AIR QUALITY MEASUREMENTS 1987 AND 1988

PERTH, KWINANA, KALGOORLIE AND PORT HEDLAND

Environmental Protection Authority
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CONTENTS

1. INTRODUCTION

This Technical Bulletin on Air Quality Monitoring Results is the first consolidated publication of air quality monitoring data collected by the Environmental Protection Authority of Western Australia. The Bulletin provides detailed summaries of information for 1987 and 1988.

The monitoring network provides information on air quality in Perth's central business district, the Kwinana region and the regional areas of Kalgoorlie and Port Hedland.

2. AIR QUALITY MONITORING NETWORKS

The monitoring networks maintained by the Environmental Protection Authority provide air quality measurements in various strategic locations throughout Western Australia.

In Perth's central business district a network of high volume samplers is used to monitor total suspended particulates and atmospheric lead. This programme has been in operation since 1982 and has recently detected a reduction in the concentration of airborne lead since the introduction of lead free petrol.

In the Kwinana region a network of air quality monitors and measurements were established in the late 1970s for ambient concentrations of sulphur dioxide. This information has been well documented in the Kwinana Air Modelling Study Report of 1982. The initial network based in Hope Valley and Wattleup was increased in 1988 to include Rockingham. During 1988 additional air quality measurements were introduced into the network to measure concentrations of carbon monoxide and nitrogen oxides and in 1989 the measurement of non methane hydrocarbons commenced at Hope Valley. The most significant technical change to this network has been the introduction of a real time telemetry linkage between all stations in the Kwinana region and the Authority's office in Murray Street, Perth which allows quicker access to monitoring information and a faster response to problems with the equipment and complaints.

Regional air quality monitoring networks have been located at Kalgoorlie and Port Hedland to measure sulphur dioxide and total suspended particulates respectively.

At each air quality monitoring station in the Kwinana and Kalgoorlie region meteorological information is obtained at the same time to provide an accurate assessment and evaluation of that local environment. This information coupled with air quality measurements provide the essential ingredients for the Authority's air pollution computer modelling investigations.

Special investigations commenced during 1988 to measure ground level and source emission concentrations of fluoride in the Midland, Swan Valley and Guildford regions. A network of thirty four (34) monitors are located in the region and have been in operation since July 1988. A separate Technical Bulletin has been published on this programme.

A network of high volume air samplers has been established throughout the metropolitan area of Perth to investigate the distribution of total suspended particulates in this air shed. An integral part of this programme will be an investigation into the chemical composition of the particulates and an endeavour to establish a source apportionment scenario.

3. MONITORING SITE LOCATIONS

Air quality measurement networks have been established at the follow locations throughout Perth, Kwinana and the regional centres of Kalgoor and Port Hedland:

PERTH CENTRAL BUSINESS DISTRICT
- Total suspended particulates and lead.
  - 57 Murray Street - kerb and footpath.
  - Cr William and Murray Street - 2 metres above intersection.

KWINANA INDUSTRIAL REGION
- Hope Valley Air Quality Station.
  - Sulphur dioxide, nitrogen oxides, carbon monoxide.
  - Total suspended particulates.
  - Meteorology.

- Wattleup Air Quality Station.
  - Sulphur dioxide, nitrogen oxides.
  - Meteorology.

- Rockingham Air Quality Station.
  - Sulphur dioxide.
  - Meteorology.

KALGOORLIE REGION
- Air Quality Stations are located at:
  - Kalgoorlie Regional Hospital.
  - Kalgoorlie Technical School.
  - Boulder Primary School.
    - Sulphur dioxide.
    - Meteorology.

PORT HEDLAND REGION
- Howe Street.
  - Total suspended particulates.

PERTH METROPOLITAN REGION
- Midland, Shenton Park, Gwelup, Murdoch, Gosnells, Perth, Hope Valley a
- Orange Grove.
  - Total suspended particulates.

4. AIR QUALITY SAMPLING METHODOLOGY

4.1 SULPHUR DIOXIDE

A sample of air is exposed to ultra-violet light radiation which causes a contained sulphur dioxide to fluoresce. The intensity of this light directly related to the concentration of sulphur dioxide in that a sample.

4.2 TOTAL SUSPENDED PARTICULATES

A large sample of air is drawn through a filter paper which remov suspended particulates and the weight of the particles collected determine Australian Standard Method AS 2724 - 3, 1984 should be consulted for fu details. This document is available from offices of the Australian Standa Association.

All chemical analysis is done by X-Ray fluorescence spectrophotometry.

