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Fluoride Investigations
in The Dalles Area
1968-1974



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Fluoride Investigations in The Dalles Area 1968-1974

T. J. FACTEAU and W. M. MELLENTHIN

ABSTRACT

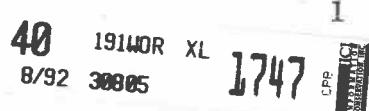
Percent fruit set of 'Royal Ann' sweet cherries during 1967, 1969, and 1970 was found to increase with distance and decrease with increasing direction (from 0-140 degrees, based on East = 0 degrees) from the aluminum reduction plant in The Dalles, Oregon. Correlative studies also indicate that annual growth and number of buds and spurs (for growth years 1965-1969) increased as distance from the aluminum reduction plant increased, decreased with clockwise direction, and decreased as fluoride leaf levels increased. Similar results were found with air and vegetative fluoride sampling patterns, although these data were also influenced by wind direction. Areas closer to and downwind from the aluminum plant tended to have higher air and vegetative fluoride levels. Comparison studies of various fluoride air samplers at one location indicated that filter paper samplers were in close agreement with an automated bubbler system.

Key words: fluoride, sweet cherry, air fluoride levels, leaf fluoride levels, percent fruit set, growth, air fluoride sampling.

INTRODUCTION

Fluoride has been known to be an air pollutant since late in the 19th century but has only become a serious problem since the second World War. Fluorine compounds are evolved during the manufacture of certain metals such as aluminum and steel and also in the manufacture of ceramics and phosphate fertilizers. Plants vary greatly in their susceptibility to fluoride injury and all factors relating to economic losses have not been fully elucidated.

Lower yields, reduced growth and vigor, and premature leaf abscission have resulted from exposure of 'Navel' orange trees to hydrogen fluoride (HF), sodium fluoride (NaF), or HF solutions (Brewer et al., 1960, 1969). Other experiments on citrus showed that trees grown in a filtered air system produced significantly more fruit than did trees with unfiltered air (Leonard and Graves, 1966). Reduced leaf area probably accounted for much of the lower yields. However, it was believed that exposures of the citrus trees to relatively high fluoride air levels during spring bloom caused the greatest reduction in yields, either through leaf injury or through abscission of young leaves, bloom, and young fruit. Abscission of sweet cherry fruits has been found in a fluoride air polluted area and fluoride sprays (0.05% ammonium fluoride [NH₄F]) induced a complete abscission layer and damaged the apical part of the fruit (Stosser and Dinh, 1973). Damage to the apical part of the fruit has been seen near



The Dalles and has been duplicated by sprays of NaF, NH₄F, and by exposing 'Royal Ann' cherry limbs to HF (Mid-Col. Expt. Sta., unpub. data).

Inhibition of pollen tube growth of tomato (Sulzbach and Pack, 1972), cucumber (Sulzbach and Pack, 1972), and sweet cherry (Facteau, Wang, and Rowe, 1973) has been observed. The responses by tomato and cucumber were related to calcium nutrition and to fluoride levels believed to be higher than normally found in the field (Sulzbach and Pack, 1972). Pollen tube growth of sweet cherries in controlled fumigations was reduced (Facteau, Wang, and Rowe, 1973) at air fluoride levels that have been reported in The Dalles (Compton et al., 1965); see Tables 6 to 19 in this bulletin. However, Dinh, Buchloh, and Oelschlager reported that sweet cherry pollen exposed to 97 $\mu\text{gF}/\text{m}^3$ was not inhibited in germination on an artificial media. Reductions in cherry pollen tube growth, thus delaying fertilization, might have an effect on reducing fruit set since egg degeneration in sweet cherry occurs shortly after anthesis and delaying pollination one to two days has resulted in reduced set (Eaton, 1959). More than 300 limb fumigations with fluoride concentrations of approximately 1 to 60 $\mu\text{gF}/\text{m}^3$ and durations of exposure of 2 to 24 hours resulted in the conclusion that fluoride interfered with 'Royal Ann' cherry fruit set (Mid-Col. Expt. Sta., unpub. data). However, field trials with cherry trees growing near a factory emitting fluoride-containing pollutants (2.5 $\mu\text{gF}/\text{m}^3$) did not result in reduced fruit set (Dinh, Buchloh, and Oelschlager, 1973) when count was made four weeks after pollination. No comparison was made between fluoride-treated and control flowers, but rather between hand and natural pollination in a polluted area.

Possible growth responses caused by HF are also not clearly defined. Apricots in the vicinity of an aluminum reduction plant were observed to have reduced growth of fruit wood (De Ong, 1946), and effects on citrus have been noted (Brewer et al., 1960, 1969; Leonard and Graves, 1966). Fumigated pinto beans, however, had accelerated growth and positive increases in fresh and dry weights (Treshow and Horner, 1968).

This report presents 1968-1974 leaf and air fluoride levels for various orchard sites in The Dalles, Oregon. The results of three years of fruit set surveys and one year's growth survey are reported along with a comparison of several types of fluoride air samplers.

METHODS

Vegetation fluoride measurements

Vegetation samples were collected the first weeks in July and September for all years. The oldest spur leaves were sampled in 49 'Royal Ann' and 13 'Bing' cherry orchard sites. Location of the 'Royal Ann' sites are

shown in Figure 1. All sites were selected according to criteria previously described by Compton and others (1968). Samples collected in 1968 were prepared and analyzed as described previously (Compton et al., 1968). Samples collected in 1969-1974 were prepared and analyzed according to methods of Cralley and others (1969). No differences were found in analyzing samples by the two methods. Samples taken in 1969 and 1970 were also analyzed for nitrogen content.

Air fluoride measurements

Air samples were collected starting before bloom at ten locations in 1968 and 1970, nine locations in 1969 and 1971, and three in 1972, 1973, and 1974 (Figure 1). Sampling durations varied from year to year but are presented in the tables as 24-hour averages. Footnotes on the tables for a given year indicate the specific sampling durations. The automatic air samplers (AA) previously described (Compton et al., 1968) were used.

In 1970 and 1971, nine sampling locations were further equipped with 24 filter holders (Millipore Swinnex 47) and a 24-port valve. The three stations used in 1972, 1973, and 1974 also had these filter paper samplers. In 1970, two Whatman No. 4 filter papers were placed in each filter holder, the outer one treated with citric acid and the inner treated with sodium hydroxide (NaOH) (Mandl et al., 1970). Treatment of the papers permitted separation of the gaseous and particulate components of the total fluoride levels. We made numerous trial runs under various types of particulates and found this treatment to be satisfactory. Filter papers used in 1971, 1972, 1973, and 1974 were Whatman No. 4 for the inner and Whatman No. 52 for the outer one. Whatman No. 52, a closer grained paper, was thought to remove more particulates. These samplers were timed by the AA samplers, thus sampling durations were the same. During 1973 and 1974 only the filter paper samplers, and not the AA samplers, were used.

Sampler comparisons

Comparisons were made of several types of fluoride air samplers at station E in 1970, 1971, and 1972 (Figure 1). The AA sampler was compared with the filter paper sampler in all years. For 1971, comparisons included double tape (citric acid and NaOH) and single tape systems (NaOH). Both the single and double tape systems were roll filter papers treated in the same manner as the double paper system described above. The single tape instrument was an RAC smoke sampler, Model F-2, modified with stainless steel inlet parts coated with Teflon, type S. An air flow rate of 15 cubic feet per hour was maintained for one, two, or three hours of sample collections. The double tape unit was constructed of plexiglass, similar to one described by Mandl and others (1970), except that the two

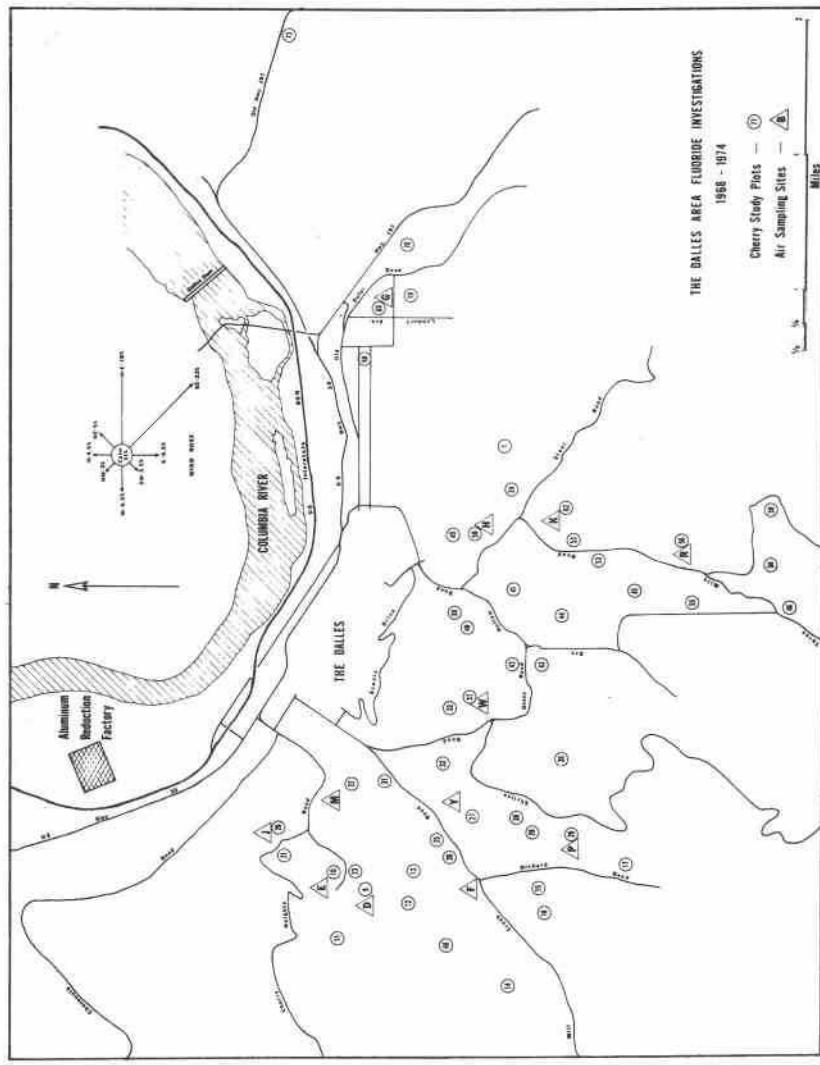


Figure 1. Geographical distribution of foliage and air fluoride sampling locations, 1968-1974. Numbered circles represent locations of 'Royal Ann' cherry orchards from which foliage samples were collected. Triangles identified by letters represent air sampling locations.

tapes were separated by a plexiglass block. Air flow rate of 1 cubic meter per hour was maintained for sample collection durations of one, three, and six hours.

Fluoride analysis, air and vegetative samples

Air samples collected in 0.001 N NaOH (AA samples) were analyzed directly for fluoride content and all tape and filter paper samples were eluted in 10 ml of 1N H₂SO₄. Fluoride determinations were made according to Cralley and others (1969). Fluoride was determined in the 1968 samples according to Weinstein and others (1965) and in 1969-1974 according to Cralley and others (1969). Daily averages in $\mu\text{g F/m}^3$ were calculated where the air samples were taken in units of less than 24 hours. Correlation and regression analysis of pairs of samplers was performed on the daily averages at station E, and on weekly averages for stations J, M, D, E, and Y.

Fruit set surveys

Sampling sites in The Dalles area were selected in 73 'Royal Ann' and 17 'Bing' cherry orchards in the spring of 1967. Each orchard site contained 100 mature trees from which 20 trees were chosen at random. Limbs were selected and assigned at random from four compass quadrants (NE, NW, SE, SW). Distances from the aluminum reduction plant ranged from 1.5 miles to 5.9 miles and in direction from 100 degrees to 230 degrees (ESE-SW). The study was stratified to eliminate known frost-damage areas. The number of orchard sites in 1969 and 1970 was reduced to 49 and the number of trees per site increased to 32.

Flower counts (100-150 per limb) were made in 1967 on the previously assigned tree quadrant, providing 20 limbs per site, five in each quadrant. Increasing the number of trees per site in 1969 and 1970 provided 32 limbs per site, eight in each quadrant. Percent fruit set was determined two or three weeks prior to harvest, and the data were correlated against distance, direction, and distance x direction from the aluminum reduction plant.

Growth pattern survey

Observations were made in 48 of the original 73 'Royal Ann' orchards during spring 1971. Annual growth for the five years preceding 1971 and numbers of flowers, buds, and spurs on each year's wood were measured on five limbs selected at random from the two southerly exposure quadrants used in the fruit set survey. Twelve variables were used in the regression equations including distance from the aluminum plant, distance², direction from the aluminum plant (based on East = 0 degrees), and leaf fluoride levels for July and September, 1967 through 1970.

RESULTS AND DISCUSSION

Vegetation fluoride measurements

Leaf fluoride levels for the 'Royal Ann' cherry cultivar for 1968 through 1974 are presented in Tables 1 and 2. Data on the 'Bing' variety are presented in Tables 3 and 4. Ranges and averages for the six years

Table 1. Fluoride content of 'Royal Ann' sweet cherry leaf samples (The Dalles, 1968-1971)

Orchard No. ¹	1968		1969		1970		1971	
	July	Sept.	July	Sept.	July	Sept.	July	Sept.
<i>ppm fluoride content, dry weight basis</i>								
1	9.1	12.1	6.4	13.4	7.9	11.1	3.1	7.7
9	9.2	12.6	2.8	19.3	12.2	11.8	2.5	12.8
10	9.8	13.9	3.8	19.5	10.8	14.6	3.8	16.7
11	8.2	11.8	5.5	9.6	10.2	9.5	3.1	16.5
12	8.9	13.0	6.5	15.8	9.4	16.4	2.5	11.4
13	7.5	10.5	4.0	7.9	8.7	11.1	3.5	12.0
14	4.9	8.2	2.8	6.4	8.0	8.6	2.3	9.8
15	5.8	9.5	4.8	8.0	6.0	7.6	2.0	8.3
16	6.1	7.8	2.8	8.1	5.7	10.3	2.3	7.3
17	7.0	5.1	3.3	6.9	5.2	7.6	2.7	8.4
19	8.4	16.2	5.5	16.2	15.7	27.6	8.2	20.3
20	12.2	23.2	6.8	15.2	21.1	17.7	4.1	20.8
21	9.1	17.6	6.8	10.8	15.0	13.6	4.0	15.3
22	10.5	11.7	2.8	7.5	6.2	11.0	3.0	8.7
23	11.3	12.3	4.5	8.5	14.2	11.2	4.4	13.5
24	7.6	6.3	1.0	9.7	7.5	11.7	2.2	11.7
25	6.4	8.9	7.3	4.6	5.8	5.0	3.1	6.9
26	6.3	6.2	1.5	6.3	8.2	7.6	3.6	9.8
27	5.1	10.4	4.5	5.9	6.5	13.1	2.9	7.2
28	5.1	7.9	2.8	3.7	6.7	8.3	2.2	6.4
29	6.9	6.8	2.8	6.5	7.5	6.2	3.2	6.5
30	5.8	7.3	4.0	7.7	5.3	5.8	3.6	6.3
31	7.5	9.7	5.0	13.5	6.5	12.9	3.1	8.5
32	8.1	12.6	4.5	11.0	10.2	12.9	3.3	8.8
33	4.9	9.1	4.1	4.4	7.9	8.3	3.3	6.6
35	7.1	7.2	1.0	5.1	6.4	6.8	3.7	8.2
37	6.6	9.4	3.5	7.6	6.3	6.8	1.7	8.5
39	4.1	9.8	9.7	12.1	9.1	11.0	3.5	10.0
40	5.7	8.7	7.9	9.0	14.8	15.3	2.1	12.8
41	6.4	6.2	6.5	8.5	8.3	8.6	3.2	8.7
42	4.5	10.4	1.3	10.3	7.0	7.3	3.0	7.3
43	7.0	8.1	1.5	8.0	7.2	9.2	3.4	10.2
44	3.5	-----	2.8	6.3	4.8	7.5	2.2	6.0
45	5.1	10.0	4.5	8.9	5.1	7.9	13.8	8.2
46	6.9	5.8	1.0	6.6	5.6	4.8	2.8	7.5
48	8.0	7.9	5.0	13.0	15.7	16.3	2.7	10.2
49	8.7	16.4	4.7	7.1	9.7	15.4	2.7	11.1
50	4.9	7.1	7.8	7.8	6.4	9.7	3.3	8.2
52	6.3	8.5	3.0	9.8	7.2	8.7	4.1	8.4
53	5.0	8.8	4.3	6.4	6.0	7.3	2.3	5.4
55	3.9	8.7	3.4	4.3	3.6	7.4	2.4	7.5

Table 1. (Continued)

Orchard No. ¹	1968		1969		1970		1971	
	July	Sept.	July	Sept.	July	Sept.	July	Sept.
<i>ppm fluoride content; dry weight basis</i>								
56	6.8	11.2	3.5	7.6	2.9	9.5	3.9	6.2
58	4.2	9.9	3.0	9.7	2.6	5.7	3.0	6.1
59	4.1	7.9	3.8	5.0	3.9	6.8	2.3	7.2
62	4.9	7.1	2.3	8.2	2.6	6.8	2.5	6.8
68	11.8	11.3	7.5	15.8	11.8	22.1	6.2	16.7
69	8.3	15.7	12.5	15.6	20.6	26.5	6.7	21.7
70	11.1	11.8	9.0	12.7	13.8	12.8	6.6	16.3
73	8.3	.....	4.7	12.6	12.3	28.0	4.1	12.9
Average	7.0	10.2	4.5	9.5	8.6	11.2	3.5	10.2
Range	3.5-12.2	5.1-23.2	1-12.5	4.3-19.5	2.6-21.1	4.8-28.0	1.7-13.8	5.4-21.7

¹ See Figure 1 for location.

Table 2. Fluoride content of 'Royal Ann' sweet cherry leaf samples (The Dalles, 1972-1974)

Orchard No. ¹	1972		1973		1974	
	July	Sept.	July	Sept.	July	Sept.
<i>ppm fluoride content, dry weight basis</i>						
1	4.6	13.4	6.7	9.5	5.6	14.4
9	5.6	19.0	11.0	18.2	6.4	.....
10	5.4	18.4	6.0	11.5	6.1	15.2
11	4.4	15.9	4.6	10.9	5.2	14.0
12	4.6	18.2	8.6	12.7	6.5	16.9
13	2.5	13.9	8.2	9.7	6.0	11.1
14	3.3	13.3	4.7	8.6	3.9	11.1
15	4.4	9.4	7.7	10.4	5.2	9.4
16	2.9	11.3	6.9	10.4	3.9	9.0
17	3.2	7.8	6.6	9.4	3.6	6.3
19	13.1	23.3	.....	.....	.....	.....
20	10.3	48.0	15.1	17.9	9.1	23.0
21	6.3	18.9	7.6	11.9	6.1	18.1
22	4.0	15.3	.....	.....	.....	.....
23	4.0	18.4	11.6	14.9	.....	.....
24	3.5	9.5	5.4	10.4	5.8	13.9
25	3.0	9.1	8.2	7.0	6.4	8.4
26	5.5	10.6	5.7	8.9	4.2	11.4
27	1.9	8.9	6.6	7.1	7.5	.....
28	3.9	6.5	6.0	.....	.....	.....
29	1.4	6.4	3.1	4.2	4.1	7.2
30	2.3	7.1	4.0	9.4	.....	.....
31	3.3	14.2	4.2	7.4	.....	.....
32	4.5	9.5	4.0	10.1	6.0	10.9
33	3.1	6.0	3.9	7.1	6.9	13.6
35	.....	8.9	5.1	4.7	6.0	8.8
37	4.2	9.8	7.9	8.2	3.8	10.0
39	4.4	12.3	7.5	10.9	4.4	11.1
40	5.4	12.8	6.4	11.1	6.4	11.4
41	3.4	8.0	4.2	6.5	3.7	6.4

(Table 2. (Continued)

Orchard No. ¹	1972		1973		1974	
	July	Sept.	July	Sept.	July	Sept.
<i>ppm fluoride content, dry weight basis</i>						
42	5.9	9.5	3.6	7.2	5.2	12.7
43	4.0	7.0	3.2	6.5	3.7	9.1
44	3.4	7.2	5.0	7.2	3.7	9.1
45	3.9	8.1	6.2	7.7	5.7	11.0
46	3.1	7.1	4.2	4.1	3.4	6.0
48	3.9	16.0	9.4	15.5	8.1	14.4
49	5.0	15.0	3.9	7.0	5.9	.....
50	4.4	10.6	4.2	9.4	4.6	13.2
52	4.9	8.1	8.0	8.2	4.6	9.0
53	3.8	7.7	5.2	5.5	4.5	8.1
55	4.1	6.2	3.4	7.0	3.7	9.4
56	4.9	7.9	5.4	6.7	4.5	11.6
58	2.1	5.7	5.3	7.9	4.2	6.1
59	2.4	4.6	4.1	6.0	3.9	7.9
62	3.6	6.6	5.5	8.4	6.5	10.2
68	13.3	20.7	15.2	19.5	11.2	25.0
69	10.1	28.3	19.5	21.6	11.8	21.5
70	11.1	19.8	18.1	18.3	11.8	8.5
73	6.4	14.1	18.7	10.8	7.9	16.5
Average	4.8	12.5	7.1	9.8	5.8	11.8
Range	1.4-13.1	4.6-48.0	3.1-19.5	4.2-21.6	3.4-11.8	6.0-25.0

¹ See Figure 1 for location.

