

Swan Valley Fluoride Monitoring Programme

Interim Report 1

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SWAN VALLEY FLUORIDE MONITORING PROGRAMME

Interim Report 1

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1. INTRODUCTION

The proposed expansion of Western Australia's brick manufacturing capacity by Prestige Bricks Pty Ltd at the old Midland Abattoir site was seen by residents of the Midland, Guildford and Swan Valley regions as having the potential to result in environmentally unacceptable fluoride levels. This concern was expressed during the Environmental Protection Authority's assessment of the company's proposal through a number of submissions made by local residents in the environs of the proposed development.

The Environmental Protection Authority in its assessment of Prestige's proposal found that it was environmentally acceptable and the Hon Minister for Environment Mr Barry Hodge MLA formalised the proposal on 14 December 1987 pursuant to Section 45(2) of the Environmental Protection Act (1986).

During September and October 1987 the Environmental Protection Authority initiated discussions on a fluoride monitoring programme with all brick and tile manufacturers in the Midland and Swan Valley region (Midland Brick Company Pty Ltd, Prestige Brick Pty Ltd and Bristile Ltd). In November 1987 the Hon Minister for Environment advised the brick and tile manufactures that an extensive study into all aspects of fluoride emissions would be conducted by the Authority's Pollution Control Division and that all manufacturers would financially support the study programme.

The fluoride study programme was formulated by the Authority and costs were apportioned amongst the region's brick and tile manufacturers. An initial assessment of programme detail and costing produced a budget estimate of \$145 000 to service the monitoring programme over a period of two years.

In its initial concept the programme was to consider ground level concentrations of fluoride as well as source emissions, meteorological measurements and if possible a biological survey of the region.

2. PROGRAMME OBJECTIVES

The prime objectives of the monitoring programme are to:

- (i) determine the present magnitude and spacial distribution pattern of ambient fluoride concentrations in the Midland, Guildford and Swan Valley region;
- (ii) produce an information source from a combination of monitoring and computer modelling studies which will enhance knowledge of the fluoride dispersion process and characteristics in the Midland, Guildford and Swan Valley region; and
- (iii) where possible conduct a biological survey to determine the extent that fluoride may have contributed to general vegetation damage within the Midland, Guildford and Swan Valley region.

3. MANAGEMENT STRUCTURE

The programme is directed by a Technical Working Group comprising staff from the Authority and a technical representative from each of the participating companies together with a contract consultant working full time on the monitoring programme. The overall management responsibility for the programme is being directed by the Authority's Pollution Monitoring Services Branch.

4. EQUIPMENT AND DEVELOPMENT

4.1 FIELD MONITORS

The field fluoride monitors developed for the programme have been designed and constructed by staff of the Authority's Pollution Control Division. A major concern in the design criteria was that each monitor would need to be totally self contained and able to operate remotely from any public utilities input. The final design is based on the working standard associated with Australian Standard Part 5 AS 2618 - 1984, Ambient Air - Determination of Gaseous and Particulate Fluorides - Select Ion Electrode Method - Gaseous Fluorides and/or Particulate Fluorides (0.1ug/m³ or greater) - Sodium Acetate Coated Tube Absorption Method.

The fluoride monitor comprises a solar panel which provides electrical power through a controlling electronic circuit with battery backup to an air pump which draws ambient air through a glass absorption U-tube at a constant rate over the sampling period. The fluoride monitor is mounted on a steel pole 3 metres above ground level at each location.

4.2 METEOROLOGICAL STATION

An essential part of the monitoring programme was to determine meteorological conditions in the area of Midland, Guildford and Swan Valley. This detailed meteorological information is critical in defining parameters required for air dispersion modelling of fluoride emissions in the area. The programme's meteorological station measures the following parameters: wind speed and direction, temperature, solar radiation, relative humidity, rainfall and standard deviation of wind direction. This information is compiled on a data logger recording the average of each parameter over a 30 minute period throughout a 24 hour cycle.

5. FLUORIDE ANALYSIS

The fluoride monitor's glass absorption U-tube is serviced on a seven (7) day cycle and the eluted solution is analysed by use of a selection electrode and accompanying standard analytical procedures. The fluoride concentration is determined and expressed in micrograms per cubic metre.

