poorest at the Hillside station, where the percentiles were consistently the highest of all stations.

3 Maximum SO_2 Concentrations

The maximum SO_2 concentrations (in ppb) measured during 2000 are shown in Table 3. While there were no exceedances of the DEAT guidelines, the maximum is reflected as a percentage of the guideline in parenthesis. More detailed descriptions of the peak analyses are available in the weekly and monthly reports.

The highest instantaneous (5-minute average) and hourly average SO_2 was recorded at the TLC building, while the maximum daily average SO_2 occurred at Hillside. A case study was performed to investigate the maximum peaks late on 14 August and early on 15 August. The Hawk dispersion model indicated a source north-west of Richards Bay, although there is no known source from this direction in the SO_2 emission inventory. It was concluded that the source was other than industrial SO_2, possibly a fire.

Table 3: Highest SO_2 concentration (ppb) measured at each station during 2000 and percent of National guideline (brackets)

STATION	DAILY AVERAGE		HOURLY AVERAGE		5-MIN AVERAGE	
	SO_2 (ppb)	Date	SO_2 (ppb)	Date & time	SO_2 (ppb)	Date & time
Arboretum	33.1	15/08	197.2	15/08	331.0	15/08
(% of guideline)	(33%)		(66%)	04h00	(55%)	04:55
Wildenweide	14.5	14/08	232.5	14/08	359.3	14/08
(% of guideline)	(15%)		(78%)	23h00	(60%)	2305
Esikhawini	14.4	20/04	84.8	20/04	152.0	20/4
(% of guideline)	(14%)		(28%)	07h00	(25%)	07:30
Umhlatuze	29.0	26/04	124.9	26/04	147.0	26/04
(% of guideline)	(29%)		(42%)	18h00	(25%)	18:00
Veldenvlei	22.7	20/11	111.6	14/08	205.0	14/08
(% of guideline)	(23%)		(37%)	23h00	(34%)	23:15
Caravan (TLC)	31.7	15/08	243.3	15/08	470.3	15/08
(% of guideline)	(32%)		(81%)	03h00	(78%)	03:30
Hillside	43.1	13/10	113.6	08/06	286.0	12/02
(% of guideline)	(43%)		(38%)	08h00	(48%)	00:30

4 Complaints

A total of 40 complaints were lodged with the RBCAA during the year 2000. The monthly breakdown is shown in Table 4 and an area breakdown is shown in Table 5.

Table 4: Number of complaints logged with the RBCAA during the year.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	1	2	6	8	2	5	5	4	2	4

Table 5: Most common locality of complaints.

Location	Compaints Total for 2000
Veldenvlei	12
Arboretum	9
CBD	8
Meerensee	3
John Ross Highway	3
Alton	2
Arboretum Extension	2
Wildenweide	2
Other	3

Most complaints were logged during the calm period of May to June, however an increasing number of complaints were also logged during the latter half of the year (relative to previous years). Most of the complaints stemmed from the resildential areas of Veldenvlei, Arboretum, followed by the Central Business District (CBD).

5 Atmospheric Data

5.1 Weather Summary

The lapse rate is the difference between the measured temperatures at 2 m and 70m at the Bayside Aluminium tower. If the lapse rate is negative, it indicates warm air above cool air, and hence stable atmospheric conditions. If the lapse rate is positive this indicates warm air below cool air, and neutral to unstable atmospheric conditions. Figure 16 indicates the daily average lapse rate, while Figure 17 indicates the average diurnal trend in lapse rate for the year.