Table 3. Fluoride content of 'Bing' sweet cherry leaf samples (The Dalles, 1968-1971)

Orchard No. ¹	1968		1969		1970		1971	
	July	Sept.	July	Sept.	July	Sept.	July	Sept.
<i>ppm fluoride content, dry weight basis</i>								
101	6.5	13.3	6.5	14.3	11.1	14.6	3.6	12.5
102	8.3	18.3	7.1	9.3	13.3	16.5	4.6	14.8
103	7.2	9.4	3.0	20.4	7.3	12.3	2.5	10.3
105	4.7	14.7	2.8	6.7	6.3	5.3	4.2	8.3
106	4.7	9.5	3.5	13.3	5.6	9.6	4.9	8.7
108	7.6	12.0	1.0	9.8	8.6	12.0	3.3	12.5
109	4.0	10.8	4.1	6.7	3.2	8.4	3.1	9.5
110	10.4	11.7	10.7	19.2	11.0	24.0	6.5	22.0
112	9.5	9.9	1.5	13.3	12.4	10.5	2.4	9.7
113	3.8	9.4	3.3	13.7	6.5	9.2	3.4	7.5
114	4.4	15.8	3.0	7.4	6.7	13.2	3.7	11.6
115	4.9	9.6	1.8	9.2	1.6	5.9	2.5	7.6
117	10.1	10.0	10.8	16.9	12.6	16.3	6.3	15.9
Average	6.9	10.5	4.5	10.1	8.2	12.1	3.9	11.6
Range	3.8-11.3	5.1-23.2	1-12.5	3.7-20.4	1.6-12.6	5.3-24.0	2.4-6.5	7.5-22.0

¹ See Compton and others (1968) for location of the 'Bing' orchards.

Table 4. Fluoride content of 'Bing' sweet cherry leaf samples (The Dalles, 1972-1974)

Orchard No. ¹	1972		1973		1974	
	July	Sept.	July	Sept.	July	Sept.
ppm fluoride content, dry weight basis						
101	5.6	18.5	7.0	15.0	5.9	16.8
102	6.4	20.2	8.7	10.6	6.0	16.0
103	4.5	15.3	6.2	9.1	5.4	13.2
105	.....	8.9	6.5	8.0	5.2	7.8
106	2.4	8.7	5.0	7.6	4.4	9.5
108	6.7	11.4	7.0	9.6	9.1	14.0
109	3.5	10.3	4.7	9.6	6.1	11.4
110	13.7	20.2	13.6	19.7	12.9	26.6
112	4.9	12.2	3.5	7.5	3.9	7.7
113	4.5	9.4	5.1	10.1	4.7	12.9
114	6.1	17.3	7.4	10.5	6.5	12.6
115	2.7	6.3	5.0	6.2	4.0	8.7
117	11.1	16.9	17.9	18.0	14.6	21.3
Average	6.0	13.5	7.5	10.7	6.8	13.7
Range	2.7-13.7	6.3-20.2	3.5-17.9	6.2-19.7	3.9-14.6	7.7-26.6

¹ See Compton and others (1968) for location of the 'Bing' orchards.

were similar for the two cultivars. September values were lower than those taken prior to operation of the aluminum plant and also lower than those taken from 1963 through 1967. However, direct comparisons of the data are not possible because of two factors. First, prior to 1964 no mention was made in any reports of washing leaf samples before fluoride analysis (Compton et al., 1960, 1961, 1962, 1963, 1965). Some portion of the total amount of fluoride in leaves is generally adsorbed on the surface and is not toxic to plants (McCune et al., 1965). Results from 1953-1963 could be somewhat elevated because of surface contamination. Second, starting in approximately 1965, an irrigation district became operational in The Dalles. All leaf samples were taken at approximate head height within the zone wetted by sprinklers, and leaching of foliar fluorides could have occurred as has been reported (Brewer, 1969).

Surface contamination and leaching are important only to the actual absolute fluoride levels and not to any patterns of fluoride distribution resulting from distance to the aluminum plant or wind direction. Data from samples taken every year since 1958 showed that orchards in the SE-E sector, or downwind from the aluminum plant, had relatively high leaf fluoride levels (Tables 1-4) (Compton et al., 1968). Orchards close to the aluminum plant also had and continued to have elevated leaf fluoride levels (Tables 1-4) (Compton et al., 1968). We have attempted to construct a simple mathematical model involving distance and direction of the sample sites with respect to the aluminum plant. Annual growth

Table 5. Correlation coefficients for 'Royal Ann' cherry leaf fluoride levels versus absolute direction, distance, and direction from the aluminum reduction plant (The Dalles, Oregon)

Leaf ppm F, date	Absolute direction ¹	Direction ²	Distance ³
July 1968	+0.605	-0.016	-0.403
Sept. 1968	+0.380	-0.016	-0.430
July 1969	+0.201	-0.324	-0.155
Sept. 1969	+0.456	-0.167	-0.241
July 1970	+0.558	-0.077	-0.391
Sept. 1970	+0.512	-0.447	-0.053
July 1971	+0.056	-0.374	+0.137
Sept. 1971	+0.587	-0.170	-0.292
July 1972	+0.352	-0.501	-0.020
Sept. 1972	+0.559	-0.444	-0.015
July 1973	+0.563	-0.380	+0.013
Sept. 1973	+0.606	-0.101	-0.303
July 1974	+0.487	-0.380	-0.160
Sept. 1974	+0.499	-0.147	-0.406

¹ Absolute direction refers to 70 degrees (based on East = 0 degrees) as a baseline.

² Sample site values based on East = 0 degrees.

³ Straight-line distances from the aluminum reduction plant.

plotted against direction indicated an inflection point (maximum growth) at approximately 70 degrees (based on East = 0 degrees). This point (70 degrees) would normally be 160 degrees, but 0 degrees was set as being due East and not 90 degrees as in a compass. We used this imaginary radius line as a baseline and related each orchard site direction to this line, giving an absolute direction value for each site. Thus, in this model orchards downwind from the plant and orchards close to the plant had similar absolute direction values. Correlations of absolute direction versus leaf fluoride levels for the September and July leaf values in 1968-1974 were positive in all cases, showing that as the absolute direction increased leaf fluoride levels increased (Table 5). Only two of the fourteen correlations were not statistically significant. No such evidence either for slope or significance was found when samples taken prior to the operation of the aluminum plant (Compton et al., 1960) were treated in a similar manner. We interpret this model to mean that the environmental conditions, primarily wind direction in The Dalles area, and distance had an effect on the leaf fluoride levels. Since the SE-E sector is downwind from the aluminum plant, some atmospheric fluoride would be present even though the levels may be diluted because of the increased distance. The atmospheric measurements generally show this to be true (Tables 6-19). Orchards in a clockwise rotation from the 70 degree baseline (orchards with direction values greater than 70 degrees when East = 0 degrees) are closer to the plant and are also in an area that would be fumigated during periods of

inversion or calm conditions. On an entire seasonal basis, these two areas tend to be similar. During the spring and late summer, calm and inversion conditions occur more frequently than in other seasons (Hewson, Bates), and the area clockwise from the 70 degree line generally has higher atmospheric fluoride levels (Tables 6-19).

No relationship was found between leaf nitrogen, leaf fluoride, and percent fruit set for 1969 and 1970 (see Table 20 for nitrogen values, Tables 1 and 2 for leaf fluoride values, and Table 23 for percent fruit set).

Table 6. Weekly average and maximum day atmospheric fluoride levels at air sampling sites (The Dalles, April 1-Oct. 28, 1968)

Start	End	Sampler site ^a									
		J		M		D		F		P	
		Av./day	Max.	Av./day	Max.	Av./day	Max.	Av./day	Max.	Av./day	Max.
<i>Micrograms fluoride per cubic meter</i>											
4- 1	4- 8	0.51	2.47	0.21	1.00	0.28	1.30	0.08	0.37	0.03	0.27
4- 8	4-15	0.27	0.72	0.04	0.30	.....	.....	0	0	0	0
4-15	4-22	0	0	0	0	0	0	0	0	0	0
4-22	4-29	0	0	0	0	0	0	0	0	0	0
4-29	5- 6	0	0	0	0	.....	.....	.....	.....	.....	.....
5- 6	5-13	0.48	1.50	0.37	1.20	0.29	0.77	0.09	0.33	0.09	0.33
5-13	5-20	0.75	2.00	0.35	1.10	0.30	0.71	0.12	0.33	0.15	0.33
5-20	5-27	0.08	0.40	0	0	0	0	0	0	0	0
5-27	6- 3	0.25	0.76	0.24	0.68	0	0	0	0	0	0
6- 3	6-10	0	0	0	0	0	0	0	0	0	0
6-10	6-17	0	0	0	0	0	0	0	0	0	0
6-17	6-24	0	0	0	0	0	0	0	0	0	0
6-24	7- 1	0.60	2.30	0.38	1.40	0.26	0.87	0	0	0.21	1.50
7- 1	7- 8	0.47	1.30	0.08	0.57	0.23	0.61	0	0	0.06	0.41
7- 8	7-15	0	0	.....	0	0	0	0	0	0	0
7-15	7-22	0	0	.....	0	0	0	0	0	0	0
7-22	7-29	0.43	1.60	0.79	0.90	0	0	0	0	0	0
7-29	8- 5	0.63	2.50	0.35	1.10	0.29	0.80	0	0	0	0
8- 5	8-12	0.83	4.30	0.40	1.30	0	0	0	0	0	0
8-12	8-19	0	0	0	0	0	0	0	0	0	0
8-19	8-26	0	0	0	0	0	0	0	0	0	0
8-26	9- 2	1.01	2.70	0.52	1.40	0.24	0.75	0	0	0	0
9- 2	9- 9	0.93	3.10	0.35	1.20	0.25	0.71	0	0	0	0
9- 9	9-16	.....	0	0	0	0	0	0	0	0	0
9-16	9-23	0.07	0.47	0	0	0	0	0	0	0	0
9-23	9-30	1.18	3.40	0.96	2.70	0.59	1.60	0.20	0.78	0	0
9-30	10- 7	1.81	5.60	1.22	4.00	0.22	0.94	0	0	0	0
10- 7	10-14	0.94	1.70	0.36	0.87	0.50	1.30	0.14	0.97	0	0
10-14	10-21	1.62	2.20	0.74	2.40	0.63	1.60	0.19	1.30	.....	.....
10-21	10-28	2.57	3.50	1.50	3.20	0.99	1.80	.....	.....	.....	.....

Table 6. (Continued)

Sampler site ¹											
		W		R		K		H		G	
Start	End	Av./ day	Max.	Av./ day	Max.	Av./ day	Max.	Av./ day	Max.	Av./ day	Max.
<i>Micrograms fluoride per cubic meter</i>											
4- 1	4- 8	0	0	0	0	0	.....	0	0	0.06	0.45
4- 8	4-15	.....	.....	.....	.....	0	0	0	0	0	0
4-15	4-22	0	0	0	0	0	0	0	0	0	0
4-22	4-29	0	0	0	0	0	0	0	0	0	0
4-29	5- 6	0	0	0	0	0	0	0	0	.....	.....
5- 6	5-13	0.12	0.36	0	0	0	0	0.09	0.16	0.20	0.32
5-13	5-20	0.13	0.26	0	0	0.06	0.17	0.15	0.32	0.27	0.44
5-20	5-27	0	0	0	0	0	0	0	0	0.05	0.19
5-27	6- 3	0.09	0.66	0	0	0	0	0	0	0.30	0.55
6- 3	6-10	0	0	0	0	0	0	0	0	.....	.....
6-10	6-17	0.11	0.74	0	0	0	0	0.07	0.26	.....	.....
6-17	6-24	0	0	0	0	0	0	0	0	0.16	0.47
6-24	7- 1	0	0	0	0	0	0	0	0	0.15	0.40
7- 1	7- 8	0	0	0.14	1.00	0	0	.....	.....	0.14	0.50
7- 8	7-15	0	0	0.08	0.59	0	0	.....	.....	0.09	0.41
7-15	7-22	0.21	0.77	0	0	0	0	.....	.....	0	0
7-22	7-29	0.14	0.33	0	0	0	0	.....	.....	0.13	0.94
7-29	8- 5	0.06	0.19	0	0	0	0	.....	.....	0.29	0.83
8- 5	8-12	.....	.....	0	0	0	0	.....	.....	0.21	0.50
8-12	8-19	.....	.....	0	0	0	0	.....	.....	0.06	0.44
8-19	8-26	.....	.....	0	0	0	0	.....	.....	.....	.....
8-26	9- 2	.....	.....	0	0	0	0	.....	.....	0.17	0.73
9- 2	9- 9	.....	.....	0	0	0	0	.....	.....	0.27	0.77
9- 9	9-16	.....	.....	0	0	0	0	.....	.....	0	0
9-16	9-23	.....	.....	0	0	0	0	.....	.....	0	0
9-23	9-30	.....	.....	0	0	0	0	.....	.....	0.25	0.55
9-30	10- 7	.....	.....	0	0	0	0	.....	.....	0.16	0.51
10- 7	10-14	.....	.....	0	0	0	0	.....	.....	0.09	0.62
10-14	10-21	.....	.....	.....	.....	0.28	1.20	.....	.....	0.36	0.98
10-21	10-28	.....	.....	.....	.....	1.96	3.20	.....	.....	0.49	0.98

¹ See Figure 1 for sampler location. Automatic air sampler values, total fluorides; zero values were below detectable limit.

Table 7. Weekly average and maximum day atmospheric fluoride levels at air sampling sites
 (The Dalles, April 1 to Aug. 31, 1969)

		Sampler site ¹									
Start	End	J		M		D		F		P	
		Av./day	Max.	Av./day	Max.	Av./day	Max.	Av./day	Max.	Av./day	Max.
<i>Micrograms fluoride per cubic meter</i>											
4- 1	4- 8	0.65	4.00	0.29	1.55	0.28	0.81	0	0	0.12	0.52
4- 8	4-15	1.07	5.15	0.68	2.92	0	0	0	0	0	0
4-15	4-22	0.38	1.52	0.12	0.85	0	0	0	0	0	0
4-22	4-29	0.46	2.50	0.43	1.10	0	0	0	0	0	0
4-29	5- 6	0.22	0.60	0.08	0.55	0.26	1.00	0	0	0.13	0.55
5- 6	5-13	1.58	3.60	0.81	2.20	1.03	1.80	0.60	0.80	0.34	0.45
5-13	5-20	0.40	0.97	0.09	0.28	0.18	0.66	0.11	0.80	0	0
5-20	5-27	0.91	3.10	0.28	0.74	0.45	1.20	0	0	0	0
5-27	6- 3	0.66	2.50	0.15	0.65	0.20	1.40	0	0	0	0
6- 3	6-10	0.39	1.70	0.08	0.45	0.16	0.68	0.08	0.57	0	0
6-10	6-17	0.80	2.30	0.07	0.46	0.31	0.73	0	0	0	0
6-17	6-24	0	0	0.08	0.56	.....	.....	0	0	0	0
6-24	7- 1	0.10	0.74	0.07	0.50	0.16	1.10	0	0	0	0
7- 1	7- 8	0.46	2.60	0	0	.....	.....	0	0	0	0
7- 8	7-15	0.09	0.65	0.04	0.29	.....	.....	0	0	0	0
7-15	7-22	0.15	0.58	0.14	0.57	.....	.....	0	0	.....	.....
7-22	7-29	0.55	2.33	0.54	1.87	.....	.....	0.05	0.38	.....	.....
7-29	8- 5	0	0	0.11	0.42	.....	.....	0	0	.....	.....
8- 5	8-12	.....	.....	0.08	0.56	.....	.....	0	0	.....	.....
8-12	8-19	.....	.....	0.21	0.57	.....	.....	0	0	.....	.....
8-19	8-26	0.49	1.37	0.24	0.67	.....	.....	0	0	.....	.....
8-26	8-31	0.40	2.45	0.32	1.50	.....	.....	0	0	.....	.....
R											
		R		K		H		G			
4- 1	4- 8	0.05	0.33	0.06	0.44	0	0	0	0	0	0
4- 8	4-15	0	0	0	0	0	0	0	0	0	0
4-15	4-22	0	0	0	0	0.09	0.60	.....	.....	.....	.....
4-22	4-29	0.40	1.50	0	0	0	0	0	0	0	0
4-29	5- 6	0.39	1.30	0.36	1.75	0.11	0.80	0.09	0.65	.....	.....
5- 6	5-13	0.11	0.40	0.16	0.65	0.37	0.81	0.17	0.67	.....	.....
5-13	5-20	0.06	0.40	0	0	0.14	0.66	0.31	0.76	.....	.....
5-20	5-27	0	0	0.07	0.48	0	0	0.08	0.59	.....	.....
5-27	6- 3	0	0	0.07	0.47	0	0	0	0	0	0
6- 3	6-10	0.08	0.56	0.07	0.49	.....	.....	0.09	0.60	.....	.....
6-10	6-17	0	0	0	0	0	0	0.06	0.40	.....	.....
6-17	6-24	0	0	0	0	.....	.....	0.30	0.65	.....	.....
6-24	7- 1	0	0	0	0	0	0	0	0	0	0

Table 7. (Continued)

Sampler site ¹										
Start	End	R		K		H		G		
		Av./day	Max.	Av./day	Max.	Av./day	Max.	Av./day	Max.	
<i>Micrograms fluoride per cubic meter</i>										
7- 1	7- 8	0	0	0	0	0	0	0	0	0
7- 8	7-15	0	0	0	0	0	0	0.28	0.66	
7-15	7-22	.....	.....	0	0	0	0	0.06	0.44	
7-22	7-29	.....	.....	0	0	0.06	0.45	0.07	0.47	
7-29	8- 5	.....	.....	0	0	0	0	0	0	
8- 5	8-12	.....	.....	0	0	0	0	0	0	
8-12	8-19	.....	.....	0	0	0	0	0.07	0.46	
8-19	8-26	.....	.....	0	0	0	0	0	0	
8-26	8-31	.....	.....	0	0	0	0	0	0	

¹ See Figure 1 for sampler location. Automatic air sampler values, total fluorides; zero values were below detectable limit.

Table 8. Weekly average and maximum day atmospheric fluoride levels as measured by the automatic air sampler and double paper gas/particulate separator sampler (The Dalles, 1970)¹

Start	End	AA ²	Max.	DP-G ^a	Max.	DP-P ^b	Max.	DP-T ^c	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler Site J									
4- 1	4- 8	0	0	0.18	0.43	0.09	0.23	0.26	0.65
4- 8	4-15	0.21	0.85	0.23	0.54	0.15	0.59	0.38	1.12
4-15	4-22	0.26	0.91	0.22	0.66	0.14	0.63	0.35	1.28
4-22	4-29	0	0	0.11	0.29	0.07	0.27	0.17	0.57
4-29	5- 6	.....	.....	0.32	1.49	0.30	1.74	0.63	3.23
5- 6	5-13	0	0	0.06	0.18	0.02	0.09	0.08	0.27
5-13	5-20	0.61	1.83	0.32	0.81	0.24	0.66	0.56	1.47
5-20	5-27	0.26	0.53	0.15	0.60	0.14	0.66	0.29	1.26
5-27	6- 3	.....	.....	0.18	0.86	0.20	0.69	0.38	1.51
6- 3	6-10	1.17	0.86	0.16	0.35	0.13	0.38	0.29	0.73
6-10	6-17	0	0	0.05	0.13	0.02	0.05	0.07	0.18
6-17	6-24	0.44	0.86	0.22	0.41	0.14	0.39	0.36	0.60
6-24	7- 1	0.08	0.28	0.11	0.32	0.05	0.13	0.15	0.45
7- 1	7- 8	0.39	0.68	0.18	0.35	0.10	0.21	0.28	0.51
7- 8	7-15	0.25	1.72	0.18	0.80	0.08	0.38	0.26	1.18
7-15	7-22	0.19	0.60	0.12	0.30	0.03	0.08	0.15	0.37
7-22	7-29	0.06	0.45	0.07	0.20	0.02	0.07	0.08	0.27
7-29	8- 5	0.11	0.41	0.10	0.17	0.03	0.05	0.12	0.22
8- 5	8-12	0.35	1.54	0.16	0.64	0.11	0.55	0.27	1.19
8-12	8-19	0.86	4.90	0.35	1.86	0.32	1.98	0.68	3.84
8-19	8-26	0.30	1.00	0.19	0.53	0.06	0.19	0.25	0.72
8-26	9- 2	0.20	1.10	0.15	0.55	0.07	0.40	0.22	.....

