

ISCOR VANDERBIJLPARK STEEL

ENVIRONMENTAL MASTER PLAN

SPECIALIST REPORT

AIR POLLUTION

BY ENPRO

SERIES IV DOCUMENT IVS/SR/041 DECEMBER 2002





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BY NICO BOEGMAN **ENPRO**

SERIES IV **DOCUMENT IVS/SR/041 DECEMBER 2002**







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IVS/SR/041

VANDERBIJLPARK STEEL MASTERPLAN SPECIALIST REPORT AIR POLLUTION

Prepared for

OFT MASTERPLAN TEAM

by

N. Boegman of ENPRO (Pty) Ltd



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REPORT BV/00/11 NOVEMBER 2002

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EXECUTIVE SUMMARY

 The OFT Team was commissioned by Vanderbijlpark Steel (VDBS) to undertake a baseline study of all environmental aspects for the works and prepare a Masterplan, to be completed by December 2002.

This report covers the air pollution aspects, to be included in the integrated environmental plan for VDBS.

2. In order to adjudicate the acceptability of the VDBS air emissions and assess the potential risk, a set of benchmarks, consisting of international standards as well as RSA standards and guidelines have been compiled for ambient air quality.

The guidelines for dust fall-out published by the Chief Air Pollution Control Officer are also recorded.

3. The dispersion of air pollution in the free atmosphere is controlled by the atmospheric conditions pertaining at the time. Site specific meteorological data has been collated and interpreted within the local topographic context.

A full year of hourly wind direction and speed data from the VDBS South Gate together with generic and derived atmospheric stability data is later used as input to the air pollution dispersion modelling.

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4. Because it is not practical to monitor gaseous and fine particulate concentrations outside the plant perimeter, and because such measurements would include the contributions by all surrounding sources, recourse was taken to atmospheric dispersion modelling. To this end, a very detailed description of all sources of air pollution was drawn up, containing all available information and from this a full air pollution source inventory was drawn up.

This source inventory contains the exact details on location, type of source, ground level at the source, emission height, exit dimensions, emission volume rate, efflux velocity, temperature and mass of emission rate of each air pollutant. Also included for each source is an accuracy rating of the emission rate data.

The actual monitored data from the instrumented caravan operated by VDBS, stationed roughly in the middle of the production activity on the site is also recorded and assessed.

5. Using the assembled meteorological and topographic data and the emission inventory as input, atmospheric dispersion of fine particulates and gases were modeled with the American EPA regulatory Industrial Source Complex model. Where possible the model results were calibrated against the monitoring caravan results. The pictorial model results are contained in the main text of the report.

The overall findings are as follows:

Fine particulates (PM10), mainly from fugitive sources are below the benchmark value but requires more attention.

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- The calibrated sulphur dioxide concentrations do not exceed the RSA standard outside the plant perimeter.
- Oxides of nitrogen do not exceed the RSA guideline or the very strict German standard.
- The hydrogen sulphide concentration exceeds the odour threshold south of the plant from time to time but not the benchmark for health.
- Total hydrocarbon concentration is below the 10 microgram/m3
 level beyond the plant perimeter. Due to the wide range of
 compounds included in this category no benchmarks can be
 applied.
- Both hydrogen chloride and carbon monoxide concentrations are insignificant beyond the plant perimeter.
- 6. Particulate deposition was measured over a full year at 36 fall-out monitors in two monthly periods covering the whole site. This programme included insolubles, total dissolved solids, calcium, magnesium, sodium, potassium, sulphate, nitrate, chloride and fluoride.

The insoluble particulate fall-out rate beyond the southern plant perimeter was marginally outside the RSA guideline for residential but not for industrial. The soluble components varied from less than 3% to 38% of the total mass depending on the locality of the monitor within the plant and consisted mainly of calcium sulphate. Chloride, fluoride, sodium and potassium fall-out rates were generally low, at or below detection limits at the plant perimeter. Pictorial isopleth images of all components are contained in the main text.

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7. Based on the measurements undertaken by VDBS on point sources, an assessment was made of compliance with legal requirements as

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contained in the air pollution registration certificates issued in terms of the Atmospheric Pollution Prevention Act. It must be noted that these measurements are done on an ongoing basis and the findings vary from time to time as action is taken when a source is found not to be in compliance. At the time of writing the report on this aspect (September 2002), 35 sources were in compliance, 5 were non-compliant and 6 had not been measured. The latter is being addressed at present.

8. The coke oven gas cleaning project and the development of new technology for abatement on the sinter plant main stack, which have been budgeted for separately and are at present underway, are the most important and urgent as far as air pollution is concerned. They represent the only formal sources of air pollution emissions without adequate emission control.

The five sources which were not in compliance with the legal requirements require urgent attention while the 6 not assessed represent a deviation from the requirement of measuring.

In addition to the sources addressed above, a further 25 lesser sources of air pollution, mainly fugitive dust, were identified and discussed as to what needs to be done, including a first order cost estimate where possible. Of these, 15 were identified for short to medium term attention. A technique for prioritization based on cost-benefit and modified by other material parameters is presented. The total cost estimate for the correction of the 15 sources is R6,5 million.

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9. The final chapter in the report covers a summary risk assessment on air pollution for VDBS as a whole.

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The ambient concentrations of fine particulates and sulphur dioxide are both within the benchmarks (standards or guidelines) but with little margin of safety. If the short term measures proposed are implemented, the point sources which are not in compliance are addressed and the undetermined sources measured, the fine particulate situation will improve noticeably. The coke oven gas project will similarly improve the position regarding sulphur dioxide.

With the exception of the VDBS southern boundary, dust fall-out is within the RSA residential guideline. Steps are in place to reduce in particular road dust which is the main source along this perimeter section.

Compliance with point source legal emission limits varies continually as abatement equipment malfunction or require maintenance. Noncompliance and failure to implement corrective action remains a risk. At the time of writing the compliance level was 76%, with a further 13% not determined.

New air pollution legislation has been in preparation for close on two years, but nothing is known about it, as it has not been published yet. It is likely to be based on standards. At this stage VDBS is advised to attend to any points of non-compliance with the existing Act, and to implement the recommended short term measures.

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 A list of reference sources and an appendices on fall-out bucket detail data, respirable dust at the waste facility and the blast furnace D tap floor are attached.

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CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

A Pre-Master Plan study by the OFT Team, being an environmental data gap analysis was completed during the first half of 2000. Based on the findings, a Master Plan Study was commissioned by Vanderbijlpark Steel (VDBS) in July 2000 for completion by December 2002.

This report covers all air pollution aspects of the integrated environmental study, and the findings will also be reflected in the Master Plan Summary Report.

1.2 TERMS OF REFERENCE

The terms of reference for this study is contained in the Master Plan contract but for ease of reference may be listed as follows:

- Establishment of bench marks for ambient air pollution as contained in the Chief Air Pollution Control Officer (CAPCO) Guideline Values, compared with international standards.
- Compilation of topographic and meteorological parameters relevant to the site, and to be used for dispersion modelling.
- Measurement of particulate fall-out over the whole site, analysed as insolubles and soluble macros over one year, presented in graphic form.

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Compilation of an inventory of all identifiable emissions to air including:

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- point sources
- area sources
- fugitive emissions.

This inventory will be correlated with all available measurements.

- Comparison of measured emissions with the legal requirements as contained in the Air Pollution Registration Certificates and an assessment of the degree of legal compliance.
- Collation of ambient air pollution measurements as recorded at the VDBS monitor caravan.
- Modelling of the ambient air quality for the common pollutants using the emission inventory compiled, and comparing the results with the monitored results.
- Assessment of the significance of the existing air pollution sources and ranking of the need for improvement, linking it to significance, corrective cost and legal requirements.
- Assistance with the procurement and setting up of an appropriate air pollution dispersion modelling facility at VDBS.
- Participation in the formulation of an Integrated Environmental Master Plan for VDBS.
- Contribution to the development and implementation of an Environmental Monitoring Programme for VDBS.
- Preparation of a comprehensive report covering all the aspects detailed above and contribution to the Integrated Summary Report.

1.3 FORMAT

The report will follow the sequence as listed in the Terms of Reference.

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CHAPTER 2 BENCHMARKS

2.1 LEGISLATION

The legislation on air pollution for South Africa as it stands at present (October 2002) is the Atmospheric Pollution Prevention Act (45) of 1965 (APPA) as amended by Amendment Act (17) of 1973. At the time of writing the Minister for the Environment has indicated an intention to prepare new air pollution legislation based on standards, to be submitted to Cabinet in June 2002. At present no indication has been given as to the principles on which it will be based, the application and administration or when it is expected to come into force.

As regards VDBS, the relevant section of the APPA is Part 2 – Scheduled Processes. The requirement is that the "best practicable means" as prescribed by the Chief Officer (CAPCO) shall be used to reduce to a minimum emissions to the atmosphere. The prescribed mechanism is that VDBS must apply for permission to operate a scheduled process and that CAPCO shall issue a Registration Certificate detailing the requirements.

The APPA does not prescribe any ambient air or emission standards. Nor does it provide for the promulgation of standards, as the operative principle is "best practicable means" which is defined in the Act. CAPCO has however published Guideline Values for some of the more common pollutants, as minimum air quality aims, which have a standing comparable to internationally published Ambient Air Quality Standards



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2.2 AMBIENT AIR QUALITY

A selection of RSA Guidelines, standards for various countries, World Bank recommendations and World Health Organization recommended guidelines are given below.

TABLE 2.1 : SUMMARY OF VARIOUS STANDARDS & GUIDELINES FOR AMBIENT AIR.

Pollutant /	Concentration (microgm/m ^s)		
Country	1 hour	24 hour	<u>1 year</u>
Sulphur Dioxide			
RSA Guideline		125 (5)	50 (5)
World Bank	-	500	100
Germany	400 (1)	290	140
USA	41118	365	80
Canada	900	300	60
Finland	500 (2)	200 (3)	12-12
Italy	_	250 (3)	_
Netherlands		200 (1)	*****
Switzerland	100 (4)		142114-
Japan	300	120	
WHO Guideline	500	125	50
Nitrogen Oxides			
RSA Guideline #	600	300	150
World Bank	**	500	100
Germany		200	80
USA			100
Particulates			
RSA Guideline	—	300	100
World Bank		500	100
Germany	—	300	150
USA	-	260	75
Canada	~~~~	120	70
Japan	200	100	-

Total oxides of nitrogen of which 25% is NO₂.

1) Not to be exceeded 95% of year.

2) Not to be exceeded 99% of 720 hours.

3) Not to be exceeded 98% of year.

4) 30 minute concentration not to be exceeded 95% of year.

5) Promulgated 21/12/2001 GN 1387 GG 22941





2.3 AD HOC AMBIENT LIMITS

Even in countries where air quality standards are published, there are still gaps. In situations where other pollutants are being emitted, for which standards or guidelines are not published two options are available.

The first is to use the Ambient Air Level Goals (AALG). These are extrapolations from available data on health effects, to a level where it is believed to be absolutely safe.

In cases where AALG figures are not available, recourse must be taken to the application of a numeric safety factor to Threshold Limit Values (TLV). The TLV represents a level which is safe for the normal healthy worker for a 40 hour workweek and a normal working life of 40 years. The usual safety factor applied for the general public is 50 (divide TLV by 50). For substances suspected of having carcinogenic or mutagenic effects, the safety factor is raised to 100. It must however be pointed out that this approach has no scientific basis.

2.4 DUST FALLOUT

The Chief Officer has also made available a guideline classification basis for dust fallout.

TABLE 2.2 GUIDELINE FALLOUT CLASSIFICATION BY THE CHIEF OFFICER

Classification	Dust Deposition (gram/m²/day)
Slight	< 0,25
Moderate	0,25 to 0,50
Heavy	0,50 to 1,20
Very heavy	> 1,20

Few countries have dust fallout standards. Reference was found to 0,133 $gram/m^2/day$ for Malaysia, 0,33 $gram/m^2/day$ for the Argentine and 0,50 $gram/m^2/day$ for Brazil but without any indication if these values were considered high or low, or to what type of area they would apply.





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Under the German TA Luft, the annual mean dust deposition may be 0,35 gram/m²/day and the 24 hour deposition 0,65 gram/m²/day.

The naturally occurring dust fallout at a given site obviously sets a rational lower limit for fallout. Thus, on the semi-and South African west coast natural dust fall-out levels in excess of 20 gram/m²/day over a period of one month were recorded. Even on the RSA highveld, significant dust fall-out is recorded in rural areas during the dry season.

CHAPTER 3 METEOROLOGY AND TOPOGRAPHY

3.1 LOCATION AND TOPOGRAPHY

The VDBS plant is situated on the highveld on relatively flat terrain at 1 500 m above MSL and sloping down to the Vaal River. A very mild water shed traverses the plant site from north to south. The variation in elevation over the whole site of approximately 4 by 6 kilometers is not more than 25 m. The surrounding terrain is very similar, with the Vaal valley 8 kilometer south of the site at 1 425 m.



Figure 3.1 TOPOGRAPHY AROUND THE VANDERBIJLPARK STEEL PRODUCTS SITE (Base 20x20 km with elevation in m. Iscor in centre of the map.)

The figure above, as seen from the south-east, clearly shows the Vaal

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Draft for discussion CONFIDENTIAL Research for IVS River valley along the lower right edge, with the Leeuspruit starting almost at the middle and running east and then south to the Vaal. The Rietspruit runs along the western edge towards the Vaal while the Rietkullspruit joins it running west from near the Iscor property. The elevations have been accentuated to display the slight variations in topography, particularly the watershed running northwards from the middle of the site.

The Vaal River valley is a major feature for catabatic flow to the west as was identified by Ten Cate et al. (1980) but the high ground on the Iscor property and northwards forms a minor constriction to this flow, diverting the nocturnal flow from east to south-east. This may be seen in the Caravan wind data as will be described later.

3.2 CLIMATOLOGY

The site falls within the highveld summer rainfall region with precipitation as showers and thunder storms, with periodic severe lightning, hail and gusty south-westerly winds. Otherwise the synoptic winds are mainly from the northern sector.

3.2.1 Precipitation

A nine year record indicates an average annual rainfall of 633 mm, ranging from 347 to 1 012 mm. The precipitation occurs mainly in summer, but a few mm may also fall during the winter months.

3.2.2 Temperature

During the same record period the annual winter minimums varied from -1,4 to -6,5°C. In summer the maxima varied between 32,0 and 34,2°C. The average winter day temperatures varied between high teens and

lower twenties while the summer day temperatures ranged between the low and high twenties.

3.2.3 Barometric Pressure

The winter atmospheric pressure is normally around 858 mbar while the summer pressure is around 854 mbar.

3.2.4 Near Surface Winds

VDBS records surface winds at the air pollution monitoring caravan in location x = -660 y = +375 Iscor grid at a height of 5 m. This provides an indication of the near ground wind pattern. The data for the period May 2001 to April 2002 was analysed. Although only 76,1% complete, with the missing data mainly during spring and early summer, it provides a good image of the near ground air movement at approximately the centre of the Iscor operations.

The wind speeds are on average much lower than that recorded at 10 m as may be expected with the surface roughness. The directional pattern is also modified by the near surface catabatic flow and the deflection around the ridge of high ground running from north to south through the northern half of the site.

3.2.5 <u>10 m Wind</u>

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A Weather Bureau station was operated for many years within the Gascor tank farm enclosure near the VDBS South Gate at x = -825 y = -675 Iscor grid with the anemometer at 10 m. The station was closed down in 1999, but the charts for a full year of continuous data was retrieved from the archives for the year 1996, and analysed by hand, to create the wind input for modelling. The wind roses are reproduced in Figure 3.3, and displays



Figure 3.2WIND MEASURED AT 5 m AT THE VANDERBIJLPARK STEELMONITORING CARAVAN (May 2001 to April 2002, position x = -660 y = +375 local grid, 76% data capture).







Figure 3.3 WIND MEASURED AT 10 m AT THE VANDERBIJLPARK STEEL SOUTH GATE (January to December 1996, position x = -825 y = -675 local grid, 100% data capture).

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the typical pattern for the area, with northerly winds most prominent. Also clearly visible are the westerly and south-westerly strong storm winds.

3.2.6 Atmospheric Stability

Located on the South African highveld, the site is subject to nocturnal stability. From the extensive study of Tyson et al. (1976), analyzing four years of weather balloon soundings, surface inversions may be expected after midnight during more than 82% of winter and 45% of summer. The mean depth in winter would be about 380 m with a strength of 5°C while in summer it would reduce to about 350 m and 1,5°C.

Multiple non-surface inversions also occur with regularity over the region according to Preston-Whyte et al. (1977). The mean base height varies from about 1 700 m in winter to 2 000 m in summer and would therefore not normally influence the dispersion of air pollution from the site.



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CHAPTER 4

VANDERBIJLPARK STEEL OPERATIONS

4.1 OVERVIEW

The present operations of VDBS developed from a conventional steel plant of six decades ago. The essential present components are:

- Raw Materials Handling
- Sinter Plant
- Direct Reduction Plant
- Coke Ovens
- Blast Furnaces
- Basic Oxygen Furnaces Complex
- Electric Arc Fumace Complex
- Rolling Mills
- Coating Plants
- Supporting Activities (Suprachem, Lurgi, Steel Serve etc.)

Each of the plant areas will be discussed, stating what is known about air pollution sources and abatement, and what can be established by mass balance and other primary sources of information. This information will be used to compile an emission inventory.

The framework thus established will then lend itself to refinement, expansion with new sources or adjusted for improvements in abatement efficiency or new equipment. The emissions inventory will serve as the

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basis for source strenght inputs in the numeric air pollution dispersion modelling.

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4.2 SINTER PLANT

4.2.1 Sinter Strands

The combined gas streams from the two sinter strands go through a set of 10 cyclones to remove larger particles, which are returned to the process. In the past the gas then went to 10 electrostatic gravel bed canisters from where the cleaned gas exited through a 99 m stack. At present the gas is diverted past the gravel beds at 1,26 million Am3/hour but the original design was for 1,47 million Am3/h.

The particulate load in the gas after the cyclones used to be on average 500 mg/Am3, but through process adjustments this was reduced to the present average 250 mg/Am3 (ranging from 200 to 300 mg/Am3). These particulates consist of 90% KCI and 10 % iron and silica oxides together with limited quantities of carbon. At the higher dust loads, the KCI emission rate remains nearly constant at about 225 mg/Am3 while the oxides of iron and silica increase.

Gaseous pollutants were also measured during testing of various abatement technologies, including sulphur dioxide at 500 mg/Nm3, oxides of nitrogen at 275 mg/Nm3, hydrogen chloride at 6 mg/Nm3 and organics at 117 mg/Nm3. Traces of chlorinated dioxins and furanes were also recorded.

4.2.2 Sinter Strand 1

The hot crushing, screening and transfer to the export bins as well as the extraction of the belt below the strand fire boxes and the cyclone discharge return belt are extracted through electrostatic precipitator AG

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at 63,3 Am3/s (design 95 Am3/second or 60 Nm3/second), discharging at 50°C and a height of 37 m. An average of 12 iso-kinetic dust measurements over a year returned 214 mg/Am3.

4.2.3 Sinter Strand 2

This layout is similar to the first strand, except that the dust emission averaged to 172 mg/Am3 at a temperature of 31°C.

4.2.4 Raw Materials

The material brought in by conveyer is stored in the raw material silo which is extracted through electrostatic precipitator CG. This precipitator also services the screens and material handling after the sinter export hoppers. The average of twelve measurements was an emission of 187 mg/Am3 of particulates at 39°C, released in a volume of 63,9 Am3/second (design 150 Am3/second or 110 Nm3/second) at 37 m above grade. This precipitator is at present (September 2001) being refurbished.

4.2.5 Cooler Carousels

Air is drawn through the hot sinter from the strands by three axial flow fans on each of the two carousels. No measurements have ever been done but by observation, each of the six fans extract about 80 Am3/second with a dust load of between 100 and 200 mg/Am3. The temperature is about 100°C and the release height about 5 m.

4.2.6 Sinter Raw Material Tippler

The tippler is fitted with a Dustech pulse bag filter containing 660 polyester needlefelt bags of 150 mm diameter and 3,048 m long (total area 935 m2), handling 1 416 Am3/minute and discharging at a height of 7,5 m through a



square outlet of 1x1,5 m. No dust measurements have been done but by observation emission is not expected to exceed 20 mg/Am3.

4.2.7 Sinter Mixing Bed Screens

A much smaller Dustech filter serves the screens and crusher, with 344 m2 cloth area, extracting air at 523,2 Am3/minute and discharging at 6 m above ground. This emission has also not been measured to date and an estimate of not more than 20 mg/Am3 is entered. There is a significant component of fugitive dust from the building and the area in general.

4.2.8 Sinter Feed Preparation Bed.

The bed has a luffing stacker boom with drop sensors maintaining a 2 m drop. The reclaimer is a drum type scoop which normally operates fairly dust-free. The stacker however is very dusty, particularly under windy conditions. If it is assumed that 0,1% of the bed material, at 157 000 tons/month, is blown and less than 1% of this is in the respirable range, then this would amount to 1,57 tons/month or 0,606 gm/second. The larger than 10 micron material will fall out within a short distance from the source and be recorded in the fall-out monitors.

4.2.9 General Comments

The extraction ducting on the sinter strands appears to have been modified from time to time and fugitive dust emissions are found all over the plant near ground. This will require further investigation.

In addition the fall-out bucket (No 18) next to the raw material belt transfer tower north of the rail lines gave consistently excessive dust deposition values over each of six periods of two months, at more than 35 gr/m2/day. There is reason to believe that other transfer points without dust control on



both the raw materials and product belts would also contribute high dust loads.

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4.3 DIRECT REDUCTION PLANT

4.3.1 Raw Materials

Ore is wetted down in the rail trucks prior to tipping, and very little dust was observed on site. The bottom discharge trucks for coal was similarly practically dust free as the coal arrived wet from the mine. All dust sources from the further handling and storage of raw materials (ore, coal and dolomite) are extracted through a 2 field Lurgi electrostatic precipitator. The design volume is 100,0 m3/s at 50 °C and emissions are not to exceed 50 mg/Nm3 or 69,6 mg/Am3. The release height is 25 m above ground through an opening of 2,5m diameter. The actual volume and emission have not been measured and are assumed from basic design. There will be no gaseous emissions.

The lime silos were served by a bag filter but is now handled by the raw materials electrostatic precipitator.

4.3.2 Rotary Kilns

The four rotary kilns are each fitted with a drop-out chamber followed by a 2 field Lurgi electrostatic precipitator designed for 96120 Nm3/hour at 220 °C with a capture efficiency of 99,67% to give an emission rate of not more than 50 mg/Nm3. The four precipitators discharge through a multi flue stack of 100 m with each flue being 2,10 m in diameter. In practice, both the volumes, temperatures and dust loads differ materially from design and are given below.

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Kiln	1	2	3	4	Design
Volume ((Am3/second)	60	45	54	55	56,1
Temperature (°C)	80	101	90	91	220
Emission (mg/Am3)	67,8	72,5	40,8	4,1	<u>69,6</u>

Monitoring indicates complete combustion with 425 ppm of sulphur dioxide and 27 ppm of oxides of nitrogen on average for the four kilns.

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4.3.3 Product Separation

The screening, magnetic separation and general product handling are all extracted through a 2 field Lurgi electrostatic precipitator with a design volume of 360 000 Nm3/hour and a collection efficiency of 99,5%. The discharge is through a 3,12 m diameter stack of 30 m. Measurements indicate a volumetric flow of 80,0 Am3/second at 31 °C emitting 56,2 mg/Am3 at an efflux velocity of 10,5 m/second. No gaseous emissions are relevant.