4.3 NITROGEN OXIDES

Air samples are mixed with ozone which on combination with any contained nitrogen oxide emits light which is proportional to the nitric oxide concentration in the air sample. This process is called chemiluminescence. Nitrogen dioxide is converted to nitric oxide within the instrument which then produces concentration values of nitric oxide and nitrogen dioxide.

4.4 CARBON MONOXIDE

Infra red radiation is passed through samples of air containing carbon monoxide. The amount of radiation absorbed provides a measure of the concentration of carbon monoxide in an air sample.

4.5 QUALITY CONTROL AND QUALITY ASSURANCE

All air quality monitoring equipment undergoes routine calibration and maintenance which ensures accuracy and precision for all information obtained from each monitoring network.

5. AIR QUALITY CRITERIA

The Environmental Protection Authority sets standards for individual air pollutants through Ministerial Conditions, Licencing and Environmental Protection Policy provisions contained within the Environmental Protection Act 1986.

In this assessment and review process the Authority uses, as guidelines, ambient air quality criteria established by organisations such as the World Health Organisation, National Health and Medical Research Council and Environmental Protection Authorities and Agencies throughout the world.

The guidelines used for common urban and industrial air pollutants are given together with their source.

POLLUTANT	GUIDELINE		SOURCE AGENCY
Total suspended particulates	90 ug/m3	annual mean	NHMRC
	260 ug/m3	24 hour max	USEPA
Lead	1.5 ug/m3	3 month average	NHMRC, USEPA EPA Vic
Sulphur dioxide	350 ug/m3	1 hour average	WHO
	700 ug/m3	1 hour average	NHMRC
Nitrogen dioxide	328 ug/m3	1 hour max	NHMRC, USEPA
	400 ug/m3	1 hour average	WHO
	150 ug/m3	24 hour average	WHO
Carbon monoxide	30 000 ug/m3	1 hour average	WHO
	10 000 ug/m3	8 hour average	WHO

where:

* NHMRC National Health and Medical Research Council
* USEPA United States Environmental Protection Agency
* WHO World Health Organisation

* EPA Vic Environmental Protection Authority of Victoria
* ug/m3 micrograms per cubic meter at standard temperature pressure, 0 degrees Celsius and 101.3 kilo pascals
* 1 hour average is the average value obtained in any time perioc one (1) hour. The average is the arithmetic value. Similarly for eight (8) and twenty four (24) hours time periods.
* 1 hour maximum is the maximum value obtained in any time period of (1) hour. Similarly for the twenty four (24) hour time period.
* Annual mean is the arithmetic mean of all in any one (1) year perioc

Under the provisions of the Environmental Protection Policy for Kalgoor sulphur dioxide concentrations have been defined and enforceable which li a maximum value of 1300 micrograms per cubic meter for a time period three (3) hours at standard temperature and pressure.

The EPA is involved in a full review of ambient air quality criteria as p of developing Environmental Protection Policies (EPP) for the Kwin Industrial Area and the Perth Metropolitan Region. The EPP for Kwinana w initially deal with sulphur dioxide and total suspended particulates and expected to be available for public comment in the second half of 1989. other pollutants will be dealt with in the second EPP which should available early in the second half of 1989.

6. PROGRAMME RESULTS

For all Tables of sulphur dioxide, nitrogen oxides and carbon monoxide Section 6, concentrations are quoted in micrograms per cubic metre a degrees Celsius and 101.30 kPa, dry. This is the standard method of d presentation and allows direct comparison of results between vari locations whether national or international.

The maximum ten (10) minute average is that value averaged over a fixed (10) minute time interval, the maximum one (1) hour average is that va averaged over a moving ten (10) minute step sequence and the maximum th (3) hour is that value averaged over a moving ten (10) minute step sequen The twenty four (24) hour value is the arithmetic average of all val obtained in a time period commencing and finishing at midnight.

6.1 KWINANA INDUSTRIAL REGION, HOPE VALLEY AIR QUALITY STATION SULPHUR DIOXIDE

Station commenced operation in 1986.