Table 8. (Continued)

Start	End	AA ²	Max.	DP-C ³	Max.	DP-P ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler	Site Y								
4- 1	4- 8	0	0	0.12	0.34	0.06	0.24	0.18	0.58
4- 8	4-15	0	0	0.14	0.31	0.07	0.12	0.21	0.41
4-15	4-22	0	0	0.09	0.13	0.05	0.09	0.14	0.22
4-22	4-29	0	0	0.07	0.13	0.03	0.06	0.10	0.19
4-29	5- 6	0	0	0.13	0.19	0.10	0.23	0.23	0.42
5- 6	5-13	0	0	0.04	0.07	0.01	0.03	0.05	0.09
5-13	5-20	0.04	0.31	0.09	0.14	0.06	0.11	0.15	0.25
5-20	5-27	0.05	0.38	0.05	0.09	0.06	0.14	0.11	0.21
5-27	6- 3	0.17	0.49	0.18	0.52	0.11	0.26	0.29	0.70
6- 3	6-10	0.04	0.31	0.05	0.10	0.07	0.32	0.12	0.42
6-10	6-17	0	0	0.04	0.07	0.02	0.04	0.06	0.11
6-17	6-24	0.04	0.32	0.12	0.16	0.10	0.21	0.22	0.35
6-24	7- 1	0.05	0.19	0.08	0.20	0.04	0.08	0.12	0.28
7- 1	7- 8	0.03	0.21	0.08	0.14	0.09	0.21	0.17	0.25
7- 8	7-15	0.06	0.44	0.08	0.14	0.05	0.09	0.13	0.19
7-15	7-22	0.04	0.27	0.06	0.14	0.03	0.08	0.09	0.19
7-22	7-29	0	0	0.05	0.14	0.02	0.05	0.07	0.19
7-29	8- 5	0.02	0.12	0.07	0.11	0.03	0.04	0.10	0.15
8- 5	8-12	0	0	0.05	0.12	0.03	0.09	0.08	0.21
8-12	8-19	0.09	0.34	0.07	0.22	0.07	0.27	0.14	0.49
8-19	8-26	0.05	0.37	0.10	0.21	0.03	0.08	0.13	0.26
8-26	9- 2	0.06	0.44	0.08	0.20	0.02	0.10	0.10	0.30
Sampler	Site M								
4- 1	4- 8	0.10	0.71	0.15	0.42	0.07	0.21	0.22	0.63
4- 8	4-15	0	0	0.23	0.54	0.15	0.48	0.38	0.84
4-15	4-22	0.09	0.65	0.15	0.39	0.10	0.47	0.25	0.86
4-22	4-29	0	0	0.10	0.22	0.06	0.17	0.16	0.39
4-29	5- 6	0.33	1.68	0.19	0.65	0.23	1.13	0.43	1.78
5- 6	5-13	0	0	0.06	0.12	0.02	0.05	0.08	0.17
5-13	5-20	0.06	0.45	0.24	0.55	0.18	0.51	0.42	1.01
5-20	5-27	0.19	0.96	0.11	0.29	0.14	0.74	0.25	1.16
5-27	6- 3	1.23	3.96	0.59	2.25	0.49	1.23	1.08	3.48
6- 3	6-10	0.15	0.63	0.12	0.22	0.08	0.15	0.20	0.51
6-10	6-17	0	0	0.06	0.13	0.02	0.07	0.08	0.20
6-17	6-24	0.37	0.74	0.22	0.42	0.13	0.30	0.36	0.62
6-24	7- 1	0.12	0.44	0.12	0.24	0.06	0.14	0.18	0.37
7- 1	7- 8	0.30	0.67	0.13	0.22	0.06	0.16	0.18	0.38
7- 8	7-15	0.08	0.30	0.16	0.62	0.07	0.28	0.68	0.90
7-15	7-22	0.06	0.41	0.09	0.23	0.03	0.07	0.12	0.28
7-22	7-29	0.04	0.31	0.07	0.21	0.02	0.08	0.08	0.29
7-29	8- 5	0.06	0.43	.....	.....	.....	.....	.....	.....
8- 5	8-12	.....	.....	0.11	0.33	0.06	0.26	0.17	0.67
8-12	8-19	.....	.....	0.30	1.44	0.27	1.55	0.57	2.99
8-19	8-26	0.20	0.54	0.14	0.28	0.04	0.10	0.24	0.33
8-26	9- 2	0.16	0.78	0.10	0.31	0.04	0.16	0.26	0.47

Table 8. (Continued)

Start	End	AA ²	Max.	DP-G ³	Max.	DP-P ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler	Site D								
4- 1	4- 8	0.19	0.68	0.16	0.32	0.10	0.22	0.26	0.54
4- 8	4-15	0.12	0.87	0.18	0.42	0.13	0.55	0.32	0.95
4-15	4-22	0	0	0.16	0.43	0.07	0.34	0.23	0.77
4-22	4-29	0	0	0.08	0.15	0.03	0.10	0.11	0.25
4-29	5- 6	0.22	0.98	0.18	0.57	0.24	1.21	0.42	1.78
5- 6	5-13	0.08	0.58	0.07	0.17	0.02	0.09	0.10	0.25
5-13	5-20	0.37	1.11	0.21	0.50	0.17	0.59	0.34	0.94
5-20	5-27	0.17	0.74	0.11	0.32	0.09	0.44	0.18	0.66
5-27	6- 3	0.90	2.06	0.41	0.97	0.25	0.46	0.42	0.94
6- 3	6-10	0.24	0.93	0.14	0.34	0.10	0.30	0.22	0.90
6-10	6-17	0	0	0.04	0.09	0.01	0.05	0.06	0.14
6-17	6-24	0.43	0.90	0.04	0.05	0.08	0.09	0.26	0.43
6-24	7- 1	0.12	0.47	0.08	0.20	0.04	0.10	0.12	0.27
7- 1	7- 8	0.35	0.91	0.16	0.31	0.09	0.23	0.20	0.40
7- 8	7-15	0.09	0.62	0.14	0.35	0.06	0.21	0.14	0.39
7-15	7-22	0.06	0.43	0.08	0.21	0.03	0.08	0.10	0.24
7-22	7-29	0	0	0.06	0.17	0.02	0.06	0.08	0.22
7-29	8- 5	0	0	0.07	0.12	0.02	0.05	0.10	0.16
8- 5	8-12	0.18	0.82	0.11	0.36	0.06	0.30	0.12	0.41
8-12	8-19	0.23	1.10	0.12	0.46	0.09	0.41	0.18	0.56
8-19	8-26	0.18	0.47	0.15	0.31	0.04	0.08	0.18	0.37
8-26	9- 2	0.16	0.71	0.12	0.35	0.06	0.27	0.14	0.49
Sampler	Site E								
4- 1	4- 8	0.09	0.64	0.18	0.35	0.11	0.22	0.29	0.57
4- 8	4-15	0.21	0.78	0.21	0.56	0.19	0.88	0.40	1.44
4-15	4-22	0	0	0.14	0.37	0.07	0.39	0.22	0.76
4-22	4-29	0	0	0.08	0.14	0.03	0.09	0.11	0.23
4-29	5- 6	0	0	0.17	0.57	0.16	0.78	0.33	1.35
5- 6	5-13	0.08	0.58	0.07	0.17	0.02	0.09	0.09	0.26
5-13	5-20	0.27	1.11	0.21	0.50	0.17	0.59	0.38	1.00
5-20	5-27	0.17	0.74	0.11	0.32	0.09	0.44	0.21	0.76
5-27	6- 3	0.90	2.06	0.41	0.97	0.25	0.46	0.66	1.41
6- 3	6-10	0.24	0.93	0.14	0.34	0.10	0.30	0.24	0.64
6-10	6-17	0	0	0.05	0.09	0.02	0.05	0.07	0.14
6-17	6-24	0.43	0.90	.....	.....	.....	.....	.....	.....
6-24	7- 1	0.12	0.47	0.08	0.20	0.04	0.10	0.12	0.80
7- 1	7- 8	0.35	0.91	0.16	0.31	0.09	0.23	0.25	0.54
7- 8	7-15	0.09	0.62	0.14	0.35	0.06	0.21	0.20	0.56
7-15	7-22	0.06	0.43	0.08	0.21	0.03	0.08	0.11	0.27
7-22	7-29	0	0	0.06	0.17	0.02	0.06	0.08	0.23
7-29	8- 5	0	0	0.07	0.12	0.02	0.05	0.09	0.16
8- 5	8-12	0.18	0.82	0.11	0.36	0.06	0.30	0.17	0.66
8-12	8-19	0.23	1.10	0.12	0.46	0.09	0.41	0.21	0.87
8-19	8-26	0.18	0.47	0.15	0.31	0.04	0.08	0.19	0.38
8-26	9- 2	0.16	0.71	0.12	0.35	0.06	0.27	0.18	0.62

Table 8. (Continued)

Start	End	AA ²	Max.	DP-G ³	Max.	DP-P ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler	Site K								
4- 1	4- 8	0	0	0.09	0.18	0.05	0.13	0.14	0.31
4- 8	4-15	0	0	0.10	0.24	0.07	0.15	0.17	0.39
4-15	4-22	0	0	0.05	0.18	0.02	0.10	0.07	0.28
4-22	4-29	0	0	0.05	0.09	0.02	0.04	0.07	0.13
4-29	5- 6	0	0	0.08	0.12	0.06	0.12	0.14	0.24
5- 6	5-13	0	0	0.04	0.07	0.02	0.04	0.06	0.11
5-13	5-20	0.07	0.46	0.09	0.12	0.04	0.07	0.13	0.17
5-20	5-27	0.05	0.33	0.05	0.09	0.05	0.17	0.10	0.23
5-27	6- 3	0.04	0.31	0.04	0.06	0.06	0.16	0.10	0.20
6- 3	6-10	0.12	0.53	0.06	0.08	0.11	0.31	0.17	0.39
6-10	6-17	0.09	0.34	0.03	0.04	0.02	0.06	0.05	0.08
6-17	6-24	0	0	0.06	0.08	0.10	0.15	0.16	0.18
6-24	7- 1	0	0	0.02	0.04	0.02	0.04	0.04	0.08
7- 1	7- 8	0.04	0.31	0.05	0.06	0.06	0.09	0.11	0.14
7- 8	7-15	0.04	0.31	0.06	0.10	0.04	0.08	0.10	0.18
7-15	7-22	0	0	0.06	0.09	0.03	0.04	0.09	0.13
7-22	7-29	0	0	0.04	0.08	0.02	0.03	0.06	0.11
7-29	8- 5	0	0	.....	.....	.....	.....	.....	.....
8- 5	8-12	0	0	.....	.....	.....	.....	.....	.....
8-12	8-19	0.05	0.34	.....	.....	.....	.....	.....	.....
8-19	8-26	0.05	0.35	0.05	0.17	0.01	0.05	0.06	0.22
8-26	9- 2	0	0	0.05	0.11	0.02	0.03	0.07	0.11
Sampler	Site G								
4- 1	4- 8	0	0	0.18	0.29	0.12	0.19	0.30	0.43
4- 8	4-15	0	0	0.16	0.47	0.10	0.24	0.26	0.71
4-15	4-22	0	0	0.11	0.25	0.05	0.16	0.16	0.41
4-22	4-29	0	0	0.12	0.17	0.08	0.10	0.20	0.25
4-29	5- 6	0	0	0.14	0.27	0.12	0.25	0.26	0.52
5- 6	5-13	0	0	0.11	0.18	0.06	0.08	0.17	0.26
5-13	5-20	0.15	0.55	0.10	0.18	0.07	0.16	0.17	0.32
5-20	5-27	0.09	0.64	0.11	0.20	0.10	0.23	0.21	0.38
5-27	6- 3	0	0	0.03	0.13	0.09	0.32	0.17	0.41
6-3	6-10	0	0	0.08	0.11	0.09	0.24	0.17	0.33
6-10	6-17	0.21	0.40	0.06	0.15	0.04	0.07	0.10	0.20
6-17	6-24	0.17	0.47	0.12	0.15	0.10	0.13	0.22	0.25
6-24	7- 1	0.05	0.35	0.09	0.18	0.06	0.16	0.15	0.34
7- 1	7- 8	0.06	0.42	0.12	0.15	0.07	0.10	0.19	0.25
7- 8	7-15	0.06	0.40	0.11	0.19	0.06	0.10	0.17	0.29
7-15	7-22	0	0	0.12	0.18	0.06	0.11	0.18	0.29
7-22	7-29	0	0	0.11	0.16	0.04	0.05	0.15	0.21
7-29	8- 5	0.06	0.38	0.11	0.14	0.05	0.08	0.16	0.19
8- 5	8-12	0.06	0.38	0.09	0.12	0.07	0.15	0.16	0.27
8-12	8-19	0.08	0.54	0.08	0.16	0.09	0.14	0.17	0.30
8-19	8-26	0	0	0.09	0.45	0.04	0.16	0.13	0.61
8-26	9- 2	0.08	0.55	0.11	0.15	0.04	0.05	0.15	0.20

Table 8. (Continued)

Start	End	AA ²	Max.	DP-G ³	Max.	DP-P ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler	Site H								
4- 1	4- 8	0	0	0.10	0.17	0.06	0.14	0.16	0.31
4- 8	4-15	0	0	0.12	0.28	0.09	0.17	0.21	0.45
4-15	4-22	0	0	0.07	0.16	0.03	0.10	0.10	0.25
4-22	4-29	0	0	0.07	0.11	0.03	0.05	0.10	0.16
4-29	5- 6	0	0	0.03	0.12	0.06	0.08	0.14	0.24
5- 6	5-13	0	0	0.03	0.06	0.02	0.06	0.05	0.12
5-13	5-20	0.11	0.39	0.07	0.13	0.04	0.08	0.11	0.21
5-20	5-27	0	0	0.05	0.13	0.05	0.13	0.10	0.20
5-27	6- 3	0	0	0.05	0.06	0.08	0.27	0.13	0.32
6- 3	6-10	0	0	0.06	0.10	0.10	0.26	0.16	0.36
6-10	6-17	0	0	0.04	0.06	0.04	0.06	0.08	0.12
6-17	6-24	0	0	0.11	0.15	0.13	0.26	0.24	0.29
6-24	7- 1	0.05	0.38	0.06	0.14	0.05	0.13	0.11	0.27
7- 1	7- 8	0.05	0.36	0.10	0.13	0.06	0.07	0.16	0.20
7- 8	7-15	0	0	0.08	0.19	0.04	0.05	0.12	0.24
7-15	7-22	0	0	0.05	0.07	0.05	0.11	0.10	0.17
7-22	7-29	0	0	0.04	0.10	0.03	0.06	0.08	0.16
7-29	8- 5	0	0	0.07	0.10	0.04	0.09	0.11	0.16
8- 5	8-12	0	0	0.06	0.12	0.03	0.07	0.09	0.19
8-12	8-19	0	0	0.07	0.12	0.05	0.11	0.11	0.23
8-19	8-26	0.05	0.36	0.11	0.25	0.03	0.08	0.14	0.33
8-26	9- 2	0	0	0.06	0.13	0.03	0.05	0.09	0.17
Sampler	Site R								
4- 1	4- 8	0	0	0.08	0.17	0.04	0.13	0.12	0.30
4- 8	4-15	0	0	0.08	0.15	0.05	0.08	0.12	0.21
4-15	4-22	0	0	0.05	0.09	0.02	0.05	0.07	0.13
4-22	4-29	0	0	0.05	0.08	0.02	0.04	0.06	0.12
4-29	5- 6	0	0	0.07	0.08	0.05	0.08	0.11	0.16
5- 6	5-13	0	0	0.03	0.05	0.02	0.07	0.05	0.10
5-13	5-20	0	0	0.08	0.12	0.04	0.07	0.12	0.19
5-20	5-27	0	0	0.05	0.10	0.06	0.14	0.11	0.18
5-27	6- 3	0	0	0.03	0.04	0.04	0.11	0.07	0.13
6- 3	6-10	0	0	0.04	0.05	0.05	0.18	0.09	0.23
6-10	6-17	0	0	0.02	0.04	0.02	0.06	0.04	0.09
6-17	6-24	0	0	0.07	0.09	0.06	0.09	0.13	0.16
6-24	7- 1	0	0	0.05	0.10	0.03	0.07	0.08	0.15
7- 1	7- 8	0	0	0.05	0.06	0.03	0.04	0.08	0.09
7- 8	7-15	0	0	0.05	0.07	0.04	0.08	0.09	0.15
7-15	7-22	0	0	0.05	0.07	0.03	0.05	0.08	0.12
7-22	7-29	0	0	0.04	0.08	0.01	0.03	0.05	0.11
7-29	8- 5	0	0	0.05	0.06	0.02	0.04	0.07	0.10
8- 5	8-12	0	0	0.03	0.06	0.01	0.03	0.04	0.08
8-12	8-19	0	0	0.05	0.10	0.03	0.05	0.08	0.15
8-19	8-26	0	0	0.05	0.09	0.03	0.08	0.08	0.16
8-26	9- 2	0	0	0.04	0.08	0.01	0.04	0.05	0.12

Table 8. (Continued)

Start	End	AA ²	Max.	DP-G ³	Max.	DP-P ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler	Site P								
4- 1	4- 8	0	0	.....	.....	.....	.....	.....	.....
4- 8	4-15	0	0	.....	.....	.....	.....	.....	.....
4-15	4-22	0	0	.....	.....	.....	.....	.....	.....
4-22	4-29	0	0	.....	.....	.....	.....	.....	.....
4-29	5- 6	0	0	.....	.....	.....	.....	.....	.....
5- 6	5-13	0	0	.....	.....	.....	.....	.....	.....
5-13	5-20	0	0	.....	.....	.....	.....	.....	.....
5-20	5-27	0	0	.....	.....	.....	.....	.....	.....
5-27	6- 3	0.11	0.42	.....	.....	.....	.....	.....	.....
6- 3	6-10	0	0	.....	.....	.....	.....	.....	.....
6-10	6-17	0	0	.....	.....	.....	.....	.....	.....
6-17	6-24	0.05	0.33	.....	.....	.....	.....	.....	.....
6-24	7- 1	0	0	.....	.....	.....	.....	.....	.....
7- 1	7- 8	0	0	.....	.....	.....	.....	.....	.....
7- 8	7-15	0	0	.....	.....	.....	.....	.....	.....
7-15	7-22	0	0	.....	.....	.....	.....	.....	.....
7-22	7-29	0	0	.....	.....	.....	.....	.....	.....
7-29	8- 5	0	0	.....	.....	.....	.....	.....	.....
8- 5	8-12	0	0	.....	.....	.....	.....	.....	.....
8-12	8-19	0.05	0.37	.....	.....	.....	.....	.....	.....
8-19	8-26	0	0	.....	.....	.....	.....	.....	.....
8-26	9- 2	0	0	.....	.....	.....	.....	.....	.....

¹ See Figure 1 for location of sampling site.² Automatic air sampler; zero values were below detectable limit.³ Double paper sampler, gas value.⁴ Double paper sampler, particulate value.⁵ Double paper sampler, total value.Table 9. Weekly average and maximum day atmospheric fluoride levels as measured by the automatic air sampler and double paper gas/particulate separator sampler (The Dalles, 1971)¹

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler	Site J								
4- 1	4- 8	1.40	4.39	0.82	2.80	0.28	0.72	1.10	3.44
4- 8	4-15	0.20	2.10	0.25	1.38	0.12	0.49	0.38	1.71
4-15	4-22	0.28	2.46	0.06	0.62	0.06	0.40	0.12	1.02
4-22	4-29	0.18	1.77	0.19	1.34	0.12	0.53	0.30	1.71
4-29	5- 6	0.53	2.48	0.20	1.08	0.12	0.45	0.33	1.48
5- 6	5-13	1.54	7.41	0.82	4.12	0.33	1.12	1.15	5.24
5-13	5-20	0	T ⁶	0.02	0.06	0.05	0.10	0.07	0.15
5-20	5-27	0	T	0.03	0.06	0.07	0.16	0.10	0.22
5-27	6- 3	0.04	0.30	0.01	0.03	0.03	0.08	0.05	0.11
6- 3	6-10	0	T	0.02	0.05	0.04	0.07	0.06	0.10
6-10	6-17	0	T	0.01	0.02	0.03	0.05	0.04	0.06
6-17	6-24	0.16	0.74	0.10	0.43	0.09	0.16	0.19	0.56

Table 9. (Continued)

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁶	Max.
<i>Micrograms fluoride per cubic meter</i>									
6-24	7- 1	0.18	0.72	0.06	0.18	0.10	0.27	0.16	0.45
7- 1	7- 8	0.23	1.34	0.10	0.55	0.09	0.31	0.20	0.86
7- 8	7-15	0.42	2.24	0.21	1.16	0.14	0.55	0.35	1.71
7-15	7-22	0.87	1.41	0.30	0.59	0.28	0.51	0.58	1.02
7-22	7-29	1.42	4.69	0.29	1.33	0.41	1.27	0.71	2.60
7-29	8- 5	0.33	0.84	0.09	0.25	0.16	0.32	0.25	0.51
8- 5	8-12	0.46	1.08	0.23	0.44	0.30	0.64	0.53	1.03
Sampler		Site D							
4- 1	4- 8	0.41	1.25	0.29	1.47	0.20	0.80	0.48	2.27
4- 8	4-15	0	T	0.09	0.54	0.10	0.46	0.18	1.00
4-15	4-22	0	T	0.22	0.04	0.36	0.06	0.10	0.58
4-22	4-29	0.03	0.47	0.12	0.20	0.05	0.08	0.16	0.26
4-29	5- 6	0.07	1.90	0.16	0.73	0.15	0.61	0.30	1.34
5- 6	5-13	0	T	0.22	1.06	0.20	0.73	0.42	1.79
5-13	5-20	0	T	0.02	0.03	0.04	0.14	0.06	0.17
5-20	5-27	0	T	0.04	0.07	0.06	0.10	0.10	0.16
5-27	6- 3	0	T	0.01	0.03	0.04	0.09	0.05	0.12
6- 3	6-10	0	T	0.04	0.15	0.05	0.09	0.09	0.17
6-10	6-17	0	T	0.02	0.02	0.03	0.05	0.05	0.07
6-17	6-24	0.05	0.38	0.09	0.23	0.11	0.19	0.19	0.33
6-24	7- 1	0.06	0.41	0.04	0.15	0.06	0.17	0.10	0.32
7- 1	7- 8	0	T	0.03	0.09	0.05	0.07	0.08	0.14
7- 8	7-15	0.09	0.62	0.05	0.23	0.07	0.19	0.12	0.42
7-15	7-22	0.33	0.61	0.12	0.16	0.15	0.24	0.27	0.38
7-22	7-29	0.33	1.25	0.15	0.49	0.20	0.53	0.35	1.02
7-29	8- 5	0.19	0.50	0.05	0.14	0.14	0.37	0.19	0.48
8- 5	8-12	0.19	0.38	0.12	0.23	0.15	0.24	0.27	0.47
Sampler		Site E							
4- 1	4- 8	0.57	1.75	0.35	1.38	0.14	0.77	0.48	2.15
4- 8	4-15	0.13	1.76	0.16	0.69	0.11	0.59	0.26	2.28
4-15	4-22	0.18	1.70	0.05	0.44	0.06	0.38	0.12	0.82
4-22	4-29	0.29	2.46	0.14	1.69	0.09	0.58	0.22	2.27
4-29	5- 6	0.15	1.34	0.15	0.87	0.13	0.71	0.28	1.58
5- 6	5-13	0.54	2.63	0.35	1.69	0.17	0.44	0.52	2.13
5-13	5-20	0	T	0.02	0.06	0.04	0.08	0.06	0.14
5-20	5-27	0	T	0.03	0.09	0.07	0.18	0.10	0.27
5-27	6- 3	0	T	0.01	0.04	0.05	0.11	0.06	0.15
6- 3	6-10	0	T	0.02	0.06	0.05	0.08	0.08	0.14
6-10	6-17	0	T	0.02	0.03	0.04	0.06	0.06	0.09
6-17	6-24	0.09	0.38	0.10	0.35	0.12	0.18	0.21	0.50
6-24	7- 1	0.06	0.44	0.07	0.16	0.09	0.24	0.16	0.48
7- 1	7- 8	0.06	0.41	0.05	0.13	0.07	0.15	0.12	0.28
7- 8	7-15	0.14	0.98	0.16	0.70	0.16	0.51	0.32	1.21
7-15	7-22	0.34	0.49	0.27	0.39	0.28	0.52	0.55	0.88
7-22	7-29	0.68	1.87	0.24	0.77	0.39	1.02	0.63	1.79
7-29	8- 5	0.23	0.63	0.08	0.20	0.13	0.35	0.21	0.51
8- 5	8-12	0.23	0.87	0.14	0.32	0.17	0.27	0.31	0.59