4.4 COKE OVENS

4.4.1 Oven Detail

A total of 7 coke oven batteries are in operation. Number 1 is being operated by Suprachem, number 2 is no longer in use and number 5 was never built. With the exception of number 4, which is about 15 years old, all the others have been in operation for more than 20 years. The table below summarises further detail.

Battery Number	Mains	Charging	Condition	Codel Reading
1	Double	Sequential	Unknown	-
3	Single	L	BÉ	36
4	4	42	u	19
6	ĸ	66	Ends rebuilt	24
7	EL.	66	14	25
8	Double	44	Being rebuilt	26
9	п	(c	u .	28

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4.4.2 Ovens

All the batteries except 1 (Suprachem) handle a total of 1,72 million tons of coal per year at 8% moisture and produce 1,29 million tons of coke. Battery 1 operates at 80% of the others. Gas generation is at 340 Nm3/ton of coal, of which 40% or 136 Nm3/ton of coal is re-used in the ovens. Each battery has its own stack of 110 m for the combustion gas, through a top opening of 3,0 m diameter, and each stack, except for number 1, is fitted with a Codel continuous opacity monitor. Readings over a year are tabulated above. Number 1 is an estimate based on observation.

Unfortunately the Codels are not calibrated in gravimetric units, but in opacity only. Based on experience with other combustion processes with black smoke, the assumption is made that an opacity reading of 40 would correspond roughly to 100 milligram/Am3. As regards oxides of nitrogen, there is no data and a concentration of 200 ppm is assumed.

For all other emissions, measurements have not been done and recourse will have to be taken to internationally published emission factors, augmented by material balances.

At present the whole gas treatment plant is in a poor state of repair, to such a degree that the gas is no longer fit for use at most of the IFSP user points, and has to be flared. The ammonium sulphate plant is still operational, but the sulphuric acid plant is not, resulting in the emission of H2S through the emergency stack of 70 m.

4.4.3 Production Rates

If the Suprachem Battery 1 is included, the annual coal usage will be 1,949 million tons and the coke production 1,462 million tons. For



convenience of calculation of emission rates, these values may be expressed as 61,8 kg/second of coal and 46,4 kg/second of coke. This would be associated with a gas production rate of 21,01 Nm3/second containing the following compounds:

- 145 to 150 gram/Nm3 of tar
- 6,5 to 8,5 gram/Nm3 of ammonia
- 5,5 to 6,0 gram/Nm3 of hydrogen sulphide
- 1,3 to 1,6 gram/Nm3 of hydrogen cyanide
- 35 to 38 gram/Nm3 of benzene, toluene and xylene.

4.4.4 Coal Preparation

The total coal dust emission for handling is published (US EPA, 1996) as 0,2 kg/ton of coal handled, while for coal crushing with cyclones, the dust emission is given as 0,055 kg/ton of coke, or 0,041 kg/ton of coal. A total coal dust emission for coal receipt, crushing and screening and conveyers and silos of 0,2 kg/ton of coal or 12,360 gram/second is accepted as realistic. This would originate mainly at the crushing and screening station.

4.4.5 Oven Charging

With sequential charging on all batteries, and no possibility of measured data, the emission factor of 0,008 kg/ton of coke gives an emission rate of 0,371 gram/second. This can best be treated as a continuous line of area sources along the full length of the batteries.

4.4.6 Oven Door Leaks

Again measurements are not practical, and the EPA emission factor of 0,27 kg particulates, 0,3 kg of carbon monoxide and 0,75 kg of volatile organic compounds per ton of coke is assumed. This will also be treated as a line of area sources.

4.4.7 Oven Pushing

With no control of emissions during discharge of the ovens, the emission factors are 0,58 kg of particulates, 0,035 kg of carbon monoxide and 0,1 kg of volatile organics per ton of coke. Similar to the previous this will also be treated as a string of continuous area sources.

4.4.8 Combined Oven Emissions

For practical reasons the emissions from the oven charging, door leaks and pushing will be dealt with together as two area sources per operational batter, giving 14 area emissions of 44 x 44 m each.

The combined emissions would be 39,811 gram/second of dust, 15,544 gm/second of carbon monoxide and 39,440 gram/second of a mixture of organic compounds. On the basis that battery 1 has only 80% of the production rate of each of the others, 11,8% of the above will be allocated to battery 1 and 14,7% to each of the other six.

4.4.9 Quenching

The baffles in the towers are in good repair and the quench water contains on average more than 1500 milligram/liter of dissolved inorganic material. The emission factor would then be 0,65 kg of particulates per ton of coke produced. This will be discharged through four individual towers, each with a total top opening of 8x8 m and with heights of respectively 15, 15, 18 and 18 m at a temperature of 100 °C. The volume rate will vary continuously during the quench cycle and all but stop during the periods between quenches. The average quench consists of an initial spray of 30 seconds, a 30 second rest period and then a further 30 second spray, the cycle being repeated every 10 to 12 seconds on towers 2 to 4. Tower 1 handles only battery 1 and therefore has only half as many quenches per day. The total volume of quench water used on all four towers runs to 90

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to 100 megaliters/month or on average 36,65 liter/second. This water contains more than 800 milligram/liter of inorganic salts and 1040 milligram/liter of organic compounds. The latter consists of:

- 630 milligram/liter phenol
- 250 milliggram/liter cresols
- 40 milligram/liter xylenols
- 20 milligram/liter each of quinoline and indole
- 40 milligram/liter pyrrole
- 10 milligram/liter all others

Exactly what happens during particularly the intense first stage of quenching is not known. Some pyro-cracking of organics will occur. Similarly it is likely that organic compounds will adsorb onto the coke during the later stages of the quench. What is known is that the quench water is re-circulated until it is all evaporated. The first assumption is that 70% of the organics load of 1040 milligram/liter is evaporated and discharged while 30% is adsorbed onto the coke. This would imply that a quarter of 26,68 gram/second of organic material is on average emitted from each of the four quenching towers.

It is noteworthy that the EPA particulates emission factor calculation returned an emission rate of 30,13 gram/sacond total for all the towers. 70% of the inorganic material contained in 36,65 liter/second gives an emission of 20,52 gram/second. The higher value will be used because it is known that some coke particles will be entrained in the up-welling.

4.4.10 Ammonium Sulphate Plants

Plants 1 and 2 merely remove ammonia water from the gas streams and no emissions to atmosphere occur from the gas scrubbing. At plant 3 the ammonia is reacted with sulphunc acid. This drives off the hydrogen

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sulphide which is vented through a 70 m tall, 0,45 m diameter emergency vent at an average rate of 370 kg/hour in a volume of about 1,6Am3/ second. To support this emission value, a mass balance would indicate that 1,793 million tons of dry coal containing 0,233% organic sulphur would release 4 439 tons/year of hydrogen sulphide or 507 kg/hour. 73% of this is quoted in the inventory as H2S emission. The remaining 137 kg/hour of hydrogen sulphide would be in the coke oven gas, with a volume of 73 646 Nm3/hour at 1,8 gm/Nm3 of gas. This is confirmed by the regular analytical figures which ranges from 1,6 to 1,9 gram/Nm3.

The only other sources of air pollution are minor spills of liquids containing organic compounds, and a periodic emission of dust from the dried ammonium sulphate. This spunous release defies quantification but is not considered significant and will discontinue with the process modifications now underway.

4.5 BLAST FURNACE COMPLEX

4.5.1 Blast Fumace C

The furnace produces on average 200 million Am3/month of gas. This fuel gas is scrubbed in a Lurgi Bischoff scrubber to a dust content of about 8 milligram/m3. The gas contains between 23 and 25% of carbon monoxide and for complete combustion requires 48% of its own volume as combustion air. The furnace stoves use 0,0730 GJ/second or 22,14 Sm3/second of the scrubbed furnace gas, containing less than 8 milligram/m3 of particulates and less than 10 ppm hydrogen sulphide. The emission would thus be less than 0,177 gram/second of particulates and less than 0,497 gm/second of sulphur dioxide. The combustion gas, with a total volume of 1,548 times the fuel gas volume would contain about 300



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ppm of oxides of nitrogen, giving an emission rate of 10,283 gram/second at 880 °C in a volume of 172,5 Am3/second.

4.5.2 Blast Furnace C Slips

In addition, periodic slips in the furnace burden leads to brief emissions directly into the atmosphere, without cleaning or combustion. This is an unpredictable occurrence and can not be quantified in absolute terms, but at the same time represents a significant emission. Extensive enquiry would indicate one slip on average per day, with a duration of 5 seconds. Having regard to the pressure, it is assumed that during the 5 seconds, four times the normal volume of gas flow, or 458 Am3/second will escape, at a temperature of 900 °C end at a height of 83 m. The dust load is assumed to be about 10 gram/Nm3. This would translate to 906 gram/second for 5 seconds per day or 0,052 gram/second on average over a day. The carbon monoxide emission would be 24% of the volume which reduces to 90,6 Nm3/second. The 21,7 Nm3/ssecond of carbon monoxide would have a mass of 27,62 kg. For an emission of 5 seconds per day this would represent 1,598 gram/second of carbon monoxide over a day. The hydrogen sulphide is estimated at less than 100 ppm giving an average emission over a day of not more than 0.001 gram/second.

4.5.3 Furnace C Raw Materials

The bin withdrawal is served by a bag filter which was recently rebuilt. The twin fans discharge through a common stack of 1,76 m diameter and 18 m high. The measured volume is 58,4 Am3/second emitted at 24,0 m/second and at ambient temperature. Emission tests returned an average dust concentration of 15 milligram/Am3.

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4.5.4 Blast Furnace C Tap Hall

A Howden Energy Systems reverse pulse bag filter with 1 936 bags, providing 5 305 m2 of polyester needle felt surface, is installed. The design flow of 8 040 m3/minute. would give a 1,51 m/minute. filtration velocity, exhausting through a 2,80 m diameter stack of 25 m. The particulate emission concentration as measured by a Codel optical monitor is 40 milligram/m3 at 45 °C.

4.5.5 Blast Fumace C Tap Hall Fume

At present an estimated 50% of the tap floor fumes are not collected and escapes to atmosphere as a fugitive emission at a height of 20 m and an estimated temperature of 100°C. On the assumption of 50% of the fume escaping, and with the Howden filter collecting on average 22,5 tons/week, the rate of fume escape from the tap floor would be an average of 37,202 gram/second. An area source of 30 m square is assumed.

4.5.6 Furnace C Dust Fall-out Chamber

While discharging the dust from the fall-out chamber once a day for about an hour, into rail trucks, very copious volumes of dark brown dust was dispersed as a fugitive emission (5/11/2001). The discharge pug mill was due for overhaul at the time of the site visit, but even if well serviced, the gas pressure in the system will cause some blow-by towards the end of the cycle when the hopper is near empty.

It is not possible to measure the source strength as it varies during a cycle and also with the progress of time. As a first approximation, 2% of the 14 000 tons per year unloaded would equate to a year round source strength of 8,879 gram/second at a height of 5 m, at ambient temperature over an area of 10 m square.

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4.5.7 Blast Furnace D

The gas evolution rate is slightly lower than in furnace C, at 57 million m3/month. As in the case of furnace C, the gas is cleaned to 8 milligram/m3 in a Lurgi Bischoff scrubber before being used in the stoves and elsewhere. The three stoves burn blest furnace gas and discharge at a height of 61m through a stack of 3,4 m diameter end at a temperature of 880 °C.

Similar to fumace C, with a gas consumption of 19,99 Sm3/second, the emissions would be 0,160 gram/second of particulates, 0,449 gram/second of sulphur dioxide end 9,283 gm/second of nitrogen oxides in a volume of 155,7 Am3/second.

4.5.8 Blast Furnace D Slips

Slips also occur at this fumace with about the same regularity and intensity as at furnace C. As quantification is based on essumptions, the same figures as for furnace C are eccepted.

4.5.9 Furnace D Raw Materials

The bag filter was only recently (before 5/11/2001) re-commissioned after being inoperative for about a yeer. The configuration is similar to the unit on C furnace with extraction only on the bin withdrawal points. The bag filter is served by two fans with a single stack of 2,53 m diameter and 20 m high at 11 m/s. The design volume flow rate is 55,3 Am3/second at embient temperature. A dust emission of 30 milligram/Am3 at ambient temperature was measured efter re-commissioning.

4.5.10 Furnace D Tap Floor

No extraction equipment is installed. The best estimate of this source must therefore be a fugitive emission at 10 m elevation and 100°C with a source





strength double that of furnace C. This would amount to 74.405 gram/second and at a temperature of 100°C.

4.5.11 Furnace D Dust Fall-out Chamber

There is again no data on the fugitive emissions during discharge from the dust silo. Using the same assumptions as for C furnace, and a dust removal rate of 12 900 tons per year, the fugitive source strength is 8,161 gm/second on a year round basis at ambient temperature.

4.5.12 Furnaces C & D Coal Mills

The blast fumace coal mills are swept with mainly nitrogen (less than 1% oxygen) to two N2 pulse jet filters with 684 bags providing 2 600 m2 of anti-static polyester cloth. The dasign volume is 41,7 Am3/second when two mills are in operation and 29,17 Am3/second with only one mill. The exhaust from the filters go to a hot air generator which returns combustion gas to tha mills. About 15% of the volume is bled off to atmosphere at 45 m above ground. An estimated particulate load of 10 milligram/Am3 is assumed in a volume of 5,3 Am3/second at 150°C.

The coal silos have two N2 pulse jet filters with a total of 96 anti-static polyester bags (124,5 m2). The combined volume is 9 000 m3/h at ambient temperature. No measurements on volume has been done. The emissions as measured by a Codel optical instrument is 10 milligram/Am3, released at 30 m and 11,0 m/second.

4.6 BASIC OXYGEN FURNACE COMPLEX

4.6.1 Oxygen Furnaces

Three Lintz Donowitch type converters are each fitted with a venturi scrubber with discharge heights of 75 m for furnaces 1 and 2 and 73 m for





furnace 3. Two of the three fumaces are in operation at any one time. From 20 calibration tests the average volume after the scrubbers is 14,0 m3/second at 35 °C and with a particulates load of 86,4 milligram/Am3.

The cleaned gas, containing on average 19,4% carbon monoxide, is flared to about 1000 °C and a volume of 96,72 Am3/second. This discharge would contain 1,21 gram/second of fume on a continuous basis for each furnace, or 0,806 gram/second on average over the year. The hydrogen sulphide content is less than 5 milligram/Am3, giving an emission of 9,41 milligram/Am3 of gas or 0,607 gram/second of sulphur dioxide per stack. There is no way of measuring the oxides of nitrogen above the flare but based on known flare technology a value of 200 milligram/Am3 of flared gas will return 12,896 gram/second of nitrogen oxides per stack.

4.6.2 Secondary Emission Bagfilters

Filter 1 is a Kawasaki shaker type unit, extracting secondary air around the BOF mouths while blowing, also during hot metal loading, hot metal de-slagging and reladling. The unit has 8 compartments handling 83,0 Am3/second at 41 °C with a filtration velocity of 1,2 m/minute and discharging at 20 m above ground through a 3,36 m diameter stack. The particulates load as measured is 33,1 milligram/Am3 but there is no data on the nitrogen and sulphur oxides. This is unlikely to be measurable as it is mainly ambient air being sucked in.

Filter 2 is a 12 compartment Kawasaki shaker sharing the load with filter 1. The measured volume is 87,0 Am3/second discharging at 43 °C, emitting at 20 m above ground through a 3,38 m diameter stack. The measured particulates load is 81,5 milligram/Am3 giving an emission rate of 7,091 gram/second. Gaseous components are unlikely to be significant.

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Filter 3 is of AAF manufacture and handles mainly the desulphunisation stations, pit 3 and the torpedo desulphunisation. The filter is fitted with 8736 m2 of cloth filtering 182,0 Am3/second of gas, emitting 20 m above ground through a 3,57 m diameter stack at an efflux velocity of 20,6 m/second. The temperature is on average 47 °C and the emission concentration of particulates, as measured over a year is 8,7 milligram/Am3. Oxides of sulphur was measured at 8 ppm but no oxides of nitrogen could be detected.

4.6.3 Raw Material Bagfilters

Filter 4 is a seven compartment shaker unit of unknown manufacture and serves the high level storage bunkers. The filtration velocity is about 1,06 m/minute, the filtration volume is 22,1 Am/second and the particulate emission concentration is assumed to be 30 milligram/Am3. The height of release is 60 m and the temperature is at ambient, accepted as 25 °C.

4.6.4 Ladle Fumaces

Ladle fumace 1 (and the RH-OB degasser) has an IJFC type reverse pulse filter supplied by Dustech, with 620 m2 of cloth filtering at 1,5 m/minute, total volumetric flow 9,9 m/second. Emission to atmosphere is through a 1,32 m diameter stack 11 m above ground at 90 °C. The concentration of particulates as measured over a year is 17 milligram/ Am3. (This filter is at present being replaced by a larger Howden unit ex Pretona Works.)

Ladle fumace 2 is fitted with a Scheuch pulse jet filter. The volume extracted is 41,0 Am3/second at 45 °C through 2 455 m2 of bags and is emitted at 15 m above ground through a 2,08 m diameter stack.

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4.6.5 Continuous Casters V1 & V2

The continuous caster reheating uses a mixture of 400 000 m3/month of VDBS fuel gas with on average 50 ppm of hydrogen sulphide plus 150 000 m3/month of Sasol gas containing 3 ppm of hydrogen sulphide. This translates to 0,212 m3/second of mixed gas with 37,2 ppm of hydrogen sulphide. The emission of sulphur dioxide will therefore be 0,023 gram/second. The burnt gas volume rate will be about 5 times the gas feed rate, containing about 300 ppm of oxides of nitrogen or 0,493 gram/second.

4.6.6 Scarfing Units

The volume of steel passing through the scarfing operation has reduced to a point where only one of the two units is in operation for 5% of the time. The emissions from the Holmes type wet electrostatic precipitator exhausts through a 1,8 m diameter stack of 30 m. The design volume for both units combined was 61,1 Nm3/second. For one unit the measured volume was 24,7Am3/second at 9,7 m/second and a temperature of 31°C,with a dust load of average 70 milligram/Am3. The combustion gas as extracted will be diluted about 20 times with air inflow and will contain not more than 20 ppm of oxides of nitrogen or 0,001 gram/second.

4.6.7 Slab Cutting

This operation does create some fume on an intermittent basis but it is not practical to fit extraction and the magnitude does not warrant it.

4.6.8 BOF Fugitive Emissions

When the silica in the iron is too high the charge froths over the mouth at the start of the oxygen blow. The occurrence depends entirely on the composition of the iron received but it would appear that incidents do occur on an average once a day basis over a year. The duration is rather





brief, average 3 minutes, during which the existing secondary filters can not cope. The best estimate would be about 20% of the normal dust and fume capture through both the primary and secondary systems for three minutes per day. This would amount to about 10% of the primary extraction scrubber mud of 4 600 tons/month at 45% moisture for 3 minutes per day or 0,203 gram/second on a year round basis which have to be dealt with as an area source over 10 m square at a height of 55m.

4.7 ELECTRIC ARC FURNACE COMPLEX

4.7.1 Electric Arc Furnaces 1 to 3

Three 150 ton nominal capacity arc furnaces are equipped with individual bag filters. Besides 4th hole extraction, roof extraction is also provided, the latter coming into play when the furnaces are opened or when the temperature at the filter inlets rise above the safe limit.

The three Voest Alpine reverse pulse filters each have 6 compartments with a total of 5 160 m2 of polyester cloth and the fans are capable of 300 000 Am3/hour, discharging through 25 m stacks at between 41 and 95 °C. The mass of fume removed from the three filters combined over a year was on average 2 500 tons/month. This translates to 3,86 gram/Am3 or 5,87 gram/Nm3. The measured particulate emissions were 9,5 milligram/m3 for filter 1, 18,3 milligram/m3 for filter 2 and 16,1 mg/m3 for filter 3, averaging to 14,6 milligram/m3. In addition 30 ppm of sulphur dioxide was measured on one occasion on furnace 1 outlet and 41 and 43 ppm of oxides of nitrogen. During the same measuring campaign no oxides of sulphur or nitrogen was detected in the outlets of furnaces 2 and 3. It would seem that the oxides only form to a measurable degree during oxygen blowing. For the inventory the values as measured will be used.



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4.7.2 Electric Arc Fumace Fugitives

From time to times fumes escape through the roof louvres of the furnace hall. After discussion it was concluded that this is unlikely to be more than 1% of the total operational time of the arc furnaces. This fume emission would then amount to not more than 1% of the 25 tons/month of fumes collected by the three fumaces or 9,645 gram/second on average. This will be dealt with as a volume source with a height of 40 m and a square base of 50 m sides at 40°C.

4.7.3 Ladle Fumace 1

Ladle fumace 1 has a Davy McKee reverse pulse bag filter with 672 m2 of polyester cloth handling 64 200 Am3/hour at 92 °C (filter speed 1,59 m/minute) and emits at 18 m above ground. An average emission rate of 24,8 milligram/Am3 of particulates was measured during 11 tests conducted during a 12 month period. Two sets of gaseous emission component measurements are to hand, namely 479 and 312 ppm sulphur dioxide and 1 and 6 ppm oxides of nitrogen. The average gaseous concentrations will be used for the inventory.

4.7.4 Ladle Furnace 2

Ladle fumace 2 has a 5 compartment Howden jet pulse bag filter with 1 652 m2 of polyester needle felt, handling 1 590 Am3/minute (at 0,969 m/minute) and emitting 5 m above ground at 70 °C. The average of the measured particulate emissions over 12 tests was 34,6 milligram/m3, and a sulphur dioxide concentration of 400 ppm as well as 5 and 9 ppm nitrogen oxides were recorded.

4.7.5 Vacuum Arc Degassing

This arc furnace is extracted strongly through a 4th hole to a spray chamber and a steam ejector before emission to atmosphere. No air



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pollution registration was considered necessary by the Chief Officer and no emission measurements were done. The volume is relatively small and no emissions are visible.

4.7.6 Concast V3

An arc furnace without extraction. It is mainly used for alloying and the Chief Officer has determined that no registration is required. No visible emissions were observed.

4.8 MOULD FOUNDRY

4.8.1 Sand Handling

The cyclones serving the sand screens and belt transfers discharge a volume of 14,1 Am3/second at a height of 14 m above ground through a 1,73 m diameter stack. The particulates emission concentration is 41,7 milligram/Am3 at a temperature of 32 °C.

4.8.2 Sand Drier

The drier has a Peco bag filter extracting 3,0 Am3/second and discharging through a 0,745 m diameter stack at 14 m. The emission concentration of particulates was measured as 14,6 milligram/m3 at 38 °C. With such a low volume of emission, the contribution of sulphur and nitrogen oxides will be very low.

4.8.3 Fettling Plant

A new shaker grid has just been commissioned (5/11/2001) without any dust extraction. Assuming an operational cycle of 25% of the total time and 2 gram/second of respirable dust, a source strength of 0,5 gram/second on a year round basis must be assumed, discharging



through the roof at 17 m at ambient temperature. An area source of 10 m square will be assumed.

4.8.4 Shot Blasting

Periodic shot blasting is conducted in the open immediately south of the building (this was not witnessed). Assuming a utilization of 5%, based on enquiry, and a dust source strength of 5 gram/second, the year round contribution would be 0,25 gram/second as a 10m square area source at 2 m above ground. The temperature will be ambient.