Year 1987

Month	Monthly Average	24 Hour	Maximum 3 Hour Average	1 Hour	10 Min	Data Recovery %
Jan	9	96	492	1229	1634	99.5
Feb	8	18	52	69	129	99.7
Mar	6	35	215	315	640	99.6
Apr	6	24	156	257	417	99.9
May	11	50	322	451	671	99.0
Jun	11	76	91	273	1640	99.7
Jul	26	60	140	171	269	84.1
Aug	12	77	249	439	694	99.7
Sept	24	60	400	700	1137	99.9
Oct	7	51	141	320	412	99.6
Nov	10	35	168	297	440	99.8
Dec	Monitor off line					9.8

Year 1988

Month	Monthly Average	24 Hour	Maximum 3 Hour Average	1 Hour	10 Min	Data Recovery %
Jan	12	36	179	391	834	99.6
Feb	13	43	260	439	1000	99.3
Mar	10	39	231	301	451	99.1
Apr	15	55	343	462	629	99.9
May	9	33	252	612	1163	66.8
Jun	5	59	203	260	543	99.9
Jul	1	9	44	63	100	79.5
Aug	7	39	188	304	412	95.1
Sept	4	18	83	129	157	99.7
Oct	6	45	267	659	1089	100.0
Nov	9	45	300	547	649	99.6
Dec	15	68	394	581	794	99.6

6.1.1 SUMMARY OF HOPE VALLEY SULPHUR DIOXIDE

The following information on Hope Valley sulphur dioxide gives details of the number of one (1) hour events for the years 1987 and 1988 which are in defined concentration ranges. In a calendar year there are 8,760 one (1) hour events.

Concentration Range of Sulphur Dioxide		Number of One Hour Time Events 1987	1988
Less than	100	8 639	8 525
	100 to 200	78	150
	200 to 300	23	50
	300 to 400	10	26
	400 to 500	7	4
	500 to 600	1	3
	600 to 700	0	2
	700 to 1000	1	0
	1000 to 1500	1	0
Greater than	1500	0	0

6.2 WATTLEUP AIR QUALITY STATION
SULPHUR DIOXIDE

Station operated from 1978 to 1981 and recommenced operation in 1986.

Year 1987

Month	Monthly Average	24 Hour	Maximum 3 Hour Average	1 Hour	10 Min	Data Recovery %
Jan	21	140	834	1883	3028	99.6
Feb	6	74	103	126	146	99.8
Mar	15	34	120	250	463	94.6
Apr	3	18	91	151	283	58.4
May	2	9	65	174	369	99.8
Jun	1	8	62	186	1117	99.9
Jul	13	45	139	236	291	99.8
Aug	11	63	234	340	534	99.8
Sept	8	32	242	460	854	99.9
Oct	4	23	96	178	406	76.6
Nov	11	45	252	396	597	99.9
Dec	9	33	97	159	209	99.8

Year 1988

Month	Monthly Average	24 Hour	Maximum 3 Hour Average	1 Hour	10 Min	Data Recovery %
Jan	13	76	286	338	417	99.9
Feb	21	111	294	386	520	88.6
Mar	12	74	353	832	1880	99.7
Apr	8	30	163	320	646	99.9
May	6	39	258	602	823	93.5
Jun	-	-	-	-	-	4.6
Jul	2	13	101	236	277	98.6
Aug	3	14	52	119	206	99.8
Sept	3	13	103	180	237	99.4
Oct	6	34	178	240	329	98.9
Nov	9	29	194	393	520	99.7
Dec	19	63	381	478	660	99.8

6.2.1 SUMMARY OF WATTLEUP SULPHUR DIOXIDE

The following information on Wattleup sulphur dioxide gives details of the number of one (1) hour events for the years 1987 and 1988 which are defined concentration ranges. In a calendar year there are 8,760 one hour events.

Concentration Range of Sulphur Dioxide		Number of One Hour Time Events 1987	1988
Less than	100	8 635	8 531
	100 to 200	92	143
	200 to 300	23	52
	300 to 400	6	24
	400 to 500	2	6
	500 to 600	0	2
	600 to 700	0	1
	700 to 1000	1	1
	1000 to 1500	0	0
Greater than	1500	1	0

6.3 ROCKINGHAM AIR QUALITY STATION. SULPHUR DIOXIDE

Station commenced operation in July 1988.

Year 1988

Month	Monthly Average	Maximum 24 Hour	3 hour Average	1 Hour Average	10 Min	Data Recovery %
Jul	0	2	15	30	43	75.3
Aug	8	26	57	94	126	99.8
Sept	4	18	110	126	171	99.7
Oct	1	5	20	33	49	99.8
Nov	1	14	48	60	114	99.6
Dec	1	8	53	110	148	99.8

6.4 HOPE VALLEY AIR QUALITY STATION. NITROGEN OXIDES

Station commenced operation in September 1988.