Table 9. (Continued)

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler	Site G								
4- 1	4- 8	0.15	0.39	0.14	0.32	0.06	0.23	0.30	0.49
4- 8	4-15	0.17	2.86	0.07	0.26	0.06	0.19	0.13	0.34
4-15	4-22	0.19	1.89	0.05	0.20	0.04	0.10	0.09	0.26
4-22	4-29	0.07	1.86	0.07	0.22	0.08	0.18	0.15	0.36
4-29	5- 6	0	T	0.09	0.23	0.08	0.17	0.17	0.36
5- 6	5-13	0	T	0.08	0.15	0.06	0.15	0.15	0.26
5-13	5-20	0	T	0.03	0.04	0.04	0.10	0.07	0.14
5-20	5-27	0	T	0.02	0.04	0.04	0.06	0.06	0.10
5-27	6- 3	0	T	0.05	0.06	0.06	0.07	0.11	0.12
6- 3	6-10	0.20	0.38	0.09	0.14	0.10	0.14	0.19	0.22
6-10	6-17	0.09	0.33	0.05	0.12	0.07	0.11	0.12	0.19
6-17	6-24	0.24	0.53	0.07	0.13	0.10	0.19	0.17	0.29
6-24	7- 1	0.10	0.38	0.06	0.10	0.07	0.12	0.12	0.22
7- 1	7- 8	0.18	0.50	0.04	0.08	0.08	0.17	0.12	0.25
7- 8	7-15	0.19	0.39	0.05	0.07	0.08	0.11	0.12	0.18
7-15	7-22	0.44	0.80	0.10	0.20	0.12	0.17	0.22	0.37
7-22	7-29	0.26	0.61	0.05	0.13	0.10	0.19	0.50	0.30
7-29	8- 5	0.31	0.48	0.05	0.09	0.12	0.17	0.17	0.23
8- 5	8-12	0.26	0.39	0.08	0.12	0.12	0.14	0.19	0.23
Sampler	Site H								
4- 1	4- 8	0.15	1.74	0.12	0.41	0.08	0.18	0.20	0.59
4- 8	4-15	0.07	2.05	0.06	0.31	0.05	0.14	0.10	0.44
4-15	4-22	0.07	2.05	0.01	0.13	0.02	0.09	0.03	0.22
4-22	4-29	0	T	0.02	0.23	0.03	0.18	0.05	0.36
4-29	5- 6	0.06	0.86	0.08	0.22	0.05	0.14	0.12	0.34
5- 6	5-13	0	T	0.08	0.19	0.06	0.18	0.13	0.37
5-13	5-20	0	T	0.03	0.06	0.03	0.07	0.06	0.13
5-20	5-27	0.06	0.42	0.02	0.07	0.01	0.04	0.04	0.11
5-27	6- 3	0	T	-----	-----	-----	-----	-----	-----
6- 3	6-10	0.05	0.36	0	0.01	0	0.02	0	0.03
6-10	6-17	0	T	0.04	0.13	0.03	0.04	0.07	0.16
6-17	6-24	0	T	0.08	0.14	0.08	0.12	0.15	0.24
6-24	7- 1	0	T	0.04	0.07	0.06	0.17	0.11	0.22
7- 1	7- 8	0.04	0.29	0.05	0.10	0.11	0.19	0.16	0.29
7- 8	7-15	0	T	0.03	0.06	0.07	0.10	0.10	0.14
7-15	7-22	0	T	0.27	0.54	0.10	0.23	0.37	0.64
7-22	7-29	0.04	0.31	0.08	0.14	0.15	0.27	0.23	0.41
7-29	8- 5	0	T	0.07	0.18	0.14	0.34	0.22	0.52
8- 5	8-12	0	T	0.06	0.14	0.18	0.26	0.25	0.34
Sampler	Site K								
4- 1	4- 8	0	0	0.09	0.26	0.05	0.08	0.14	0.34
4- 8	4-15	0.06	1.64	0.04	0.21	0.04	0.14	0.08	0.32
4-15	4-22	0.19	1.98	0.01	0.08	0.02	0.08	0.03	0.16
4-22	4-29	0.12	1.71	0.02	0.18	0.02	0.14	0.03	0.32
4-29	5- 6	0.05	0.73	0.05	0.17	0.05	0.19	0.10	0.29

Table 9. (Continued)

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
5- 6	5-13	0.06	0.79	0.05	0.10	0.03	0.07	0.08	0.17
5-13	5-20	0	T	0.02	0.04	0.03	0.05	0.04	0.08
5-20	5-27	0	T	0.03	0.05	0.03	0.05	0.06	0.08
5-27	6- 3	0	T	0.02	0.05	0.05	0.13	0.07	0.18
6- 3	6-10	0.05	0.37	0.04	0.07	0.05	0.06	0.09	0.12
6-10	6-17	0	T	0.03	0.10	0.04	0.07	0.07	0.12
6-17	6-24	0.04	0.28	0.05	0.07	0.07	0.13	0.12	0.20
6-24	7- 1	0	T	0.03	0.04	0.05	0.07	0.07	0.11
7- 1	7- 8	0	T	0.03	0.05	0.04	0.06	0.07	0.11
7- 8	7-15	0	T	0.03	0.05	0.04	0.06	0.07	0.11
7-15	7-22	0.36	0.73	0.11	0.25	0.11	0.22	0.21	0.47
7-22	7-29	0.14	0.37	0.06	0.15	0.08	0.14	0.14	0.22
7-29	8- 5	0.09	0.33	0.05	0.12	0.11	0.28	0.16	0.40
8- 5	8-12	0	T	0.07	0.11	0.10	0.14	0.17	0.24
Sampler Site M									
4- 1	4- 8	0.88	3.01	0.58	1.87	0.26	0.71	0.84	2.58
4- 8	4-15	0.06	1.71	0.20	1.27	0.15	0.49	0.34	1.68
4-15	4-22	0.13	1.76	0.04	0.24	0.07	0.28	0.12	0.52
4-22	4-29	0.07	2.06	0.10	0.65	0.10	0.63	0.20	1.11
4-29	5- 6	0.15	1.34	0.18	0.96	0.15	0.51	0.32	1.44
5- 6	5-13	0.77	3.43	0.48	2.23	0.26	0.88	0.74	4.11
5-13	5-20	0	T	0.02	0.05	0.05	0.13	0.07	0.16
5-20	5-27	0	T	0.04	0.11	0.06	0.13	0.10	0.24
5-27	6- 3	0	T	0.01	0.03	0.05	0.13	0.06	0.16
6- 3	6-10	0	T	0.02	0.05	0.05	0.09	0.07	0.12
6-10	6-17	0	T	0.01	0.03	0.03	0.04	0.04	0.07
6-17	6-24	0.04	0.30	0.06	0.12	0.08	0.12	0.14	0.19
6-24	7- 1	0.05	0.36	0.04	0.07	0.09	0.21	0.12	0.28
7- 1	7- 8	0.23	1.03	0.09	0.55	0.09	0.28	0.18	0.83
7- 8	7-15	0.23	1.27	0.08	0.40	0.12	0.41	0.20	0.81
7-15	7-22	0.14	0.53	0.18	0.40	0.21	0.43	0.39	0.83
7-22	7-29	0.76	2.55	0.16	0.62	0.32	1.04	0.48	1.66
7-29	8- 5	0.22	0.76	0.05	0.15	0.15	0.39	0.20	0.54
8- 5	8-12	0.23	0.54	0.11	0.22	0.16	0.24	0.28	0.44
Sampler Site R									
4- 1	4- 8	0	0	0.06	0.14	0.06	0.12	0.12	0.24
4- 8	4-15	0.06	1.72	0.04	0.13	0.03	0.14	0.08	0.27
4-15	4-22	0.12	1.75	0.01	0.06	0.02	0.06	0.02	0.12
4-22	4-29	0.15	2.43	0.02	0.13	0.02	0.10	0.03	0.23
4-29	5- 6	0	T	0.04	0.12	0.04	0.09	0.08	0.19
5- 6	5-13	0	T	0.04	0.08	0.04	0.06	0.08	0.14
5-13	5-20	0	T	0.01	0.03	0.02	0.04	0.03	0.07
5-20	5-27	0	T	0.01	0.02	0.01	0.02	0.02	0.04
5-27	6- 3	0	T	0	0.02	0.01	0.02	0.01	0.04
6- 3	6-10	0	T	0	0.02	0.01	0.03	0.01	0.05
6-10	6-17	0	T	0.03	0.07	0.02	0.04	0.05	0.09
6-17	6-24	0	T	0.04	0.06	0.05	0.07	0.08	0.13
6-24	7- 1	0.10	0.72	0.03	0.05	0.05	0.12	0.08	0.13
7- 1	7- 8	0	T	0.03	0.06	0.04	0.05	0.07	0.10

Table 9. (Continued)

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
7- 8	7-15	0.05	0.32	0.03	0.06	0.03	0.06	0.07	0.12
7-15	7-22	0.04	0.26	0.11	0.24	0.11	0.17	0.21	0.41
7-22	7-29	0.05	0.32	0.05	0.12	0.09	0.19	0.14	0.27
7-29	8- 5	0	T	0.04	0.11	0.08	0.22	0.12	0.30
8- 5	8-12	0	T	0.06	0.09	0.07	0.09	0.13	0.16
Sample Site Y									
4- 1	4- 8	0.44	2.32	0.24	0.78	0.11	0.25	0.34	1.00
4- 8	4-15	0	T	0.06	0.35	0.06	0.26	0.12	0.61
4-15	4-22	0.06	1.66	0.02	0.14	0.03	0.12	0.04	0.26
4-22	4-29	0.11	2.95	0.04	0.31	0.03	0.23	0.08	0.49
4-29	5- 6	0	T	0.07	0.21	0.07	0.19	0.14	0.39
5- 6	5-13	0.17	1.35	0.01	0.05	0.01	0.06	0.02	0.11
5-13	5-20	0	T	0.02	0.04	0.03	0.06	0.05	0.10
5-20	5-27	0	T	0.02	0.04	0.04	0.09	0.06	0.12
5-27	6- 3	0	T	0.01	0.03	0.04	0.09	0.05	0.11
6- 3	6-10	0	T	0.02	0.04	0.05	0.07	0.07	0.10
6-10	6-17	0	T	0.03	0.06	0.04	0.05	0.07	0.11
6-17	6-24	0	T	0.05	0.10	0.06	0.11	0.11	0.17
6-24	7- 1	0.06	0.42	0.04	0.13	0.06	0.16	0.10	0.29
7- 1	7- 8	0	T	0.03	0.06	0.05	0.07	0.07	0.13
7- 8	7-15	0.04	0.31	0.05	0.21	0.06	0.11	0.11	0.32
7-15	7-22	0.34	0.63	0.15	0.26	0.15	0.29	0.30	0.55
7-22	7-29	0.23	0.48	0.09	0.17	0.15	0.27	0.24	0.42
7-29	8- 5	0.17	0.52	0.06	0.16	0.13	0.35	0.19	0.51
8- 5	8-12	0.10	0.26	0.09	0.13	0.10	0.12	0.19	0.24

¹ See Figure 1 for sampler location.² Automatic air sampler, total value; zero values were below detectable limit.³ Double paper sampler, particulate value.⁴ Double paper sampler, gas value.⁵ Double paper sampler, total value.

* T = Trace amount.

Table 10. Weekly average and maximum day atmospheric fluoride levels as measured by the automatic air sampler and double paper gas/particulate separator sample (The Dalles, 1972)¹

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
Sampler Site M									
4- 1	4- 8	0.08	0.58	0.12	0.47	0.22	0.48	0.34	0.78
4- 8	4-15	0	0	0.01	0.06	0.07	0.12	0.08	0.18
4-15	4-22	0	0	0	0.01	0.02	0.03	0.02	0.04
4-22	4-29	0.27	1.31	0.31	1.08	0.25	0.71	0.56	1.79
4-29	5- 6	0.08	0.53	0.06	0.23	0.15	0.43	0.20	0.66
5- 6	5-13	0	0	0.04	0.18	0.07	0.21	0.11	0.39
5-13	5-20	0.06	0.44	0.04	0.13	0.09	0.18	0.13	0.31
5-20	5-27	0.15	0.73	0.10	0.49	0.14	0.47	0.24	0.96
5-27	6- 3	0.32	1.10	0.19	1.10	0.26	0.91	0.44	2.01

Table 10. (Continued)

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
6- 3	6-10	0.16	0.47	0.05	0.13	0.16	0.42	0.21	0.48
6-10	6-17	0	0	0.01	0.03	0.05	0.08	0.07	0.10
6-17	6-24	0.04	0.28	0.02	0.04	0.05	0.11	0.08	0.15
6-24	7- 1	0	0	0.02	0.06	0.05	0.07	0.06	0.13
7- 1	7- 8	0.67	1.31	0.27	0.65	0.30	0.62	0.57	1.18
7- 8	7-15	0	0	0.02	0.03	0.05	0.10	0.07	0.13
7-15	7-22	0.58	1.00	0.16	0.39	0.25	0.49	0.42	0.88
7-22	7-29	0.15	0.42	0.05	0.08	0.10	0.20	0.14	0.28
7-29	8- 5	0.32	1.26	0.14	0.61	0.15	0.51	0.29	1.12
8- 5	8-12	0.42	0.53	0.08	0.15	0.15	0.24	0.23	0.39
8-12	8-19	0.06	0.22	0.05	0.18	0.13	0.31	0.18	0.47
8-19	8-26	0.44	1.10	0.10	0.52	0.17	0.43	0.28	0.95
8-26	8-29	0.62	1.10	0.16	0.25	0.28	0.44	0.44	0.69
Sampler	Site E								
4- 1	4- 8	0	0	0.08	0.18	0.20	0.54	0.28	0.72
4- 8	4-15	0	0	0.01	0.04	0.05	0.10	0.06	0.13
4-15	4-22	0	0	0	0.01	0.01	0.02	0.02	0.03
4-22	4-29	0.14	0.60	0.07	0.18	0.09	0.22	0.15	0.39
4-29	5- 6	0.21	0.47	0.05	0.14	0.11	0.22	0.16	0.36
5- 6	5-13	0.05	0.37	0.02	0.08	0.05	0.12	0.07	0.20
5-13	5-20	0.15	0.40	0.03	0.06	0.07	0.17	0.09	0.23
5-20	5-27	0.22	0.81	0.08	0.31	0.07	0.22	0.15	0.53
5-27	6- 3	.....	.....	0.04	0.14	0.07	0.17	0.11	0.31
6- 3	6-10	0.18	0.60	0.03	0.08	0.10	0.17	0.14	0.25
6-10	6-17	0	0	0.02	0.04	0.04	0.07	0.06	0.10
6-17	6-24	0	0	0.01	0.04	0.04	0.09	0.05	0.13
6-24	7- 1	0.03	0.24	0.02	0.05	0.03	0.06	0.05	0.11
7- 1	7- 8	0.41	0.76	0.08	0.21	0.16	0.29	0.12	0.42
7- 8	7-15	0.04	0.29	0.01	0.02	0.09	0.08	0.04	0.09
7-15	7-22	0.50	0.88	0.13	0.27	0.15	0.25	0.28	0.52
7-22	7-29	0.07	0.49	0.03	0.04	0.06	0.15	0.09	0.19
7-29	8- 5	0.17	0.73	0.07	0.29	0.08	0.20	0.15	0.49
8- 5	8- 9	0.32	0.48	0.09	0.12	0.18	0.24	0.27	0.36
12-22	12-29	.....	.....	0.28	0.62	0.51	1.27	0.79	1.89
12-29	12-31	.....	.....	0.19	0.27	0.24	0.31	0.43	0.55
Sampler	Site G								
4- 1	4- 8	0	0	0.04	0.06	0.05	0.08	0.09	0.14
4- 8	4-15	0	0	0.01	0.02	0.04	0.05	0.05	0.07
4-15	4-22	0	0	0.01	0.02	0.03	0.04	0.04	0.06
4-22	4-29	0.05	0.36	0.03	0.06	0.05	0.08	0.07	0.13
4-29	5- 6	0	0	0.02	0.03	0.04	0.05	0.06	0.07
5- 6	5-13	0	0	0.02	0.03	0.04	0.06	0.06	0.08
5-13	5-20	0.05	0.33	0.02	0.03	0.05	0.09	0.07	0.12
5-20	5-27	0.23	0.38	0.03	0.10	0.05	0.09	0.09	0.13
5-27	6- 3	0.64	0.28	0.03	0.06	0.04	0.06	0.06	0.09
6- 3	6-10	0.10	0.39	0.03	0.04	0.06	0.09	0.09	0.11
6-10	6-17	0.06	0.43	0.02	0.03	0.06	0.09	0.08	0.11
6-17	6-24	0.09	0.38	0.04	0.05	0.06	0.12	0.09	0.17

Table 10. (Continued)

Start	End	AA ²	Max.	DP-P ³	Max.	DP-G ⁴	Max.	DP-T ⁵	Max.
<i>Micrograms fluoride per cubic meter</i>									
6-24	7- 1	0.17	0.36	0.03	0.04	0.06	0.09	0.09	0.13
7- 1	7- 8	0.17	0.38	0.04	0.07	0.07	0.11	0.11	0.15
7- 8	7-15	0.09	0.39	0.02	0.04	0.07	0.11	0.10	0.15
7-15	7-22	0.13	0.26	0.03	0.05	0.05	0.08	0.08	0.13
7-22	7-29	0.22	0.26	0.04	0.05	0.07	0.09	0.10	0.14
7-29	8- 5	0.18	0.59	0.04	0.09	0.07	0.16	0.11	0.25
8- 5	8-12	0.43	0.70	0.06	0.09	0.11	0.15	0.17	0.23
8-12	8-19	0.08	0.35	0.02	0.03	0.06	0.08	0.08	0.10
8-19	8-26	0.13	0.34	0.02	0.04	0.08	0.12	0.10	0.15
8-26	8-29	0.40	0.57	0.07	0.10	0.14	0.17	0.22	0.27

¹ See Figure 1 for location.² Automatic air sampler, total value; zero values were below detectable limit.³ Double paper sampler, particulate value.⁴ Double paper sampler, gas value.⁵ Double paper sampler, total value.Table 11. Weekly average and maximum day atmospheric fluoride levels as measured by the double paper gas/particulate sampler (The Dalles, 1973)¹

Start	End	DP-G ²	Max.	DP-P ³	Max.	DP-T ⁴	Max.
<i>Micrograms fluoride per cubic meter</i>							
Sampler	Site M						
3- 4	3-11	0.09	0.20	0.07	0.16	0.16	0.36
3-11	3-18	0.07	0.20	0.05	0.19	0.12	0.39
3-18	3-25	0.18	0.80	0.19	1.10	0.37	1.90
3-25	4- 1	0.08	0.19	0.03	0.11	0.11	0.31
4- 1	4- 8	0.10	0.30	0.10	0.44	0.20	0.74
4- 8	4-15	0.10	0.32	0.12	0.56	0.22	0.88
4-15	4-22	.....	.....	.....	.....	.....	.....
4-22	4-29	.....	.....	.....	.....	.....	.....
4-29	5- 6	.....	.....	.....	.....	.....	.....
5- 6	5-13	.....	.....	.....	.....	.....	.....
5-13	5-20	0.14	0.30	0.07	0.27	0.21	0.57
5-20	5-27	0.06	0.15	0.02	0.06	0.08	0.21
5-27	6- 3	0.22	0.84	0.13	0.40	0.35	1.24
6- 3	6-10	0.12	0.29	0.03	0.06	0.15	0.35
6-10	6-17	0.04	0.06	0.01	0.03	0.05	0.07
6-17	6-24	0.12	0.26	0.07	0.23	0.19	0.49
6-24	7- 1	0.06	0.13	0.01	0.02	0.07	0.15
7- 1	7- 8	0.05	0.07	0.02	0.03	0.07	0.10
7- 8	7-15	.....	.....	.....	.....	.....	.....
7-15	7-22	.....	.....	.....	.....	.....	.....
7-22	7-29	0.06	0.09	0.03	0.04	0.09	0.13
7-29	8- 5	0.05	0.08	0.02	0.04	0.07	0.11
8- 5	8-12	0.07	0.24	0.02	0.08	0.09	0.32
8-12	8-19	0.11	0.49	0.05	0.22	0.16	0.71
8-19	8-26	0.04	0.06	0.01	0.02	0.05	0.07