From Figure 16 it can be clearly seen that the lapse rate during summer months is positive, thus atmospheric conditions are more turbulent and dispersion of pollution is generally favourable. The lapse rate progressively tends to become more negative with the approach of autumn and winter, which indicates a stable atmosphere. It is during this time that dispersion appears to be the worst. The daily average lapse rate was predominantly negative from 10 April to 6 September. Very stable conditions were experienced on 30 May, 26 June and 6 August. With the advent of spring the lapse rate returns to positive again and atmospheric conditions become less stable

Figure 16: Daily Average Lapse Rate at the Bayside Tower (T2m – T70m)

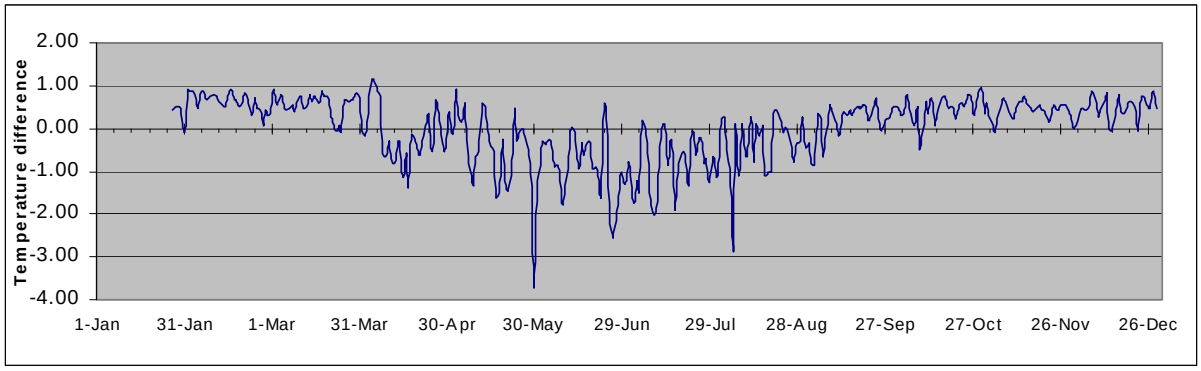
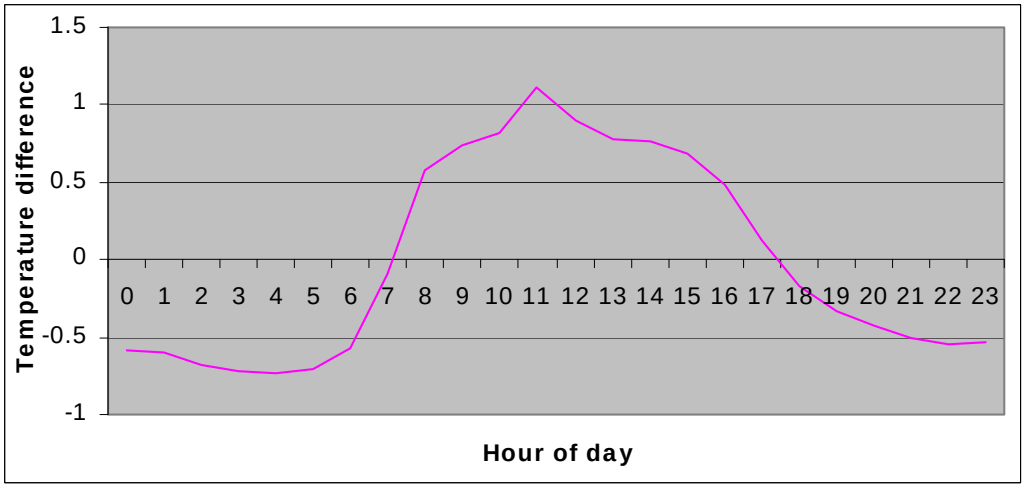


Figure 17: Average Diurnal Lapse Rate at Bayside Tower (T2m – T70m)



The diurnal lapse rate is presented in Figure 17. The lapse rate is generally negative overnight, indicating stable conditions. After the onset of diurnal heating during the day, the lapse rate becomes positive, which leads to unstable conditions. As discussed earlier (Chapter 2.2.4) the diurnal trend at some of the stations is influenced by this lapse rate, with an increase in the SO_2 concentrations at night and early morning and a decrease in the SO_2 concentrations during the day.

The annual wind frequency given in Figure 18 plots the frequency of speed and direction towards which the winds blow to give a perspective of the direction of plume transport. The highest frequency of winds were of the moderate speed category (1.5 to 5.0 m/s), predominantly from the NNE to NNW and SSW to south-west (i.e. blowing to the SSW to SSE and NNE to NE). Higher speed winds were predominantly from the NNE and SSW to south-west. It was noticed that, especially during the colder months, a land- sea breeze situation occurred. The landbreeze occurred during nighttime and early morning and was from the west to north, but most frequently from the north-west sector. These landbreezes prevailed approximately 10% of the time. The seabreeze from the NNE to north-east would start after the effect of daytime heating was felt and the overnight surface inversion was raised or eliminated.