4.9 SOUTH PLATE MILL

The re-heating fumaces discharge through two adjacent stacks of 32 m high, with an internal diameter of about 1 m, at a temperature of about 600°C. No measurements were done on the gaseous emissions, but it is known that on average 9340 GJ per month of coke oven gas was burnt over the past year. This equates to 0,2427 Sm3/second of gas or 1,267 Sm3/second of products of combustion. The coke oven gas contains 1,8 gram/Sm3 of hydrogen sulphide which burns to 0,822 gram/second of sulphur dioxide. The exhaust gas will have a volume of 4,825 Am3/second at 600°C, and is divided between the two stacks about 8 m apart. The oxides of nitrogen is assumed to be 300 ppm.

4.10 PICKLE LINE SOUTH

4.10.1 Pickle Line

Four pickle baths are followed by four rinse baths. The pickle baths use 32 kg of 16% regeneration acid/ton of steel. The pickle baths are extracted to a packed scrubber with two fans (one standby) discharging into a 1,5 m



diameter stack of 38 m, at an assessed volume rate of 26,5 Am3/second at ambient temperature and containing 15 milligram/Am3 of HCI.

4.10.2 Roll Oiling

After pickling the strip is coated with a mixture of Quaker and Ferrocoat mineral oils at a rate of 0,2 kg/ton steel. An extraction system at the point of application passes through a droplet catcher and then discharges through a 200 mm diameter stack at a height of about 25 m. It is quite evident that there is an emission as there is an oil sludge rundown along the stack. The actual mass was measured as 2,5 milligram/m3 by Dräger.

4.11 <u>TIN LINE</u>

4.11.1 Strip Preparation

Strip is cleaned in an electro-bath and then caustic before passing through an electrically heated continuous annealing oven. From there the strip passes through a temper mill before entering the electro-tinning baths containing stannous chloride, pH controlled with hydrochloric acid. The strip is then washed, coiled and annealed in 36 fumaces using a total of 0,231 Nm3/second of Sasol gas. The furnace combustion gas is emitted in the building at 5 m and 700°C. The NOx emission, in a volume of 5,3 Am3/second is estimated at 400 ppm. The hydrogen sulphide content at 5ppm in the fuel gas would give an emission of 0,002 gram/second of sulphur dioxide.

A solvent containing dichlorometane is used for roll cleaning at a rate of 200 to 400 liters/month. It is estimated that about 100 liters/month or 0,031 gram/second of dichlorometane is evaporated in the building.

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4.112 Tinning

The actual tin plating is done electrolytically and thus there will be no gaseous or particulate emissions to atmosphere.

4.12 PAINT LINE

Minor concentrations of solvents may be detected inside the works area and in particular within the enclosed and extracted paint application spaces. All the extracted air including the enclosed paint drying ovens is passed to two incinerator sections. Sasol gas at 2,657 Nm3/second augments the fuel in the incinerators which are exhausted through a 25 m stack of 2,0 m diameter at 10,2 m/second and a temperature of 350 °C after the heat exchanger providing hot air for the drying ovens. No particulates and insignificant sulphur dioxide is emitted. The hydrocarbon emissions were measured in February 1997 by the CSIR as 370,5 milligram/Am3 while the sulphur dioxide was 14,7 milligram/Am3 and the oxides of nitrogen was 110 milligram/Am3.

4.13 HOT MILL NORTH

This plant consists of 4 reheating furnaces (3 pusher and one newer walking beam) each of which uses about equal portions of the total fuel gas feed, at present (5/11/2001) consisting of 60% Sasol gas and 40% VDBS fuel gas, at a rate of 297 560 GJ/month total. The hot slab is descaled in two stands and then milled through coarse and fine mill stands before coiling.

4.13.1 Re-heating Furnaces

The walking beam furnace 4 discharges through a stack of 70 m while the other three furnaces have separate stacks of 40 m, the diameters all being

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2,40 m. The exhaust gas leaves the stacks at about 600 °C and a velocity of 10 m/second, containing on average 392 ppm SO2 and 417 ppm NOx.

4.13.2 De-scaling Stands

Water is sprayed on the hot slab and this water may contain organic compounds. There is however no exhaust system and therefore meaningful measurements can not be made. The level of organic compound evaporation is considered insignificant as nothing could be detected by nose.

4.13.3 Mills

The water sprayed on the rolls is contaminated with lubricating and hydraulic oils. The total oil usage on this section of the plant is about 75 000 liter/month or 104 l/hour. If it is assumed that 5% of the oil is cracked or evaporated on the hot strip, it could be as much as 1,374 gram/second, escaping mainly through the roof vents. For modelling purposes an area source of 25 m square will be used with a source strength of 0,003 gram/m2/second at a height of 27 m and at near ambient temperature.

The finishing mills have extraction which goes to a spray chamber scrubber for particulate removal and is then exhausted through a 30 m stack of 2,3 m diameter at 47,85 Am3/second (efflux velocity 11,5 m/second). The emission temperature is ambient and the emission dust loading was measured at 67 milligram/Am3. The rolling lubricant of 5 000 to 10 000 liter/month is mainly of a tallow nature and organic components which could be dispersed to atmosphere is assessed as insignificant.





4.13.4 Fume Extractor

The extractor stack, 27 m high and 2,27 m diameter emits 25 milligram/Am3 of particulates, 13 ppm of carbon monoxide and no measurable concentrations of either sulphur dioxide or oxides of nitrogen. The efflux velocity is 10,8 m/second and the temperature 29°C.

4.13.5 Coilers

The approximately 350 liter/month of lubricating oils and 180 liter/month of water based paint for roll marking would not make a significant contribution to air pollution beyond the level of 0,001 gram/m2/second over an area of 20 m square.

4.14 COLD ROLLING NORTH

4.14.1 5-Stand Cold Rolling

A mixed rolling oil consisting of 20% tallow and 80% mineral oil is used at a rate of 0,6 kg oil/ton of steel strip. The oil remaining on the strip going to annealing is expected to be less than 0,2 kg/ton steel at a production rate of 80 000 t/month. This translates to 6,173 gram/second of which about 99% is likely to incinerate during annealing.

At each rolling stand there is extraction leading to underground ducts and inertial (chevron or louvre type) droplet catchers before exhausting through a 30 m stack of 1,5 m diameter. There is no indication of oil vapour of significance from this stack.

4.14.2 Batch Annealing

A total of 43 HNx and 3 H2 ovens are in operation, consuming 0,0818 Nm3/second of Sasol gas per unit. All emissions are within the building at a height of 5 m. The three H2 ovens have recuperators resulting in an



emission temperature of 350 °C while the HNx ovens exhaust directly at 780 °C. The emissions are unlikely to contain unburned oils distilled from the steel and the NOx levels are likely to be low as the furnaces are run in a reducing mode.

4.14.3 Finishing Mills

The finishing mills have no emissions.

4.15 PICKLING LINE NORTH

Three pickling baths and four rinsing baths are operated in line, and the acid additions consist of 918 tons/month of fresh 32% HCL plus 1 337 tons/month of 16 to 18% regeneration acid. The actual acid usage is equivalent to 18,4 kg 32% acid/ton of steel on a steel throughput of 80 000 to 88 000 tons/month.

The acid baths are extracted to a scrubber before discharge through a 1,52 m diameter stack of 38 m at an assessed efflux velocity of 15 m/second which would give a volume of 27,2 Am3/second containing 8 milligram/Am3 of HCl at ambient temperature.

4.16 GALVANIZING LINE 4

This line consists of strip preparation and heating, a molten zinc bath and an irrigated chromic acid applicator.

4.16.1 Strip Preparation

The strip is heated with Sasol gas in an inert atmosphere and then passes through a long temperature equalization section, to a temperature just above that of the bath. The gas usage is 26 000 GH/month or 3,04





Nm3/second. Combustion air ratio depends on the zone or application but varies between 3,7 and 4,3:1 so that the average combustion gas volume is 12,16 Nm3/second at about 900°C for the vertical kiln and 800°C for the horizontal oven. The stacks are both 40 m high and respectively 1,22 m and 1,88 m diameter and the estimated volume rates are respectively 17,5 Am3/second and 41,6 Am3/second for the RT and DF furnaces. Both emissions contain about 300 ppm of NOx and the industrial gas contains less than 5 ppm of hydrogen sulphide.

4.16.2 Zinc Bath

The bath is electrically heated to between 440 and 460°C depending on the coating thickness required. The bath metal contains 0,4% aluminium, 0,2% antimony and 0,000 8% lead. No flux is used and no visible fume is evolved.

4.16.3 Chromic Acid

This is a flood application on rolls and there is no detectable emission.

4.17 ELECTRO-GALVANISING LINE

The operation consists of a caustic wash, ten sulphuric acid pickling baths, four rinse baths, six electro-galvanizing roll sets, and for a part of the production a chromate and phosphate application. Dräger tests on the stacks indicated less than 1 ppm of sulphur dioxide in all three the stacks. The stack diameters are respectively 1,60 m, 1,75 m and 1,60 m, all being 32,7 m high and assuming an efflux velocity of 15 m/second the flow volumes will be of the order of 30,2 , 36,1 and 30,2 Am3/second at 25 °C. The galvanizing electrolyte is produced from zinc ingot with sulphuric acid in a closed reactor with extraction. The de-leading sludge is disposed of at Holfontein.





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4.18 CONTINUOUS ANNEALING NORTH

4.18.1 Annealing

The roll steel is heated in a furnace fired with Sasol gas at a rate of 1 861 800 Nm3/month or 0,718 Nm3/second. Assuming a 4,4:1 air ratio, the combustion gas will be 3,88 Nm3/second. The off-gas goes through a recuperator and then to atmosphere via a stack of 1,0 m diameter and 40 m tall at 300 °C with a calculated volumetric flow rate of 7,9 Am3/second. The sulphur dioxide emission, based on 3 ppm in Sasol gas will be 0,006 gram/second while the oxides of nitrogen is assumed at 300 ppm

4.18.2 Rust Protection

Finally the plate is sprayed with an oil mist. The spray operation is extracted through an agglomerator and discharges through a 200 mm diameter horisontal outlet at about 3 m above ground. The oil emission is insignificant.

4.19 HIGH PRESSURE STEAM BOILER

This boiler fires mainly coke oven and blast furnace gas, but when this is not available, Coal Tar Fuel 200 ex Suprachem, with 90% carbon, 6,5% hydrogen and less than 0,2% sulphur is used to augment the needs.

Based on the consumption of the three fuels over a year, the per second averages are 7,595 gram fuel tar, 41,201 Sm3 of blast furnace gas and 5,141 Sm3 of coke oven gas. The hydrogen sulphide in the blast furnace gas is less than 10 ppm and in the coke oven gas 1,8 gram/Sm3. From this the respective contributions to sulphur dioxide would be 0,015, 1,003 and 17,420 gram/second.





Both gases are essentially particle free and the coal tar fuel is low in ash. The particulate emission contributions are evaluated as 0,008, 0,264 and 0,051 gram/second respectively.

As regards the volume of combustion gases, the coal tar will produce 0,084, the blast furnace gas 65,261 and the coke oven gas 27,432 Nm3/second , totaling 92,9 Nm3/second. The emission height is 15 m.

There is no information on the oxides of nitrogen formed during combustion, but assuming 400 ppm, the total emission rate would be 47,984 gram/second.

4.20 **FLARES**

4.20.1 Configuration

There are four flares numbered 1 to 5 (flare 2 was not built). Flares 1 and 3 can take both blast furnace gas and coke oven gas while 5 can handle only coke oven gas and is located next to coke oven batteries 8 and 9. Flare 4 is next to the new blower house and handles only blast furnace gas.

4.20.2 Flares

The total volumes of gases flared over a year is known and amounts to 33,901 Sm3/second of blast furnace gas and 1,473 Sm3/second of coke oven gas. With the hydrogen sulphide in the blast furnace gas at 10 ppm and the coke oven gas at 1,8 gram/Sm3 the total emission of sulphur dioxide after flaring will be 5,816 gram/second.





Particulates at 10 milligram/Sm3 for both the fuel gases after scrubbing will return a total particulate emission of 0,775 gram/second. The formation of oxides of nitrogen above the flare tips is assumed at 300 ppm based on the fuel gas volume. This returns 23,236 gram/second.

The proportioning of the gas to each flare is not metered and it is therefore assumed that the four flares share the excess gas equally. With the temperature at the point of combustion at 1 000°C, the combined volume of the expanded gas would be 315,6 Am3/second. For plume buoyancy it is assumed that the flares will have a virtual emission velocity of 15 m/second. Flares 1, 3 and 5 are 45 m above ground and flare 4 is 50 m.

4.21 SUPRACHEM (LURGI AND FERRITE PLANTS)

This plant recovers hydrochloric acid from the spent liquor of the pickling lines and converts the iron oxide to ferrite.

4.21.1 Lurgi Plant

The three Lurgi acid regeneration plants each have a stack of 750 mm diameter and 38 m high. The emission velocities were measured at respectively 9,5, 9,3 and 9,6 m/second with HCl concentrations measured at 191, 62 and 192 ppm respectively.

4.21.2 Ferrite Plant

This plant has only three emission sources of significance, namely two air bleed-offs from the mill classifiers to small Flowline bag filters. The volumes of about 1,4 Am3/second emit through 300 mm diameter stacks of 27 m height at 18 m/second and at ambient temperature with dust loads of 20 milligram/Am3.





The kiln is fired with Sasol gas and tha venturi scrubber emits 5,2 Am3/second at 10 m/second through a 750 mm diameter stack at 25 m above ground and 57°C. The emission contains 107 milligram/Am3 HCI and 100 ppm NOx.

4.22 SUPRACHEM (ORGANIC)

The large number of tanks, sumps, distillation columns and bunded arees with organic material defies proper identification of components and quantification within the temporal constraints of this study. As a first order estimete, recourse is taken to tha concept of a box model consisting of a circular area of 252 m diametar, being representative of the 5 ha plant area, to a depth of 10 m and with a lateral air displacement of 1,5 m/second (average wind movement). The concentrations of tha pollutants within the box are equated to tha average concentrations as measured over an 8-hour shift on a representative mix of the entire work force. Such a monitoring programme was run during the first half of 2001. The resultant calculations era tabulated below, together with the Threshold Limit Values (Time Weighted Averaga) (TLV(TWA)) as a first indication of the environmental undesirabilities of the various components.

Compound	πLV	Average Component	Total Compound
	(TWA)	Concentration (mg/m3)	Carried Off-sit
(gm/s)			
Volatile Organic Compo	ounds		
N-Octane	1 450	0.023	0,0087
N-Nonane	1 050	0,147	0,0556
N-Decane	N/A	0,219	0,0828
Undecane	140	0,259	0,0979
Acetone	1 188	0,350	0,1323
Hexane	1 800	0,119	0,0450
Benzene	1.6	0,571	0,2158
N-Heptane	1 640	0,003	0,0011
Toluene	188	2,010	0,7598
Tetrachloroethylene	335	0,143	0,0541
Ethylbenzene	435	0,040	0,0151
Xylene	435	0,149	0,0563
2-Butoxyethanol	16	0,432	0,1633
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123-Trimethylbenzene	188	0,249	0,0941
124-TMB	435	0,121	0,0457
135-TMB	70	0,100	0,0378
Coal Tar Pitch Volatiles	0,14	0,464	0,1754
Tar Dust	N/A	0,050	0,0189
Phenol	19	BDL	
Cresol	22	BDL	-
Quinoline	0,4	BDL	-

Combining the above into families of compounds, the tabulated results are as follows:

Compound Group	Emission Rate (gram/second)
Paraffins (strait chains)	0,291
Aromatics	1,225
Ketones	0,132
Alcohols	0,163
Tetrachloroetylene	0,054
Total Coal Tars	0,197
Phenols	BDL
Total	2,062

The conclusion is reached that of the order of 2,062 gram/second of hydrocarbons is lost to the atmosphere from the site, translating to about 180 kg/day. Purely based on experience with other refining processed and in particular oil re-refining the first estimate would have been between 50 and 500 kg/day for this operation.

What the above quantification does allow in particular is an indication of the relative abundance of species, and in particular of the biologically less desirable compounds. In this regard note should be taken of benzene at 0,216 gram/second, 2-butoxyethanol at 0,163 gram/second and coal tar pitch volatiles at 0,175 gram/second.

4.23 STEEL SERVE

The operations may be divided into:







- Scrap lancing
- Scrap flame cutting
- Slag crushing
 - South operation
 - North operation

4.23.1 Scrap Lancing

The scrap being reduced by lancing includes:

- 5 000 t/month from cones
- 2 700 t/month tundishes
- 7 500 t/month coil
- 1 000 t/month pool iron
- 4 500 t/month rolling mill scrap

4.23.2 Carousel

Of the 20 200 tons/month lancing product, about 3 000 tons/month passes through the cutting carousel which is fitted with a Brandt Engineering bag filter, which collects about 5,3 tons/month of fume while the filter outlet of 34,7 Am3/second contains 5 milligram/Am3 of particulates, through a 1,7 m diameter stack, 4 m high at a temperature of 30°C.

4.23.3 Open Lancing

The remaining 17 200 tons/month of scrap is at present lanced in the open, at various locations. Failing any other means of quantification, it must be assumed that a similar mass of fume per ton of metal will be derived as for the scrap cut in the carousel, namely 1,767 kg/ton or 30,387 tons/month. This would equate to 11,723 gram/second. The release would be near ground and spread over a wide area. An area source of 50 m



square and a height of 5 m at ambient temperature will be assumed, giving a fume release rate of 0,005 gram/m2/second.

4.23.4 Flame Scrap Cutting

Approximately 12 000 tons/month of steel scrap is cut in the open by gas fiame. This also occurs over a wide area. The emissions are less visible than for lancing but no means of quantification is to hand. Failing a better indication, visual observation and experience would put the emission factor at 50% of lancing or 0,883 kg/ton of scrap. This translates to 10,6 tons/month or 4,088 gram/second. Again, using an area source of 50 m square with an effective release height of 3 m at ambient temperature, the release rate would be 0,002 gram/m2/second.

4.23.5 Slag Crushing and Screening South

A total of about 110 000 tons/month of slag from the basic oxygen and arc furnaces is crushed and screened. The arc furnace aggregate goes to the sinter plant while the remaining slag and fines go to the solid waste disposal site.

The US EPA (1996) emission factor for mineral crushing, screening and conveying is 9,5 kg/ton of material handled while Calvert and Englund (1984) provides a slightly more conservative figure of 8,8 kg/ton. Using the average of 9,15 kg/ton, the emission would be 388,3 gram/second. If the operation was taking place on an area of 100 m square the rate would be an average of 0,039 gram/m2/second, with an average point of origin of 5 m above ground. The above assessment is qualitatively confirmed by the two fall-out monitors in the vicinity.



4.23.6 Slag Crushing and Screening North

This operation is based on blast furnace slag recovery from the waste dump and the shipment of aggregate to outside users. The material being handled is 5 000 ton/month. On the same basis as above, the dust emission would be 17,65 gram/second or using an area source of 40 m square, 0,011 gram/m2/second. This agrees with what was observed from the nearby fall-out monitor.

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4.24 <u>BASF</u>

This is a paint mixing plant using mainly imported materials. Aside from pigments, the main components are esters – 30 000 liter/month of dimetyl succinate, glutarate and adipate plus 20 000 liter/month of Fluodan (ex Engen) containing about 96% heavy aromatics with a molecular mass in excess of 150, boiling point above 180°C and TLV(TWA) of 525 milligram/m3.

Aside from the above, there is a solvent recovery distillation unit handling both methyl ethyl ketone and methyl isobutyl ketone from their own washing down and from Vanderbijlpark Steel. The distillation is conducted under vacuum at 110°C. There is some evaporation loss, estimated at less than 100 liters/month or 0,039 gram/second. This would escape through the roof at about 8 m above ground over an area of about 6x6 m.

4.25 AIR EMISSION INVENTORY

The foregoing data was used to compile an inventory of all identified emissions from the Vanderbijlpark Steel plant. The format used corresponds to the input requirements for the Industrial Source Complex dispersion model which will be used.




Table 4.1 VANDERBIJL STEEL AIR POLLUTION SOURCE INVENTORY

Plant/	х	Y	Sour.	Elev.	Н	Diam/	Vol	Vel	Т	Emission	Pollut.	Accur.
Equipment	(m)	(m)	Туре	(m)	(m)	Area(m)	(m3/s)	(m/s)	(°C)	(gm/s)		Rating
Sinter Plant												
Sinter Strands 1 & 2	-632	655	Р	1495	- 99	6.67	350.0	10.0	100	78.750	KCI	В
										8 750	Dust	В
										108.870	SO2	В
										59.880	NOX	в
										1.306	HCI	в
			_		_					26.476	CH	В
Precipitator AG	-756	673	P	1495	37	2,77	63.3	10.5	50	13.546	Dust	A
Precipitator BG	-757	634	. Р 	1495	3/	2.77	65.1	10.8	31	11.19/	Dust	A
Precipitator CG	-822	/03	- P	1495	- 33	2.//	63.9	10.5	39	11.943	Dust	A
Cooling Carouseis	-828	640	۲ I	1495	5	7.82	480.0	10.0	100	72.000	Dust	A
Sinter Bed Screens	817	1209	P	1498	6	0.81	7.9	15.0	25	0.157	Dust	C
Sinter Tippter	-829	1123	P	1497	8	1.42	23.6	15.0	25	0.472	Dust	С
Mixing Bed	-803	1528	A	1508	15	25.00	i +++	~	25	0.001	Dust	С
Direct Reduction Plant												
Raw Materials ESP	-1590	954	P	1493	25	2.50	100.0	20.4	25	6.960	Dust	С
Kilo 1	-1621	972	р	1494	100	2 10	60.0	17.3	80	4 068	Dust	A
	1000	014	•		,40				~-	51 053	902	A.
										1 657	M/Nu	à
1/3- 0	4004	070		4 4 1 4	400	0.40		40.0	404	9,490	Dent	2
NULL &	-1021	972		14/94	:00	<u> </u>	40.U	13.9	101	3.400	Dust	
										36.751	SO2	A
										1.248	NOx	A
Kiln 3	-1621	972	P	1494	100	2.10	54.0	15.6	90	2.203	Dust	A
										42.598	SO2	А
										1.446	NOx	Α
Kiln 4	-1621	972	Р	1494	100	2.10	55.0	15.9	91	1.876	Dust	Α
										43.268	SO2	А
										1.469	NOx	А
Separation ESP	-1895	937	р	1492	30	3.10	80. 0	10.5	31	4.496	Dust	A
Coko Ouman												
Cost Destaustion	4400			A 400	-						-	~
Coarreparation	*1128 005	000		1490	5	JU 	~~	~	20	0.014	DUSt	C A
Totais ; Oven 1A	-637	733	A	1495	10	44	~	~	50	0.001	Dust	G
										0.001	co	С
										0.001	CH	C
Oven 1B	-875	733	A	1495	10	44	~	~	50	0.001	Dust	С
										neg	co	С
										0.001	CH	С
Oven 3A	-1027	733	A	1495	10	44	~~	~	50	0.002	Dust	С
										0.001	со	С