Table 11. (Continued)

Start	End	DP-G ²	Max.	DP-P ³	Max.	DP-T ⁴	Max.
<i>Micrograms fluoride per cubic meter</i>							
8-26	9- 2	0.14	0.70	0.04	0.23	0.18	0.93
9- 2	9- 9	0.26	0.80	0.08	0.32	0.34	1.12
9- 9	9-16	0.28	0.71	0.16	0.65	0.44	1.36
9-16	9-23	0.19	0.69	0.10	0.28	0.29	0.97
9-23	9-30	0.19	0.51	0.05	0.12	0.24	0.63
9-30	10- 7	0.10	0.23	0.03	0.08	0.13	0.31
10- 7	10-14	0.11	0.30	0.05	0.20	0.16	0.50
10-14	10-21	0.48	1.33	0.24	0.90	0.72	2.18
10-21	10-28	0.11	0.22	0.05	0.19	0.16	0.41
10-28	11- 4	0.06	0.18	0.03	0.08	0.09	0.26
11- 4	11-11	0.04	0.06	0.06	0.11	0.10	0.17
11-11	11-18	0.06	0.14	0.04	0.11	0.10	0.25
11-18	11-25	0.09	0.18	0.07	0.14	0.16	0.24
11-25	12- 2	0.05	0.08	0.04	0.18	0.09	0.26
12- 2	12- 9	0.15	0.30	0.13	0.35	0.28	0.65
12- 9	12-16	0.08	0.18	0.04	0.10	0.12	0.28
12-16	12-23	0.08	0.20	0.09	0.18	0.17	0.38
12-23	12-30	0.08	0.26	0.06	0.13	0.14	0.39
Sampler Site E							
1- 7	1-14	0.09	0.20	0.08	0.28	0.17	0.48
1-14	1-21	0.07	0.13	0.11	0.20	0.18	0.33
1-21	1-28	0.23	0.65	0.20	0.74	0.43	1.39
1-28	2- 4	0.37	0.66	0.33	0.49	0.70	1.13
2- 4	2-11	0.26	0.50	0.10	0.20	0.36	0.70
2-11	2-18	0.23	0.71	0.13	0.52	0.36	1.23
2-18	2-25	0.41	0.59	0.37	0.66	0.78	1.19
2-25	3- 4	0.27	0.66	0.51	1.53	0.78	2.19
3- 4	3-11	0.08	0.12	0.07	0.15	0.15	0.26
3-11	3-18	0.09	0.20	0.10	0.18	0.19	0.38
3-18	3-25	0.13	0.40	0.08	0.31	0.21	0.71
3-25	4- 1	0.07	0.17	0.03	0.10	0.10	0.27
4- 1	4- 8	0.08	0.12	0.06	0.18	0.14	0.29
4- 8	4-15	0.07	0.17	0.05	0.24	0.12	0.41
4-15	4-22	0.03	0.04	0	0.02	0.03	0.06
4-22	4-29	.....	.....	.....	.....	.....	.....
4-29	5- 6	.....	.....	.....	.....	.....	.....
5- 6	5-13	.....	.....	.....	.....	.....	.....
5-13	5-20	0.07	0.12	0.02	0.03	0.09	0.15
5-20	5-27	0.06	0.15	0.03	0.08	0.09	0.21
5-27	6- 3	0.08	0.16	0.06	0.17	0.14	0.33
6- 3	6-10	0.10	0.18	0.04	0.07	0.14	0.25
6-10	6-17	.....	.....	.....	.....	.....	.....
6-17	6-24	.....	.....	.....	.....	.....	.....
6-24	7- 1	.....	.....	.....	.....	.....	.....
7- 1	7- 8	.....	.....	.....	.....	.....	.....
7- 8	7-15	.....	.....	.....	.....	.....	.....
7-15	7-22	.....	.....	.....	.....	.....	.....
7-22	7-29	.....	.....	.....	.....	.....	.....
7-29	8- 5	.....	.....	.....	.....	.....	.....
8- 5	8-12	0.06	0.18	0.01	0.04	0.07	0.22

Table 11. (Continued)

Start	End	DP-G ²	Max.	DP-P ³	Max.	DP-T ⁴	Max.
Micrograms fluoride per cubic meter							
8-12	8-19	0.07	0.13	0.03	0.13	0.10	0.26
8-19	8-26	0.05	0.07	0.01	0.02	0.06	0.08
8-26	9- 2	0.06	0.18	0.02	0.07	0.08	0.25
9- 2	9- 9	0.09	0.18	0.03	0.06	0.12	0.24
9- 9	9-16	0.09	0.19	0.05	0.17	0.14	0.36
9-16	9-23	0.11	0.25	0.14	0.45	0.25	0.65
9-23	9-30	0.13	0.30	0.02	0.04	0.15	0.31
9-30	10- 7	0.08	0.24	0.02	0.05	0.10	0.29
10- 7	10-14	0.06	0.15	0.02	0.06	0.08	0.21
10-14	10-21	0.24	0.48	0.13	0.30	0.37	0.62
10-21	10-28	0.10	0.24	0.06	0.13	0.16	0.37
10-28	11- 4	0.10	0.35	0.07	0.29	0.17	0.64
11- 4	11-11	0.08	0.18	0.09	0.22	0.17	0.40
11-11	11-18	0.09	0.21	0.05	0.10	0.14	0.31
11-18	11-25	0.09	0.13	0.12	0.25	0.21	0.38
11-25	12- 2	0.08	0.12	0.02	0.04	0.10	0.15
12- 2	12- 9	0.21	0.70	0.17	0.53	0.38	1.23
12- 9	12-16	0.11	0.16	0.10	0.25	0.21	0.38
12-16	12-23	0.05	0.09	0.06	0.20	0.11	0.28
12-23	12-30	0.10	0.29	0.07	0.17	0.17	0.46
Sampler Site G							
3- 4	3-11	0.04	0.07	0.05	0.10	0.09	0.17
3-11	3-18	0.03	0.07	0.03	0.06	0.06	0.09
3-18	3-25	0.05	0.07	0.04	0.08	0.09	0.12
3-25	4- 1	0.05	0.07	0.03	0.05	0.08	0.12
4- 1	4- 8	0.06	0.10	0.05	0.09	0.11	0.18
4- 8	4-15	0.04	0.06	0.04	0.07	0.08	0.12
4-15	4-22	0.03	0.04	0.02	0.04	0.05	0.07
4-22	4-29	0.04	0.07	0.02	0.04	0.06	0.11
4-29	5- 6	0.05	0.11	0.02	0.04	0.07	0.13
5- 6	5-13	0.04	0.06	0.03	0.06	0.07	0.09
5-13	5-20	0.04	0.07	0.03	0.04	0.07	0.11
5-20	5-27	0.03	0.05	0.02	0.03	0.05	0.08
5-27	6- 3	0.04	0.05	0.03	0.06	0.07	0.10
6- 3	6-10	0.05	0.07	0.02	0.04	0.05	0.11
6-10	6-17	0.03	0.04	0.03	0.05	0.06	0.08
6-17	6-24	0.05	0.09	0.03	0.07	0.08	0.16
6-24	7- 1	0.05	0.08	0.02	0.04	0.07	0.12
7- 1	7- 8	-----	-----	-----	-----	-----	-----
7- 8	7-15	-----	-----	-----	-----	-----	-----
7-15	7-22	-----	-----	-----	-----	-----	-----
7-22	7-29	0.07	0.09	0.03	0.05	0.10	0.14
7-29	8- 5	0.08	0.11	0.03	0.05	0.11	0.16
8- 5	8-12	0.07	0.09	0.02	0.04	0.09	0.12
8-12	8-19	0.06	0.11	0.03	0.05	0.09	0.14
8-19	8-26	0.06	0.09	0.03	0.04	0.09	0.13
8-26	9- 2	0.10	0.18	0.04	0.09	0.14	0.27
9- 2	9- 9	0.11	0.26	0.05	0.16	0.16	0.42
9- 9	9-16	0.08	0.13	0.03	0.04	0.11	0.17
9-16	9-23	0.05	0.09	0.05	0.12	0.10	0.21

Table 12. (Continued)

Start	End	DP-G ²	Max.	DP-P ³	Max.	DP-T ⁴	Max.
Micrograms fluoride per cubic meter							
8-12	8-19	0.11	0.22	0.02	0.05	0.13	0.26
8-19	8-26	0.08	0.16	0.02	0.03	0.10	0.19
8-26	9- 2	0.33	0.48	0.16	0.29	0.49	0.71
9- 2	9- 9	0.18	0.61	0.10	0.47	0.28	1.08
9- 9	9-16	0.17	0.32	0.31	0.63	0.48	0.95
9-16	9-23	0.29	0.41	0.36	0.55	0.65	0.81
9-23	9-30	0.20	0.34	0.20	0.61	0.40	0.95
9-30	10- 7	0.23	0.52	0.17	0.52	0.40	1.04
10- 7	10-14	0.38	0.65	0.30	0.58	0.68	1.23
10-14	10-21	0.65	1.04	0.32	0.74	0.97	1.78
10-21	10-28	0.62	0.74	0.45	1.18	1.07	1.81
10-14	10-21	0.65	1.04	0.32	0.74	0.97	1.78
10-28	11- 4	0.16	0.36	0.15	0.72	0.31	0.99
11- 4	11-11	0.24	0.47	0.24	0.65	0.48	0.88
11-11	11-18	0.54	0.90	0.39	0.83	0.93	1.69
11-18	11-25	0.14	0.24	0.21	0.58	0.35	0.81
11-25	12- 2	0.15	0.33	0.08	0.27	0.23	0.60
12- 2	12- 9	0.32	1.40	0.65	3.60	0.97	5.00
12- 9	12-16	0.18	0.58	0.28	1.15	0.46	1.73
12-16	12-23	0.15	0.24	0.10	0.23	0.25	0.46
12-23	12-30	0.10	0.16	0.04	0.12	0.14	0.28

Sampler Site G

1- 1	1- 7	0.03	0.07	0.03	0.04	0.06	0.11
1- 7	1-14	0.10	0.31	0.09	0.20	0.19	0.41
1-14	1-21	0.09	0.12	0.09	0.23	0.18	0.34
1-21	1-28	0.05	0.09	0.02	0.03	0.07	0.11
1-28	2- 4	0.05	0.08	0.03	0.06	0.08	0.10
2- 4	2-11	0.06	0.11	0.08	0.16	0.14	0.25
2-11	2-18	0.06	0.11	0.05	0.14	0.11	0.22
2-18	2-25	0.05	0.10	0.05	0.16	0.10	0.26
2-25	3- 4	0.09	0.32	0.04	0.05	0.13	0.37
3- 4	3-11	0.08	0.20	0.05	0.13	0.13	0.28
3-11	3-18	0.07	0.16	0.06	0.16	0.13	0.32
3-18	3-25	0.07	0.11	0.05	0.08	0.12	0.18
3-25	4- 1	0.07	0.14	0.05	0.11	0.12	0.22
4- 1	4- 8	0.07	0.10	0.02	0.04	0.09	0.13
4- 8	4-15	0.04	0.07	0.02	0.03	0.06	0.10
4-15	4-22	0.06	0.09	0.03	0.06	0.09	0.13
4-22	4-29	0.04	0.05	0.03	0.08	0.07	0.13
4-29	5- 6	0.06	0.09	0.03	0.06	0.09	0.14
5- 6	5-13	.....	.....	.....	.....	.....	.....
5-13	5-20	.....	.....	.....	.....	.....	.....
5-20	5-27	.....	.....	.....	.....	.....	.....
5-27	6- 3	0.05	0.08	0.03	0.05	0.08	0.13
6- 3	6-10	0.07	0.11	0.02	0.03	0.09	0.14
6-10	6-17	0.07	0.10	0.05	0.07	0.12	0.15
6-17	6-24	.....	.....	.....	.....	.....	.....
6-24	7- 1	.....	.....	.....	.....	.....	.....
7- 1	7- 8	.....	.....	.....	.....	.....	.....

Table 12. (Continued)

Start	End	DP-G ²	Max.	DP-P ³	Max.	DP-T ⁴	Max.
<i>Micrograms fluoride per cubic meter</i>							
7- 8	7-15	.....	.....	.....	.....	.....	.....
7-15	7-22	0.10	0.12	0.03	0.04	0.13	0.16
7-22	7-29	0.08	0.11	0.04	0.06	0.12	0.16
7-29	8- 5	0.11	0.14	0.07	0.09	0.18	0.22
8- 5	8-12	0.09	0.13	0.04	0.07	0.13	0.20
8-12	8-19	0.07	0.10	0.04	0.07	0.11	0.15
8-19	8-26	0.09	0.12	0.02	0.04	0.11	0.16
8-26	9- 2	0.11	0.17	0.05	0.07	0.16	0.23
9- 2	9- 9	0.08	0.10	0.03	0.06	0.11	0.14
9- 9	9-16	0.05	0.13	0.06	0.16	0.11	0.29
9-16	9-23	0.12	0.18	0.21	0.55	0.33	0.73
9-23	9-30	0.10	0.11	0.09	0.26	0.19	0.37
9-30	10- 7	0.06	0.12	0.05	0.12	0.11	0.22
10- 7	10-14	0.08	0.15	0.06	0.15	0.14	0.29
10-14	10-21	0.20	0.31	0.10	0.21	0.30	0.49
10-21	10-28	0.12	0.24	0.14	0.37	0.26	0.44
10-28	11- 4	0.05	0.08	0.08	0.13	0.13	0.21
11- 4	11-11	0.06	0.08	0.04	0.07	0.10	0.12
11-11	11-18	0.09	0.13	0.07	0.12	0.16	0.24
11-18	11-25	0.06	0.10	0.10	0.23	0.16	0.32
11-25	12- 2	0.05	0.08	0.03	0.11	0.08	0.19
12- 2	12- 9	0.09	0.35	0.13	0.77	0.22	1.12
12- 9	12-16	0.06	0.10	0.05	0.14	0.11	0.24
12-16	12-23	0.04	0.07	0.04	0.19	0.08	0.26
12-23	12-30	0.06	0.13	0.03	0.08	0.09	0.20

¹ See Figure 1 for sampler location.² Double paper sampler, gas value.³ Double paper sampler, particulate value.⁴ Double paper sampler, total value.Table 13. Daily average fluoride levels during sweet cherry anthesis for the air sampling sites
(The Dalles, 1968)

Date	Sampler site ¹										
	J	M	D	F	P	W	R	K	H	G	
<i>Micrograms fluoride per cubic meter</i>											
3-15	3-16 ²	1.20 ³	0.80	1.10	0.50	0.60	0.61	0	0.60	0.60
3-16	3-17	0	0	0	0	0.19	.....	0.20	0.16	0.20
3-17	3-18	0	0	0	0	0	.....	0.40	0	0
3-18	3-19	0.52	0.10	0.20	0	0	.....	0	0	0.60
3-19	3-20	3.40	1.40	1.10	0.40	0.40	0.68	0.30	0.40	0.40
3-20	3-21	6.20	5.00	3.00	0.80	0.80	0.81	0.30	0.30	0.40
3-21	3-22	5.10	3.30	3.40	0.70	0.80	0.76	0.40	0.50	0.40
3-22	3-23	9.55	3.47	0.97	0	0.96	.....	0.45	0.35	0.27
3-23	3-24	0	0	0	0	0	.....	.....	0	0
3-24	3-25	0	0	0	0	0	.....	.....	0	0
3-25	3-26	0	0	0	0	0	.....	.....	0	0

Table 13. (Continued)

Date	Sample site ¹									
	J	M	D	F	P	W	R	K	H	G
Micrograms fluoride per cubic meter										
3-26	3-27	0	0	0	0	.....	.....	.....	0	0.20
3-27	3-28	0	0	0	.....	.....	.....	.....	0	0
3-28	3-29	0	0	0	.....	0	.....	.....	.....	0
3-29	3-30	0	0	0	.....	0	.....	.....	.....	0
3-30	3-31	4.05	3.42	0	0	.....	.....	.....	.....	0
3-31	4-1	3.50	2.07	1.25	0.18	.....	.....	.....	.....	0.25
4-1	4-2	1.07	0.45	0.68	0	0	0	.....	0	0.45
4-2	4-3	0	0	0	0	0	.....	.....	0	0
4-3	4-4	2.47	1.00	0.97	0.37	0.27	.....	.....	0	0
4-4	4-5	0	0	.....	0	0	0	.....	0	.....
4-5	4-6	0	0	.....	0	0	0	.....	0	.....
4-6	4-7	0	0	.....	0	0	.....	.....	0	0
4-7	4-8	0	0	.....	0	0	.....	.....	.....	.....
4-8	4-9	0.17	0	.....	0	0	.....	.....	.....	0
4-9	4-10	0.72	0	.....	0	0	.....	.....	.....	0
4-10	4-11	0.35	0.30	.....	0	0	.....	.....	.....	0
4-11	4-12	0	0	.....	0	0	0	0	0	0
4-12	4-13	0	0	.....	0	0	.....	0	0	0
4-13	4-14	0.67	0	.....	0	0	.....	.....	0	0
4-14	4-15	0	0	.....	0	0	.....	0	0	0
4-15	4-16	0	0	.....	0	0	.....	.....	0	0
4-16	4-17	.....	0	0	0	0	.....	.....	.....	.....
4-17	4-18	.....	0	0	0	0	.....	.....	.....	.....
4-18	4-19	0	0	0	0	0	0	.....	0	.....
4-19	4-20	0	0	0	0	0	0	.....	0	0
4-20	4-21	0	0	0	0	0	0	0	0	0
4-21	4-22	0	0	0	0	0	0	0	0	0
4-22	4-23	0	0	0	0	0	0	0	0	0
4-23	4-24	0	0	0	0	0	0	0	0	0
4-24	4-25	0	0	0	0	0	0	0	0	0
4-25	4-26	.....	.....	.....	.....	0	0	.....	0	.....
4-26	4-27	.....	.....	.....	.....	0	0	.....	0	.....
4-27	4-28	.....	.....	.....	.....	0	0	.....	0	.....
4-28	4-29	.....	.....	.....	0	0	0.04	0	.....	.....
4-29	4-30	.....	.....	.....	0	0	0	0	0	.....
4-30	5-1	.....	.....	.....	0	0	0	0	0	.....

¹ See Figure 1 for sampler location. All values were taken with the automatic air sampler; zero values were below detectable limit.

² 24-hour sample duration, 3-15 to 3-23; 6-hour sample duration averaged to 24-hour sample, 3-23 to 4-11; 12-hour sample duration averaged to 24-hour sample, 4-11 to 5-1.

Table 14. Daily average fluoride levels during sweet cherry anthesis for the air sampling sites
 (The Dalles, 1969)

Date	J	M	D	F	P	R	Sampler site ¹		
							K	H	G
<i>Micrograms fluoride per cubic meter</i>									
3-19	3-20 ²	0.92	0	0	0	0	0	0	0
3-20	3-21	1.53	0.95	0.92	0	0	0	0.30	0
3-21	3-22	1.26	0.88	1.09	0.76	0.37	0.44	0	0.63
3-22	3-23	.....	0	0	0	0	0	0	0
3-23	3-24	.....	0.46	0.90	0	0	0	0	0
2-24	3-25	.....	3.01	1.93	0.72	0.56	0	0	0
3-25	3-26	.....	2.20	3.32	1.00	1.10	0	0.40	0.78
3-26	3-27	.....	1.77	1.72	0	0.62	0	0	0.49
3-27	3-28	.....	0.40	0.55	0	0.28	0	0	0.99
3-28	3-29	.....	2.19	1.55	0.79	0.41	0	0	0.54
3-29	3-30	.....	0.56	1.00	0	0.29	0	0.86	0.36
3-30	4-1	.....	0.45	0.50	0	0.46	0.44	0.60	0.52
3-31	4-1	0	0	0.61	0	0	0	0	0
4-1	4-2	0	0.45	0.62	0	0.52	.....	0	0
4-2	4-3	0	0	0	0	0	0	0	0
4-3	4-4	0.57	0	0.52	0	0	0	0	0
4-4	4-5	4.00	1.55	0.81	0	0.33	0.33	0	0
4-5	4-6	0	0	0	0	0	0	0.44	0
4-6	4-7	0	0	0	0	0	0	0	0
4-7	4-8	0	0	0	.....	0	0	0	0
4-8	4-9	2.35	0.69	0	.....	0	0	0	.....
4-9	4-10	0	0	0	.....	0	0	0	0
4-10	4-11	0	0	.....	0	0	0	0	0
4-11	4-12	5.15	2.92	.....	0	0	0	0	0
4-12	4-13	0	1.13	.....	0	0	0	0	0
4-13	4-14	0	0	.....	0	0	0	0	0
4-14	4-15	0	0	0	0	0	0	0	.....
4-15	4-16	0	0	0	0	0	0	0.65	.....
4-16	4-17	0	0	0	0	0	0	0	.....
4-17	4-18	0	0	0	0	0	0	0	.....
4-18	4-19	0	0	0	0	0	0	0	.....
4-19	4-20	0	0	0	0	0	0	0	.....
4-20	4-21	1.52	0.85	0	0	0	0	.....	0
4-21	4-22	1.17	0	0	0	0	0	0	0
4-22	4-23	0	0	0	0	0	0.75	0	0
4-23	4-24	0	0	0	0	0	0	0.06	0
4-24	4-25	0	0	0	0	0	0	0	0
4-25	4-26	0.37	0	0	0	0	0.42	0.03	0.50
4-26	4-27	1.25	0.42	0.40	0	0	0	0.06	0
4-27	4-28	0	0.52	0.70	0	0	0.23	0.04	0
4-28	4-29	0	0.55	0	0	0	0	0	0.37
4-29	4-30	0	0	0	0	0	0	0	0
4-30	5-1	0	0	0	0	0	0	0.40	0

¹ See Figure 1 for sampler location. All values were taken with the automatic air sampler; zero values were below detectable limit.