Year 1988

Month	Monthly Average		Maximum 24 Hour Average		1 Hour		10 Min		Data Recovery %
	No2	No	No2	No	No2	No	No2	No	
Sept	13	2	21	4	69	41	82	46	78.8
Oct	9	1	18	3	58	30	74	49	93.2
Nov	7	1	14	3	51	12	70	17	99.6
Dec	7	2	18	10	69	84	88	179	99.8

6.5 WATTLEUP AIR QUALITY STATION. NITROGEN OXIDES

Station commenced operation in March 1988.

Year 1988

Month	Monthly Average		Maximum 24 Hour Average		1 Hour		10 Min		Data Recovery %
	No2	No	No2	No	No2	No	No2	No	
Mar	17	7	37	26	78	302	97	441	71.8
Apr	18	5	29	17	86	108	101	165	99.9
May	19	7	31	22	70	108	78	154	99.5
Jun	11	6	22	16	63	119	68	134	99.6
Jul	16	7	32	21	69	138	80	159	99.5
Aug	15	7	32	20	63	113	74	174	99.5
Sept	7	4	22	12	60	96	76	155	99.2
Oct	10	4	29	16	72	92	84	114	99.5
Nov	12	3	20	8	178	102	690	404	95.3
Dec	10	5	27	11	137	168	487	498	99.8

6.6 HOPE VALLEY AIR QUALITY STATION. CARBON MONOXIDE

Station commenced operation in September 1988.

Year 1988

Month	Monthly Average	Maximum 24 Hour	3 Hour Average	1 Hour	10 Min.	Data Recovery %
Sept	323	801	1597	2291	4125	99.8
Oct	87	338	722	833	1250	99.8
Nov	97	417	1312	1750	2000	99.8
Dec	192	561	930	1562	2750	99.8

6.7 KALGOORLIE REGION. KALGOORLIE REGIONAL HOSPITAL STATION. SULPHUR DIOXIDE

Station commenced operation in July 1982.

Year 1987

Month	Monthly Average	Maximum 24 Hour	3 Hour Average	1 Hour	10 Min.	Data Recovery %
Jan	100	440	1390	2458	3380	96.6
Feb	60	278	1180	1857	2734	99.7
Mar	38	283	1119	1891	3011	99.1
Apr	19	195	950	1799	2668	92.2
May	14	221	1048	2219	3068	99.4
Jun	7	106	725	983	2100	98.3
Jul	14	159	757	1470	2968	99.4
Aug	29	149	710	1852	3068	99.6
Sept	26	190	686	1122	2308	99.5
Oct	56	291	850	1479	3280	99.7
Nov	36	200	932	1675	2977	99.8
Dec	43	178	890	1931	3331	99.3

Year 1988

Month	Monthly Average	Maximum 24 Hour	3 Hour Average	1 Hour	10 Min.	Data Recovery %
Jan	55	211	872	2208	3885	99.3
Feb	30	139	718	1229	2606	99.4
Mar	49	310	904	1652	2760	98.9
Apr	23	107	462	919	1951	60.0
May	10	100	732	1094	1588	98.9
Jun	10	84	397	939	2720	99.7
Jul	17	174	1107	2523	3614	99.5
Aug	13	147	591	1550	2329	98.8
Sept	12	190	1062	2668	3177	99.6
Oct	31	159	749	1880	2751	98.7
Nov	52	233	826	1923	2626	98.4
Dec	-	-	-	-	-	20.9

Monitor relocated at Fire Station in December.

6.7.1 KALGOORIE TECHNICAL SCHOOL STATION

Station commenced operation in February 1983

Year 1987

Month	Monthly Average	Maximum 24 Hour	3 Hour Average	1 Hour Average	10 Min.	Data Recovery %
Jan	197	668	1632	2282	3631	82.8
Feb	189	442	1907	2783	4286	99.3
Mar	97	475	1239	2283	2363	98.9
Apr	58	348	859	1497	4760	99.4
May	31	194	746	1365	3320	99.7
Jun	29	220	1261	2953	3760	99.4
Jul	29	169	829	1900	3711	99.7
Aug	88	375	862	1771	4717	99.7
Sept	106	420	862	1672	4343	99.8
Oct	131	358	996	2078	4143	99.3
Nov	119	327	955	2575	4314	99.8
Dec	180	427	911	1650	5048	99.6

Year 1988

Month	Monthly Average	Maximum 24 Hour	3 Hour Average	1 Hour Average	10 Min.	Data Recovery %
Jan	156	357	1074	2458	4697	99.2
Feb	192	453	898	1856	5223	99.8
Mar	122	482	881	1894	4688	99.5
Apr	147	351	885	2025	4688	99.3
May	57	273	758	1873	4294	96.7
Jun	25	152	865	1225	1760	97.7
Jul	34	215	715	1338	2820	99.6
Aug	40	321	781	1461	3385	99.5
Sept	33	229	1109	1772	5151	99.9
Oct	51	240	887	2284	4211	99.2
Nov	139	353	936	1748	3408	99.1
Dec	149	560	1022	1525	3911	99.4

6.7.2 BOULDER PRIMARY SCHOOL STATION. SULPHUR DIOXIDE

Station commenced operation in March 1984.