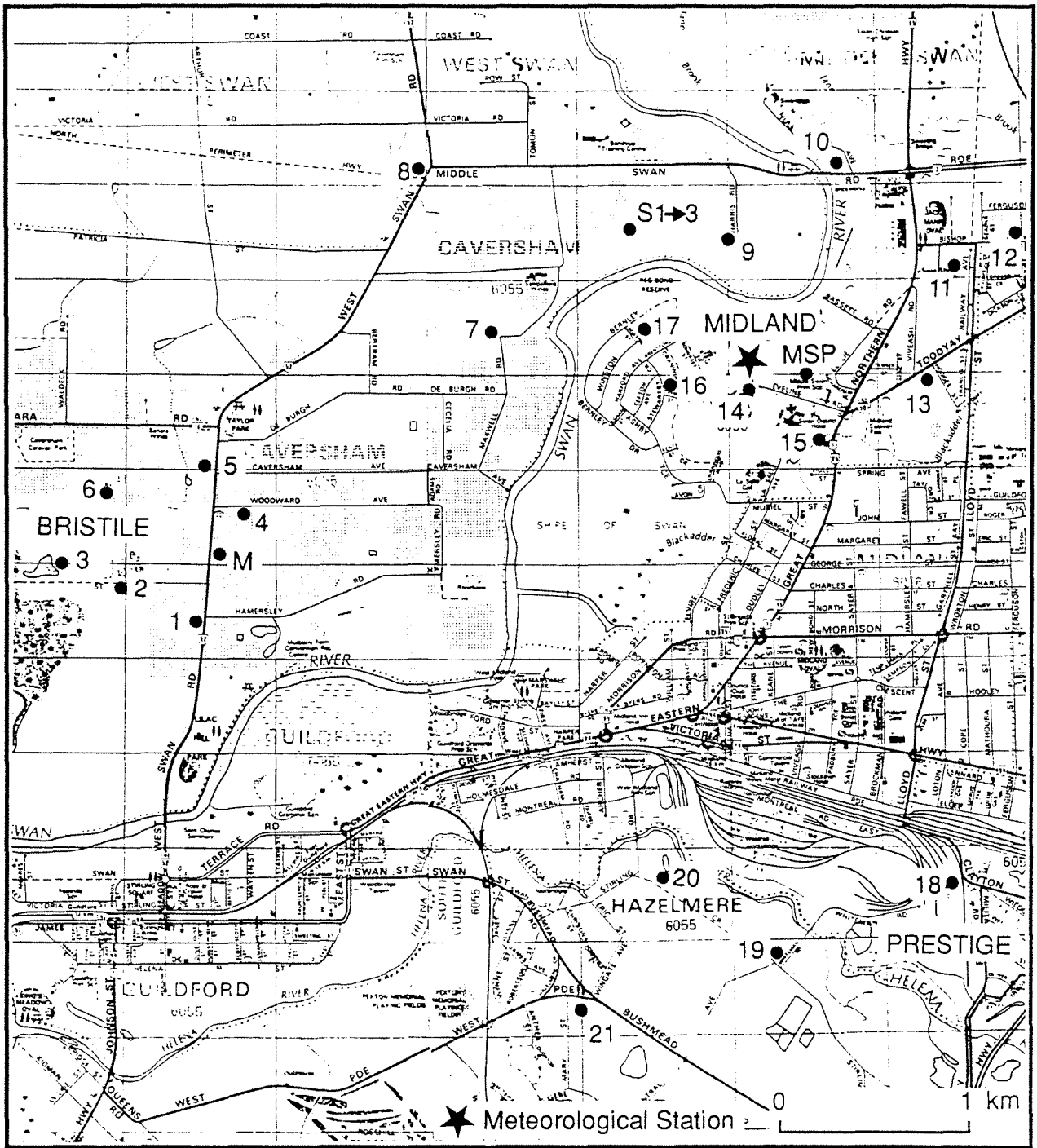
The equipment used in this analytical procedure is an Orion Research Expandable Ion Analyser EA90 coupled to an Orion fluoride electrode.

6. MONITOR LOCATIONS

The monitoring programme has twenty four (24) field monitors located at strategic sites throughout the Midland, Guildford and Swan Valley region. The location of each monitor was determined by preliminary computer modelling of the fluoride emission sources of the region. The field monitors were located as shown in Map 1. Quality control and assurance monitors have been located within and well outside the region to provide the necessary safeguards for accuracy and precision of the analytical and sampling methodology.