² 24-hour sample duration, 3-19 to 4-8; 6-hour sample duration averaged to 24-hour sample, 4-8 to 4-23; 12-hour sample duration averaged to 24-hour sample, 4-23 to 5-1.

Table 15. Daily average fluoride levels during sweet cherry anthesis for the air sampling sites
 (The Dalles, 1970)

Date		Sampler site ¹											
		J				M				E			
		AA ²	DP-T ³	DP-G ⁴	DP-P ⁵	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
<i>Micrograms fluoride per cubic meter</i>													
3-17	3-18 ^a	0	0.20	0.10	0.10	0	0.17	0.09	0.08	0	0.17	0.09	0.08
3-18	3-19	2.09	2.31	0.80	1.51	1.40	1.97	0.89	1.08	1.24	1.59	0.73	0.86
3-19	3-20	1.41	1.28	0.56	0.72	0.98	0.83	0.42	0.41	1.22	1.07	0.52	0.55
3-20	3-21	0.67	0.31	0.16	0.15	0.50	0.24	0.40	0.10	0.51	0.14	0.09	0.05
3-21	3-22	.....	0.10	0.07	0.03	0	0.10	0.07	0.03	0	0.09	0.06	0.03
3-22	3-23	0.87	0.35	0.18	0.17	0	0.33	0.18	0.14	0.45	0.31	0.15	0.16
3-23	3-24	0.48	0.32	0.06	0.26	0	0.07	0.05	0.02	0	0.07	0.04	0.03
3-24	3-25	0.65	0.33	0.17	0.16	0	0.19	0.11	0.09	0.67	0.24	0.08	0.16
3-25	3-26	0.56	0.25	0.12	0.13	0	0.20	0.10	0.10	0.66	0.14	0.09	0.05
3-26	3-27	1.21	1.05	0.54	0.51	0	0.44	0.26	0.18	0	0.65	0.29	0.36
3-27	3-28	0.85	0.39	0.21	0.18	0	0.31	0.18	0.13	0	0.29	0.15	0.14
3-28	3-29	1.34	0.06	0.06	0	0	0.04	0.04	0	0	0.06	0.06	0
3-29	3-30	0.69	0.07	0.05	0.02	0	0.06	0.03	0.03	.....	0.09	0.06	0.03
3-30	3-31	0	0.21	0.13	0.08	0	0.20	0.13	0.07	0	0.16	0.10	0.06
3-31	4-1	0	0.19	0.09	0.10	0	0.21	0.10	0.11	0	0.16	0.09	0.07
4-1	4-2	0	0.17	0.07	0.10	0	0.07	0.06	0.01	0	0.07	0.06	0.01
4-2	4-3	0	0.29	0.19	0.10	0	0.15	0.10	0.05	0	0.35	0.22	0.13
4-3	4-4	0	0.65	0.42	0.23	0	0.62	0.41	0.21	0	0.57	0.35	0.22
4-4	4-5	0	0.21	0.15	0.06	0.71	0.17	0.13	0.04	0.64	0.38	0.22	0.16
4-5	4-6	0	0.37	0.24	0.13	0	0.24	0.16	0.08	0	0.33	0.21	0.12
4-6	4-7	0	0.04	0.04	0	0	0.06	0.05	0.01	0	0.05	0.05	0
4-7	4-8	0	0.20	0.12	0.08	0	0.17	0.11	0.06	0	0.28	0.18	0.10
4-8	4-9	0	0.44	0.33	0.11	0	0.77	0.54	0.23	0	0.77	0.52	0.25
4-9	4-10	0	0.33	0.25	0.08	0	0.34	0.24	0.10	0.66	0.18	0.13	0.05
4-10	4-11	0	0.06	0.06	0	0	0.05	0.05	0	0	0.01	0.01	0
4-11	4-12	0	0.09	0.06	0.03	0	0.04	0.04	0	0	0.04	0.04	0
4-12	4-13	0.65	1.12	0.53	0.59	0	0.84	0.36	0.48	0.78	1.44	0.56	0.88
4-13	4-14	0.85	0.37	0.21	0.16	0	0.40	0.23	0.17	0	0.23	0.14	0.09
4-14	4-15	0	0.19	0.12	0.07	0	0.21	0.13	0.08	0	0.15	0.10	0.05
4-15	4-16	0.91	0.51	0.36	0.15	0	0.37	0.27	0.10	0	0.18	0.15	0.03
4-16	4-17	0.90	1.29	0.66	0.63	0.65	0.85	0.39	0.46	0	0.76	0.37	0.39
4-17	4-18	0	0.34	0.20	0.14	0	0.26	0.17	0.09	0	0.22	0.16	0.06
4-18	4-19	0	0.09	0.08	0.01	0	0.08	0.07	0.01	0	0.17	0.15	0.02
4-19	4-20	0	0.04	0.04	0	0	0.02	0.02	0	0	0.03	0.03	0
4-20	4-21	0	0.07	0.07	0	0	0.05	0.05	0	0	0.04	0.04	0
4-21	4-22	0	0.11	0.09	0.02	0	0.11	0.09	0.02	0	0.11	0.09	0.02
4-22	4-23	0	0.10	0.07	0.03	0	0.06	0.06	0	0	0.06	0.06	0
4-23	4-24	0	0.18	0.12	0.06	0	0.24	0.17	0.07	0	0.14	0.10	0.04
4-24	4-25	0	0.06	0.05	0.01	0	0.08	0.06	0.02	0	0.04	0.04	0
4-25	4-26	0	0.57	0.29	0.28	0	0.39	0.22	0.17	0	0.23	0.14	0.09
4-26	4-27	0	0.16	0.10	0.06	0	0.17	0.10	0.07	0	0.14	0.09	0.05
4-27	4-28	0	0.09	0.07	0.02	0	0.07	0.05	0.02	0	0.05	0.05	0
4-28	4-29	0	0.07	0.06	0.01	0	0.09	0.06	0.03	0	0.09	0.05	0.04
4-29	4-30	0	0.05	0.05	0	0	0.05	0.05	0	0	0.05	0.05	0
4-30	5-1	0	0.07	0.06	0.01	0	0.06	0.05	0.01	0	0.09	0.06	0.03

Table 15. (Continued)

Start	End	Sampler site ¹														
		D	P	Y	R	AA ^a	DP-T ^b	DP-G ^c	DP-P ^d	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
Micrograms fluoride per cubic meter																
3-17	3-18 ^e	0	0.03	0.03	0	.....	0	0.02	0.02	0	0	0	0.03	0.03	0.03	0
3-18	3-19	1.21	1.07	0.41	0.66	.....	0	0.34	0.18	0.16	0	0.23	0.09	0.14		
3-19	3-20	1.16	1.24	0.43	0.81	0	0	0.30	0.15	0.15	0	0.22	0.12	0.10		
3-20	3-21	0.58	0.31	0.19	0.12	0	0	0.33	0.18	0.15	0	0.18	0.10	0.08		
3-21	3-22	0.30	0.10	0.07	0.03	0	0	0.08	0.06	0.02	0	0.07	0.05	0.02		
3-22	3-23	0.30	0.25	0.16	0.09	0	0	0.35	0.19	0.16	0	0.17	0.11	0.06		
3-23	3-24	0	0.04	0.04	0	0	0	0.07	0.05	0.02	0	0.13	0.08	0.05		
3-24	3-25	0.40	0.20	0.13	0.07	0	0	0.05	0.04	0.01	0	0.06	0.05	0.01		
3-25	3-26	0.29	0.22	0.11	0.11	0	0	0.17	0.08	0.09	0	0.10	0.05	0.05		
3-26	3-27	0.57	0.43	0.28	0.14	0	0	0.14	0.09	0.05	0	0.06	0.04	0.02		
3-27	3-28	0.43	0.25	0.14	0.11	0	0	0.24	0.14	0.10	0	0.12	0.06	0.06		
3-28	3-29	0	0.07	0.07	0	0	0	0.06	0.06	0	0	0.06	0.06	0		
3-29	3-30	0.33	0.07	0.05	0.02	0	0	0.06	0.04	0.02	0	0.03	0.02	0.01		
3-30	3-31	0	0.15	0.10	0.05	0	0	0.15	0.10	0.05	0	0.12	0.08	0.04		
3-31	4- 1	0	0.15	0.09	0.06	0	0	0.15	0.08	0.07	0	0.09	0.06	0.03		
4- 1	4- 2	0	0.07	0.06	0.01	0	0	0.08	0.06	0.02	0	0.06	0.05	0.01		
4- 2	4- 3	0	0.23	0.17	0.06	0	0	0.11	0.08	0.03	0	0.07	0.06	0.01		
4- 3	4- 4	0.68	0.54	0.32	0.22	0	0	0.58	0.34	0.24	0	0.26	0.13	0.13		
4- 4	4- 5	0	0.39	0.20	0.19	0	0	0.12	0.09	0.03	0	0.11	0.07	0.04		
4- 5	4- 6	0	0.29	0.19	0.10	0	0	0.21	0.15	0.06	0	0.11	0.08	0.03		
4- 6	4- 7	0	0.03	0.02	0.01	0	0	0.03	0.03	0	0	0.07	0.04	0.03		
4- 7	4- 8	0.67	0.22	0.13	0.09	0	0	0.11	0.08	0.03	0	0.07	0.05	0.02		
4- 8	4- 9	0	0.63	0.41	0.22	0	0	0.40	0.30	0.10	0	0.15	0.09	0.06		
4- 9	4-10	0	0.19	0.15	0.04	0	0	0.31	0.22	0.09	0	0.21	0.15	0.06		
4-10	4-11	0	0.05	0.04	0.01	0	0	0	0	0	0	0.01	0.01	0		
4-11	4-12	0	0.02	0.02	0	0	0	0.01	0.01	0	0	0.02	0.02	0		
4-12	4-13	0.87	0.95	0.40	0.55	0	0	0.20	0.11	0.09	0	0.12	0.06	0.06		
4-13	4-14	0	0.21	0.12	0.09	0	0	0.27	0.15	0.12	0	0.18	0.10	0.08		
4-14	4-15	0	0.15	0.11	0.04	0	0	0.21	0.13	0.08	0	0.17	0.11	0.06		
4-15	4-16	0	0.17	0.13	0.04	0	0	0.17	0.09	0.08	0	0.02	0.01	0.01		
4-16	4-17	0	0.76	0.42	0.34	0	0	0.15	0.10	0.05	0	0.07	0.04	0.03		
4-17	4-18	0	0.33	0.24	0.08	0	0	0.22	0.13	0.09	0	0.01	0.01	0		
4-18	4-19	0	0.17	0.15	0.02	0	.....	.....	.....	.....	0	0.09	0.07	0.02		
4-19	4-20	0	0.06	0.06	0	0	.....	.....	.....	.....	0	0.11	0.06	0.05		
4-20	4-21	0	0.06	0.06	0	0	.....	.....	.....	.....	.....	0.11	0.08	0.03		
4-21	4-22	0	0.09	0.08	0.01	0	.....	.....	.....	.....	.....	0.01	0.01	0		
4-22	4-23	0	0.06	0.06	0	0	0	0.04	0.04	0	.....	0.01	0.01	0		
4-23	4-24	0	0.15	0.11	0.04	0	0	0.19	0.13	0.06	.....	0.09	0.06	0.03		
4-24	4-25	0	0.04	0.04	0	0	0	0.09	0.06	0.03	.....	0.06	0.05	0.01		
4-25	4-26	0	0.25	0.15	0.10	0	0	0.16	0.11	0.05	.....	0.12	0.08	0.04		
4-26	4-27	0	0.05	0.05	0	0	0	0.13	0.08	0.04	.....	0.08	0.05	0.03		
4-27	4-28	0	0.07	0.05	0.02	0	0	0.05	0.05	0	.....	0.05	0.05	0		
4-28	4-29	0	0.06	0.05	0.01	0	0	0.06	0.05	0.01	0	0.04	0.04	0		
4-29	4-30	0	0.07	0.05	0.02	0	0	0.04	0.04	0	0	0.06	0.04	0.02		
4-30	5- 1	0	0.30	0.15	0.15	0	0	0.10	0.07	0.03	0	0.04	0.04	0		

Table 15. (Continued)

Start	End	Sampler site ¹											
		K				H				G			
		AA ²	DP-T ³	DP-G ⁴	DP-P ⁵	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
<i>Micrograms fluoride per cubic meter</i>													
3-17	3-18*	.....	.....	.....	.....	.....	.....	.....	.....	0.88	.....	.....	.....
3-18	3-19	0.99	.....	.....	.....	0.48	.....	.....	.....	0.62	.....	.....	.....
3-19	3-20	0.71	.....	.....	.....	0.44	.....	.....	.....	0.60	0.92	0.30	0.62
3-20	3-21	0.70	.....	.....	.....	0.62	.....	.....	.....	0.91	0.27	0.16	0.11
3-21	3-22	0.58	.....	.....	.....	0.31	.....	.....	.....	0.37	0.33	0.18	0.15
3-22	3-23	0.72	.....	.....	.....	0.39	.....	.....	.....	.....	0.13	0.07	0.06
3-23	3-24	0.57	0.19	0.12	0.07	0.60	0.18	0.13	0.05	0.72	0.20	0.14	0.06
3-24	3-25	0.56	0.04	0.03	0.01	0	0.04	0.03	0.01	0.44	0.25	0.23	0.02
3-25	3-26	0.83	0.13	0.07	0.06	0.44	0.14	0.07	0.07	0.44	0.20	0.11	0.09
3-26	3-27	0	0.07	0.05	0.02	0.29	0.10	0.06	0.04	0	0.12	0.07	0.05
3-27	3-28	0.55	0.15	0.08	0.07	0.44	0.18	0.10	0.08	0.59	0.27	0.16	0.11
3-28	3-29	0	0.06	0.06	0	0	0.06	0.06	0	0.86	0.21	0.13	0.08
3-29	3-30	0	0.04	0.03	0.01	0	0.09	0.07	0.02	0.54	0.13	0.08	0.05
3-30	3-31	0	0.17	0.11	0.06	0	0.19	0.11	0.08	0.54	0.29	0.16	0.13
3-31	4- 1	0	0.12	0.07	0.05	0	0.17	0.09	0.08	0	0.36	0.19	0.17
4- 1	4- 2	0	0.17	0.11	0.06	0	0.23	0.13	0.10	0	0.22	0.14	0.08
4- 2	4- 3	0	0.06	0.06	0	0	0.11	0.07	0.04	0	0.20	0.11	0.09
4- 3	4- 4	0	0.30	0.17	0.13	0	0.30	0.17	0.13	0	0.38	0.20	0.18
4- 4	4- 5	0	0.07	0.05	0.02	0	0.10	0.07	0.03	0	0.28	0.18	0.10
4- 5	4- 6	0	0.16	0.10	0.06	0	0.12	0.09	0.03	0	0.42	0.28	0.14
4- 6	4- 7	0	0.10	0.07	0.03	0	0.12	0.08	0.04	0	0.35	0.23	0.12
4- 7	4- 8	0	0.11	0.08	0.03	0	0.12	0.09	0.03	0	0.17	0.10	0.07
4- 8	4- 9	.....	0.24	0.11	0.13	0	0.29	0.17	0.12	.....	0.21	0.14	0.07
4- 9	4-10	.....	0.39	0.24	0.15	0	0.43	0.28	0.15	.....	0.71	0.47	0.24
4-10	4-11	0	0.04	0.04	0	0	0.04	0.04	0	0	0.07	0.06	0.01
4-11	4-12	0	0.03	0.03	0	0	0.03	0.03	0	0	0.14	0.09	0.05
4-12	4-13	0	0.12	0.06	0.06	0	0.19	0.09	0.10	0	0.17	0.09	0.08
4-13	4-14	0	0.26	0.15	0.11	0	0.32	0.17	0.15	0	0.24	0.12	0.12
4-14	4-15	0	0.12	0.08	0.04	0	0.15	0.09	0.06	0	0.25	0.14	0.11
4-15	4-16	0	0.03	0.03	0	0	0.06	0.05	0.01	0	0.10	0.08	0.02
4-16	4-17	0	0.03	0.02	0.01	0	0.05	0.04	0.01	0	0.07	0.03	0.04
4-17	4-18	0	0.28	0.18	0.10	0	0.25	0.16	0.09	0	0.43	0.25	0.18
4-18	4-19	0	0.09	0.05	0.04	0	0.04	0.04	0	0	0.16	0.14	0.02
4-19	4-20	0	0.03	0.03	0	0	0	0	0	0	0.05	0.05	0
4-20	4-21	0	0.03	0.03	0	0	0.04	0.04	0	0	0.09	0.08	0.01
4-21	4-22	0	0	0	0	0	0.24	0.14	0.10	0	0.23	0.14	0.09
4-22	4-23	0	0.08	0.06	0.02	0	0.05	0.05	0	0	0.20	0.12	0.08
4-23	4-24	0	0.07	0.05	0.02	0	0.12	0.09	0.03	0	0.24	0.14	0.10
4-24	4-25	.....	0.13	0.09	0.04	0	0.10	0.06	0.04	0	0.25	0.17	0.08
4-25	4-26	.....	0.09	0.05	0.04	0	0.16	0.11	0.05	0	0.20	0.11	0.09
4-26	4-27	.....	0.07	0.05	0.02	0	0.10	0.07	0.03	0	0.16	0.09	0.07

Table 15. (Continued)

Start	End	Sampler site ¹											
		K				H				G			
Start	End	AA ²	DP-T ³	DP-G ⁴	DP-P ⁵	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
<i>Micrograms fluoride per cubic meter</i>													
4-27	4-28	.....	0.06	0.05	0.01	0	0.05	0.04	0.01	0	0.10	0.07	0.03
4-28	4-29	.....	0.05	0.04	0.01	0	0.04	0.04	0	0	0.19	0.11	0.08
4-29	4-30	.....	0.05	0.04	0.01	0	0.06	0.04	0.02	0	0.22	0.06	0.16
4-30	5-1	0	0.04	0.04	0	0	0.11	0.07	0.04	0	0.17	0.09	0.08

¹ See Figure 1 for sampler location.² Automatic air sampler; zero values were below detectable limit.³ Double paper sampler, total value.⁴ Double paper sampler, gas value.⁵ Double paper sampler, particulate value.⁶ 24-hour sample duration, 3-17 to 3-28; 6-hour sample duration averaged to 24-hour sample, 3-28 to 4-23; 8-hour sample duration averaged to 24-hour sample, 4-23 to 5-1.Table 16. Daily average fluoride levels during sweet cherry anthesis for air sampler sites
(The Dalles, 1971)

Start	End	Sampler site ¹											
		J				M				E			
Start	End	AA ²	DP-T ³	DP-G ⁴	DP-P ⁵	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
<i>Micrograms fluoride per cubic meter</i>													
3-17	3-18 ⁶	T ⁷	0.92	0.51	0.41	0.64	0.75	0.33	0.42	0.75	0.87	0.44	0.43
3-18	3-19	0	0.58	0.26	0.32	1.74	1.59	0.28	1.31	1.30	0.75	0.20	0.55
3-19	3-20	1.04	0.80	0.32	0.48	0.98	0.86	0.51	0.35	0.80	0.66	0.38	0.28
3-20	3-21	T	0.12	0.07	0.05	T	0.11	0.06	0.06	T	0.10	0.06	0.04
3-21	3-22	0.50	0.47	0.26	0.21	0.34	0.36	0.22	0.14	0.64	0.48	0.23	0.25
3-22	3-23	0.50	0.34	0.06	0.28	T	0.31	0.17	0.14	0.42	0.36	0.20	0.16
3-23	3-24	0.61	0.52	0.26	0.26	0.57	0.53	0.24	0.29	T	0.28	0.13	0.15
3-24	3-25	T	0.10	0.06	0.04	T	0.10	0.06	0.04	T	0.12	0.07	0.05
3-25	3-26	.....	0.38	0.11	0.27	T	0.22	0.13	0.09	0.41	0.36	0.12	0.24
3-26	3-27	0.78	0.39	0.22	0.17	.....	0.32	0.20	0.12	T	0.13	0.08	0.05
3-27	3-28	0	0.22	0.11	0.11	.....	0.26	0.17	0.09	0.40	0.54	0.26	0.28
3-28	3-29	2.37	1.86	0.60	1.26	1.37	1.37	0.56	0.81	1.45	1.35	0.37	0.98
3-29	3-30	1.51	1.08	0.28	0.80	0.91	0.85	0.34	0.51	0.53	0.56	0.25	0.31
3-30	3-31	T	0.10	0.05	0.05	0	0.09	0.06	0.03	T	0.02	0.02	T
3-31	4-1	T	0.16	0.11	0.05	0	0.07	0.04	0.03	T	0.22	0.03	0.19
4-1	4-2	T	0.15	0.07	0.08	T	0.13	0.08	0.05	T	0.10	0.05	0.05
4-2	4-3	T	0.31	0.12	0.19	T	0.13	0.08	0.05	T	0.17	0.05	0.12
4-3	4-4	2.63	2.15	0.72	1.43	1.46	1.56	0.29	1.27	0.72	0.67	0.18	0.49
4-4	4-5	4.39	3.44	0.64	2.80	3.01	2.58	0.71	1.87	1.37	1.00	0.21	0.79
4-5	4-6	1.67	1.19	0.23	0.96	1.27	1.09	0.44	0.65	0.68	0.61	0.12	0.49
4-6	4-7	0.44	0.10	0.07	0.03	T	0.14	0.08	0.06	T	0.10	0.06	0.03
4-7	4-8	0.44	0.41	0.14	0.27	0.43	0.26	0.16	0.10	1.23	0.76	0.32	0.45