0.002 CH C



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Equipment (m) (m) Type (m) (m) Area(m) (m)	Inventory (continue) Plant/	ued) x	Y	Sour.	Elev	н	Diam/	Val	Vel	т	Emission	Pollut.	Accur.
Oven $3B$ -1069 733 A 1495 10 44 \sim \sim 50 0.001 Dust C Oven $4A$ -1131 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Oven $4B$ -1171 733 A 1495 10 44 \sim \sim 50 0.001 Dust C Oven $6A$ -1412 733 A 1495 10 44 \sim \sim 50 0.001 Dust C Oven $6A$ -1412 733 A 1495 10 44 \sim \sim 50 0.001 Dust C Oven $6B$ -1452 733 A 1494 10 44 \sim \sim 50 0.001 Dust C 0.002 Dust C<	Equipment	(m)	(m)	Туре	(m)	(m)	Area(m)	(m3/s)	(m/s)	(°C)	(gm/s)		Rating
Oven 4A -1131 733 A 1494 10 44 ~ ~ 50 0.001 CH C Oven 4B -1171 733 A 1494 10 44 ~ ~ 50 0.001 CU CU 0.002 CU C Oven 6A -1171 733 A 1495 10 44 ~ ~ 50 0.001 CU C Oven 6A -1412 733 A 1495 10 44 ~ ~ 50 0.002 CU C Oven 6B -1452 733 A 1495 10 44 ~ ~ 50 0.002 CU C 0.001 CU C 0.002 CH C 0.001 CU C 0.002 CH C 0.001 CU C 0.001 CU C 0.001 CU C 0.002 CH C 0.002 CH	Oven 3B	-1069	733	A	1495	10	44	~	~	50	0.001	Dust CÒ	c c
Oven 4A -1131 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 4B -1171 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 6A -1171 733 A 1495 10 44 ~ ~ 50 0.002 Dust C Oven 6A -1412 733 A 1495 10 44 ~ ~ 50 0.001 Dust C Oven 6B -1452 733 A 1495 10 44 ~ ~ 50 0.001 Dust C Oven 7A -1564 733 A 1494 10 44 ~ ~ 50 0.001 Dust C 0.001 C C 0.001 C C 0.002 Dust C 0.002 Dust C 0.001 Dust C											0.001	СН	С
Oven 4B -1171 733 A 1494 10 44 ~ ~ 50 0.001 CO C Oven 6A -1171 733 A 1495 10 44 ~ ~ 50 0.001 CO C Oven 6A -1412 733 A 1495 10 44 ~ ~ 50 0.002 Dust C 0.001 CH C 0.002 CH C 0.001 CO C 0.001 CH C C 0.001 CH C C 0.001 CH C C	Oven 4A	-1131	733	A	1494	10	44	~	~	50	0.002	Dust	Č ·
Oven 4B -1171 733 A 1494 10 44 ~ ~ 50 0.002 CH (0.001 CE (0.001 CH (0.001 CE (0.001 CH (0.001 CE (0.001 CE (0.00											0.001	co	С
Oven 4B -1171 733 A 1494 10 44 ~ ~ ~ 50 0.001 Dust C Oven 6A -1412 733 A 1495 10 44 ~ ~ 50 0.002 Dust C 0.001 CH C 0.002 Dust C 0.002 CH C 0.001 CH					•						0.002	СН	С
Oven 6A -1412 733 A 1495 149 44 e e 50 6002 CH C Oven 6B -1452 733 A 1495 10 44 e e 50 0.002 CH C Oven 6B -1452 733 A 1495 10 44 e e 50 0.002 $Dust$ C Oven 7A -1504 733 A 1494 10 44 e e 50 0.002 $Dust$ C Oven 7B -1545 733 A 1494 10 44 e e 50 0.002 $Dust$ C Oven 7B -1545 733 A 1494 10 44 e e 50 0.002 $Dust$ C Oven 6A -1659 733 A 1494 10 44 e e	Oven 4B	-1171	733	A	1494	10	44	~	~	50	0.001	Dust	C
Oven 6A -1412 733 A 1495 10 44 ~ ~ 50 0.001 -1 C Oven 6B -1452 733 A 1495 10 44 ~ ~ 50 0.001 -1.000 -1.000 -1.000 733 A 1495 10 44 ~ -50 0.001 -1.0000 -1.00000 $-1.000000000000000000000000000000000000$											neg	co	С
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$											0.001	СН	C
Oven 6B -1452 733 A 1495 10 44 ~ ~ \sim 60 0.002 CH C Oven 6B -1452 733 A 1495 10 44 ~ ~ \sim 60 0.001 -0.002 CH C Oven 7A -1504 733 A 1494 10 44 ~ ~ 50 0.002 -0.002 CH C Oven 7B -1545 733 A 1494 10 44 ~ ~ 50 0.001 -0.00 CH C 0.001 CH C </td <td>Oven 6A</td> <td>-1412</td> <td>2 733</td> <td>A</td> <td>1495</td> <td>10</td> <td>44</td> <td>~</td> <td>~</td> <td>50</td> <td>0.002</td> <td>Dust</td> <td>C</td>	Oven 6A	-1412	2 733	A	1495	10	44	~	~	50	0.002	Dust	C
Oven 6B -1452 733 A 1493 10 44 ~ ~ 600 0.001 <td></td> <td>0.001</td> <td>CO</td> <td>С</td>											0.001	CO	С
Oven 6B -1452 733 A 1493 0 44 \sim \sim 50 0.001 Uut C nog CO CO Oven 7A -1504 733 A 1494 10 44 \sim \sim 50 0.002 Uut CO CO <td></td> <td>0.002</td> <td>CH</td> <td>С</td>											0.002	CH	С
Note Note <t< td=""><td>Oven 6B</td><td>-1452</td><td>: 733</td><td>A</td><td>1495</td><td>10</td><td>44</td><td>~</td><td>~</td><td>50</td><td>0.001</td><td>Dust</td><td>C</td></t<>	Oven 6B	-1452	: 733	A	1495	10	44	~	~	50	0.001	Dust	C
Oven 7A -1504 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 7B -1545 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 7B -1545 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 6A -1609 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 6A -1609 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 6B -1654 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Oven 9A -1713 733 A 1494 10 44 \sim \sim 50 0.001 Dust											neg	co i	C
Oven 7A -1504 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 7B -1545 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 7B -1545 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 6A -1609 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 6A -1609 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~											0.001	CH	С
Oven 7B -1545 733 A 1494 10 44 ~ ~ 50 0.001 C0 C Oven 7B -1545 733 A 1494 10 44 ~ ~ 50 0.001 Dutt C Oven 6A -1609 733 A 1494 10 44 ~ ~ 50 0.001 CU C Oven 6A -1609 733 A 1494 10 44 ~ ~ 50 0.001 CU C Oven 6B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Dutt C Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Dutt C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.001 Dutt C Oven 9A -1713 733 A 1494 10 44 ~ <t< td=""><td>Oven 7A</td><td>-1504</td><td>733</td><td>A</td><td>1494</td><td>10</td><td>44</td><td>~</td><td>~</td><td>.50</td><td>0.002</td><td>Dust</td><td>C</td></t<>	Oven 7A	-1504	733	A	1494	10	44	~	~	.50	0.002	Dust	C
Oven 7B -1545 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Oven 6A -1609 733 A 1494 10 44 \sim \sim \sim 50 0.001 $Dust$ C Oven 6A -1609 733 A 1494 10 44 \sim \sim \sim 50 0.002 $Dust$ C Oven 8B -1854 733 A 1494 10 44 \sim \sim \sim 50 0.002 $Dust$ C Oven 8B -1854 733 A 1494 10 44 \sim \sim 50 0.002 $Dust$ C Oven 9A -1713 733 A 1494 10 44 \sim \sim 50 0.002 $Dust$ C Oven 9B -1713 733 A 1494 10 44 \sim \sim 50 0.002 $Dust$ C Oven 1 Stack		`									0.001	co	С
Oven 7B -1545 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Oven 6A -1609 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Oven 6A -1609 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 8B -1654 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 8B -1654 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 9A -1713 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven 9B -1713 733 A 1494 10 44 \sim \sim 50 0.001 Dust			· ·								0.002	CH	С
New Problem -1609 733 A 1494 10 44 \sim \sim 50 600 CH C Oven 6A -1609 733 A 1494 10 44 \sim \sim 50 0.002 Cu 0.002 CU 0.002 CH C Oven 8B -1654 733 A 1494 10 44 \sim \sim 50 0.001 Cu C Oven 9A -1713 733 A 1494 10 44 \sim \sim 50 0.001 Cu C Oven 9A -1713 733 A 1494 10 44 \sim \sim 50 0.001 Cu 0.001 CU 0.001 CU 0.001 CU C_0 0.001 CU C_0 0.001 CU C_0 0.001 CU C_0 C_0 C_0 C_0 C_0 <	Oven 7B	-1545	5 733	A	1494	10	44	~	~	5(0.001	Dust	С
Oven 6A -1609 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 6A -1609 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>neg</td><td>co</td><td>C</td></td<>											neg	co	C
Oven 6A -1609 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C <t< td=""><td></td><td></td><td></td><td></td><td>·,</td><td></td><td></td><td></td><td></td><td></td><td>0.001</td><td>СН</td><td>С</td></t<>					·,						0.001	СН	С
Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Ed C Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Eds C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Eds C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Eds C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Eds C Oven 9B -1758 733 A 1494 10 44 ~ ~ ~ 50 0.001 Eds C 0.002 CH C 0.001 C C 0.001 C C 0.001 C C 0.001 C C 16.0 S00 16.0 S00 16.0 S00 2.886 S02 B	Oven 6A	-1609	733	A	1494	10	- 44	~	~	50) 0.002	Dust	C
Oven 8B -1654 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Cu Cu 0.002 CH C 0.001 CO C 0.002 CH C 0.002 CH C 0.002 CH C 0.002 CH C C 0.001 CH C 0.001 CH C 0.001 CH C 0.001 CH C 2.868 SO2 B											0.001	co	C
Oven $3B$ -1654 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Nown $9A$ -1713 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Oven $9A$ -1713 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven $9B$ -1758 733 A 1494 10 44 \sim \sim 50 0.002 Dust C Oven $9B$ -1758 733 A 1494 10 44 \sim \sim 50 0.001 Dust C Oven $9B$ -1758 733 A 1494 10 444 \sim \sim \sim 50 0.001 Dust C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 15.140 NOx C Oven 3 Stack -999 735 P 1495											0.002	CH	C -
Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.001 CH C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C 0.001 CO C 0.002 CH C 0.001 CO C 0.002 CH C 0.002 CH C 0.002 CH C 0.001 CU C 0.001 CU C 0.001 CU C 0.001 CH C 2.868 SO2 B 15.140 NOX C 3.607 SO2 B 3.607 SO2 B 3.607 SO2	Oven 8B	-1654	1 733	A	1494	10	44	~	~	50	0.001	Dust	C
Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.0											neg	00	C O
Oven 9A -1713 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.002 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -899 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 </td <td>0</td> <td>4 784 0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td>0.001</td> <td>GH</td> <td>C A</td>	0	4 784 0								-	0.001	GH	C A
Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 C0 C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ ~ 50 0.001 Dust C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -872 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -999 735 P 1494 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P	Oven 9A	-1713	5 733	S A	1494	10		~	~	54	0.002	Dust	C O
Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Oven 9B -1758 733 A 1494 10 44 ~ ~ 50 0.001 Dust C Noven 9B -1758 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -999 735 P 1494 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P											0.001		
Oven 1 Stack -872 735 P 1494 10 44 ~ ~ 50 0.001 Dust C Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 <td>Olion OP</td> <td>4750</td> <td>) ""</td> <td></td> <td>1404</td> <td></td> <td></td> <td>. .</td> <td></td> <td>C'r</td> <td>0.002</td> <td>Dunt</td> <td>5</td>	Olion OP	4750) " "		1404			. .		C'r	0.002	Dunt	5
Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0	Over ap	-1750	> /30	A	1424	10	49	. ~	~	DC.		CO	C C
Oven 1 Stack -872 736 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 10.600 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C											neg 0.004		с с
Oven 3 Stack -999 735 P 1495 110 3.00 106.0 13.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 3.00 10.00 10.00 3.00 10.00 3.00 10.00 10.00 3.00 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C 3.607 SO2 B B 3.00 106.0 15	Over 1 Stack	975	796		1406		3.00	1064	n 4⊆0	າ ວຍ/	100.0) Smoka	c c
Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C	CYGH I SIGON	-072	. 100	<i>з</i> г	146.35	110	0.00	100.1	0 10.0	200	2 222	SUDA C	в ·
Oven 3 Stack -999 735 P 1495 110 3.00 106.0 15.0 280 9.540 Smoke C 3.607 SO2 B 15.140 NOx C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C											15 140	002 NOV	c c
Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 10.0 200 3.540 3.607 SO2 B Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C 3.607 SO2 B 15 140 NOx C C	Oven 3 Stack	-900	3 725	q ;	1404	1 1440	3.00	1061	1 15/	1 284) Q.54£) Smoke	c c
Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C 3.607 SO2 B 3 3 5 3 5 3 5 3 3 5 3 3 5 3 5 3 3 3 3 5 3 <td< td=""><td>O FOR A ALONA</td><td>-000</td><td>, 100</td><td>, 1</td><td>1430</td><td>, 110</td><td></td><td>100.1</td><td>J 10.1</td><td>, 201</td><td>2 5.040 3 607</td><td>SO2</td><td>R</td></td<>	O FOR A ALONA	-000	, 100	, 1	1430	, 110		100.1	J 10.1	, 201	2 5.040 3 607	SO2	R
Oven 4 Stack -1096 735 P 1494 110 3.00 106.0 15.0 280 5.035 Smoke C 3.607 SO2 B											15 140		c
3.607 SO2 B	Oven 4 Stack	-1096	3 734	; p	1494	111	3.00) 1064	0 15 () 280) 5.035	Smoke	č
							0.00	- ingradio			3.607	' SO2	B
15.140 NOX C											15.140) NOx	C



ARCHIVE FOR JUSTICE

Inventory (continu	ued) X	Ŷ	Sour.	Elev.	н	Diam/	Vol	Vel.	Ť	Emission	Poliut.	Accur.
Equipment	(m)	(m)	Туре	(m)	(m)	Area(m)	(m3/s)	(m/s)	(°C)	(gm/s)		Rating
Oven 6 Stack	-1434	735	i P	1495	110	3.00	106.0	15.0	280	6.360	Smoke	с
										3.607	SO2	В
										15,140	NOx	С
Oven 7 Stack	-1535	735	S P	1493	110	3.00	106.0	15.0	280	6.625	Smoke	С
										3.607	\$02	в
										15.140	NOx	С
Oven 8 Stack	-1578	735	; P	1494	110	3.00	106.0	15.0	280	6.890	Smoke	С
										3.607	SO2	в
										15.140	NOx	С
Oven 9 Stack	-1754	736) P	1494	110	3.00	106.0	15.0	280	7.420	Smoke	С
										3.607	SO2	В
										15.140	NOx	C
Emergency Stack	-1791	831	P	1492	70	0.45	1.6	10.0	25	102.778	H2S	B
Quench Tower 1	-882	755	5. P	1495	15	8.85	615.1	10.0	100	3.548	Dust	C
										6.671	СН	В
Quench Tower 2	-1074	757	' P	1495	15	8.85	615.1	10.0	100	8.871	Dust	С
										6.871	CH	В
Quench Tower 3	-1463	759) P	1494	18	8.85	615.1	10.0	100	8.871	Dust _	C
										6,671	CH	B
Quench Tower 4	-1658	763	S P	1494	18	8.85	615.1	10.0	100	8.871	Dust .	C
Right Examples Complete										6.671	Сн	в
Blast rumace Complex	4400			4400		4 70			~~	4.040	F1	
DF C Stock House	-1303	048		1490	10	1.70	70.0	29.U 45.0	20	4.043		A A
br C Stoves	~1301	Q72	: P	1495	01	3.80	172.5	15.0	000	0.177	rume	A n
										0.497	SO2	в 0
	4074	600		1404	E	40.00			05	0.000	- INUX	
PE C Eurosco Silon	"12/i 1976	020	e n	14894	- 0 62	0.00		- 15 0	20 000	0.009	Dust	с С
on o numace disps	* (Z7Q		, t	1434	- 00	0.2.3	400.0	10.0	800	4 500		ž
										6.000	100 1100	ĉ
RF C Tenholl Filter	_1320	524		1405	25	2 80	134.0	24.9	Л	5 360	FLGO	Δ
RFC Tenhal Firsting	-1270	546		1400	10	30.00		~ ~ ~ ~	 46	0.000	Dust	ĉ
RE D Stock House	-1501	575	; ;	1404	20	253	55.3	110	 25	1 650	Dust	Δ
RF D Stource	-1478	570 8 400	, r , p	1/10/1	20 55	2.00	166.7	16.0	20	: 1.00a i ∩.46∩		Δ
	- 1-41 10	- 492	. 1	1404		0.00	100.1	10. V	000	OULUU .	1 000	R
										0.783	N/Nv	c
RE D Duct Romanal		690	> A	1404	s	40.00			AR	9.200	Duet	с С
RED Europea Sine	-1406	· 002 : 491		1494	יט. דידיי	10.00	. ~ 	45.0	99 000	0.002	Eumo	~
Dr. D. I. dr. I doc O silps	-1430	401		142-1	- 14	0.2.3	- 400.0	τų.u	900	4 500		~
										0.001	100	c c
RE A Tanhall Europhine		470	2 A	1.404	ł٨	20.00			A 52	0.001	nzo Duet	с с
DE CAN MER	-1010	9 4/C) M 1 M	1434	• •U	00.00	 	40.0	40	0.063	Dust	с р
DE Cosi Ruelles	-1425) D/U	, r	1495	45	0.82	. 0.3	10.0 10.0	150	0.053	Durt	9 61
Dr Voai Bunker	~1420	557	P	1495	30	U.54	2.5	11.0	25	0.025	ljust	5

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Inventory (continue Plant/	ued) x	Y	Sour.	Elev.	Н	Diam/	Vol.	Vel.	T	Emission	Pollut.	Accur.
Equipment	(m)	(m)	Туре	(m)	(m)	Area(m)	(m3/s)	(m/s)	(°C)	(gm/s)		Rating
Basic Oxygen Fumaces												
BOF 1	-1096	-379	P	1495	75	2,25	96.7	15.0	1000	0.806	Fume	A
										0.607	SO2	В
										12.896	NOx	c
BOF 2	~1096	-379	P	1495	75	2.25	96.7	15.0	1000	0.806	Fume	A
										0.607	SO2	B
										12.896	NOX	C
BOF 3	-1096	-379	P	1495	75	2.25	96.7	15.0	1000	0.806	Fume	A
										0.607	SO2	в
										12.896	NOx	C
Bag Filter 1	-1277	-391	P	1495	20	3.36	83.0	9.4	41	2.747	Fume	A
										neg,	SO2	A
			•							neg.	NOx	A
Bag Filter 2	-1404	-372	P	1495	20	3.36	87.0	9.8	43	7.091	Fume	A
										neg.	SO2	A
										neg.	NOx	A
Bag Filter 3	-1502	-303	i P	1495	20	3.36	182.0	20.6	47	1.219	Fume	A
										neg.	SO2	A
										neg.	NOx	А
Bag Filter 4	-1178	-347	P	1495	60	1.38	22.1	15.0	25	0.663	Dust	С
Ladle 1 & RH-OB	-1025	-469	P	1495	11	1.32	9,9	7.2	90	0.168	Fume	А
Ladle 2	-906	-276	P	1495	15	2.08	41.0	11.5	45	0.238	Fume	А
Concasts V1 & V2	-888	-517	' P	1496	30	2.67	54.3	9.7	51	0.626	Fume	А
										0.023	SO2	B
										0.493	NOx	С
Scarfing	-889	-517	P	1496	- 30	1.80	24.7	9.7	31	0.086	Fume	А
										0.001	NOx	С
BOF Fugitives	-1137	7 -357	' A	1495	55	10.00	~	~	30	0,002	Fume	С
Arc Furnaces												
Furnace 1	-1741	-345	; P	1495	25	2.50	83.3	17.0	68	1.217	Fume	A
										5.612	SO2	A
										4.174	NOx	A
Furnace 2	-1742	-364	p p	1495	25	2.50	83.3	17.0	68	1.217	Fume	A
,										nea.	SO2	c
										neg.	NOY	č
Furnace 3	-1742		; P	1405	25	250		170	. 69	1.09. 1.017	Fuma	Ā
i usadoo o	13 "N6		· ·	1400		~ 2.00		· + • • •		nea	502	2
										HCy.	NO-	č
Eunithee	_1201	2	۰ ۸	1404	- AZ	E0.00		.	40	aey.	Fumo	c C
i adla Eumona i	-1004	. "241. 197		1404	- 40 40	4.00				0.004 5 8.444	Cunto Curso	~
Louis Fuinace I	-100	104	r r'	1491	10	1.00	17.6	22.1	i 92	: U.41U	CUIDE	~
										15.809	302	A

0.074 NOx A



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Inventory (continue Plant/	ued) x	Y	Sour.	Elev.	н	Diam/	Vol	Vel.	т	Emission	Pollut.	Accur.
Equipment	(m)	(m)	Туре	(m)	(m)	Area(m)	(m3/s)	(m/s)	(°C)	(gm/s)		Rating
1 adle Fumace 2	-1939	-202	p	1489	5	1.38	26.5	17.7	70	0.922	Fume	A
Louis I alliabo L										23.804	SO2	A
										0.035	NOx	А
Vacuum Arc	-1845	-180								nea.	all	С
Concest V3	-1884	-87								nea.	all	с
Outpust VO	,,,,,									~~~		
Mould Foundry												
Sand Handling	-1785	214	Р	1495	14	1.73	14.1	6.0	32	0.588	Dust	A
Sand Drier Filter	-1724	178	P	1495	14	0.75	3.2	7.3	38	0.046	Dust	А
										neg.	SO2	С
										neg.	NOx	С
Fettling Plant	-1754	210	A	1495	17	10.00	~	~	25	0.005	Dust	С
Sand Blast	-1766	i 117	A	1495	2	10.00	- 	~	25	0.003	Dust	С
South Mill												
Stack 1	-393	90	P	1495	32	: 1	2.4	3	600	0.411	SO2	В
										0.123	NOx	С
Stack 2	-393	84	P	1495	32	: 1	2.4	. з	600	0.411	SO2	В
										0.123	NOx	С
South Pickle Line												
Pickle Line	319	514	P	1496	38	1.50	26.5	15.0	25	0.382	HCI	А
Rolling Mill	328	280	P	1494	25	0.20	0.5	5 15.0	25	5 0.001	Oil	В
*												
Tin Line												
Strip Preparation	234	330	A	1494	25	20	I ~	~	25	6 0.002	SO2	С
										2,582	NOx	С
										0.031	СН	С
Palnt Line												
Paint Line Booths	97	49 6) P	1495	i 25	2.00	32.0	10.2	350	3.525	NOx	А
										11,872	CH	A
										0.471	SO2	А
Hot Mill												
Re-heating Furnace 1	749) 1471	P	1503	40) 2.4	44.5	5 10	600) 4.986	i SO2	в
•										3,149	NOx	С
Re-heating Furnace 2	796	5 1471	I P	1503	3 40	2.4	44.5	5 10	600) 4.986	i SO2	в
•										3,149	I NOx	с
Reheating Furnace 3	824	1 1471	P	1503	3 40) 2.4	44.5	5 10	600) 4.986	SO2	в
a										3.149	NOx	с
Re-heating Furnace 4	729) 1368	3 P	1504	1 70	2.4	44.5	5 10) 600) 4,986	SO2	В
			•••		• • •					3 1 4 9	NOx	c
Fume Extractor	1113	2 1519	5 P	1504	1 27	2.27	436	5 10 8	3 29	9 1.09) Fume	Ā
	1 + 14	- 1911	. ,	,001		**************************************	1204			0.557	7 CO	A
Pickle Line North										0.007		••
Stack	128	5 1792	2 7	2 1508	5 38	3 1.52	2 27.2	2 15.0) 2	5 0.218	3 HCI	A