7. THRESHOLD LIMIT VALUES AND BIOLOGICAL INDICATORS

The American Conference of Governmental Industrial Hygienists has published values for threshold values which refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.



Map 1 Location of Field Monitors

The threshold limit value - time weighted average for hydrogen fluoride as fluoride is 2 500 micrograms per cubic metre.

The following Table of Biological Indicators provides concentrations of fluoride in the ambient atmosphere considered by various national and international Environmental Protection Authorities to be capable of causing an impact on the most sensitive of floral and forage species.

Table of Biological Indicators
(Sensitive Floral and Forage Species)
Average fluoride concentrations expressed as micrograms per cubic metre

Exposure time	24 hours	7 days	30 days
U.S.A	2.9	1.6	0.92
Canada	0.7	0.38	0.34
Hungary	10.0		
Italy	20.0		
Romania	5.0		
Spain	20.0		
U.S.S.R.	5.0		
Netherlands	10.0		
West Germany	2.0		
Australia	2.9	1.7	0.85 (proposed)

8. RESULTS

All results are an average of a seven day cycle and expressed in micrograms of fluoride per cubic metre at 0 degrees Celsius and 101.3 kPa.

SITE NUMBER - BRISTILE AREA

Date of Sample	1	2	3	4	5	6	M
22 July 1988	*0.15		*0.53		*0.36		*0.07
29	0.35		0.13		EF		0.27
5 Aug 1988	0.08		0.33		0.26		0.09
10	0.30		1.53		0.20		0.13
17	0.20		0.13		0.11		0.74
24	0.12		0.34		0.08		0.21
31	0.17		0.17		0.17		0.17
7 Sept 1988	0.14		0.10		0.11	*0.11	0.15
14	EF		0.07		0.10	0.06	0.17
21	0.15		0.12		0.12	0.05	0.36
28	0.19		0.04		PF	0.01	0.53
5 Oct 1988	0.09		0.04		PF	0.03	0.64
12	0.08		0.07		PF	0.03	0.45
19	0.11		0.12		PF	0.09	0.41
26	0.07		0.12		PF	0.12	0.62
2 Nov 1988	PF		0.11		PF	0.09	0.31
9	0.05	*0.20	0.15	*0.72	0.23	0.05	0.45
16	0.02	0.26	0.22	0.33	0.26	0.09	0.15
23	0.06	0.18	0.33	0.18	0.27	0.19	0.24
30	0.11	0.10	0.26	0.09	0.36	0.53	0.28
7 Dec 1988	0.12	0.09	0.19	0.14	0.36	0.21	0.26
14	0.05	0.15	0.13	0.19	0.53	0.14	0.13

SITE NUMBER - MIDLAND BRICK AREA

Date of Sample	7	8	9	10	11	12
22 July 1988					*0.17	
29					0.32	
5 Aug 1988					0.04	
10					P&EF	
17					P&EF	
24					P&EF	
31					P&EF	
7 Sept 1988		*0.10		*0.19	0.55	
14	*0.14	0.06		0.24	0.22	
21	PF	0.11	*0.09	0.26	0.21	
28	PF	0.04	0.08	0.08	0.46	
5 Oct 1988	PF	0.04	0.08	0.09	0.45	
12	PF	0.06	0.11	0.15	0.23	
19	PF	0.12	0.26	0.25	0.23	
26	PF	0.13	0.27	0.33	0.22	
2 Nov 1988	PF	0.09	0.18	0.47	0.10	
9	0.11	0.12	0.27	0.41	0.20	*0.37
16	0.23	0.17	0.20	0.36	0.08	0.11
23	0.26	0.21	0.36	0.29	0.08	0.07
30	0.26	0.32	0.25	0.44	0.09	0.05
7 Dec 1988	0.10	0.30	0.25	0.37	0.17	0.17
14	0.10	0.17	0.27	0.69	0.11	0.15