Year 1987

Month	Monthly Average	24 Hour	Maximum 3 Hour Average	1 Hour	10 Min.	Data Recovery %
Jan	61	454	1483	2317	3711	97.2
Feb	76	277	968	1890	3071	67.2
Mar	59	258	1138	2062	3217	98.9
Apr	76	313	848	1410	3168	99.0
May	29	187	514	1182	2463	82.2
Jun	45	181	668	1565	2686	95.5
Jul	36	158	878	1847	4528	80.8
Aug	60	279	655	1483	3274	99.3
Sept	68	276	750	2088	4183	99.8
Oct	73	254	819	1543	3131	99.4
Nov	33	210	564	814	2911	99.8
Dec	99	309	820	1676	3389	99.1

Year 1988

Month	Monthly Average	24 Hour	Maximum 3 Hour Average	1 Hour	10 Min.	Data Recovery %
Jan	61	252	743	1420	2840	86.2
Feb	83	377	777	1825	3611	99.8
Mar	94	316	664	1652	2760	98.9
Apr	87	243	775	1421	3346	99.6
May	21	142	423	932	1403	99.4
Jun	23	128	551	1169	2743	99.5
Jul	26	161	859	1471	3626	99.6
Aug	50	267	854	1424	5777	99.6
Sept	31	133	1064	2870	4960	75.2

Operation of monitor taken over by Gold Roasting companies and Kalgoorl Nickel Smelter in July.

6.8 PERTH'S CENTRAL BUSINESS DISTRICT. TOTAL SUSPENDED PARTICULATES AND ATMOSPHERIC LEAD

Murray Street station operated from 1972 to 1975 and recommenced operation in 1982.

Queens Building station commenced operation in 1980.

In Sections 6.5.1 and 6.5.2 all TSP and Lead values are expressed in micrograms per cubic metre.

Year 1987

	Murray Street Station			Queens Building Station		
Month	TSP	Pb	90 Day av.	TSP	Pb	90 Day av.
Jan	54	1.05	1.44	53	1.12	1.55
Feb	69	1.28	1.32	55	0.76	1.15
Mar	63	1.63	1.32	50	1.28	1.05
Apr	69	2.26	1.72	65	2.33	1.46
May	49	1.82	1.90	60	1.86	1.82
Jun	45	1.93	2.00	51	1.80	2.00
Jul	57	2.38	2.04	59	2.36	2.01
Aug	44	2.24	2.18	49	2.06	2.07
Sep	51	2.34	2.32	45	1.93	2.12
Oct	43	1.90	2.16	51	1.89	1.96
Nov	56	1.57	1.94	71	1.91	1.91
Dec	57	1.57	1.68	77	1.78	1.86
Annual Average	55	1.83		57	1.76	

Year 1988

	Murray Street Station			Queens Building Station		
Month	TSP	Pb	90 Day av.	TSP	Pb	90 Day av.
Jan	57	1.34	1.49	68	1.22	1.64
Feb	59	1.30	1.40	74	1.25	1.42
Mar	87	1.61	1.42	90	1.54	1.34
Apr	74	1.26	1.39	67	1.21	1.33
May	60	2.15	1.67	57	1.32	1.36
Jun	62	1.98	1.80	61	1.93	1.49
Jul	45	1.45	1.86	59	1.54	1.60
Aug	55	1.56	1.66	68	1.87	1.78
Sep	57	1.16	1.40	70	1.48	1.64
Oct	69	1.30	1.36	73	1.66	1.68
Nov	71	1.44	1.30	96	1.69	1.61
Dec	57	1.31	1.35	68	1.43	1.59
Annual Average	63			71		

6.9 PORT HEDLAND REGION. TOTAL SUSPENDED PARTICULATES STATION. HOWE STREET

Howe Street station commenced operation in 1978.

Month	Year 1987 TSP	Year 1988 TSP
Jan	88	87
Feb	132	78
Mar	113	94
Apr	72	128
May	121	72
Jun	151	151
Jul	169	126
Aug	126	116
Sept	119	97
Oct	112	210
Nov	89	86
Dec	95	74
Annual average TSP		
1987 113		
1988 110		