Table 16. (Continued)

Sampler site ^a													
Start	End	J				M				E			
		AA ^b	DP-T ^c	DP-G ^d	DP-P ^e	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
<i>Micrograms fluoride per cubic meter</i>													
4- 8	4- 9	T	0.30	0.17	0.13	T	0.30	0.17	0.13	0.44	0.23	0.15	0.08
4- 9	4-10	T	0.26	0.07	0.19	T	0.35	0.19	0.16	T	0.18	0.11	0.07
4-10	4-11	T	0.16	0.07	0.09	T	0.23	0.15	0.08	T	0.15	0.08	0.06
4-11	4-12	0.43	0.30	0.10	0.20	T	0.22	0.11	0.11	T	0.18	0.09	0.09
4-12	4-13	T	0.43	0.08	0.35	0.43	0.27	0.11	0.16	T	0.58	0.15	0.43
4-13	4-14	0.97	1.04	0.28	0.76	.....	0.94	0.24	0.70	T	0.52	0.15	0.37
4-14	4-15	T	0.12	0.06	0.06	.....	0.13	0.06	0.07	0.44	0.09	0.05	0.04
4-15	4-16	0.44	0.03	0.01	0.02	.....	0.05	0.04	0.01	T	0.05	0.03	0.02
4-16	4-17	T	0.17	0.08	0.09	0.44	0.19	0.12	0.07	T	0.22	0.12	0.10
4-17	4-18	0.44	0.20	0.10	0.10	0.45	0.15	0.09	0.06	0.43	0.12	0.08	0.04
4-18	4-19	T	0.04	0.03	0.01	T	0.07	0.05	0.02	T	0.07	0.05	0.02
4-19	4-20	0.43	0.10	0.05	0.05	T	0.13	0.08	0.05	T	0.10	0.05	0.05
4-20	4-21	T	0.01	0.01	T	T	0.02	0.02	T	0.42	T	T	0
4-21	4-22	0.62	0.28	0.12	0.16	T	0.19	0.12	0.07	0.42	0.24	0.13	0.11
4-22	4-23	T	0.30	0.09	0.21	T	0.24	0.10	0.14	1.06	0.22	0.10	0.12
4-23	4-24	T	0.01	0.01	T	0.52	0.02	0.02	T	T	0.02	0.02	0
4-24	4-25	T	0.27	0.14	0.13	T	0.13	0.07	0.06	T	0.16	0.07	0.09
4-25	4-26	0.42	0.72	0.24	0.48	T	0.32	0.12	0.20	0.53	0.80	0.24	0.56
4-26	4-27	0.86	0.77	0.29	0.48	T	0.61	0.31	0.30	0.43	0.31	0.15	0.16
4-27	4-28	T	0.05	0.04	0.01	T	0.03	0.03	T	T	T	T	0
4-28	4-29	T	0.03	0.03	T	T	0.02	0.02	T	T	0.04	0.03	0.01
4-29	4-30	0.44	0.40	0.14	0.26	T	0.37	0.14	0.23	T	0.62	0.28	0.34
4-30	5- 1	1.64	0.96	0.28	0.68	0.67	1.00	0.38	0.62	0.67	0.62	0.25	0.37
D				Y				R					
3-17	3-18 ^a	0.76	0.69	0.32	0.37	T	0.10	0.06	0.04	T	0.05	0.02	0.03
3-18	3-19	1.18	0.84	0.23	0.61	T	0.34	0.19	0.15	T	0.14	0.06	0.08
3-19	3-20	0.87	0.74	0.42	0.32	0.26	0.33	0.16	0.17	T	0.15	0.05	0.10
3-20	3-21	0.39	0.11	0.07	0.04	T	0.11	0.05	0.06	T	0.11	0.06	0.05
3-21	3-22	0.53	0.46	0.11	0.35	0.34	0.20	0.12	0.08	T	0.14	0.07	0.07
3-22	3-23	0.46	0.33	0.17	0.16	T	0.26	0.17	0.09	T	0.18	0.11	0.07
3-23	3-24	0.46	0.31	0.12	0.19	T	0.46	0.20	0.26	T	0.22	0.11	0.11
3-24	3-25	T	0.09	0.05	0.04	T	0.09	0.06	0.03	T	0.05	0.03	0.02
3-25	3-26	T	0.29	0.14	0.15	T	0.20	0.15	0.05	T	0.12	0.05	0.07
3-26	3-27	T	0.14	0.08	0.06	T	0.11	0.08	0.03	T	0.04	0.02	0.02
3-27	3-28	0.42	0.44	0.20	0.24	T	0.09	0.05	0.04	T	0.15	0.08	0.07
3-28	3-29	1.32	1.05	0.50	0.55	0.87	0.76	0.32	0.44	T	0.39	0.19	0.20
3-29	3-30	0.73	0.72	0.32	0.40	0.55	0.45	0.22	0.23	T	0.14	0.07	0.07
3-30	3-31	T	0.05	0.03	0.02	0	0.01	0.01	T	T	0.06	0.02	0.04
3-31	4- 1	T	0.22	0.11	0.11	0	0.10	0.05	0.05	T	0.06	0.02	0.04
4- 1	4- 2	T	0.12	0.07	0.05	0	0.13	0.06	0.07	T	0.24	0.10	0.14
4- 2	4- 3	T	0.10	0.06	0.04	T	0.09	0.04	0.05	T	0.03	0.03	.....
4- 3	4- 4	0.84	0.73	0.28	0.45	0.39	0.37	0.09	0.28	T	0.12	0.06	0.06
4- 4	4- 5	1.28	1.02	0.49	0.58	0.97	0.69	0.25	0.44	T	0.11	0.04	0.07
4- 5	4- 6	0.80	0.74	0.26	0.48	1.13	1.00	0.22	0.78	T	0.21	0.12	0.09
4- 6	4- 7	.....	.....	.....	.....	T	0.03	0.03	T	T	0.09	0.06	0.04
4- 7	4- 8	T	0.67	0.27	0.41	0.58	0.10	0.05	0.04	T	0.06	0.03	0.02

Table 16. (Continued)

Start	End	Sampler site ¹											
		D				Y				R			
		AA ^a	DP-T ^b	DP-G ^c	DP-P ^d	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
Micrograms fluoride per cubic meter													
4- 8	4- 9	T	0.19	0.12	0.06	T	0.15	0.09	0.06	T	0.11	0.06	0.05
4- 9	4-10	T	0.13	0.07	0.05	T	0.21	0.10	0.11	0.43	0.10	0.05	0.05
4-10	4-11	T	0.15	0.10	0.05	T	0.12	0.06	0.06	T	0.06	0.03	0.03
4-11	4-12	T	0.17	0.08	0.10	T	0.17	0.09	0.08	T	0.12	0.06	0.06
4-12	4-13	T	0.07	0.07	T	T	0.06	0.03	0.02	T	0.03	T	0.03
4-13	4-14	T	0.54	0.23	0.31	T	0.12	0.05	0.07	T	0.03	0.01	0.02
4-14	4-15	T	0.08	0.04	0.05	T	0.06	0.03	0.04	T	0.06	0.03	0.03
4-15	4-16	T	0.02	0.01	0.01	T	T	T	0.87	0.02	0.02	T	
4-16	4-17	T	0.19	0.11	0.08	T	0.09	0.05	0.04	T	0.04	0.03	0.02
4-17	4-18	T	0.11	0.07	0.05	T	0.08	0.04	0.04	T	0.03	0.01	0.02
4-18	4-19	T	0.07	0.05	0.02	T	0.04	0.04	T	T	0.06	0.05	0.01
4-19	4-20	T	0.09	0.05	0.04	T	0.09	0.05	0.03	T	0.04	0.02	0.02
4-20	4-21	T	0.01	0.01	T	0.42	0.01	0.01	T	T	0.01	0.01	T
4-21	4-22	T	0.16	0.10	0.06	T	0.01	0.01	T	T	0.01	0.01	T
4-22	4-23	T	.....	.....	.....	0.74	T	T	T	T	0.06	0.04	0.03
4-23	4-24	.....	.....	.....	.....	T	0.18	0.07	0.11	0.61	0.01	0.01	T
4-24	4-25	.....	.....	.....	.....	.....	.....	.....	0.44	0.02	0.01	0.01	
4-25	4-26	.....	.....	.....	.....	.....	.....	.....	T	0.04	0.01	0.03	
4-26	4-27	0.11	T	T	T	.....	.....	.....	T	0.10	0.06	0.04	
4-27	4-28	T	0.01	0.01	T	T	0.02	0.02	T	T	T	T	T
4-28	4-29	T	0.04	0.04	T	T	0.01	0.01	T	T	T	T	T
4-29	4-30	0.48	0.40	0.20	0.20	T	0.06	0.03	0.02	T	0.04	0.03	0.01
4-30	5- 1	T	0.72	0.34	0.38	T	0.22	0.10	0.12	T	0.07	0.04	0.04
K													
H													
G													
3-17	3-18 ^e	T ^f	0.04	0.02	0.02	T	0.07	0.04	0.03	.....	0.07	0.03	0.04
3-18	3-19	T	0.11	0.07	0.04	T	0.34	0.18	0.16	.....	0.10	0.07	0.03
3-19	3-20	T	0.15	0.08	0.07	T	0.67	0.29	0.38	.....	0.26	0.13	0.13
3-20	3-21	T	0.09	0.04	0.05	T	0.28	0.14	0.14	.....	0.30	0.11	0.19
3-21	3-22	T	0.11	0.07	0.04	T	0.20	0.13	0.07	.....	0.15	0.03	0.12
3-22	3-23	T	0.20	0.06	0.14	T	0.22	0.13	0.09	.....	0.22	0.14	0.08
3-23	3-24	0.42	0.36	0.13	0.23	0.41	0.45	0.24	0.21	.....	0.38	0.14	0.24
3-24	3-25	0.46	0.06	0.03	0.03	0	0.07	0.04	0.03	.....	0.18	0.09	0.09
3-25	3-26	0	0.09	0.04	0.05	T	0.14	0.10	0.04	T	0.11	0.07	0.04
3-26	3-27	T	0.05	0.03	0.02	T	T	T	T	0	0.25	0.13	0.12
3-27	3-28	0	0.18	0.10	0.08	T	0.01	T	0.01	.....	0.36	0.16	0.20
3-28	3-29	0.40	0.38	0.18	0.20	0.39	T	T	T	.....	0.38	0.14	0.24
3-29	3-30	T	0.15	0.08	0.07	T	T	T	T	.....	.....	0.20	
3-30	3-31	0	0.05	0.03	0.02	T	0.06	0.03	0.03	T	0.75	0.08	0.67
3-31	4- 1	0	0.03	0.01	0.02	0	0.04	0.02	0.02	0.39	.....	0.08	.....
4- 1	4- 2	T	0.18	0.08	0.10	T	0.21	0.11	0.10	0.38	.....	.....	.....
4- 2	4- 3	T	0.07	0.04	0.03	T	0.10	0.05	0.05	T	.....	.....	.....
4- 3	4- 4	T	0.14	0.07	0.07	T	0.17	0.05	0.12	0.36	0.31	0.08	0.23
4- 4	4- 5	0	0.16	0.04	0.12	T	0.19	0.09	0.10	T	0.18	0.03	0.15
4- 5	4- 6	T	0.34	0.08	0.26	0.58	0.59	0.18	0.41	0.34	0.44	0.12	0.32
4- 6	4- 7	T	0.05	0.03	0.01	0	0.10	0.05	0.04	T	0.30	0.12	0.18

Table 16. (Continued)

Start	End	Sampler site ¹											
		K				H				G			
		AA ²	DP-T ³	DP-G ⁴	DP-P ⁵	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
<i>Micrograms fluoride per cubic meter</i>													
4- 7	4- 8	T	0.07	0.03	0.04	0.44	0.06	0.02	0.04	T	0.13	0.06	0.07
4- 8	4- 9	T	0.10	0.05	0.05	T	0.11	0.06	0.06	0.46	0.12	0.07	0.05
4- 9	4-10	T	0.11	0.06	0.06	T	0.17	0.08	0.09	T	0.16	0.09	0.07
4-10	4-11	T	0.05	0.04	0.01	T	0.13	0.06	0.08	T	0.09	0.05	0.04
4-11	4-12	T	0.13	0.05	0.08	T	0.17	0.08	0.09	0.72	0.16	0.07	0.10
4-12	4-13	T	0.02	0.02	T	T	0.03	0.01	0.02	T	0.05	0.02	0.03
4-13	4-14	T	0.05	0.01	0.04	T	0.04	0.02	0.02	T	0.13	0.06	0.08
4-14	4-15	0.41	0.10	0.05	0.05	0.51	0.09	0.03	0.06	T	0.21	0.09	0.12
4-15	4-16	0.50	0.01	0.01	T	T	0.01	0.01	T	T	0.04	0.03	0.01
4-16	4-17	T	0.04	0.02	0.02	T	0.06	0.03	0.03	0.89	0.06	0.04	0.02
4-17	4-18	T	0.05	0.03	0.02	0.51	0.05	0.03	0.02	T	0.11	0.05	0.06
4-18	4-19	0.42	T	T	T	T	0.04	0.03	0.01	T	0.10	0.05	0.05
4-19	4-20	T	0.06	0.03	0.03	.....	0.08	0.04	0.05	T	0.15	0.05	0.10
4-20	4-21	0.42	0.01	0.01	T	.....	T	T	T	.....	0.08	0.04	0.04
4-21	4-22	T	0.02	0.02	T	.....	0.01	0.01	T	0.47	0.11	0.05	0.06
4-22	4-23	T	0.10	0.05	0.06	.....	0.10	0.05	0.06	0.47	0.17	0.08	0.09
4-23	4-24	0.43	0.01	0.01	T	.....	0.01	T	0.01	T	0.06	0.04	0.03
4-24	4-25	0.44	0.02	T	0.02	.....	0.01	0.01	T	T	0.11	0.06	0.05
4-25	4-26	T	0.05	0.02	0.02	.....	0.12	0.07	0.06	T	0.12	0.06	0.06
4-26	4-27	T	0.06	0.03	0.04	T	0.11	0.06	0.05	T	0.19	0.09	0.10
4-27	4-28	T	T	T	T	T	0.01	0.01	T	T	0.27	0.14	0.13
4-28	4-29	T	T	T	T	T	T	T	T	T	0.16	0.07	0.09
4-29	4-30	T	0.04	0.02	0.02	T	0.01	T	0.01	T	0.10	0.05	0.05
4-30	5- 1 ⁶	T	0.10	0.05	0.05	T	0.14	0.07	0.07	T	0.18	0.09	0.09

¹ See Figure 1 for sampler location.² Automatic air sampler; zero values were below detectable limit.³ Double paper sampler, total value.⁴ Double paper sampler, gas value.⁵ Double paper sampler, particulate value.⁶ 24-hour sample duration, 3-17 to 4-7; 6-hour sample duration averaged to 24-hour sample, 4-7 to 5-1.⁷ Trace amount.

Table 17. Daily average fluoride levels during sweet cherry anthesis for the air sampling sites
 (The Dalles, 1972)

Start	End	Sampler site ¹											
		M				E				G			
		AA ²	DP-T ³	DP-G ⁴	DP-P ⁵	AA	DP-T	DP-G	DP-P	AA	DP-T	DP-G	DP-P
<i>Micrograms fluoride per cubic meter</i>													
3-23	3-24 ^a	0	0.08	0.05	0.03	0.49	0.22	0.14	0.08	0	0.03	0.02	0.01
3-24	3-25	0.24	0.15	0.09	0.06	0	0.20	0.14	0.06	0	0.07	0.04	0.03
3-25	3-26	0	0.10	0.05	0.05	0	0.07	0.05	0.02	0	0.02	0.01	0.01
3-26	3-27	0	0.02	0.02	0	0	0.03	0.03	0	0	0.03	0.02	0.01
3-27	3-28	0	0.04	0.03	0.01	0	0.07	0.05	0.02	0	0.05	0.03	0.02
3-28	3-29	0	0.07	0.05	0.02	0	0.09	0.05	0.04	0	0.06	0.03	0.03
3-29	3-30	.....	0.19	0.11	0.08	0	0.18	0.11	0.07	0	0.08	0.04	0.04
3-30	3-31	.....	0.49	0.21	0.28	0	0.21	0.11	0.10	0	0.09	0.05	0.04
3-31	4- 1	0	0.26	0.15	0.11	0	0.15	0.09	0.06	0	0.10	0.06	0.04
4- 1	4- 2	0	0.04	0.04	0	0	0.02	0.02	0	0	0.13	0.08	0.05
4- 2	4- 3	0.58	0.78	0.31	0.47	0	0.42	0.25	0.17	0	0.08	0.04	0.04
4- 3	4- 4	0	0.39	0.27	0.12	0	0.37	0.27	0.10	0	0.14	0.08	0.06
4- 4	4- 5	0	0.65	0.48	0.17	0	0.72	0.54	0.18	0	0.08	0.05	0.03
4- 5	4- 6	0	0.23	0.18	0.04	0	0.15	0.12	0.03	0	0.09	0.05	0.04
4- 6	4- 7	0	0.09	0.08	0.01	0	0.06	0.05	0.01	0	0.07	0.04	0.03
4- 7	4- 8	0	0.23	0.18	0.05	0	0.20	0.15	0.05	0	0.06	0.04	0.02
4- 8	4- 9	0	0.06	0.06	0	0	0.06	0.05	0.01	0	0.06	0.04	0.02
4- 9	4-10	0	0.09	0.07	0.02	0	0.13	0.10	0.03	0	0.04	0.03	0.01
4-10	4-11	0	0.18	0.12	0.06	0	0.12	0.08	0.04	0	0.04	0.03	0.01
4-11	4-12	0	0.11	0.09	0.02	0	0.05	0.04	0.01	0	0.05	0.04	0.01
4-12	4-13	0	0.03	0.03	0	0	0.03	0.03	0	0	0.04	0.03	0.01
4-13	4-14	0	0.05	0.05	0	0	0.02	0.02	0	0	0.07	0.05	0.02
4-14	4-15	0	0.05	0.05	0	0	0.03	0.03	0	0	0.07	0.05	0.02
4-15	4-16	0	0.01	0.01	0	0	0.01	0.01	0	0	0.04	0.03	0.01
4-16	4-17	0	0.03	0.03	0	0	0.03	0.02	0.01	0	0.02	0.02	0
4-17	4-18	0	0.02	0.02	0	0	0.02	0.01	0.01	0	0.02	0.01	0.01
4-18	4-19	0	0.02	0.02	0	0	0	0	0	0	0.03	0.02	0.01
4-19	4-20	0	0.04	0.03	0.01	0	0.01	0.01	0	0	0.06	0.04	0.02
4-20	4-21	0	0.02	0.01	0.01	0	0.01	0.01	0	0	0.05	0.04	0.01
4-21	4-22	0	0.02	0.01	0.01	0	0	0	0	0	0.04	0.03	0.01
4-22	4-23	1.31	1.79	0.71	1.08	0	0.30	0.12	0.18	0	0.07	0.03	0.04
4-23	4-24	0.58	0.22	0.12	0.10	0	0.14	0.08	0.06	0	0.13	0.07	0.06
4-24	4-25	0	0.06	0.06	0	0	0.01	0.01	0	0	0.05	0.04	0.01
4-25	4-26	0	0.02	0.02	0	0	0.02	0.02	0	0	0.08	0.06	0.02
4-26	4-27	0	0.87	0.28	0.59	0.60	0.39	0.22	0.17	0	0.05	0.03	0.02
4-27	4-28	0	0.95	0.52	0.43	0.37	0.18	0.13	0.05	0.36	0.11	0.08	0.03
4-28	4-29	0	0.02	0.02	0	0	0.03	0.02	0.01	0	0.03	0.02	0.01
4-29	4-30	0	0.06	0.04	0.02	0	0.05	0.03	0.02	0	0.07	0.04	0.03
4-30	5- 1	0	0.09	0.05	0.04	0	0.11	0.07	0.04	0	0.05	0.03	0.02

¹ See Figure 1 for sampler location.

² Automatic air sampler; zero values were below detectable limit.

³ Double paper sampler, total value.

⁴ Double paper sampler, gas value.

⁵ Double paper sampler, particulate value.

^a 12-hour sample duration averaged to 24-hour sample, 3-23 to 4-19; 8-hour sample duration averaged to 24-hour sample, 4-19 to 4-25; 24-hour sample duration, 4-25 to 5-1.