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Plant/	x /	Y	Sour.	Elev.	н	Dlam/	Vol,	Vel	т	Emission	Pollut.	Accur.
Equipment	(m)	(m)	Туре	(m)	(m)	Area(m)	(m3/s)	(m/s)	(°C)	(gm/s)		Rating
Galvanising Line 4												
Vertical Kiln Stack	1457	2134	P.	1507	40	1.22	17.5	15.0	800	1.932	NOx	С
										0.002	\$02	8
Horisontal Kiln Stack	1455	2163	Ρ	1507	40	1.88	41.6	15.0	900) 4.593 0.005	NOx SO2	C B
Electro-Galvanising										0.000	002	C
Stack 1	1534	2442	Р	1508	33	1,6	32.2	15.0	25	0.068	SO2	Α
Stack 2	1534	2446	₽	1508	33	1.75	36.1	15.0	25	i 0.081	SO2	Α
Stack3	1534	2452	P	1508	33	1.6	30.2	15.0	25	0.068	SO2	A
Continuous Annealing N												
Annealing	1348	1927	Р	1508	40	1	7.8	10	300	0,006	SO2	в
Allert Deservice Dellar										3.16	NOx	С
Boiler Stack	-1194	438	Р	1494	15	3.88	177.8	15	190	0.323	Smoke	с
										17.42	SO2	С
										47.984	NOx	С
Flares Flare 1	-980	404	p	1495	45	2.59	78.4	. 15	1000	0.194	Smoke	8
				1.400	. 12			•••		1.454	SO2	В
										5.809	NOx	c
Flare 3	-1084	403	P	1494	45	2.59	78.4	15	5 1000	0.194	Smoke	в
			,							1,454	SO2	В
										5.809	NOx	с
Flare 4	-1386	i 434	P	1495	5 50	2.59	78.4	15	5 1000) 0.194	Smoke	8
										1.454	SO2	8
										5.809	NOx	С
Flare 5	-1700	684	P	1494	45	2.59	78.4	15	1000	0.194	Smoke	в
										1.454	SO2	в
										5.809	NOx	в
Lurgi Acid Recovery												
Lurgi 1	609	331	P	1494	1 38	0.75	i 4.2	9,6	5 95	6 0.805	5 HCI	А
Lurgi 2	599	336	e P	1494	38	0.75	i 4.1	9.3	95	5 0.255	5 HCl	A
Lurgi 3	589	330	P	1494	38	0.75	4.2	9.6	95	5 0.809) HCI	Α
Ferrite Plant												
Mill Classifier Filter 1	332	2 227	γ P	1493	3 27	0.30) 1,4	18.0) 25	5 0.003	3 Dust	B
Mill Classifier Filter 2	341	227	' P	1493	3 27	ʻ 0.30	1.4	18.0) 25	6 0.003	0 Dust	в
Scrubber	385	5 234	P	1494	1 25	5 0.75	5.2	2 11.8	57	0.556) HCI	А
										0.627	' NOx	Α
Suprachem (Organic)												
Whole Operating Area	-1116	905	5 A	1495	5 5	5 252.00)~	~	30	0.001	Tar	в
										0.005	5 Aromat	в

0.002 CH B



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inventory (continued)													
Plant/	X	Y	Sour.	Elev.	Н	Diam/	Vol.	Vel.	T	Emission Pollut	Accur.		
Equipment	(m)	(m)	Туре	(m)	(m)	Area(m)	(m3/s)	(m/s)	(°C)	(gm/s)	Rating		
Steel Serv													
Carousel	-1593	-643	P	1494	. 4	1.7	34.7	11.0	30	0.174 Fume	Α		
Open Lancing	-565	-226	A	1494	5	; 50	· ~	~	25	0.005 Fume	С		
Flame Scrap Cutting	-371	-862	A	1500	• 3	50	~	~	25	0.002 Fume	С		
Slag Handling S	633	-410	A	1491	5	5 100	~	~	25	0.039 Dust	C.		
Slag Handling N	1386	2085	A	1508	5	6 40	~	~	25	0.011 Dust	С		
BASE													
Solvent Still	765	691	Α	1495	8	6	~	~	25	0.001 CH	в		

The last column, accuracy rating, refers to the reliability of the emission figures.

A - The emission is based on actual measurements.

B - The emission is based on reliable mass balances.

C - No measurements or mass balances are available. The figures are based on best

estimates from published emission factors or experience as detailed in the notes.

Table 4.2 SUMMARY OF VANDERBIJLPARK STEEL AIR POLLUTANT EMISSIONS COVERED BY THE INVENTORY.

Pollutant	Emission Rate (gram/second)
Fine particulates (PM10)	875.3
Sulphur dioxide	401,5
Hydrogen sulphide	102,8
Oxides of nitrogen	335,2
Hydrocarbons	89,8
Potassium chloride	78,7
Hydrogen chloride	4,3
Carbon monoxide	19,4

4.26 CARAVAN DATA

The caravan air pollution monitoring data, recorded over the period May 2001 to April 2002, at location x = -660 y = +375 local grid, is summarized below as monthly averages, with a year average over the whole period.





Period	Concentration in ppm (except PM10)									
N	PM10	<u>SO2</u>	H2S	NO	NO2	NOx				
May 2001	67	22	24	11	11	24				
June	83	21	27	7	10	16				
July	87	19	18	8	9	19				
August	96	18	15	8	9	15				
September	101	12	14	(2)	(0,1)	(2)				
October	103	8	10	(2)	(1)	(4)				
November	-	10	10	8	***	(8)				
December 2001	-	5	7	-		**				
January 2002	103	-	-	7	-					
February	-	-	10	6	8	9				
March	69	6	5	6	6	10				
April 2002	78	_14	13	8	9	13				
Year average (ppm)	MA	13	14	8	9	15				
Year average (milligm/m3)	87	30	17	9	15	23				

Table 4.3VANDERBIJLPARK STEEL CARAVAN AIR POLLUTIONMONITORING DATA FOR MAY 2001 TO APRIL 2002.

Dashes indicate periods when the instruments were inoperative

Brackets indicate values which are suspect

Conversion from ppm to milligram/m3 takes into account local pressure at 85 kPa, 20°C and the molecular mass relative to air.

The mass concentration values above will be taken into account in the validation of the air pollution dispersion model.





CHAPTER 5 DISPERSION MODELLING

5.1 NUMERIC MODELLING

It is not technically feasible to measure the concentrations of gaseous components and fine particulates in the atmosphere with a high enough density of monitors to be able to interpolate with adequate accuracy to confirm compliance with ambient air quality norms. In addition, it would not be possible when placing the monitors, to predict where the highest levels of pollution will occur. Lastly, it will not be possible to link the measured pollutants to a particular industry or source area.

To overcome the problems above, numeric dispersion models were developed, particularly by the United States of America Environmental Protection Agency (US EPA). These models normally make use of plume rise formulations to simulate effective plume release heights, and from there applies Gaussian distribution delineated by wind speed and direction and atmospheric stability.

5.2 GAUSSIAN PLUME MODEL

The general form of the Gaussian plume model is the following:

$$\aleph(\mathbf{x},\mathbf{y},\mathbf{0},\mathbf{H}) = \underbrace{\mathbf{Q}}_{\pi \quad \sigma \mathbf{y} \, \sigma \mathbf{z} \, \mathbf{U}} \exp\left(-\frac{1}{2}\left(\underbrace{\mathbf{y}}_{\sigma \mathbf{y}}\right)^{2} \exp\left(-\frac{1}{2}\left(\underbrace{\mathbf{H}}_{\sigma \mathbf{z}}\right)^{2}\right)\right)$$

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Where	N(x,y,0,H)		Pollutant concentration at a point at ground level (z=0)
	Q		Source strength or rate of pollutant emission
	Н	=	The effective height of the release point
	x		The distance along the path of the plume
	у	×	The lateral displacement from the path of the plume
	Z	m	The vertical height above ground
	σy&σz	#	Lateral and vertical dispersion parameters
	u	=	Wind speed.

The weakness of the model lies in the fact that the dispersion parameters are derived from the wind speed, the time of day, the sun azimuth, surface temperature and cloudiness. This may introduce an error of a factor of two in the dispersion parameters and thus an error of up to an order of magnitude in the numeric value of the calculated ground level concentration. The problem is overcome by calibrating the concentration values by actual measurements at the site. The shape of the concentrations contours are determined by the wind direction and to a lesser degree the topography, and are therefore shape true.

5.3 SPECIFIC MODEL USED

The particular model used for this study is the Industrial Source Complex Long Term model as developed for a main frame by the US EPA and adapted for personal computer by Trinity Consultants in the United States. The main attributes of this model are:

- A total of up to 1000 pollution sources, being either point, area or volume sources in any combination.
- Use of hourly wind direction and speed and atmospheric stability.
- Automatic calculation of plume rise using both emission mass and temperature.
- Full incorporation of topographic effect on dispersion.
- Calculation of annual average concentrations.





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Attributes also available in the model but not used in this study, include:

- Short duration emissions.
- Specific time emissions.
- Dust fall-out rate calculations.
- Gaseous pollutant decay due to atmospheric reactions.

5.4 MODEL INPUTS

5.4.1 Meteorology

Due to the surface roughness within the plant area particularly, winds measured at 5 m above ground, as at the monitoring caravan, are not suitable for dispersion modelling beyond the first 100 m. Fortunately, the wind data from the Weather Bureau anemometer at the Iscor South Gate could be accessed from archives. The most recent 100% complete data set is for the year 1996. From statistical analysis of long term wind data it was found that the year on year wind field variation is not more than 5%, except for the most unusual weather patterns like the Demoina cyclone of a decade ago. The 1996 hourly South Gate wind data was worked up to a suitable multi dimensional meteorology matrix for input into the ISC model.

5.4.2 Topography

The local topography was extracted from the 1:50 000 South African Topo-cadastral maps 2627DA and 2627DB for an area of 20x20 km with the centre in the middle of the Vanderbijlpark site

5.4.3 Source Data

A comprehensive inventory of all the identifiable air pollution was drawn up and is described in detail in Chapter 4 of this report. The format of the inventory conforms to the input requirement for the model, including:



- Source identification.
- Source location.
- Topographic base.
- Emission height.
- Source type (point or area).
- Source opening.
- Volumetric flow.
- Temperature.
- Emission rate.
- Pollutant type.

5.4.4 Modelling and Period Runs

The model was run for a period of a year, producing contours of annual average concentrations. The pollutants modeled for are:

- Particulate matter (essentially insoluble and smaller than 10 micron).
- Sulphur dioxide.
- Hydrogen sulphide.
- Oxides of nitrogen.
- Hydrogen chloride.
- Organic compounds.
- Carbon monoxide

5.5.1 INTEGRITY OF INPUTS

The wind speed and direction data is of high integrity within the bounds of annual variation. Similarly the topographic data is firm.

The source location, both horisontal and vertical are also of high quality, but as previously stated not all the source strengths are accurate. An analysis of the inventory accuracy ratings indicate:

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Pollutant	Accurate(+ or - 5%)	<u> Fair (+ or – 25%)</u>	Estimates
Particulates	17,4%	1,1%	81,5%
Sulphur dioxide	54,9%	40,6%	4,5%
Hydrogen sulphide	0%	100,0%	0%
Oxides of nitrogen	4,3%	19,9%	75,8%
Hydrogen chloride	69,8%	30,2%	0%
Organic compounds	11,2%	52,2%	36,6%
Carbon monoxide	0%	3,0%	97,0%

The major weakness lies in the dispersion parameters as discussed earlier. This can only be addressed by actual calibration of the results using the measured values from the monitoring caravan, which was operated on site for a year and reported on in the previous chapter. In particular, the concentrations for sulphur dioxide is of value due to the high level of confidence on the inputs to the modelling. Particulates are not suitable as the caravan was located in an area where there is very heavy vehicle movement, with visible clouds of dust for much of the time. In addition, the modelling inputs are also too inaccurate to place reliance on the predicted values.

5.6 **DISPERSION MODELLING**

The results of the air pollution dispersion modelling follows, together with the interpretation.

5.6.1 Particulates

The dispersion of fine particulates follows in Figure 5.1.





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FIGURE 5.1 MODELLED CONCENTRATIONS OF FINE PARTICULATES (PM10) AROUND VANDERBIJLPARK STEEL (based on emission inventory compiled for 2001-2002).

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SO2 ANNUAL AVERAGE

FIGURE 5.2 MODELLED CONCENTRATIONS OF SULPHUR DIOXIDE AROUND VANDERBIJLPARK STEEL (based on emission inventory compiled for 2001-2002).









FIGURE 5.3 MODELLED CONCENTRATIONS OF OXIDES OF NITROGEN AROUND VANDERBIJLPARK STEEL (based on emission inventory compiled for 2001-2002).

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H2S ANNUAL AVERAGE

FIGURE 5.4 MODELLED CONCENTRATIONS OF HYDROGEN SULPHIDE AROUND VANDERBIJLPARK STEEL (based on emission inventory compiled for 2001-2002).

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FIGURE 5.5 MODELLED CONCENTRATIONS OF HYDROCARBONS AROUND VANDERBIJLPARK STEEL (based on emission inventory compiled for 2001-2002).











FIGURE 5.6 MODELLED CONCENTRATIONS OF HYDROGEN CHLORIDE AROUND VANDERBIJLPARK STEEL (based on emission inventory compiled for 2001-2002).

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FIGURE 5.7 MODELLED CONCENTRATIONS OF CARBON DIOXIDE AROUND VANDERBIJLPARK STEEL (based on emission inventory compiled for 2001-2002).







The particulate modelling indicates a concentration of about 20 microgram/m3 at the monitoring caravan while the actual measured value was 87 microgram/m3. The less than accurate values in the inventory (81% estimates) and the presence of high vehicle movement density in close proximity of the caravan makes this an unsuitable component for model calibration.

The results of the modelling would however indicate a need for attention to the fine dust emissions, particularly from near ground fugitive sources, as detailed in the text on source quantification.

5.6.2 Sulphur Dioxide

Contrary to the inventory accuracy for dust, the values for sulphur dioxide is of high integrity (54,9% accurate and 40,6% fair). The modelling indicates a sulphur dioxide concentration at the caravan of about 120 microgram/m3 while the measured value is 30. This suggests a significant over-estimation by the model by a factor of 4.

If, in addition, it is noted that the caravan measures not only the sulphur dioxide from the Vanderbijlpark Steel plant, but also the contributions from the surrounding industries and residential areas, it must be concluded that the modelling over-estimate factor will be more than 4 and the plant contribution is well within reasonable levels when evaluated against the internationally rather strict recently published annual air quality criteria of 50 microgram/m3 (this report page 4).

5.6.3 Oxides of Nitrogen

The accuracy rating for oxides of nitrogen is not very high because of a lack of measured values, but is better than officially rated because of





experience with combustion processes. At the caravan the modeled value is about 100 microgram/m3 compared to the measured 23 microgram/m3, giving an over-estimation factor of 4. Again, the 23 includes contributions by surrounding sources.

The best available criteria for oxides of nitrogen is the Chief Officer's annual guideline of 150 microgram/m3. Even if judged against the strict German 80 microgram/m3 criteria, the measured value of 23, which includes external sources, must be judged as reasonable.

5.6.4 Hydrogen Sulphide

The inventory accuracy for the few sources is fair (100%) and forms part of the total sulphur balance of the plant. The modeled value at the caravan is only 10 while the actual measured is 17 microgram/m3. Two factors in particular play a role in this. Firstly the surrounding residential areas are large contributors of this particular pollutant, particularly in winter. Secondly, practically the only plant source is high above the ground at 75 m and therefore particularly prone to misinterpretation by modelling through inaccuracies in the dispersion parameters under stable atmospheric conditions.

The emission of hydrogen sulphide is in the process of being severely curtailed with the refurbishing of the coke oven by-products plant at present underway, through the conversion of this gas to elemental sulphur.

5.6.5 <u>Hydrocarbons</u>

The inventory accuracy for this component is on average fair, mainly because the Suprachem operation, which is a significant near surface





source, is difficult to quantify.

Even though the figures in the inventory are considered pessimistic, the resultant modelling concentrations are low, particularly if a correction factor of 4, as found for sulphur dioxide and oxides of nitrogen are applied. The coke plant by-products upgrade at present in progress will further reduce emissions.

5.6.6 Hydrogen Chloride

The inventory accuracy is good and the total emission rate is very low at 4,3 gram/second only. The modelling confirms that the effect is insignificant.

5.6.7 Carbon Monoxide

With an assessed emission rate of 19,4 gram/second, even at a poor level of accuracy, but emitted from tall sources, results in insignificant concentrations at ground level.

5.7 OVERALL ASSESSMENT

The calibration of the modelling results by means of the caravan monitoring indicates an over-estimation by a factor 4, for the two more reliable components (sulphur dioxide and oxides of nitrogen).

The higher than modeled concentrations for fine particulates and hydrogen sulphide have been motivated and explained. In both cases, steps are already in place to bring about significant reductions in emissions.





The modeled concentrations for hydrocarbons are low, and if the correction factor is applied, even less significant.

The results of modelling for hydrogen chloride and for carbon monoxide are very low to insignificant, as is to be expected. Application of the correction factor would not meaningfully change the conclusion.



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CHAPTER 6 PARTICULATE DEPOSITION

6.1 SCOPE

The gaseous pollutants and fine particulates which reacts gas-like during dispersion have been dealt with in chapters 4 and 5 above. A quantification of the emissions of larger particles (mainly larger than 10 micron) by means of an emission inventory and subsequent dispersion modelling is not practical, because the sources are usually diffuse and periodic, and the dispersion is governed essentially by gravity and thus very dependent on particle size, shape and density.

To overcome this problem, the most reliable approach is to measure the actual deposition rates using a network of standard fall-out monitors, and interpreting the results spatially with the aid of appropriate software.

6.2 METHODOLOGY

A standardized method for collecting samples and the equipment to be used is given in the American Society for Testing and Materials (ASTM) Method D 1739. Essentially this consists of a metal stand of 2 m, fitted with a bird ring and a PVC bucket of 150 mm diameter and 400 mm deep.

In total 36 monitors were positioned to cover the whole Vanderbijlpark Steel site, and operated for 6 periods of 2 months each, starting on 15 - 73 -





September 2000 and terminating on 14 September 2001. On mounting each monitor, 500 ml of distilled water is placed in the bucket. After the 2 month exposure, the buckets are replaced with clean buckets, and the content filtered by suction through a 47 mm diameter pre-weighed glass fiber filter. The filters with the solids are dried and weighed, while the filtrates are made up to one liter with distilled water and analyzed for TDS and the macros calcium, magnesium, sodium, potassium, sulphate, nitrate, chloride and fluoride.

6.3 **RESULTS**

A data recovery of 99,1% was achieved, monitor 30 having been run over by a vehicle during the 5th period and monitor 17 being melted during a veld fire in the 6th period. The locations of the 36 monitors and the results of the analyses are given in table 6.1 below. For convenience, Figure 6.1 provides a pictorial overview of the monitor positions.

TABLE 6.1 POSITIONS AND SUMMARY OF THE FALL-OUT MONITORS AT VANDERBIJLPARK DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in gram/m2/day for solids and milligram/m2 day for the remainder.

No	Х	Y	Solids	TDS	Sulphate	Nitrate	Chloride	Fluoride	Calcium	Magnesium	Sodium	Potassium
1	-1735	3520	0.127	48	18	1.1	0	0.8	7	2.3	1.5	1
2	-585	3860	0.574	93	40	1.5	0.5	0,9	19	2.7	1.8	3.5
3	-850	2755	0.916	92	36	2.4	2	0.8	18	3.7	2.2	1.4
4	1725	4317	0.082	54	21	2.8	0	2	9	1.3	1.7	2.9
5	892	4815	0.059	47	18	1.6	0.8	1.2	11	0.8	1.8	1.9
6	125	4790	0.05	61	21	0.5	0	1.4	8	1.7	2	4.5
7	792	3560	0.061	70	28	1.8	0	1.4	11	0.8	2.3	3
8	1485	3040	0.064	40	14	2	1.7	1.4	11	0.7	1.8	1.3
9	1666	1987	0.108	43	19	3.7	0.5	0.6	11	0.7	1.3	1.1
10	537	2275	0.069	50	19	2.4	0	0.6	9	2.2	1.3	0.6
11	910	1832	0.176	60	23	3.5	0.5	0.6	10	1.8	1.2	0.6
12	1180	1325	0.157	79	32	2.3	0.5	0.7	14	1.7	1.2	0.5
13	1706	1035	0.088	56	22	2.7	0	0.7	10	1,7	1.2	0.5





Na	х	Y	Solids	TDS	Sulphate	Nitrate	Chloride	Fluoride	Calcium	Manganese	Sodium	Potassium
14	1137	727	0.225	85	31	2.6	1.8	0.8	17	2.7	1.2	0.6
15	601	1075	0.128	64	30	1.9	0.5	0.8	12	2	1.2	0.7
16	-216	795	0.346	93	34	1.3	1	0.9	17	3.5	1.2	1
17	-80	1390	0.151	78	30	2.6	0.8	0.9	15	6.8	. 1.4	0.9
18	-612	1080	61.672	152	53	4	3.5	0.7	26	6.2	1.7	2.2
19	-775	1725	0.877	99	37	1.7	2.3	0.8	20	5,5	1.2	0.9
20	-1275	1030	0.714	102	42	1.6	2.2	0.9	21	3.8	1.2	8.0
21	-2070	2445	0.128	56	22	2.2	1.8	0.6	12	1.5	1.3	0.8
22	-2135	1167	1.374	114	46	0.7	1.5	1.8	19	6.2	1.8	2.3
23	-2155	602	0.462	118	51	1.1	1.8	2.3	22	4.8	1.7	2.2
24	-1040	755	4.62	199	76	6.8	5.5	1.4	41	7.3	1.7	1.6
25	-1567	365	1.542	201	86	1.3	5.2	2	40	8.7	3	2.7
26	-1140	95	1.948	150	60	0.7	4.8	1.1	30	9	2	1.8
27	-670	392	1.293	129	41	0.6	2.8	1	24	7.2	1.8	2.4
28	-1935	-375	1.81	210	80	3.6	0.7	1.4	40	6.2	22	1.6
29	-1340	-597	2.109	210	84	3	0.8	1.4	40	11.8	2	1.3
30	-565	-705	1.046	164	42	1.3	2.2	1.3	30	8	22	2.3
31	-585	-145	0.823	129	43	2.3	1.8	1.1	23	6.8	0.8	1.5
32	287	-275	0.49	119	41	1.7	0.5	1	24	5.7	1	1.2
33	5 35	130	0.25	100	32	3.3	3.3	1.1	20	4.8	0.8	1.3
34	1155	120	0.329	97	38	2.8	0.5	0.8	21	4	8.0	0.6
35	800	-350	0.808	159	66	2.9	2.7	0.9	31	6.7	1	1.2
36	17	-745	1.886	183	70	2.8	1.2	1,1	34	10.5	1.7	2.6

6.4 CONTOUR MAPPING

The results in Table 6.1 have been converted to isopleth maps using the principle of Kriging with the aid of Surfer software. Figures 6.2 through 6.11 provide the interpreted results for the various components.

6.4.1 Insoluble Solids

The background dust levels are represented by monitors 4, 5, 6 and 7 averaging from 0,05 to 0,08 gram/m2/day around dams 1 to 4 and Kiewiet site. North works is also relatively clean at between 0,06 and 0,22 gram/m2/day (monitors 8 to 15), which would be acceptable for residential areas in a fairly dry region like the highveld of South Africa.