Figure 18: Wind Rose for 2000

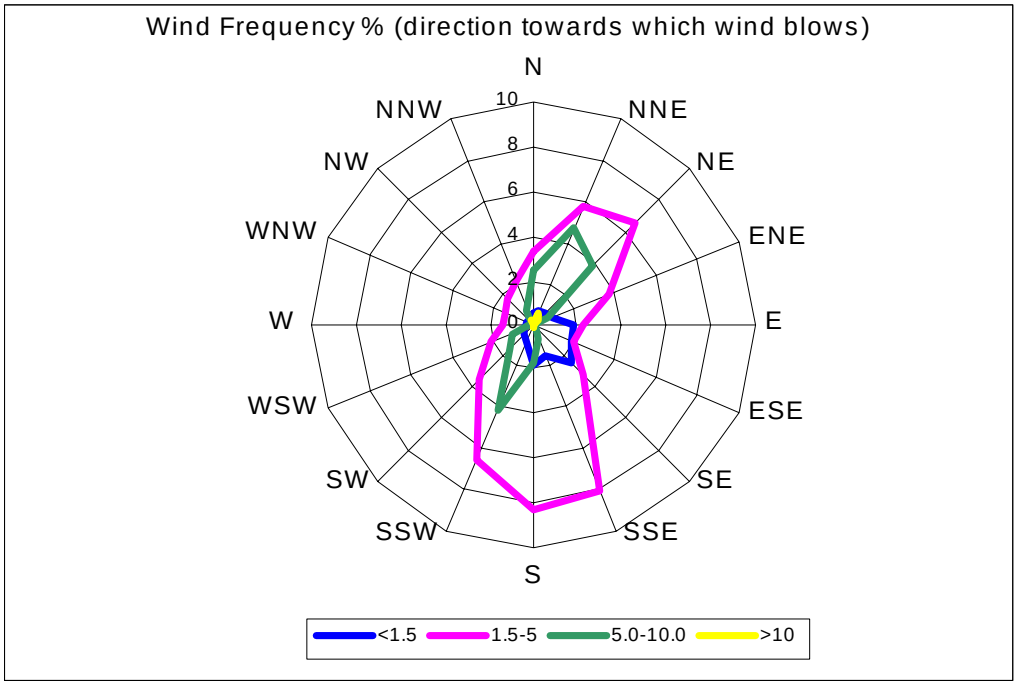


Figure 19: Average Daily Wind Speeds at the Bayside tower (21m)

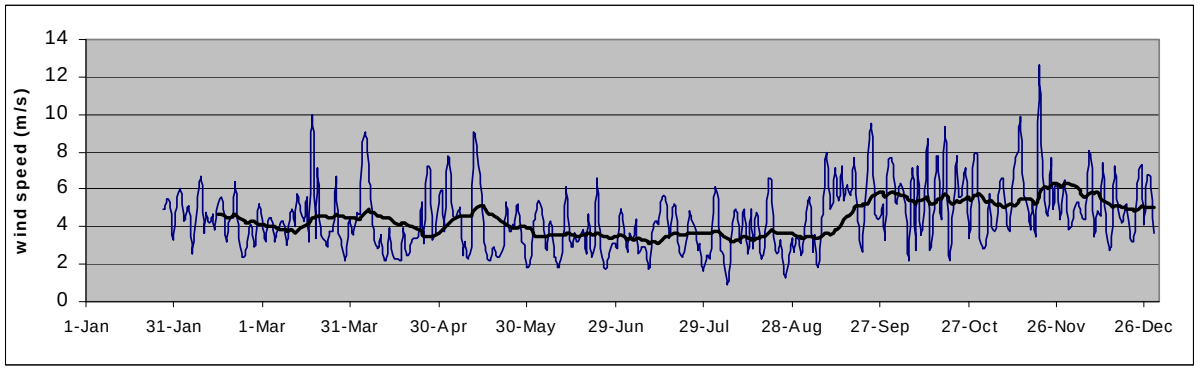


Figure 19 shows the daily average wind speed and the moving average. The wind speeds gradually decreased from approximately 4-5 m/s during summer to a minimum average around 3 m/s during late autumn and winter. From the onset of spring, around September, to November the daily average wind speed increased to approximately 6 m/s, before decreasing slightly to approximately 5 m/s with the approach of mid-summer.