SITE NUMBER - MIDLAND BRICK AREA

Date of Sample	13	14	15	16	17	MSP
29 July 1988		*1.10				
5 Aug 1988		0.21				
10		1.77				
17		2.22				
24		0.63				
31		1.79				
7 Sept 1988		0.92			*0.15	
14	*0.12	EF	*0.28		0.15	
21	0.65	1.12	0.73		0.18	
28	0.56	1.19	0.75		0.05	*0.62
5 Oct 1988	1.27	1.19	0.82		0.07	2.83
12	0.57	1.15	0.39		0.09	0.91
19	0.41	1.24	0.55		0.20	0.95
26	0.27	0.20	0.14		0.16	0.20
2 Nov 1988	0.29	0.35	0.20		0.16	0.88
9	0.14	0.19	0.12	*0.23	0.24	0.29
16	0.03	0.09	0.05	0.94	0.62	0.12
23	0.07	0.06	0.04	0.32	0.44	0.05
30	0.04	0.12	0.06	0.16	0.40	-
7 Dec 1988	0.13	0.10	0.07	0.24	0.39	0.23
14	0.07	0.05	0.10	0.17	0.17	0.07

SITE NUMBER - PRESTIGE BRICK AREA

Date of Sample	18	19	20	21
22 July 1988			*0.40	
29			0.38	
5 Aug 1988			0.05	
10			0.14	
17			0.16	
24			0.13	
31			0.33	
7 Sept 1988	*0.19		0.10	*0.09
14	0.06		0.14	0.18
21	0.09		0.19	0.20
28	0.07		0.44	0.25
5 Oct 1988	0.10		0.36	0.16
12	0.06		0.87	0.32
19	0.06		0.19	0.07
26	0.03		0.11	0.06
2 Nov 1988	0.02		0.10	0.03
9	0.01		0.12	0.01
16	0.01	*0.02	0.03	0.01
23	0.01	0.01	0.03	0.01
30	0.03	0.08	0.10	0.06
7 Dec 1988	0.02	0.11	0.14	0.08
14	0.04	0.04	0.14	0.07

SITE NUMBER - SANDALFORD AREA

QUALITY CONTROL - ASSURANCE MONITOR

Date of Sample	SI	S2	S3
22 July 1988	*PF	*0.04	*0.06
29	0.02	0.02	0.03
5 Aug 1988	0.07	0.13	0.24
10	0.09	0.14	0.19
17	0.06	PF	0.06
24	0.06	0.05	0.04
31	0.02	0.04	0.04
7 Sept 1988	0.05	0.06	0.07
14	0.02	0.03	PF
21	0.03	0.03	0.04
28	AP	0.02	0.03
5 Oct 1988	0.03	0.02	0.03
12	0.04	0.04	0.04
19	0.04	0.05	0.04
26	0.04	0.05	0.05
2 Nov 1988	0.04	0.08	0.04
9	0.04	0.08	0.06
16	PF	0.08	PF
23	0.15	0.16	0.16
30	0.48	0.44	0.48
7 Dec 1988	0.07	0.15	0.17
14	0.16	0.15	0.14

NOTES:

- * Monitoring started at site
- PF Air pump failure
- EF Electrical failure
- AP Analytical problem

9. DISCUSSION

The initial concept, design and construction of the fluoride monitor consumed a large amount of time and resources during the development and installation stage of the monitoring programme. The failure of some monitors in the early stage of the programme was disappointing and at times unrelated to the research that was needed in their development. The majority of these problems were associated with electrical and electronic components as well as some poor quality control on the part of the air pump suppliers. In any research programme such as this where proven monitoring equipment is not available "off the shelf" there are bound to be some unforeseen problems.

The current state of the network is that it is functioning to our required standards of accuracy and precision.

The fluoride monitoring network has twenty four (24) monitors in the field with three (3) quality control monitors two of which are within the network and one located at the Authority's Pollution Control Division.

Since the monitoring programme commenced in July 1988 meteorological parameters as described above have been collected which provide data to explain some of the variations in fluoride concentrations at particular sites in the network.

During the programme source emission values have been obtained from brick and tile operations within the study area. Monitoring of vegetation has been undertaken at selected locations within the study area and will continue as the programme develops.

At the present stage the monitoring programme has made considerable progress towards its aims and goals as described in a previous section. It is the aim during the next phase of the programme to enhance our understanding of source emissions this, coupled with our meteorological information may verify the initial computer model.

At this stage in the programme conclusions or interpretations of results are premature. Also Prestige Brickworks is still under construction, changes and modifications are being made to emission control equipment on existing manufacturing plant, and total seasonality factors have not been assessed. The immediate opinion however, is that there is no impact from fluoride emissions on the region's human population. In certain meteorological conditions some floral damage could occur to sensitive species.

The next interim report will be published on 30 June 1989.