Dupreez dam and opposite Plot 68, Steelvalley also returned moderate dust levels at 0,13 gram/m2/day (monitors 1 and 21). Within the South works and the dump area the dust fall varied in the main between 0,25 and 2,46 gram/m2/day . Values above 1,5 gram/m2/day are normally considered excessive even in heavy industry (Figure 6.2).



FIGURE 6.1 LOCATIONS OF DUST FALL-OUT MONITORS AT VANDERBIJL









FIGURE 6.2 INSOLUBLE PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in gram/ square meter/day).

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FIGURE 6.3 TOTAL DISSOLVED SOLIDS IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).









FIGURE 6.4 SOLUBLE CALCIUM IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).









FIGURE 6.5 SOLUBLE MAGNESIUM IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).

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The two very high values were from monitor 24 (coke ovens) at 4,62 gram/m2/day, and monitor 18 (sinter feed belt transfer station) at 61,67 gram/m2/day. The highest value recorded at the latter was in fact 145,98 gram/m2/day average over two months in the 6th period. This monitor was placed very near a sinter plant feed belt transfer point which spilled fine raw materials.To get a better understanding of what the annual average means, this rate of dust fall equates to 18,78 tons/ha/month or 22 509 tons/km2/year. Clearly the dust fall recorded would only occur over a small area. It is however not a brief peak but an average measured over a year. For a material of bulk density 2,2 it would represent a build-up of 10 mm/year.

6.4.2 Total Dissolved Solids (TDS)

The higher values recorded, above 100 milligram/m2/day, occurred over the south western part of the Vanderbijlpark property, and in particular along the haul roads handling slag and scrap. The highest value recorded was 210 milligram/m2/day which starts becoming significant as a contributing factor to surface and ground water pollution, as it would translate to about 64 kg/ha/month or 77 tons/km2/year (Figure 6.3).

Lesser contributing activities are the coke ovens, sinter plant and blending yard. Little evidence could be found of contributions by the extensive pickling operations or the Lurgi plant, but all slag handling installations contribute noticably.

6.4.3 Calcium

Values as high as 40 milligram/m2/day were recorded in the coke oven and blast furnace areas and also along the roads south of the arc furnaces and basic oxygen furnaces (Figure 6.4).









FIGURE 6.6 SOLUBLE SODIUM IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).







FIGURE 6.7 SOLUBLE POTASSIUM IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).

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FIGURE 6.8 SOLUBLE SULPHATE IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).





Values above 20 milligram/m2/day may be considered significant, and this would cover most of the South Works and blending area.

6.4.4 Magnesium

Only a small area of significance is found south of the basic oxygen fumaces, reaching above 10 milligram/m2/day. This would appear to be associated with the slag handling (Figure 6.5).

6.4.5 Sodium

The sodium deposition levels over the whole site were low, at less than 2.5 milligram/m2/day (Figure 6.6).

The slightly raised values in the south western part of the plant can be explained easily, but what is somewhat surprising is the highest recorded annual value of 2,3 milligram/m2/day next to the maturation ponds. Even within the active dump area and SteelServ operations the concentrations were lower.

6.4.6 Potassium

A swath from west to east through the middle of the Vanderbijlpark site has the lowest potassium concentrations at less than 1 milligram/m2/day, which is found very surprising and without explanation (Figure 6.7).

The iron making areas have marginally raised values, but what surprises is the significantly raised concentrations, in fact up to 4,5 milligram/m2/d, at four monitors in the vicinity of Dams 1-4, maturation ponds and SteelServ North. One possible source may be the application of fertilizer on the farm land off the north western boundary fence. A rate of 4 milligram/m2/day would equate to 15 kg/ha/year.









FIGURE 6.9 SOLUBLE NITRATE IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).







FIGURE 6.10 SOLUBLE CHLORIDE IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).







FIGURE 6.11 SOLUBLE FLUORIDE IN PARTICULATE FALL-OUT AT VANDERBIJLPARK STEEL DURING SEPTEMBER 2000 TO SEPTEMBER 2001 (in milligram/ square meter/day).

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No evidence of deposition of potassium from the sinter plant stack could be identified. Having regard to the fineness of the KCI from the stack, it is likely that this material would not reach ground level within the Vanderbijlpark site, and that the dispersion over such a distance would return very low concentrations.

6.4.7 Sulphate

The sulphate deposition distribution is very similar to the footprint for calcium, covering mainly the South Works (Figure 6.8).

6.4.8 Nitrate

The deposition rates were on average moderate except near the coke ovens, where 6,5 milligram/m2/day was recorded (Figure 6.9. This is to be expected in an area with combustion and quench tower spray.

6.4.9 Chloride

Raised values occurred in the coke oven and blast furnace areas (Figure 6.10) and this can be associated with quenching mists when using high chloride quenching liquors. The levels of deposition were not significant but may give rise to localized accelerated corrosion.

6.4.10 Fluoride

Two areas of elevated fluoride deposition are evident in Figure 6.11, namely west of the blast fumaces, and on Kiewiet site. The former may be explained by the raised fluoride levels in the TETP holding dam sediments and the extensive earth moving activity during the year of monitoring. The second may be associated with the irrigation which was practiced at Kiewiet two decades ago.



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6.5 OVERVIEW

From the data above, certain conclusions may be reached:

- There are areas of unduly high insoluble particulate fall-out, particularly in the south west of the Vanderbijlpark site. In this comment the high values recorded at the sinter plant belt transfer pylon is disregarded as being very localized. In general the areas of high dust will have to be addressed, whether over a larger area or localized.
- The dissolved solids deposition appears to be associated with insoluble fall-out, as for instance the soluble parts of the slag. The whole matter of fugitive dust will be addressed under proposed corrective actions.
- The unexpected concentration of potassium in the north-west corner of the site and in particular at the corner of Dams 1-4 could bear further investigation. It is however not a matter of significance.
- The soil sampling programme should confirm the assumption about fluorine on the Kiewiet site.





CHAPTER 7 LEGAL COMPLIANCE

7.1 <u>SCOPE</u>

A very comprehensive document on legal compliance at the Vanderbijlpark Steel plant has been compiled by the Masterplan legal team, also covering the position regarding air pollution. This chapter serves only to summarize the findings for as far as it is necessary to implement corrective steps in order to achieve compliance.

Under each sub-heading, the number of the certificate as issued by the Chief Officer in terms of the Atmospheric Pollution Prevention Act is quoted for convenience. Where reference is made in the certificates to abatement equipment, the equipment is in place and operative unless specifically stated to the contrary. As regards specified maximum limits for emissions, both the legal limits and the actual emissions as measured are noted, with comments as appropriate.

7.2 DIRECT REDUCTION

Certificate 89/20.

The raw materials precipitator limit is 50 milligram/Nm3 (or 35,9 milligram/Am3). This emission source has not been measured. No emission was observed over an extended period. <u>Compliance undetermined.</u>

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Draft for discussion CONFIDERITAL Research for IVS The rotary kilns precipitators limit is also 50 milligram/Nm3 (or 31,6 milligram/Am3). The four kilns emitted respectively 19.0, 41,9 25,9 and 29,9 milligram/Am3. Kiln 2 was non-compliant.

The product handling precipitator limit is also 50 milligram/Nm3 (or 35,9 milligram/Am3). The average of measurements returned 35,9 milligram/Nm3. <u>Compliant.</u>

7.3 SINTER PLANT

7.3.1 Sinter Strand 1

Certificate A89/18.

The gravel bed filters referred to are no longer in operation, and the emission passes directly to the stack after the cyclones. The emission limit is 110 milligram/Nm3 (or 67,6 milligram/Am3). Measurements on the unabated emissions during test work on the new Australian technology returned particulate concentrations of between 200 and 300 milligram/Am3. An agreement with the Chief Officer is in place for the further test work, pilot plant scale tests, and if the present promising results are confirmed, fuil implementation of the technology. <u>Compliant.</u>

The emission limit for precipitator AG is 120 milligram/Nm3 (or 70,9 milligram/Am3). The average of measured values over a year was 105 milligram/Am3. Maintenance work is planned and has been budgeted for. <u>Non-compliant.</u>

7.3.2 Sinter Strand 2

Certificate A 89/19.

As for Strand 1 the gravel bed filters are no longer operational and the

same agreement with the Chief Officer applies.

The emission limit for precipitator BG is 100 milligram/Nm3 (or 75,4 milligram/Am3). The emission concentration was 120 milligram/Am3. The planned maintenance is being brought forward. <u>Non-compliant.</u>

The emission limit for the raw materials and product precipitator CG is also 100 milligram/Nm3 (or 73,4 milligram/Am3). Prior to the rebuild in April 2002 the emission was 187 milligram/Am3 but is now 35 milligram/Am3. <u>Compliant.</u>

7.3.3 Sinter Mixing Bed

Certificate 89/30.

The limit for the tippler station filter is 120 milligram/Nm3 (or 92,2 milligram/Am3). No measurements have been done, but the emissions are below the visual limit of 120 milligram/Am3. Presumed compliant.

The limit for the crushing and screening station filter is also 120 milligram/Nm3 (or 92,2 milligram/Am3). No measurements were done but no visible emission was observed. Presumed compliant.

7.4 <u>COKE OVENS</u>

The following certificates are relevant:

- 89/37 Batteries 4, 8 & 9
- 89/25 Battery 2 (out of operation for more than2 years)
- 89/38 Batteries 1, 3, 6 & 7
- 89/7 Coke oven gas stripping





The coke ovens are being refurbished in terms of an agreement with the Chief Officer. In addition, the gas treatment plant is being modified and improved to provide a better quality combustion gas which will reduce the total gas usage on the whole Vanderbijlpark plant. The sulphur recovery will also be changed from sulphunc acid production to elemental sulphur recovery. There are no legal emission limits in the certificates.

7.5 BLAST FURNACES

7.5.1 Blast Furnace C

Certificate 89/23.

The raw materials handling bag filter limit is 120 milligram/Nm3 (or 92,2 milligram/Am3). The average measured dust concentration was 7 milligram/Nm3. <u>Compliant.</u>

The Howden tap floor bag filter limit is 50 milligram/Nm3 (or 36,0 milligram/Am3). The average measured value, by Codel optical monitor was 20 milligram/Nm3. <u>Compliant.</u>

7.5.2 Blast Furnace D

Certificate 89/4.

The only limit given is for the gas scrubbing in the Lurgi Bischoff venturi at 0,9 milligram/Nm3 at 1 bar and 16 °C (or 0,7 milligram/Am3). This gas is used as a fuel throughout the plant and the excess is flared. A high dust load in the gas would be unacceptable in the reticulation and combustion nozzles. This gas is not normally sampled because it is very explosive. Presumed compliant.

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7.5.3 Blast Furnace Coal Mills

Certificate 89/34.

The gas from the mill filters have a limit of 100 milligram/Nm3 (or 88,8 milligram/Am3) but goes directly to hot gas generation. The hot gas generator returns the combustion gases to the mills in a closed loop. <u>Presumed compliant.</u>

The filter extracting the fine coal bunkers has a limit of 100 milligram/Nm3 (or 85,1 milligram/Am3). A Codel instrument returned an average of 12 milligram/Am3. <u>Compliant.</u>

7.6 BASIC OXYGEN FURNACE COMPLEX

7.6.1 <u>BOFs1&2</u>

Certificate 89/4.

The limit for the furnace venturi scrubbers is 120 milligram/Nm3 (or 85,1 milligram/Am3). The measured dust concentrations after the scrubbers were respectively 70 and 51 milligram/Nm3. The flared gas has no visible particulate content. <u>Compliant.</u>

The furnace secondary extraction Kawasaki bag filters have a limit of 100 milligram/Nm3 (or 75,6 milligram/Am3). The measured dust loads were respectively 102 and 125 milligram/Nm3. Both filters are beyond their economic life, and replacement has been planned. <u>Non-compliant.</u>

7.6.2 <u>BOF 3</u>

Certificate 89/12.

The primary extraction limit is 120 milligram/Nm3 and the measured concentration was 61 milligram/Nm3. <u>Compliant</u>



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The limit for the raw materials bag filter is 100 milligram/Nm3 (or 78,2 milligram/Am3). The emission was not measured but it is not visible and discharges within the building. <u>Presumed compliant.</u>

7.6.3 <u>8OF Desulphunisation</u>

The AAF bag filter limit is 120 milligram/Nm3 (or 85,9 milligram/Am3). The measured emission was only 8,0 milligram/Nm3. <u>Compliant</u>

7.6.4 Scarfing Unit

Certificate 89/8.

The limit for the two Holmes type precipitators is 120 milligram/Nm3 or 90,4 milligram/Am3). The measured concentration was 70 milligram/Nm3. (These units are in use for less than 5% of the time). <u>Compliant.</u>

7.6.5 IHI Slab Scarfing

Certificate 89/13.

The limit for the wet electrostatic precipitator on the IHI slab mill is 120 milligram/Nm3. This equipment was taken out of service more than a year ago. <u>Compliant.</u>

7.6.6 Ladle Furnace 1 and RH-OB Degasser

Certificate 89/29.

The Dustec filter has a limit of 120 milligram/Nm3 (or 75,8 milligram/Am3). The measured concentration was only 17 milligram/Nm3. <u>Compliant.</u>

7.6.7 Ladle Furnace 2

Certificate A89/35.

The Scheuch bag filter limit is 50 milligram/Nm3. The measured concentration was 6,0 milligram/Nm3. <u>Compliant.</u>





7.7 ELECTRIC ARC FURNACE COMPLEX

7.7.1 EAFs 1, 2 & 3

Certificate 89/5.

The three Voest-Alpine bag filters has a limit of 50 milligram/Nm3 (or 33,8 milligram/Am3). The average of a year of monthly measurements were respectively 20, 11 and 60 milligrams/Nm3. <u>Filter 3 non-compliant.</u>

7.7.2 Ladle Furnace 1

Certificate 89/32.

The Davy McKee filter limit is 50 milligram/Nm3 (or 31,4 milligram/Am3). The average emission rate was 24,8 milligram/Nm3. <u>Compliant.</u>

7.7.3 Ladle Furnace 2

Certificate 89/33.

The Howden filter limit is 50 milligram/Nm3 (or 33,4 milligram/Am3). The average concentration was 15 milligram/Nm3. <u>Compliant.</u>

7.8 FOUNDRY

Certificate 89/24.

No limits are given in the certificate. Only the equipment to be used is described.

7.9 PICKLING LINE SOUTH AND LURGI PLANT

Certificate 89/9.

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7.9.1 Pickling Line

The scrubber limit is 15 milligram/Nm3 of HCl (or 11,5 milligram/Am3). The measured concentration was 12 milligram/Nm3. <u>Compliant.</u>

7.9.2 Lurgi Plant

The emission limit for the three Lurgi units is 220 milligram HCl/Nm3. The average measured concentrations were respectively 146,5, 42,0 and 52,3 milligram/Nm3. <u>Compliant.</u>

7.10 PICKLING LINE NORTH

Certificate 89/16.

The pickling line exhaust scrubber limit is 15 milligram/Nm3 HCl (or 11,5 milligram/Am3). The measured concentration was 12 milligram/Nm3 HCl. Compliant.

The Lurgi plant North has been closed down.

7.11 PAINT LINE INCINERATOR

Certificate 89/36.

No limits for emissions are specified.

7.12 FERRITE PLANT

Certificate A1010/2.

The limit for the two small bag filters is 50 milligram/Nm3 (or 38,4 milligram/Am3). The emissions, inside the building, for the east and west units were respectively 11 and 6 milligram/Nm3. <u>Compliant.</u>




The limit for the kiln is 50 milligram/Nm3 HCI (or 37,2 milligram/Am3). The measured concentration was 13 milligram/Nm3 HCI. <u>Compliant.</u>

7.13 STEELSERV CAROUSEL

Certificate 2222.

The bag filter limit is 50 milligram/Nm3 (or 37,2 milligram/Am3). The measured fume concentration was only 5 milligram/Nm3. <u>Compliant</u>.

7.14 SUMMARY

The requirements regarding emission limits in the following certificates issued in terms of the Atmospheric Pollution Prevention Act are not complied with:

- 89/4 BOF secondary extraction bag filters
- 89/5 EAF bag filter 3
- 89/18 Precipitator AG Sinter plant
- 89/19 Precipitator BG Sinter Plant
- 89/20 Direct reduction kiln 2 precipitator

In addition, the following have not been measured, but are presumed to be in compliance based on observation. Arrangements have been made to do emission measurements, and confirm compliance where this is physically possible.

- 89/4 Blast furnace D venturi scrubber
- 89/12 BOF raw materials bag filter
- 89/20 Direct reduction raw materials precipitator
- 89/30 Sinter mixing bed tippler and crushing and screening
- 89/34 Blast furnaces coal mill bag filter.



Of the 46 emission points covered by the registration certificates, 6 are not in compliance and 6 are presumed to be in compliance, and are likely to be, based on visual observation.



CHAPTER 8

AIR POLLUTION SOURCE EVALUATION

8.1 <u>RATIONALE</u>

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In the assessment of air pollution sources, it is implicit that all legal requirements must be complied with. The nsk of non-compliance is considered absolute, and these sources, as identified in chapter 7, are dealt with in paragraph 8.2 below.

During the evaluation of the emissions from the various plant areas for the air pollution emission inventory, a survey was also done of sources, many of them of a fugitive nature, requiring further attention. While the abatement of these sources are not mandatory at present, the impending new air pollution legislation (in draft form but not published for comment as yet) have to be borne in mind. It is expected to be more rigid and legalistic than the present, without the realistic and reasoned "best practicable means".

Even if the new legislation is discounted as not being in force yet, many other considerations play a role. Foremost among these are safety, worker health, general working conditions, excessive plant maintenance cost, contamination of rain run-off and ground water pollution. Further relevant considerations include public image and the Kyoto Protocol on carbon load.



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Rather than attempting to list the sources in order of magnitude or perceived importance, each plant will be addressed separately in paragraphs 8.3 et seq. with notes on the relevant aspects as well as a first order cost estimate. The findings will then be tabulated and assessed to determine a significance and urgency rating.

8.2 LEGAL NON-COMPLIANT PLANT

Five items of air pollution abatement plant were found not to be in compliance with legal requirements as contained in the registration certificates (see chapter 7).

8.2.1 BOF Secondary Extraction

The two Kawasaki shaker type bag filters are well past their useful life and maintenance is hampered by structure fatigue and non-availability of spares. Provision has been made to replace these filters at a cost of R12,2m, starting with a design in 2002/3 and construction in 2003/5. It is our opinion that this replacement is essential, but that the cost may be closer to R20m. Part of the motivation for this is that the secondary extraction capability should be expanded slightly to ensure better capture when high silica frothing occurs.

8.2.2 EAF Filter 3

This Voest-Alpine bag filter is of good design and requires routine maintenance only.

8.2.3 Sinter Precipitator AG100

The technology is still current, but the precipitator is not performing to specification. It was re-built four years ago. A maintenance programme



has been put in place to rectify minor faults and bring the precipitator into specification.

8.2.4 Sinter Precipitator BG100

The situation is the same as for AG100 above. The re-build has been budgeted for in 2003 but the matter has now become urgent and steps are in place to bring this forward to 2002.

8.2.5 DR Kiln 2 Precipitator

The exceedence of the legal requirement is not very much and routine maintenance should address the problem fully.

8.2.5 Sources Not Measured.

Six sources were identified where there are legal limits in place, but the emissions were not measured. This was conveyed to lscor and steps are in place to rectify this.

8.3 SINTER PLANT

8.3.1 Process Gas

The electrostatic gravel bed filters originally installed have proved to be ineffective and impossible to maintain in operation. Sinter plant process off-gas is a world wide problem, mainly due to the nature of the potassium chloride which is a major component of the particulates, being hygroscopic and thus sticking to all surfaces including the walls of electrostatic precipitators and bag surfaces in filter plants. The South African raw materials are high in alkali, aggravating the situation. The wet electrostatic precipitator approach proposed by VAI suffers from the same weakness. The cyclic off-line washing down of each module in tum is proving





troublesome in the plant operating in Europe, and results in limiting on-line availability.

A 1:500 scale ICGP scrubber has been tested. With no electric or electronic components or moving parts in the gas stream the technology is robust and the collection efficiencies and pressure drop achieved so far are promising, and in line with what was found with the VAI technology. A demonstration plant, aiming at 10% of the gas flow is planned for 2003-04.

8.3.2 Carousel Coolers

No indication could be found that these dust sources have been quantified in the past. It is however true that a large proportion of the emissions will consist of larger particles in the size range of 20 micron and more, which could be dealt with by cyclone. This is not seen as a priority at present, but an exploratory measurement on one of the outlets would confirm the opinion.

8.3.3 Raw Materials Tippler Station

The bag filter as installed is of adequate capacity and in good operational condition. The coal discharge bay is also adequately structured to handle the dust, with the extraction points at the bottom. The problem is on the ore side where the extraction is in the roof only while the dust is generated at and below ground level. The extraction ducts should be extended down to ground level.

Putting a mass value to the dust escaping is impossible but the result is evident on site inspection. The cost of rectification is expected not to exceed R 300 000 and this should improve the dust capture by not less than 1 gram/second on average.





8.3.4 Conveyer Feeding Crushing Plant

Dust rains down from the exposed nsing conveyer feeding the crushing and screening operation. This is aggravated by hand sweeping of the conveyer structure and walkway. The problem can be largely overcome by closing in at least one side of the structure to stop wind sweeping through, and fitting sloping side hoppers with downcomers to near ground where the dust can then be dealt with.

This would not only improve the safety and health situation, but also obviate the present high rate of belt idler replacement. The cost of the proposed steps is estimated at R200 000 and the improvement in the dust capture is estimated at 2 gram/second on average.

8.3.5 Crushing and Screening

The filter serving these activities is much to small, as is evident from the continual plume of dust emanating from the building. A properly designed extraction ducting system should be followed by an adequately sized bag filter. This is likely to reduce the present high cost of replacing and servicing belt idlers and other moving parts.

Closing in the screens properly and replacing the existing 9 m3/second bag filter with a 20 m3/second filter would cost about R2,4 million and this should reduce the escape of dust by between 2 and 3 gram/second. A further consideration is that better extraction will improve the present poor health and safety condition, and also reduce maintenance cost.

8.3.6 Sinter Bed Stacker and Reclaimer

The luffing stacker boom with electronic drop distance control is good, but the open drop of nearly 2 m allows significant quantities of the fine feed

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materials to be picked up by the wind. It is understood that IFSP have through trial and error established that the minimum clearance for safe operation is 2 m. If however the drop distance can be reduced, this will significantly reduce the wind blown dust as the relationship is exponential. In any case, a split skirt discharge tube, common in this type of operation, should be fitted, to shroud the discharge point and hang down onto the mixing bed apex.

The cost of fitting a stacker discharge shute is estimated at R150 000 and this is expected to reduce wind blown dust pick-up by not less than 1 gram/second.

Little can be done about the dust from the drum reclaimer, but it is close to the ground, in much less of a wind field. If it is desired to improve the position, consideration may be given to a very high pressure mist spray, provided the belt is not wetted.

8.4 DIRECT REDUCTION PLANT

8.4.1 Product Precipitator

This precipitator was not in a good state of repair when evaluated (5/11/2001), but a refurbishing programme was in the process of being implemented, involving plate repair, discharge electrode replacement and an update of the control equipment. The far more serious problem is however the product discharge onto a subterranean belt and subsequent handling. To this should be added the handling of the minus 1 mm metal fraction, all the way into the day bin and from there to the store.