6 Quality Assurance Report

6.1 Calibration of Equipment

The ambient air monitoring stations are SANAS accredited laboratories. The meteorological equipment was calibrated semi-annually by Inteltronics, and ESKOM TSI performed quarterly calibrations of the continuous air pollution monitors. Precision checks were performed before and after the calibrations to determine the error of each analyser before the calibration. Results of the pre-calibration checks are given in Appendix 2. Analyser span and zero checks are alternated with precision checks, using an internal calibrator, on a weekly basis.

6.2 Quality Assurance system and ISO Guide 25 Accreditation

A quality assurance document, detailing procedures and quality control limits for the Richards Bay Clean Air Association was drawn up and implemented in 1997 and 1998. This document formed the basis of the application to the South African National Accreditation System (SANAS) for ISO Guide 25 accreditation. Each monitoring station is regarded as a separate laboratory for accreditation purposes. The quality control checks made to the data are presented in Appendix 3. The monitoring system was accredited by SANAS in March 1999. Accreditation is now reviewed annually. The system was re-assessed during July 2000. Several minor non-conformances were found, but these were rectified and accreditation was confirmed in August 2000.

6.3 Table: Data Capture rates of SO_2 Monitoring Stations

Data capture for the SO_2 monitoring sites is presented in Table 6 for the period January to December 2000. The overall data capture for the year was 85%. This is in excess of quality assurance requirements (80%) but below the data capture goal of 90% and the 94% achieved during 1999. Reasons for periods of lower data capture are presented in *Appendix 1: Missing Data*. The station moves during mid-year affected data quality to some extent, while power failures were the most common cause of data loss.

Table 6: Data Capture at the RBCAA SO_2 Monitoring Stations during 2000

Month	Hillside	Arboretum	Wilden-weide	Veldenvlei	Caravan (TLC)	Esikhawini	Umhlatuze	Average
Jan	62.7	72.3	91.5			91.6	43.9	72.4
Feb	95.2	90.9	97.8			98.2	95.7	95.6
Mar	82.4	98.9	83.5			98.9	50.2	82.8
Apr	88.8	99.4	78.4			99.7	60.0	85.3
May	80.9	98.6	99.0			97.9	78.0	90.9
Jun	91.1	97.1	96.9	96.6		69.1		90.2
Jul	55.0	99.7	99.8	66.2	37.0			71.5
Aug	96.2	96.5	95.3	96.2	96.6			96.2
Sep	96.6	99.6	80.0	86.7	99.2			92.4
Oct	95.8	99.8	99.5	96.0	99.6			98.1
Nov	82.8	56.7	81.2	99.3	99.6			83.9
Dec	74.5	56.5	23.3	92.0	91.6			67.6
% of time installed	83.5	88.8	85.5	90.4	87.3	92.6	65.6	84.8
% of year	83.5	88.8	85.5	52.8	43.6	46.3	27.3	

5. Network Report

5.1. Network Description

Outstations

Power failures were the most common cause of downtime at stations during the course of 2000 and analyser malfunctions occurred at Wildenweide and Arboretum (refer Appendix 1). During mid-year, the Esikhawini and Umhlatuze stations were relocated to Hillside and Veldenvlei, respectively and the Caravan, previously at Hillside, was moved to a site adjacent to the Transitional Local Council (TLC) building. The new Hillside station was positioned adjacent to the existing Hillside weather station. This was consistent with the requirements of the model developer, who had requested that the station be moved from the slight gully in which the Caravan had previously been situated.