During a plant visit the dust levels, particularly in the lower gallery, was so high that it was not even possible to identify exact sources and frame suggestions for remediation. This problem requires urgent attention in the form of a comprehensive evaluation. This is also considered a significant health risk.

This requires a comprehensive investigation which could cost R200 000. Only after evaluation will it be possible to frame proposals and estimate cost for remediation. It is not possible to suggest the scope of improvement which can be achieved.

8.4.2 Kilns Discharge

A lesser dust problem exists at the transfer points between the kilns and the coolers. Some extraction is in place but this requires a re-think of the ductwork so as to utilize the dust extraction more effectively.

An investigation could cost R25 000 and remedial action, depending on the findings and scope, could cost between R100 000 and R400 000. The reduction of fugitive dust is likely not to be more than 0,5 gram/second.

8.5 COKE OVENS

This plant is being rebuilt at a cost of R180 million over the period 2002 to 2004, and it is therefore not appropriate to comment on the conditions found during the survey.

Aside from the expected improvement in fugitive emissions of both particulates and gases on the ovens, the quality of the gas will be improved significantly, allowing a reduction in the rate of carbon dioxide





release from the site through replacement of imported fuel gas. The hydrogen sulphide at present being released at a height of 70 m, will be converted to elemental sulphur.

8.6 BLAST FURNACES

8.6.1 Furnaces C & D Raw Materials

The filter for C was recently rebuilt. Both filters serve only the raw material bin withdrawals and belt transfers. The configurations of the off-takes are poor in general, picking up large particles which settles out in the ducts, further upsetting the already unbalanced systems due to blanked off ducts and a large number of later cut-ins. If additional extraction points are to be provided there is a question mark behind the available extraction volume for the total duty.

Both systems require in depth evaluation. This is however dependent on the whole future of fumace C. If only one blast fumace is to be operated from a future date, the two raw material bag filters (furnaces C and D) would be more than adequate to cater for the raw material handling covering both bin loading and withdrawal.

A re-design and modification of the extraction ducting could cost R300 000 for each of the two installations and should reduce the dust escape at ground level by 0,5 gram/second for each installation. This would however not address the dust from the bin tops, which is likely to require additional bag filter capacity at about R120 000 per m3/second. Establishing the exact needs would require a full investigation.



8.6.2 Furnace C Tap Floor Filter

The Howden filter which was re-bagged during the second half of 2001, was already registering a back-pressure of 2,3 kPa on 5/11/2001, which is much too high, blinding bags and reducing volume flow. It is suggested that the filter operation be evaluated extensively, including the pressure of the nitrogen being used for the pulse cleaning, the proper alignment of the nozzles and the possibility of condensation causing blinding.

Such an investigation could cost R25 000 and depending on the outcome, further expenditure would be necessary to rectify the problem. Assume R200 000. It is important to address this problem urgently so that the volume of fume being removed from the tap floor can be increased. A reduction of 25% of the fume on the tap floor would be 9 gram/second.

8.6.3 Furnace C Tap Floor

In addition to the inadequate extraction above, only about half of the fumes on the tap floor is at present being captured. This is mainly due to spatial problems on the floor and operational needs. Part of the problem is however that the present extraction is mounted either sideways or downwards on very hot fume with a strong thermal rise.

Possible options to be considered would include an improved "dog house" configuration for extraction over the tap holes and a swinging hood at the torpedo charging station. This would capture more fumes in less dilution air for the Howden filter, and improved safety and health on the floor.

The scope of work, after careful consideration of the practical implications, could be between R100 000 and R300 000. If 25% of the presently escaping fume is captured, it would reduce emission by 9 gram/second.





8.6.4 Furnace D Tap Floor

No extraction is installed at present, but a provision of R40m is included in the budget for the furnace D rebuild. This is essential but can only be addressed once the future policy for the blast furnaces has been decided on. It may be possible to use the furnace C Howden bag filter if Furnace C is no longer being operated and provided the present problems of that filter can be overcome.

8.6.5 Furnaces C & D Dust Chambers

The dust fall-out chamber pug mill and rail wagon discharge operation gives rise to a very serious dust evolution, albeit only for about an hour per day. Options to be considered include a longer pug mill which would allow better wetting down, a metal sloping chute extending to not more than 500 mm above the rail car sides, extending the bottom of the chute still lower with very light conveyer belting and installing an effective hopper level detector which will obviate the gas blow-by towards the end of the cycle.

A first order cost estimate would be R250 000 for each dust chamber, which is expected to reduce the dust emission by 8 gram/second on everage for each system. It would also improve the present safety risk due to gas blow-by and the generel working conditions.

8.7 BASIC OXYGEN FURNACES

8.7.1 Torpedo Servicing Station

At present no provision is made for fume and dust capture during routine torpedo maintenance, end in particular during the periodic lance cutting of frozen iron from torpedos. This is a periodic activity and it would not warrant a completely new bag filter. The best of the two Kawasaki filters,





standing close to the torpedo repair shop may be utilized for this service to great advantage, at the cost of a short piece of ducting and a simple hood.

The cost of about 50 m of ducting and a hood should not exceed R100 000 and would the average fugitive dust and fume escape by not less than 0,5 gram/second. Clearly, this can only be implemented when the Kawasaki filters have been replaced.

8.7.2 BOF Raw Materials

The conveyer system east of the BOF building has a very significant dust source, as evidenced by two flexible tubes from about 10 m leading down to a bin, and the whole area contaminated by a fine brown dust. With the replacement of the existing ladle furnace 1 and RHOB bag filter (at present underway), this filter can be applied most fruitfully at this source of dust.

The re-location of the filter, with ducting and electrical supply could cost R150 000 and would obviate a dust release of not less than 1 gram/second.

8.8 ARC FURNACES

8.8.1 Main Filters Dust Silo

While on site (7/11/2001) the process of dust withdrawal was observed. There was a large area covered by 50 mm and more of dust being blown about by the wind. There were also piles of dust which had been wetted and partially leached by the rain of a week earlier.



During the silo draining a heavy cloud of dust welled up from the rail truck and drifted away. The rail truck itself was in poor repair with one side flap gaping at one end a steam of dust pouring to the ground through an opening of more than 150 mm. It was evident that much of the dust would not reach its destination.

This whole operation of extracting the already collected dust from the silo requires a comprehensive re-think. The most appropriate way, if the dust is to be disposed of on the residue management site, would be pelletising in one or other form at the silo discharge. If however the dust is to be reintroduced at another process on site, it may be necessary to retain it in the dust form. The same may apply if it is to form part of a chemical inerting process. The way forward will have to take into account the final destination of the dust.

While the future of this dust is being decided, improvements in both the discharge shute and the rolling stock would not cost more than R100 000 and would reduce dust and fume losses by not less than 3 gram/second.

8.8.2 Fumace Hall Roof Emission

Significant red fume emissions occur from time to time through the roof ventilation of the furnace building (about 1% on average of the total time). Possible reasons which could be formulated to date include:

- Build-up of material in the water cooled elbows extracting from the fourth holes, restricting extraction flow.
- The air dilution dampers which either do not close after a temperature excursion, or close only partially, limiting extraction at the furnace.



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Forced draft coolers with dirty tubes providing inadequate cooling and thus forcing dilution air intake and extraction starvation.

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- Rotary valves on bag filters being stopped, disrupting extraction.
- Use of oxygen while the extraction is not applied as for instance with the furnace roof open.
- Excessive use of oxygen during brief periods.

The above, and other possible contributing factors require investigation and correction via operational control.

It is our opinion that the installation is essentially adequate but that minor control equipment additions may be necessary. The main input for correction will however have to come from operational control. Assuming a cost of R50 000 to halve the emissions, the fume escape can be reduced by 5 gram/second. The emission is right next to the plant entrance, clearly visible from surrounding main roads and psychedelic in hue.

8.9 FOUNDRY

8.9.1 New Shakeout Grid

This unit was installed recently and when in operation it creates a dust laden hot air plume which fills the whole upper part of the building, and eventually is released to the open air via the roof. There is little doubt that an extraction and dust abatement system is required, but the operational requirements make it difficult to install a conventional canopy. Side extraction with an air curtain appears to be a possibility. An in-depth evaluation and formulation of a plan is necessary, No estimate of either cost or potential improvement in emission can be given at this stage.

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8.9.2 Shot Blasting

This is done in the open, south of the foundry building, with a medium obtained from the sinter plant, which is likely to have a lower risk than silica sand. The castings however have a significant casting sand component, which will break up during operation. The health risk needs to be assessed.

It is recommended that a three sided shed be constructed over the rail line position, with the fourth side closed in by strips of old conveyer belt, and an exhaust and bag filter erected. The cost of such an installation may be anything from R500 000 to R1,5 million. If the filter at the sinter raw material crushing and screening is replaced, that filter may well serve this duty. The improvement in emission depends on operational time and scope of blasting and can not be estimated at this time. Purely for the priority exercise, assume 1 gram/second.

8.9.3 Induction Furnaces

The two induction furnaces are used for alloying, notably chrome, manganese and copper. They are open to the work space. It is necessary to evaluate the magnitude and nature of emissions, and if necessary, swing away hoods, to allow crane access, and abatement will have to be installed. This requires further assessment.

8.10 STEELSERV NORTH

The recovery, crushing and screening, truck loading and transport of slag creates dust. While the ideal would be to extract the crushing and screening as well as the loading operations to a bag filter, the operation is apparently not permanent.



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Judicious fine water sprays on the mechanical handling, and wetting down the roadways will probably not cost more than R400 000 and can halve the present dust estimate to 8 gram/second.

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8.11 STEELSERV SOUTH

It is understood that this operation is to be closed down completely over the next few years. It is therefore not prudent to plan the spending of money on it now.

8.12 SCRAP CUTTING

The practice of open scrap cutting has largely been moved into a building east of the central laboratory.

The installation of abatement equipment is the topic of an understanding with the authority and steps are in place to attend to this by the end of 2002.

8.13 SUPRACHEM

Various projects are underway which may change the recovery of organic materials, and this is likely to have a significant influence on the steps which may be necessary to address the limiting of air pollution.

While it is a significant source of organic volatiles, it is recommended that the outcome of the investigations be awaited before abatement steps are considered, if necessary.

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8.14 PRIORITIZATION

8.14.1 Unlisted Priority

A number of the sources addressed above require further investigation and evaluation, or are in the process of being modified or phased out. It is therefore not possible to include them in any prioritization at this point in time. They are:

8.3.2 Sinter plant carousel coolers - to be evaluated.

8.4.1 DR Product Precipitator - to be investigated.

8.6.4 BF D Tap Floor - dependent on furnace rebuild.

8.7.1 BOF Torpedo Servicing Station - awaiting Kawasaki availability.

8.9.1 Foundry Shake-out Grid - to be investigated.

8.9.2 Foundry Induction Furnaces - to be evaluated.

8.11 Steelserv South - to be phased out.

8.12 Scrap Cutting - in hand.

8.13 Suprachem - to be evaluated after changes.

8.14.2 Priority Basis

For the remaining sixteen identified sources representing undesirable air pollution sources, a motivated conclusion on their level of undesirability and the best value for money to be spent has to be argued.

As a matter of principle it can be argued that the sources which will give the greatest reduction in pollution for the least money must be the highest priority, as they represent the best value for money. Reduction of emission is however not the only criteria. The following should also be taken into account:

Sources high above the ground will give less reduction in ground
level ambient concentrations, albeit over a larger area.



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- Improvement of safety and/or health conditions are very desirable if not essential.
- Reductions in plant maintenance costs represent future savings in labour and material.
- Spillages of dust with a significant soluble component is likely to contaminate both surface and ground weter.
- Public opinion is becoming more and more important and may represent future cost.

There is no absolute way of allocating monetary value to each of the above considerations. If however the cost per unit of pollution reduction is used as a starting point, an arbitrary lowering of the cost by a cumulative 10% for each of the attributes will at least be a starting point for prioritization. For very important attributes a double weight is allocated.

Paragraph	Rating	Height	Safety	Health	Maint.	Water	Opinion	Corrected
in report	R/kg/da	ι <u>γ</u>						R/kg/day
8.3.3	34-72	х			x			28-12
8.3.4	1-16	х		x	χ.			0-84
8.3.5	11-11	x	х	xx	x			6-56
8.3.6	1-74	х						1-56
8.4.2	5-79				x			5-21
8.6.1 (C)	6-94	х		х	x			5-06
(D)	6-94	х		х	х			5-06
8.6.2	0-26		х	х				0.21
8.6.3	0-26		x	х				0-21
8.6.5 (C)	0-36	х	XX	х	х			0-21
(D)	0-36	х	XX	x	x			0-21
8.7.2	1-74	х						1-56
8.8.1	0-39	х		,	x	x		0-28
8.8.2	0-12						x	0-10
8.9.2	11-57	х		x				9-37
8.10	0-58	X			x	<u> </u>		0-42_

TABLE 8.1 SUMMARY OF SOURCE CORRECTION PRIORITY ATTRIBUTES

While the allocation of significance to attributes can be faulted on many grounds, it fills a void in existing evaluation techniques.



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The result of the attribute allocation (table 8.1) may then be translated into a priority listing. For convenience, the corrected value for money rating and the estimated cost are also listed.

Priority	Item	Cost			
Rating		R/kg/day	Estimated		
1	Arc Fumace Hall Roof Emissions	0-10	R 50 000		
2	Blast Furnace C Tap Floor Filter	0-21	R 200 000		
2	Blast Furnace C Tap Floor	0-21	R 200 000		
2	Blast Furnace C Dust Chamber	0-21	R 250 000		
2	Blast Furnace D Dust Chamber	0-21	R 250 000		
6	EAF Filter Silo Discharge	0-28	R 100 000		
7	Steelserv North	0-42	R 400 000		
8	Conveyer Feeding Sinter Crush, & Screen.	0-84	R 200 000		
9	Sinter Bed Stacker	1-56	R 150 000		
9	BOF Raw Materials Conveyer	1-56	R 150 000		
11	Blast Furnace C Raw Materials	5-06	R 300 000		
11	Blast Furnace D Raw Materials	5-06	R 300 000		
13	DR Kiln Discharge Ends	5-21	R 250 000		
14	Sinter Prep. Crushing and Screening	6-56	R2 400 000		
15	Foundry Shot Blasting	9-37	R1 000 000		
16	Sinter Raw Materials Tippler Station	<u>28-12</u>	<u>R 300 000</u>		

TABLE 8.2 AIR POLLUTION CLEAN-UP PRIORITIES

8.15 SUMMARY

The emissions which are not in legal compliance (paragraph 8.2) requires urgent attention and are considered absolute risks. The abatement equipment installed are appropriate and requires only maintenance.





The annotated list of sources (paragraph 8.14.1) requires evaluation, indepth investigation, are awaiting decisions on the future, or are scheduled to be phased out. After investigation, it may be that some of these will have to be incorporated in the priority list.

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The priority listing has been motivated (paragraph 8.1) and explained (paragraph 8.14.2). There is no universal and foolproof way of prioritization for air pollution sources, but the listing provides a sequencing based on argument.

It will be noted that none of the sources discussed refers to gaseous pollutants.

- The sulphur dioxide depends on the sulphur in the fuel or raw materials. The coke oven project will reduce the hydrogen sulphide in the fuel gas, and replace some of the fuel gas from Sasol. It will also reduce the present release of hydrogen sulphide to atmosphere.
- The formation of oxides of nitrogen during combustion can not be reduced by abatement, and can only be influenced to a degree by plant and process modifications or by installing low-nox burners.
- The coke ovens and the organic byproducts work-up by Suprachem are the main sources of organic emissions. The former is being addressed and the latter requires further evaluation, probably after process changes.
- The hydrogen chloride sources are being abated appropriately.
- The carbon monoxide sources are insignificant except at the basic oxygen furnaces where they are flared.

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CHAPTER 9

OVERALL RISK EVALUATION

9.1 BASIS

Risk to Vanderbijlpark Steel ansing from air pollution, may stem from one of three aspects:

Unacceptable concentrations of gases and fine particulates at ground level outside the plant perimeter (chapter 5).

- Unacceptable concentrations of larger dust particles falling to ground outside the plant perimeter (chapter 6).
- Emissions of particulates or gases at point sources which exceed the limits stated in the air pollution registration certificates issued in terms of the Atmospheric Pollution Act (chapter 7).

Although the topic of risk has been touched on in each of the relevant chapters, it is appropriate to review and focus the findings.

9.2 AMBIENT AIR

Only one standard for ambient air quality has been published to date, namely for sulphur dioxide at 50 microgram/m3 annual average (Government Gazette 22941 of 21/12/2001). This is significantly stricter than international standards. There are also Guideline Values made available by the Chief Officer for oxides of nitrogen at 150 microgram/m3 and for particulates at 100 microgram/m3, both as annual averages. These have an uncertain legal standing but they compare well with



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international standards (chapter 2).

In the absence of measured concentrations of pollutants outside the plant boundaries, a comprehensive air pollution emission inventory was compiled covering all air pollution sources of Vanderbijlpark Steel, and this was modeled using an internationally recognised Industrial Source Complex model. The results are depicted as isopleths in chapter 5. These results are calibrated against the measured values recorded by the monitoring caravan within the property perimeter.

After application of the calibration correction of a factor of 4, the sulphur dioxide concentration as modeled is highest at the southern site boundary, at a concentration of between 50 and 60 microgram/m3. With the refurbishing of the coke oven plant and in particular the gas cleaning, the emission of sulphur dioxide in the whole plant will reduce significantly.

For the particulates and oxides of nitrogen modeled, the concentrations are well below the Guideline Values, and therefore also international standards.

The concentration of hydrogen sulphide is well below the health risk level at the site perimeter, but marginally above the odour threshold in the industrial area south of the plant. This will however disappear almost completely when the hydrogen sulphide, at present released at a height of 70 m, is converted to elemental sulphur as part of the coke oven project.

The inhalation RfC (lifetime safe dose) for hydrogen chloride is 10 microgram/m3 while the American EPA National Ambient Air Quality Standard for carbon monoxide, not to be exceeded more than once a year



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is 10 milligram/m3. Both gases are therefore insignificant risk factors, even without calibration of the model results.

9.3 DUST FALL-OUT

For South Africa there is only a set of Guideline Values for dust fall-out. In terms of these, below 0,25 gram/m2/day is considered normal and acceptable for residential areas while a rate of between 0,5 and 1,2 gram/m2/day is considered the norm for industry. No directly comparable international standards could be found.

A network of 36 fall-out buckets, covering the entire site, was in operation continuously for 6 two monthly periods over a period of 12 months, with a data capture of 91,1%. Aside from solids, the total dissolved solids and 8 macros were also analysed for in the leachate. The results were contoured to isopleths. It should be noted that without monitors outside the perimeter, and in many cases not even on the perimeter, the numeric interpolation using Kriging, over estimates the attenuation values on the perimeter.

Aside from a rogue station (number 18) directly next to a sinter plant raw material feed belt transfer point, the highest value recorded was 2,1 gram/m2/day average, inside the plant. Two significantly dusty areas in the south-eastern an south-western corners of the plant operations were identified, and steps put in place to reduce the generation of dust, mainly from the roads. The continuing monitoring program will confirm the effectiveness of the steps.

There is no evidence of excessive dust, as measured against the Guidelines, which can effect either surrounding industry or any residential



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areas. For the soluble components there are no Guidelines or standards, but this was monitored to identify any water contamination sources.

9.4 POINT SOURCE LEGAL COMPLIANCE

This refers to point sources for which limits of emission have been set in registration certificates issued by the Chief Officer of Department for Environmental Affairs and Tourism. The requirement is that the sources must be measured and exceedences reported and corrected.

By its very mature, exceedences are caused by malfunction or inadequate operation of the installed abatement equipment and therefore the situation changes continually. A summary of the cases where the limits were not complied with for the most recent measurements at the time of writing is given in chapter 8. In all of these cases the equipment are technically adequate, but require maintenance. This also applies to all other abatement equipment in service with two exceptions. These are the BOF secondary extraction bag filters, for which replacement has been planned, and the small bag filter at the sinter raw materials crushing and screening.

The two major plant areas where the emissions are unsatisfactory, but where limits are not at present applicable are the coke ovens and the sinter plant main stack. Both plants are covered by agreements with the Chief Officer. The coke ovens are in the process of being refurbished, and the gas handling is being updated. For the sinter plant, new technology has reached an advanced stage of development and a pilot plant is under design for testing during 2003, with implementation budgeted for. If successful, this development will represent a technology break through at international level.



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9.5 SUMMARY

There are no major points of risk as far as air pollution is concerned, under the Atmospheric Pollution Prevention Act. The instances where legal limits are transgressed are being dealt with as part of planned maintenance.

The emissions from the coke ovens and sinter plants are being addressed as part of the overall plan which has been accepted by the authorities. These will also reduce the total emissions from the site and therefore the ground level ambient concentrations.

A number of shorter term projects have been identified and prioritized for implementation, which will improve in particular fugitive emissions over the short and medium term.

A very significant uncertainty however remains, in the form of the new air pollution legislation which is at an unknown stage of drafting. No details are to hand as nothing has been published to date. Unconfirmed indications are that it will be based on ambient air quality standards and that implementation will not be at central government level as at present.





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ANNEXURE A

DETAIL OF FALLOUT BUCKET RESULTS AT VDBS OVER THE PERIOD 15 SEPTEMBER 2000 TO 13 SEPTEMBER 2001

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The results cover six periods of two months each plus or minus one day so that sampler change over does not fail on weekends. The results have been converted to grams/m2/day for solids and milligram/m2/day for soluble components. Data capture was better than 99%.



DUST in gram/m2/day

Monitor	х	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	0.165	0.051	0.086	0.111	0.229	0.123
2	-585	3860	0.613	0.395	0.59	0.656	0.756	0.436
3	-850	2755	1,828	1.062	0.811	0.413	0.889	0.694
4	1725	4317	0.116	0.028	0.083	0.111	0.042	0.111
5	892	4815	0.066	0.028	0.056	0.083	0.066	0.055
8	125	4790	0.09	0.009	0.014	0.073	0.066	0.05
7	792	35 60	0.048	0.036	0.048	0.058	0.126	0.049
8	1485	3040	0.121	0.013	0.035	0.033	0.072	0.111
9	1666	1987	0.01	0.412	0.037	0.048	0.079	0.064
10	537	2275	0.081	0.04	0.07	0.045	0.092	0.087
11	910	1832	0.161	0.493	0.089	0.079	0.141	0.111
12	1180	1325	0.201	0.121	0.185	0.12	0.185	0.137
13	1706	1035	0.147	0.067	0.054	0.07	0.105	0.084
14	1137	727	0.301	0.18	0.197	0.233	0.304	0.156
15	601	1075	0.15	0.099	0.155	0.126	0.152	0.087
18	-218	795	0.405	0.379	0.287	0.304	0.479	0.224
17	80	1390	0.134	0.057	0.149	0.141	0.272	Lost
18	-612	1080	31.165	23.151	49.984	49.94	69.814	145.979
19	-775	1725	0 .6	0.83	0.504	0.776	0.94	1.613
20	-1275	1030	0.718	0.829	0.815	0.669	0.902	0.551
21	-2070	2445	0.171	0.035	0.062	0.07	0.38 3	0.092
22	-2135	1167	3.062	1.496	0.563	0.367	2.423	0.335
23	-2155	602	0.471	0.354	0.515	0.534	0.648	0.252
24	-1040	755	5.782	4.075	2.947	3.76	4.221	6.954
25	-1567	36 5	1,534	1,188	1.011	1:087	1:41	3,025
26	-1140	95	2.321	1.242	1.247	1.353	1.84	3.684
27	-670	392	1.455	1. 00 8	0.59	1.173	1.888	1.644
28	-1935	-3 75	2.251	1.468	2,163	1,78	2.387	0.809
29	-1340	-597	3.535	2.203	1.994	1.826	2.079	1.02
30	-565	-705	1.139	0.72	1.025	1.033	Lost	1.314
31	- 5 85	-145	0.912	0.461	0.716	0.605	0.952	1,294
32	287	-275	0.648	0.211	0.474	0.517	0.713	0,376
33	535	130	0.364	0.212	0.114	0.22	0,369	0.22
34	1155	120	0.326	0.383	0.303	0.315	0.422	0.226
35	800	-3 50	1. 002	0.306	0.702	0.572	1.13	1.135
36	17	-745	2.837	1.749	1.706	1.858	2,298	0.868





VANDERBIJLPARK STEEL FALL-OUT BUCKETS TOTAL DISSOLVED SOLIDS in milligram/m2/day

Monitor	X	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	66	78	55	19	31	42
2	-585	3860	98	85	122	95	62	95
3	-650	2755	126	75	113	65	66	107
4	1725	4317	52	85	84	22	59	40
5	892	4815	60	75	45	42	23	38
6	125	4790	56	48	127	60	33	40
7	792	3560	78	128	47	30	10 0	42
8	1485	3040	82	10	67	14	24	44
9	1666	1987	78	41	56	20	28	36
10	537	2275	104	20	44	55	28	49
11	910	1832	98	85	29	65	36	48
12	1180	1325	136	99	53	84	. 42	61
13	1706	1035	84	61	31	70	33	59
14	1137	727	136	102	5 3	95	48	76
15	601	1075	120	78	31	74	43	38
18	-216	795	140	133	64	93	54	77
17	-80	1390	128	82	53	83	42	lost
18	-612	1080	178	126	118	171	107	210
19	-775	1725	124	58	113	114	71	116
20	-1275	1030	164	92	87	114	69	87
21	-2070	2445	112	27	51	39	43	62
22	-2135	1167	178	85	136	88	109	89
23	-2155	6 02	178	72	149	137	76	95
24	-1040	755	340	279	180	102	100	191
25	-1567	365	315	174	206	167	142	202
26	-1140	9 5	248	147	67	111	118	209
27	-670	392	190	109	111	100	92	173
28	-1935	-375	324	191	247	155	170	186
29	-1340	-597	338	228	171	204	145	175
30	-565	-705	270	211	113	97	lost	155
31	-585	-145	176	150	107	110	81	153
32	287	-275	178	130	84	90	95	136
33	535	130	190	102	87	44	69	109
34	1155	120	154	99	69	70	66	122
35	800	-350	202	167	82	90	144	267
36	17	-745	260	140	280	143	142	133





SULPHATE in milligram/m2/day

Monitor	Х	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	25	23	15	16	14	15
2	-585	3860	56	42	36	46	37	25
3	-850	2755	56	. 42	31	30	30	27
4	1725	4317	29	35	24	15	. 12	11
- 5	892	4815	24	29	13	18	10	12
6	125	4790	29	29	26	21	11	12
7	792	3560	37	33	19	18	47	16
8	1485	3040	27	2	19	14	11	12
9	1666	1987	24	29	19	18	11	13
10	537	2275	26	28	19	. 17	12	15
11	910	1832	33	33	24	18	. 15	14
12	1180	1325	52	43	- 32	26	20	19
13	1706	1035	35	30	23	18	13	15
14	1137	727	44	42	31	28	25	21
15	601	1075	45	44	28	25	22	19
16	-216	795	43	49	35	32	25	. 22
17	-80	1390	34	42	30	23	19	lost
18	-612	1080	73	63	45	42	41	53
19	-775	1725	43	51	35	34	31	29
20	-1275	1030	54	58	44	35	31	29
21	-2070	2445	34	29	22	17	17	15
22	-2135	1167	70	55	45	26	56	26
23	-2155	602	67	49	66	64	36	25
24	-1040	755	101	126	65	47	47	71
25	-1567	365	108	124	77	62	72	75
26	-1140	95	83	73	35	44	57	66
27	-670	392	51	55	35	36	32	3 5
28	-1935	-375	102	100	8 6	49	87	5 5
29	-1340	-597	94	121	69	83	76	62
30	~56 5	-705	63	29	45	46	lost	27
31	-585	-145	55	53	37	35	32	4 4
32	287	-275	65	35	35	32	44	35
33	53 5	130	34	49	31	24	27	30
34	1155	120	55	49	27	30	36	32
35	8 00	-350	70	62	32	48	77	105
36	17	-745	90	87	56	71	74	45



NITRATE in milligram/m2/day

Monitor	X	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	3.5	0.8	0.4	0	0.4	1.8
2	-585	3860	0.9	5.3	0.4	0.4	0.3	1.8
3	-850	2755	9.3	0.8	0.4	1.2	0.6	2
4	1725	4317	7.1	0.8	5.2	1.8	0.3	2
5	892	4815	5.3	0.8	1.6	· 0	0.4	1.8
6	125	4790	0	0.8	0.4	0	0,3	1.8
7	792	3560	2.2	0.8	5.8	0	0.1	2.1
8	1485	3040	7.5	1.6	0.4	0.4	0.3	1.8
9	1666	1987	8.4	5.7	3.6	2.3	0.3	1.8
10	537	2275	7.1	1.6	3.6	0	0.4	1.5
11	910	1832	9.3	6	1.6	2.3	0.4	1.6
12	1180	1325	8.9	0.8	1.6	0.4	0.3	1.6
13	1706	1035	8	2.3	2.8	1.2	0.4	1.5
14	1137	727	6.6	0.8	4	1.9	0.5	1.7
15	601	1075	8	0.8	0.4	0.4	0.4	1.5
16	-218	795	2.7	0.8	0.4	1.6	0.7	1.6
17	-80	1390	8	4.2	0.4	0	0.3	lost
.18	-612	1080	11.1	3	6.4	1.2	0.8	1.6
19	-775	1725	6.6	0.8	0.4	0	0.6	1.7
20	-1275	1030	0.4	5.3	0.4	1.2	0.5	1.8
21	-2070	2445	8.9	0.8	0.4	0.8	0.5	1.7
22	-2135	1167	0	0.8	0.4	0	1	2
23	-2155	602	3. 5	0.8	0.4	0	0.6	1.6
24	-1040	.755	19	19.2	0.4	0	0.8	1.7
25	-1567	36 5	0	0.8	2.8	0.8	0.9	2.4
26	-1140	95	0	0.8	0.4	0	0.8	2.1
27	-670	392	0	0.8	0.4	0	0.6	1.8
28	-193 5	-375	9.3	2.6	5 .6	2.3	0.5	1.5
29	-1340	-597	5.8	0.8	8.4	2.7	0.3	1.8
30	-565	-705	3. 5	0.8	0.4	0.4	lost	1.2
31	-585	-145	9.7	0.8	1.2	0	0.5	1.8
32	287	275	6.6	0.8	0.4	0	0.7	1.8
33	535	130	11.5	5.3	0.4	0	0.6	1.8
34	1155	120	5.3	1.5	6.8	0.8	0.6	2
35	800	-350	11.1	0.8	1.6	1.6	0.7	1.8
36	17	-745	8	3.4	0.4	2.7	0.8	1.7





CHLORIDE in milligram/m2/day

Monitor	Х	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	0	0	0	0	0	0
-2	-585	3860	0	0	0	0	3	0
3	-850	2755	4	0	0	2	6	0
4	1725	4317	0	0	0	· 0	0	0
5	892	4815	5	0	. 0	. 0	0	0
6	125	4790	0	0	• 0	0	0	0
7	792	3560	. 0	0	0	0	0	0
8	1485	3040	7	0	0	0	3	` O
9	1666	1987	0	0	0	. O ʻ	3	0
10	537	2275	0	0	0	0	0	0
11	910	1832	0	0	0	0	3	0
12	1180	1325	0	0	0	0	3	0
13	1706	1035	0	0	0	0	0	0
14	1137	727	8	0	0	0	3	0
15	601	1075	0	0	0	0	3	0
16	-216	795	0	0	0	0	8	0
17	-80	1390	0	0	4	0	0	lost
18	-612	1080	5	0	5	4	7	0
19	-775	1725	8	0	2	. 0	4	0
20	-1275	1030	10	0	0	0	3	0
21	-2070	2445	0	8	0	0	3	0
22	-2135	1167	0	4	2	0	3	0
23	-2155	602	0	5	3	0	3	0
24	-1040	755	20	5	5	0	3	0
25	-1567	365	16	0	6	2	7	0
26	-1140	95	18	0	0	0	8	5
27	-670	392	4	0	2	0	6	5
28	-1935	-375	0	0	4	0	0	0
29	-1340	-597	3	0	2	0	0	0
30	-585	-705	3	5	0	0	lost	3
31	-585	-145	0	0	0	0	3	8
32	287	-275	0	0	0	0	3	0
33	535	130	0	2	0	0	7	11
34	1155	120	0	0	0	0	3	0
35	800	-350	5	0	0	0	6	5
36	17	-745	0	2	2	n	2	0



FLUORIDE in milligram/m2/day

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ARCHIVE FOR JUSTICE

Monitor	х	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	1.2	0.5	0.8	1.5	0.1	0.7
2	-585	3860	· 1	0.8	0.9	1.5	0.3	1.1
3	850	2755	0.9	0.7	1.2	.1	0.3	0.9
4	1725	4317	1.1	1.8	7.3	1.1	0.1	0.7
5	892	4815	· 1	1.7	0.9	1.8	0.3	1.8
8	125	4790	1.8	1.4	1.2	2.4	0.1	1.5
7	792	3560	2.1	1.6	1.3	1.8	0.1	1.4
8	1485	3040	0.8	0.1	5.8	0.9	0.3	0.8
9	1666	1987	0.6	0.7	0.5	0.5	0.3	0.8
10	537	2275	0.6	0.6	0.5	1.3	0.1	0.7
11	910	1832	0.7	0.7	0.5	0.9	0.3	0.8
12	1180	1325	0.8	0.8	0.8	0.8	0.4	0.9
13	1706	1035	0.7	0.6	0.9	0.7	0.3	0.8
14	1137	727	1	8.0	0.7	. 1	0.3	0.8
15	601	1075	0.8	0.9	0.8	1	0.3	0.8
18	-218	795	0.9	0.9	1.3	1.3	0.3	1
17	80	1390	0.7	0.8	1.1	1.4	0.3	lost
18	-612	1080	0.9	0.8	0.6	0.8	0.2	1.2
19	-775	1725	1.1	0.9	0.7	1.	0.3	1
20	-1275	1030	1.3	1	0.2	1	0.5	1.2
21	-2070	2445	0.9	0.7	0.1	0.9	0.2	0.7
22	-2135	1167	1.1	0.9	6.2	1.4	0.4	0.8
23	-2155	602	1.6	1.4	7.8	1.5	0.5	0.8
24	-1040	755	2.1	1.2	1.5	1.5	0.9	1.5
25	-1567	365	1.3	4.3	6	1.2	0.9	1.4
26	-1140	95	1.7	1.4	1	0.9	0.5	1.3
27	-670	392	1.4	1.1	1.3	1	0.2	1
28	-1935	-375	2.2	1.3	1.2	0.9	1	1.7
29	-1340	-597	1.7	1.4	1.2	1	1.2	1.7
30	-565	-705	1.6	0.8	1.4	1.1	lost	1.4
31	-585	-145	1.1	1.3	1.6	1.3	0.4	1.2
32	287	-275	1.2	0.9	1.4	1.1	0.4	1.1
33	535	130	1.2	0.8	1.5	1.4	0.8	1.3
34	1155	120	0.9	0.9	0.8	0.8	0.4	1.1
35	800	-350	1	0.9	0.8	1.1	0.4	1.5
36	17	-745	1.2	0.9	1.5	1.2	0.6	1.2

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Draft for discussion COMPLEMENTIAL Research for IVS

CALCIUM in milligram/m2/day

Monitor	Х	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	11	11	5	6	3	· 8
2	-585	3860	23	15	30	- 22	10	14
3	-850	2755	27	17	17	22	9	19
4	1725	4317	15	9	8	15	2	5
5	892	4815	21	8	10	17	3	6
6	125	4790	15	6	8	15	2	5
* 7	792	3560	19	9	14	10	8	6
8	1485	3040	37	1	12	8	2	6
9	1666	1987	15	13	14	18	3	6
10	537	2275	. 21	11	6	8	3	5
11	910	1832	19	14	8	8	4	7
12	1180	1325	27	18	10	11	7	. 9
13	1706	1035	19	13	8	11	3	8
14	1137	727	25	21	17	17	7	14
15	601	1075	23	15	- 8	11	7	6
16	-218	795	27	22	14	18	8	14
17	-80	1390	21	18	12	17	8	lost
18	-812	1080	23	22	19	27	23	41
19	-775	1725	23	21	21	20	11	26
20	-1275	1030	37	22	19	18	11	18
21	-2070	2445	20	13	17	11	8	6
22	-2135	1167	28	17	21	18	19	14
23	-2155	602	38	13	28	27	13	14
24	-1040	755	74	56	37	22	20	37
25	-1567	365	55	49	46	33	25	33
28	-1140	95	52	35	19	22	18	37
27	-670	392	43	24	15	18	16	28
28	-1935	-375	40	32	50	31	42	45
29	-1340	-597	55	47	35	33	34	38
30	-565	-705	49	21	25	22	losť	33
31	-58 5	-145	31	24	17	27	14	25
32	287	-275	37	20	15	29	18	27
33	535	130	39	21	14	20	11	15
34	1155	120	27	22	14	24	12	25
35	800	-350	31	26	12	27	29	63
36	17	-745	33	31	48	33	26	33



MAGNESIUM in milligram/m2/day

Monitor	Χ.	Y	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	-1735	3520	3	1	3	. 5	. 2	0
2	-585	3860	0	2	0	8	3	. 3
3	-850	2755	5	3	4	4	3	3.
4	1725	4317	2	2	3	0	1	0
. 5	892	4815	0	1	0	3	0	1
8	125	4790	3	2	0	3	1	- 1
7	792	3560	0	1	0	0	3	1
8	1485	3040	0	1	0	1	1	1
9	1666	1987	0	2	0	0	1	1
10	537	2275	0	1	4	3	2	3 '
11	910	1832	0	3	1	4	1	2
12	1180	1325	0	1	1	5	1	2
13	1706	1035	3	2	0	4	1	0
14	1137	727	7	2	0	5	2	0
15	601	1075	0	2	5	4	1	0
16	-216	795	2	3	7	5	3	1
17	-80	1390	2	3	18	9	2	lost
18	-612	1080	15	7	5	9	1	0
19	-775	1725	9	4	5	11	3	1
20	-1275	1030	2	5	5	4	4	3
21	-2070	2445	3	1	0	1	2	2
22	-2135	1167	11	9	5	4	4	4
23	-2155	802	7	6	0	9	3	4
24	-1040	755	8	8	10	9	3	6
25	-1567	365	9	8	5	15	5	10
26	-1140	95	17	5	8	11	5	8
27	-670	392	4	9	5	16	3	6
28	-1935	-375	3	13	5	11	1	4
29	-1340	-597	24	9	15	18	0	5
30	-565	-705	13	7	3	12	lost	5
31	-585	-145	4	7	11	9	3	7
32	287	-275	13	3	5	7	3	3
33	535	130	2	4	5	3	3	12
34	1155	120	8	3	5	4	2	2
35	800	-350	15	10	8	1	4	2
36	17	-745	15	9	19	13	4	3


VANDERBIJLPARK STEEL FALL-OUT BUCKETS SODIUM in milligram/m2/day

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Period 6	чүн м	•	.	*	*	.		~~	×	0	0	•	0	φ	0	0	lost	<u>,</u>	0	0	2	N	2	2	ŝ	ю (റ	ო	4	4	0	0	0	0	0	0
Period 5	0	0	0	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	0	0	0		lost	0	0	0	0	0	0
Period 4	0	က	2	с́ч	2	с С	2	2	2	∼	****	*-	*	~	.	*	*	2	*	*	*	*	*	*	2	÷	*	*-	<i>4</i>	2	*	2	¥	2	2	ю
Period 3	N	က	ю (က	က	4	2	ς Ω	2	ς Γ	က	က	က	က	ę	n	က	с С	с С	ŝ	2	n	က	ę	ŝ	ю	e C	n	က	~	*	*	***	0	*	C)
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Period 1	*-	2	n	*	2	****	ທ	2	0	0	0	0	0	0	0	0	0	- 7	0	0	0	2	*	₹~~	2	2	*	2	0	0	0	0	0	0	0	2
>	3520	3860	2755	4317	4815	4790	3560	3040	1987	2275	1832	1325	1035	727	1075	795	1390	1080	1725	1030	2445	1167	602	755	365	95	392	-375	-597	-705	-145	-275	130	120	-350	-745
• ×	-1735	-585	-850	1725	892	125	792	1485	1666	537	910	1180	1706	1137	601	-216	ஜ	-612	-775	-1275	-2070	-2135	-2155	-1040	-1567	-1140	029-	-1935	-1340	-565	-585 -	287	535	1155	800	2
Monitor	~ -	2	ю	4	ŝ	0	ţ~	e	თ	10		12	13	4	13	16	17	90	0	20	21	22	23	24	25	26	27	28	53	ଞ	31	32	33	\$	35	36

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VANDERBIJLPARK STEEL FALL-OUT BUCKETS

POTASSIUM in milligram/m2/day

							· ·	
Monitor	X (%	- Y	Period 1	Period 2	Period 3 F	eriod 4	Period 5	Period 6
1	-1735	3520	1.7	0.7	1.3	16		0.8
2	-585	3860	6.2	· 2	4.5	4.2	2.2	1.7
3	-850	2755	2.2	1.3	1.6	1.4	0.9	0.9
4	1725	4317	1	4.2	7.5	0.8	3	0.7
5	892	4815	. 1	4.8	0.7	2.5	0	2.5
6	125	4790	2.6	3.9	10	:6.7	1.4	2.2
7	792	3560	6.7	4.9	1.5	· 1.3	2.1	1.3
. 8	1485	3040	1.6	0.3	4.5	0.8	0	0.9
9	1666	1987	0.6	0.6	4.5	0.4	0	0.7
10	537	2275	0.8	0.5	0.5	1.1	0	0.6
11	910	1832	0.6	0.5	0.6	1.4	0	0.6
12	1180	1325	0.8	0.4	0.7	0.5	0	0.7
13	1706	1035	0.7	0.6	0.8	0.5	0	0.6
14	1137	727	1.1	0.9	0.5	0.6	0	0.7
15	601	1075	0.8	- 1	1.3	0.8	· · · 0	0.4
16	-216	795	1	1.5	1.7	1.3	- S 0	0.6
17	-80	1390	0.8	0.7	1.2	1.6	. O	lost
18	-612	1080	3.7	1.4	2.3	3.1	2	0.8
19	-775	1725	1.2	0.7	. 1.1	1.8	0	0.6
20	-1275	1030	1.1	0.7	1.6	0.4	0	0.8
21	-2070	2445	0.9	0.7	1.4	0.3	0.8	0.7
22	-2135	1167	3	1.2	6.6	1.2	1	0.9
23	-2155	602	2.5	1.8	6.2	2	0	0.9
24	-1040	755	2.3	1.5	3	0.5	0.8	1.3
25	-1567	365	2.6	1.8	5.8	2.1	1.4	2.5
26	-1140	95	2.8	2.3	1.3	0.6		2.2
27	-670	392	3.6	2.1	2.6	2.3	1.7	1.9
28	-1935	-375	2.7	1.5	2.1	0.8	1.2	1.3
29	-1340	-597	2.5	1.2	1.4	0.5	. 1	1.2
30	-565	-705	3.7	2.7	1.5	1.5	lost	2.1
31	-585	-145	1.1	1.3	2.5	2.1	0.9	1.3
32	287	275	2.6	0.9	1.8	1.1	0	0.7
33	535	130	1.2	0.8	2.5	2.5	. 0	0.6
34	1155	120	0.9	0.4	1	0.7	0	0.6
35	8 00	-350	1.5	1.1	1.1	0.9	1.2	1.6
36	17	-745	1.9	1.3	6.3	3.7	1	1.3

ANNEXURE B RESPIRABLE AND FALL OUT DUST ALONG

THE VDBS WESTERN BOUNDARY

During the period 15 September 2000 and 13 September 2001 an extensive dust fall-out monitoring programme was run (Annexure A). Three of these points are along the westem VDBS boundary, namely at the du Preez dam corner, just inside the fence opposite Plot 68 Steel Valley and at the Steelserv North gate. The programme was continued in 2002. The table below compares the a period of a year prior to the dump shaping, with the period of shaping.

Period/Component 15/9/	2000 to 13/9/2001	22/1/2002 to 4/10/2002
Du Preez Dam Corner	· ·	
Fall-out dust (gram/m2/day)	0,127	0,383
TDS (milligram/m2/day)	48	67
Opposite Plot 68 Steel Valley		
Fall-out dust (gram/m2/day)	0,128	0,215
TDS (milligram/m2/day)	56	64
Steelserv North Gate		
Fall-out dust (gram/m2/day)	0,574	0,370
TDS (milligram/m2/day)	93	77

During the shaping of the dump the dust generation increased at both du Preez dam and opposite Plot 68 Steel Valley, but decreased at the Steelserv North gate. The total Dissolved Solids (TDS) showed the same tendency but to a lesser degree.

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A programme of monitoring for respirable dust (PM10) was started in June 2002 when the active dump shaping commenced, at du Preez dam and Plot 68 dust fall-out monitor stations. The data below is for 11/6/2002 to 14/11/2002, covering 20 periods of 2 or 3 days at a time, in total 55 (24 hour) days.

Site	Respirable Dust (PM10) (microgram/Am3)											
······································	Average	Highest	Lowest									
Du Prees Dam Corner	115,3	284,6	10,8									
Opposite Plot 68	101,5	341,6	23,4									
	. ,											

When interpreting the above, two factors should be taken into consideration. Firstly, the dump shaping has for all practical purposes been completed on the western side by the end of October 2002. From 28/10/2002 to 14/11/2002 the average respirable dust concentrations at the two stations reduced to respectively 47,5 and 33,9 microgram/Am3.

Secondly, both monitor sites are next to the R28. Public roads are a recognised large contributor to respirable dust.

Long term records in the United States indicate city centre PM10 concentrations from 58 to 180 microgram/m3 (USEPA, 1969 : Air Quality Criteria for Particulate Matter, AP49 pages 13 & 14) while an assessment in Johannesburg returned values well in excess of 100 microgram/m3 (Mizelle, A.R., Scorgie, Y. and Annegarn, H., 1996 : 27th National Clean Air Association Conference, Badplaas.)



ANNEXURE C BLAST FURNACE D TAP HALL FUME

This blast furnace was scheduled for a comprehensive refurbishing in the financial year 2004-2005, and this would have included the installation of a tap floor fume extraction system. The refurbishing project has now been split into phases and moved out to 2006-2007.

The tap floor has an assessed fume emission of 74,4 gram/second on average over a year, which is a significant pollutant source strength. With the delay in the total project implementation, the installation of a fume abatement system for the tap hall has been separated from the furnace re-build and brought forward to the financial year 2004-2005 with an estimated cost of R40 million.

VDB Steel will have to enter into the process for legal compliance at an early date to ensure no delay in implementation.