Both the PM_{10} and ozone analysers experienced problems during the latter half of 1999 and were returned to the agents for repairs. The ozone analyser was repaired and placed at Veldenvlei during August 2000. Although the analyser would not go through the span check procedure properly, calibration checks indicated that the analyser performed within acceptable limits. The RBCAA decided to postpone repairs to the PM_{10} analyser until such time as a formal policy on particulate monitoring had been finalised.

The air conditioner at the Caravan malfunctioned during January and was replaced. A fault in the radio modem at Umhlatuze contributed to some data loss during March and the datalogger at the Caravan (Hillside) malfunctioned on 29 June. A problem with one of the logger cards was identified at Hillside during July. The card was removed and repaired by Prodesign.

Master Station

The master station at the Richards Bay TLC office building functioned well during 2000, the only problem being a server failure as a result of insufficient memory space on 29 December. Software upgrades were made to the SQL Server during the year.

Base Station

The database operated well apart from a malfunction between 6 and 7 August, which resulted in some loss of data.

6. Conclusions

The following conclusions were made regarding the data and the operation of the monitoring system.

- The air quality in the Richards Bay region in terms of SO_2 for the year of 2000 is classified as "very good" (in terms of the British Department of Environment guidelines for air quality.).
- Air quality was poorest at the Hillside station in terms of SO_2.
- There were no exceedances of the National DEAT guidelines during 2000 and the highest annual average at Hillside was less than 30% of the National guideline.
- Annual averages are in the same range as previous years with no significant variation.
- A total of 40 complaints were logged with the RBCAA during the year, mostly from the Veldenvlei, Arboretum and CBD area.
- System availability was 9% down on the previous year but still above the 80% quality assurance.

7. Objectives for 2001

- Strive to achieve data capture greater than 90% for the year.
- Change the averaging period of SO_2 measurements from 5-minutes to 10-minutes to allow for comparison with World Health Organisation (WHO) guidelines.
- Maintenance of the SANAS ISO Guide 25 accreditation.
- Improvement of the Complaints procedure.
- Hawk model validation completion (following station moves)
- Policy regarding expansion of the systenms

8. Achievement of 2000 Objectives

2000 Objectives	Objective Status
♦ Improvement on the reporting of information and making it more accessible through the use of Internet capabilities.	♦ RBCAA is connected to Internet via the Richards Bay TLC, and monthly and weekly reports are posted on the ECOSERV web site (www.ecoserv.co.za)
♦ Successful movement of stations to account for more intense residential monitoring.	♦ The station locations were re-evaluated and successfully moved in 2000.
♦ Expansion of the monitoring system to incorporate particulates, as requested by existing and potential RBCAA members.	♦ One particulate monitor with agents for repair. No progress.
♦ Maintain data capture rate above 90%	♦ Data capture rate fell by 9% in 2000 due to station moves, power failures and analyser malfunctions. The overall capture rate is still greater than 80%.
♦ Maintenance of SANAS accreditation.	♦ SANAS re- accreditation achieved in August 2000.

APPENDIX 1 : MISSING DATA

FROM		TO		
Date	**Hour**	**Date**	**Hour**	**REASON/COMMENTS**
All stations				
01-Jan	00h00	03-Jan	11h00	Y2K problem: dataloggers needed to be manually reset
06-Aug	11h00	07-Aug	07h50	Database malfunctioned
29-Dec	19h00	31-Dec		Server failure due to insufficient memory space
Umhlatuze				
01-Jan	00h00	13-Jan	13h00	Power failures: moisture tripped electrical breakers, Y2K: dataloggers reset
14-Jan	13h00	19-Jan	08h00	Power failures: moisture tripped electrical breakers
01-Mar	09h00	14-Mar	13h00	Faulty modem and power failure during Umhlatuze Water Board maintenance
25-Mar	10h00	28-Mar	09h00	Power trip
06-Apr	16h00	18-Apr	15h00	Fire at Umhlatuze Water Board weir pump station
25-May	00h00	Year-end		Station decommissioned
Esikhawini				
01-Jan	00h00	03-Jan	11h00	Y2K problem: dataloggers needed to be manually reset
23-Jun	00h00	Year-end		Station decommissioned
Arboretum				
01-Jan	00h00	06-Jan	00h00	Y2K problem: dataloggers needed to be manually reset
18-Nov	00h00	03-Dec	00h00	Power failure subsequent to flooding, followed by analyser malfunction
14-Dec	20h00	20-Dec	00h00	Power supply problems
26-Dec	08h00	Year-end		Power supply problems & slow analyser response after power restored
Wildenweide				
01-Jan	00h00	03-Jan	11h00	Y2K problem: dataloggers needed to be manually reset
27-Mar	07h00	07-Apr	10h00	Power failure and analyser malfunction
20-Sep	21h00	26-Sep	16h00	Power failure and analyser malfunction
19-Nov	03h00	24-Nov	09h00	Power failure subsequent to flooding
30-Nov	21h00	Year-end		Power supply problems and analyser failed QA checks
Hillside (formerly Caravan)				
01-Jan	00h00	12-Jan	11h00	Air conditioner problems, Y2K: dataloggers reset
18-Mar	00h00	20-Mar	13h00	Heavy rain resulted in power trip
26-Apr	16h00	02-May	11h00	Main breaker tripped
12-May	00h00	15-May	11h00	
29-Jun	11h00	01-Jul	12h00	
18-Jul	10h00	25-Jul	00h00	Caravan moved to TLC offices & Esikhawini station moved to Hillside
08-Nov	18h00	10-Nov	12h00	Eskom maintenance
17-Nov	11h00	20-Nov	14h00	Power failure subsequent to flooding
01-Dec	19h00	03-Dec	07h00	Power failure
17-Dec	00h00	19-Dec	15h00	Power failure
21-Dec	10h00	24-Dec	12h00	Power failure

FROM		TO		
Date	**Hour**	**Date**	**Hour**	**REASON/COMMENTS**
Veldenvlei				
07-Jul	01h00	10-Jul	11h00	Breaker trip
23-Jul	01h00	24-Jul	08h00	Power failure
26-Jul	08h00	31-Jul	19h00	Power failure
14-Sep	21h00	17-Sep	16h00	Power failure
Bayside (met data)				
01-Jan	00h00	27-Jan		Y2K problem: dataloggers needed to be manually reset

APPENDIX 2 : ANALYSER CALIBRATION RESULTS FOR 2000

Station	March '00	June '00	September '00	December '00
Arboretum sn 93b	3.2% high	5.9% high	4.5% low	12.7% high
Caravan sn 281	2.5% low	6.2% high	5.7% low	5.5% high
Esikhawini sn 85b	1.96% high	4.7% high	-	-
Hillside sn 85b	-	-	8.1% low	14.4% high
Umhlatuze sn 291	0.15% low	7.0% low	-	-
Veldenvlei sn 291	-	-	17.3% low	11.2% high
Wildenweide sn 141	0.35% high	-	-	-
Wildenweide sn 92b TRS	1.7% high	13.5% high	3.6% high	Power problems

APPENDIX 3 : QUALITY CONTROL CHECKS MADE TO RBCAA DATA

Tolerance Check	<10ppb from zero	>10ppb from zero	Actions		
			>±5%	>±10%	>±15%
Zero (with reference calibrator)	adjust if >5ppb	multipoint calibration	-	-	-
Level I Span	-	-	adjust	multipoint calibration	multipoint calibration and invalidate data
Multipoint Calibration	-	adjust zero	adjust	adjust	adjust and invalidate
Audit Span	-	-	-	multipoint	multipoint calibration and invalidate data
Precision check					Level I span. If analyser is still out of specification replace or perform a multipoint calibration. Data is to be invalidated going back to last valid precision check.
Accuracy check					Replace and repair analyser. Data is to be invalidated going back to last valid calibration.
Tolerance Check	**Data quality objective**		**Actions if data quality objective is not achieved**		
Completeness	> 80 %		Invalidate time averaged data for which completeness is not 80 %. i.e. hourly averages are to be invalidated if less than 48 minutes of data is received and daily averages are to be invalidated if less than 19.2 hours of data is available.		