Table 18. Daily average fluoride levels during sweet cherry anthesis for the air sampling sites
 (The Dalles, 1973)

Start	End	Sampler site ¹									
		M			E			G			
		DP-G ²	DP-P ³	DP-T ⁴	DP-G	DP-P	DP-T	DP-G	DP-P	DP-T	
<i>Micrograms fluoride per cubic meter</i>											
3-15	3-16 ⁵	0.20	0.19	0.39	0.20	0.18	0.38	0.04	0.05	0.09	
3-16	3-17	0.08	0.04	0.12	0.05	0.02	0.07	0.05	0.04	0.09	
3-17	3-18	0.02	0	0.02	0.07	0.12	0.19	0.02	0.02	0.04	
3-18	3-19	0.22	0.05	0.37	0.16	0.09	0.25	0.06	0.06	0.12	
3-19	3-20	0.07	0.04	0.11	0.04	0.02	0.06	0.04	0.03	0.07	
3-20	3-21	0.05	0.01	0.06	0.05	0.01	0.06	0.07	0.02	0.09	
3-21	3-22	0.04	0.02	0.06	0.06	0.02	0.08	0.04	0.03	0.07	
3-22	3-23	0.03	0.01	0.04	0.04	0	0.04	0.03	0.03	0.06	
3-23	3-24	0.04	0.02	0.06	0.17	0.10	0.27	0.03	0.08	0.11	
3-24	3-25	0.80	1.10	1.90	0.40	0.31	0.71	0.06	0.01	0.07	
3-25	3-26	0.19	0.11	0.30	0.04	0.02	0.06	0.07	0.05	0.12	
3-26	3-27	0.03	0.01	0.04	0.03	0.01	0.04	0.04	0.02	0.06	
3-27	3-28	0.02	0	0.02	0.03	0.02	0.05	0.04	0.03	0.07	
3-28	3-29	0.03	0	0.03	0.07	0.01	0.08	0.04	0.02	0.06	
3-29	3-30	0.06	0.02	0.08	0.12	0.02	0.14	0.04	0.02	0.06	
3-30	3-31	0.18	0.10	0.28	0.17	0.10	0.27	0.05	0.05	0.10	
3-31	4- 1	0.03	0	0.03	0.04	0.01	0.05	0.06	0.03	0.09	
4- 1	4- 2	0.02	0	0.02	0.04	0	0.04	.....	.....	.....
4- 2	4- 3	0.04	0.02	0.06	0.07	0.03	0.10	.....	.....	.....
4- 3	4- 4	0.09	0.04	0.13	0.12	0.09	0.21	.....	.....	.....
4- 4	4- 5	0.19	0.16	0.35	0.11	0.06	0.17	0.09	0.09	0.18	
4- 5	4- 6	0.04	0.02	0.06	0.07	0.02	0.09	0.10	0.07	0.17	
4- 6	4- 7	0.03	0.02	0.05	0.03	0.02	0.05	0.03	0.03	0.06	
4- 7	4- 8	0.30	0.44	0.74	0.11	0.18	0.29	0.02	0.02	0.04	
4- 8	4- 9	0.32	0.56	0.88	0.17	0.24	0.41	0.03	0.10	0.13	
4- 9	4-10	0.10	0.11	0.21	0.06	0.04	0.10	0.05	0.07	0.12	
4-10	4-11	0.07	0.03	0.10	0.05	0.03	0.08	0.04	0.03	0.07	
4-11	4-12	0.05	0.03	0.08	0.05	0.03	0.08	0.06	0.04	0.10	
4-12	4-13	0.04	0.06	0.10	0.04	0.02	0.06	0.04	0.03	0.07	
4-13	4-14	0.02	0.08	0.10	0.05	0.01	0.06	0.04	0.02	0.06	
4-14	4-15	0.02	0.05	0.07	0.05	0.01	0.06	0.05	0.02	0.07	
4-15	4-16	0	0.03	0.03	0.03	0	0.03	0.02	0.04	0.06	
4-16	4-17	0	0.03	0.03	0.03	0	0.03	0.03	0.02	0.05	
4-17	4-18	0	0.02	0.02	0.02	0	0.02	0.04	0.02	0.06	
4-18	4-19	0.02	0.04	0.06	0.04	0.01	0.05	0.03	0.02	0.05	
4-19	4-20	0	0.03	0.03	0.02	0	0.02	0.04	0.02	0.06	
4-20	4-21	0	0.02	0.02	0.04	0	0.04	0.02	0.01	0.03	
4-21	4-22	0.02	0.02	0.04	0.03	0	0.03	0.04	0.03	0.07	
4-22	4-23	0.02	0.03	0.05	0.02	0.04	0.06	0.04	0.02	0.06	
4-23	4-24	.....	.....	.....	0	0.02	0.02	0.04	0.01	0.05	
4-24	4-25	.....	.....	.....	.....	.....	.....	0.06	0.02	0.08	

Table 18. (Continued)

Start	End	Sampler site ¹									
		M			E			G			
		DP-G ²	DP-P ³	DP-T ⁴	DP-G	DP-P	DP-T	DP-G	DP-P	DP-T	
<i>Micrograms fluoride per cubic meter</i>											
4-25	4-26	.....	.....	.....	.....	.....	.....	0.03	0.03	0.06	
4-26	4-27	.....	.....	.....	.....	.....	.....	0.07	0.04	0.11	
4-27	4-28	.....	.....	.....	.....	.....	.....	0.03	0.01	0.04	
4-28	4-29	.....	.....	.....	.....	.....	.....	0.03	0.02	0.05	
4-29	4-30	.....	.....	.....	.....	.....	.....	0.03	0.02	0.05	
4-30	5- 1	.....	.....	.....	.....	.....	.....	0.03	0.02	0.05	

¹ See Figure 1 for sampler location.² Double paper sampler, gas value.³ Double paper sampler, particulate value.⁴ Double paper sampler, total value.^{*} 24-hour sample duration.Table 19. Daily average fluoride levels during sweet cherry anthesis for the air sampling sites
(The Dalles, 1974)

Start	End	Sampler site ¹									
		M			E			G			
		DP-G ²	DP-P ³	DP-T ⁴	DP-G	DP-P	DP-T	DP-G	DP-P	DP-T	
<i>Micrograms fluoride per cubic meter</i>											
3-15	3-16*	0.04	0.06	0.10	.....	.....	.....	0.07	0.04	0.11	
3-16	3-17	0.08	0.27	0.35	.....	.....	.....	0.16	0.16	0.32	
3-17	3-18	0.04	0.02	0.06	.....	.....	.....	0.12	0.03	0.15	
3-18	3-19	0.12	0.04	0.16	.....	.....	.....	0.10	0.08	0.18	
3-19	3-20	0.16	0.18	0.34	.....	.....	.....	0.04	0.03	0.07	
3-20	3-21	0.41	0.36	0.77	.....	.....	.....	0.04	0.05	0.09	
3-21	3-22	0.19	0.07	0.26	.....	.....	.....	0.07	0.08	0.15	
3-22	3-23	0.05	0.02	0.07	.....	.....	.....	0.06	0.02	0.08	
3-23	3-24	0.08	0.03	0.11	.....	.....	.....	0.05	0.03	0.08	
3-24	3-25	0.10	0.04	0.14	.....	.....	.....	0.11	0.05	0.16	
3-25	3-26	0.10	0.04	0.14	.....	.....	.....	0.10	0.06	0.16	
3-26	3-27	0.12	0.14	0.26	.....	.....	.....	0.14	0.08	0.23	
3-27	3-28	0.13	0.05	0.18	.....	.....	.....	0.05	0.02	0.07	
3-28	3-29	0.07	0.13	0.20	.....	.....	.....	0.03	0.02	0.05	
3-29	3-30	0.06	0.09	0.15	.....	.....	.....	0.11	0.11	0.22	
3-30	3-31	0.01	0.02	0.03	.....	.....	.....	0.02	0.06	0.08	
3-31	4- 1	0.09	0.08	0.17	.....	.....	.....	0.04	0.02	0.06	
4- 1	4- 2	0.10	0.13	0.23	0.17	0.06	0.23	0.09	0.04	0.13	
4- 2	4- 3	0.06	0.03	0.09	0.04	0.01	0.05	0.06	0.02	0.08	
4- 3	4- 4	0.06	0.02	0.08	0.05	0.02	0.07	0.06	0.02	0.08	
4- 4	4- 5	0.06	0.06	0.12	0.07	0.10	0.17	0.06	0.02	0.08	
4- 5	4- 6	0.02	0.07	0.09	0.06	0.05	0.11	0.10	0.03	0.13	
4- 6	4- 7	0.03	0.01	0.04	0.02	0	0.02	0.03	0.01	0.04	

Table 19. (Continued)

Start	End	Sampler site ¹									
		M			E			G			
		DP-G ²	DP-P ³	DP-T ⁴	DP-G	DP-P	DP-T	DP-G	DP-P	DP-T	
<i>Micrograms fluoride per cubic meter</i>											
4- 7	4- 8	0.11	0.05	0.16	0.26	0.20	0.46	0.06	0.02	0.08	
4- 8	4- 9	0.09	0.07	0.16	0.17	0.11	0.28	0.07	0.03	0.10	
4- 9	4-10	0.02	0.01	0.03	0.04	0.02	0.06	0.05	0.02	0.07	
4-10	4-11	0.02	0.01	0.03	0.02	0	0.02	0.07	0.03	0.10	
4-11	4-12	0.04	0.02	0.06	0.05	0.03	0.08	0.02	0.01	0.03	
4-12	4-13	0.02	0.01	0.03	0.04	0.02	0.06	0.02	0.01	0.03	
4-13	4-14	0.04	0.03	0.07	0.05	0.05	0.10	0.04	0.01	0.05	
4-14	4-15	0.08	0.09	0.17	0.09	0.07	0.16	0.02	0.02	0.04	
4-15	4-16	0.03	0.01	0.04	0.03	0	0.03	0.04	0	0.04	
4-16	4-17	0.08	0.02	0.10	0.18	0.05	0.23	0.04	0.02	0.06	
4-17	4-18	0.16	0.05	0.21	.....	0.06	.....	0.06	0.02	0.08	
4-18	4-19	0.04	0	0.04	0.04	0.01	0.05	0.05	0.02	0.07	
4-19	4-20	0.04	0.01	0.05	0.04	0	0.04	0.09	0.04	0.13	
4-20	4-21	0.04	0.01	0.05	0.04	0.02	0.06	0.07	0.06	0.13	
4-21	4-22	0.05	0.02	0.07	0.08	0.02	0.10	0.06	0.02	0.08	
4-22	4-23	0.05	0.02	0.07	0.06	0.02	0.08	0.04	0.02	0.06	
4-23	4-24	0.07	0.16	0.23	0.07	0.30	0.37	0.05	0.08	0.13	
4-24	4-25	0.01	0.04	0.05	0.02	0.03	0.05	0.03	0.02	0.05	
4-25	4-26	0.03	0.01	0.04	0.03	0.01	0.04	0.03	0.03	0.06	
4-26	4-27	0.04	0.01	0.05	0.02	0.01	0.03	0.03	0.01	0.04	
4-27	4-28	0.03	0.01	0.04	0.03	0	0.03	0.05	0.02	0.07	
4-28	4-29	0.03	0.01	0.04	0.04	0.01	0.05	0.02	0.04	0.06	
4-29	4-30	0.18	0.06	0.24	0.30	0.12	0.42	0.07	0.04	0.11	
4-30	5- 1	0.05	0.02	0.07	0.06	0.02	0.08	0.09	0.04	0.13	

¹ See Figure 1 for sampler location.² Double paper sampler, gas value.³ Double paper sampler, particulate value.⁴ Double paper sampler, total value.⁵ 24-hour sample duration.

Air fluoride measurements

Weekly average and maximum daily atmospheric fluoride levels, starting from April 1 for 1968 through 1974, are presented in Tables 6 to 12. Daily averages for the anthesis period for those years are shown in Tables 13 to 19. Bloom dates varied somewhat from year to year, but April generally coincides with cherry bloom over the entire area. Sampler sites J, M, D, and E were closer to the aluminum plant and had higher fluoride levels than the other stations (Figure 1). Station G was downwind from the aluminum plant in the prevailing wind direction and had higher fluoride values than other stations closer to the aluminum plant but not downwind (stations K, H, W, P). These air fluoride levels and patterns

Table 20. Nitrogen content of 'Royal Ann' and 'Bing' sweet cherry leaf samples
 (The Dalles, 1969-1970)

Orchard No. ¹	1969		1970	
	July	Sept.	July	Sept.
Nitrogen, % dry weight				
1	2.17	2.09	2.06	2.17
9	2.60	2.30	2.46	3.01
10	2.32	.....	1.87	1.83
11	2.53	1.68	1.89	2.14
12	2.66	1.97	2.40	2.25
13	2.44	2.06	2.30	2.42
14	2.66	1.57	2.51	2.42
15	2.22	1.54	1.86	1.61
16	2.66	2.08	2.15	2.14
17	2.73	2.23	2.40	2.37
19	2.65	2.24	2.35	2.55
20	2.21	1.96	2.38	2.43
21	2.18	1.83	2.35	2.56
22	2.54	.....	.....	1.96
23	2.81	2.36	2.81	2.68
24	2.33	2.12	2.40	2.48
25	2.70	2.60	2.38	2.70
26	2.70	2.28	2.24	2.77
27	2.40	2.21	2.18	2.42
28	2.88	2.31	2.87	2.73
29	2.79	2.26	2.74	2.74
30	2.86	2.09	2.86	2.74
31	2.34	1.81	2.14	2.44
32	2.30	.....	2.20	2.29
33	2.35	2.03	2.50	2.47
35	2.83	2.29	2.71	2.95
37	2.59	2.11	3.07	2.43
39	2.16	1.77	1.93	2.33
40	1.70	.....	1.88	1.91
41	2.57	2.33	2.02	2.40
42	2.30	1.95	2.13	2.33
43	2.88	2.20	2.17	2.14
44	2.28	1.96	1.85	2.10
45	2.58	.....	2.51	2.33
46	2.49	1.63	2.06	1.94
48	2.51	1.90	2.31	2.08
49	2.33	2.01	2.54	2.86
50	2.65	1.91	2.19	2.37
52	2.38	1.99	2.93	2.36
53	2.60	2.43	2.69	2.80
55	2.27	2.20	2.14	2.60
56	2.70	2.39	2.19	2.70
58	2.49	2.11	2.73	2.35
59	2.76	2.45	2.61	2.85
62	2.40	1.76	2.39	2.54
68	2.56	2.34	2.34	2.56
69	2.12	1.85	2.22	2.65
70	2.88	.....	2.97	2.75

Table 20. (Continued)

Orchard No. ¹	1969		1970	
	July	Sept.	July	Sept.
<i>Nitrogen, % dry weight</i>				
73	2.68	2.24	2.85	2.77
101	2.38	1.80	1.91	2.46
102	2.46	1.97	1.94	2.18
103	2.34	1.92	2.13	2.56
105	2.75	2.41	2.80	2.68
106	3.01	2.01	2.08	2.08
108	1.98	1.58	2.18	2.46
109	2.51	2.20	2.17	2.73
110	2.54	2.01	2.56	2.79
112	2.74	2.14	2.90	2.12
113	2.37	1.97	1.73	2.00
114	2.42	1.93	2.08	2.56
115	2.66	2.08	2.28	2.30
117	2.65	2.45	2.49	2.68

¹ See Figure 1 for location. 'Royal Ann' samples, 1-73; 'Bing' samples, 101-117; see Compton and others (1968) for location of 'Bing' orchards.

were related to leaf fluoride levels. In The Dalles, leaf and air fluoride levels have been shown to be highly correlated (Compton et al., 1968).

A *t* test analysis of the AA sampler weekly averages (1970, 1971, and 1972) for stations J, M, D, F, and Y versus the gas plus particulate values for the filter paper sampler showed no significant differences between the two sets of means. But correlation and linear regression analysis of these values showed a difference in the samplers (Figure 2). The AA sampler gave higher values when weekly averages were greater than approximately 0.3 $\mu\text{gF}/\text{m}^3$ and lower values when concentrations were less than 0.3 $\mu\text{gF}/\text{m}^3$. The lowest weekly average which the AA sampler would sample was approximately 0.1 to 0.15 $\mu\text{gF}/\text{m}^3$. Regression lines for the three years are similar. The percent gas (based on gas/gas plus particulate filter paper sampler values) during the 1970 and 1971 seasons was approximately 60 and 45 respectively for weekly average values at stations J, M, D, E, and Y. For 1972, 1973, and 1974 the gas/gas plus particulate values were 60, 62, and 61 percent for stations M and E. Gaseous and particulate fluorides were separated because there is some evidence (McCune et al., 1965) that particulates do not have the same effect on plants as gaseous fluoride, although no literature has been found pertaining to sweet cherry.

Several other types of air fluoride samplers were tested in 1971. Regression models for linear comparisons for these samplers are shown in Table 21 and Figure 3, along with models showing the relationship of the double paper sampler to the AA sampler at station E. Values used in these

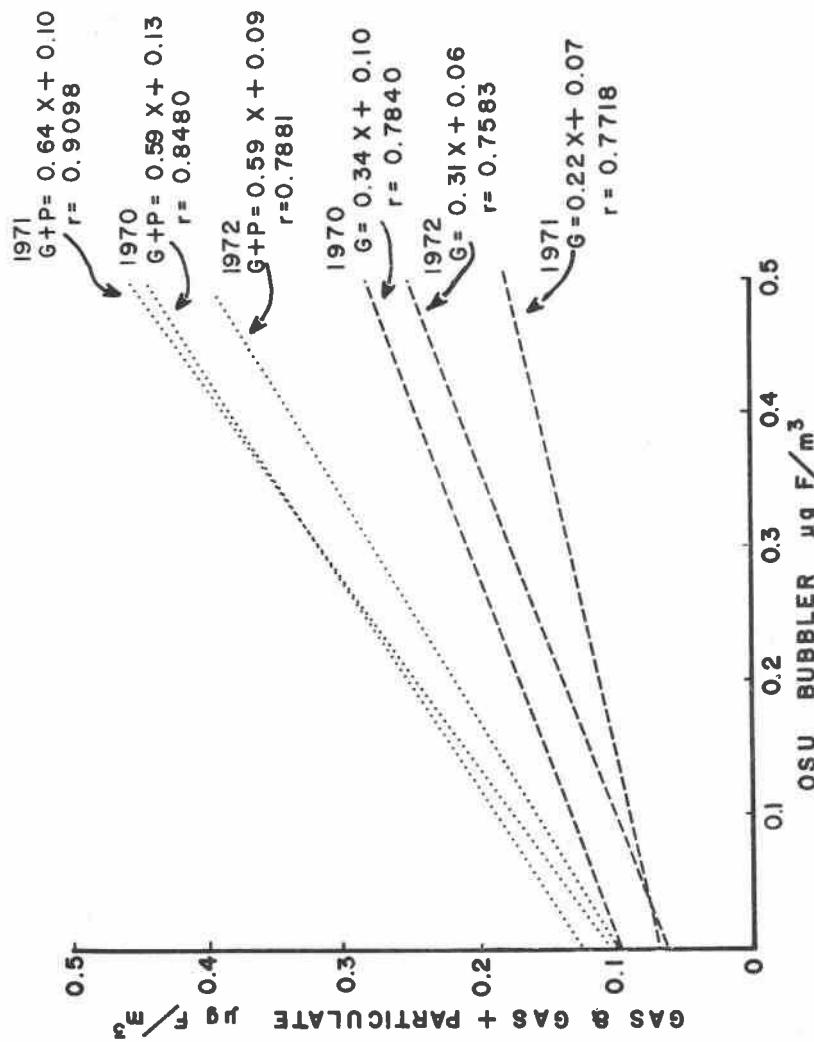


Figure 2. Comparisons between the automatic air sampler and a filter paper gas/particulate separator sampler. Values used were weekly averages in $\mu\text{gF}/\text{m}^3$ collected in The Dalles, Oregon. Stations J, M, D, E, and Y were used to calculate lines for 1970 and 1971. Stations M and E were used to calculate line for 1972.

Table 21. Regression models for various types of fluoride air samplers
(sampling site E, The Dalles, 1970-1972)¹

Line ²	Year	Sampler ³		Regression model	No. of samples	r value ⁴
		X	Y			
1	1970	DP-total	AA	$Y = 1.12X - 0.06$	178	0.841**
2	1971	DP-total	AA	$Y = 1.06X - 0.04$	57	0.781**
3	1972	DP-total	AA	$Y = 1.19X - 0.02$	130	0.706**
4	1971	DP-total	DT-total	$Y = 0.91X + 0.05$	57	0.853**
5	1971	DP-total	Single tape	$Y = 0.64X + 0.28$	80	0.474**
6	1971	DT-total	Single tape	$Y = 1.78X + 0.26$	19	0.826**
7	1971	DP-gas	DT-gas	$Y = 0.39X + 0.03$	57	0.449**
8	1971	DT-total	AA	$Y = 0.94X - 0.03$	57	0.741**

¹ Values used were daily averages in micrograms fluoride per cubic meter.

² See Figure 3 for line.

³ Types of air samplers used:

AA: automatic air sampler, total value

DP-gas: double paper sampler, gas value

DP-total: double paper sampler, total value (gas plus particulate)

DT-gas: double tape sampler, gas value

DT-total: double tape sampler, total value

Single tape: single NaOH tape automatic sampler.

⁴ Significance level: *p = 0.05, **p = 0.01.

models were daily averages expressed as $\mu\text{gF}/\text{m}^3$. The double paper, gas plus particulate, and AA samplers gave similar results during 1970, 1971, and 1972. This was also shown in Figure 2 with weekly averages from all five sampler stations. Comparing the three samplers, the single tape system resulted in larger fluoride values than either the double paper or double tape system. In both Figures 2 and 3, if any two samplers gave equal results then the regression lines should have a slope of one and pass through the origin.

Fruit set surveys

Regression models and r^2 values for the analysis of 'Royal Ann' percent fruit set surveys versus distance, direction, and direction x distance from the aluminum reduction plant in 1967, 1969, and 1970 are presented in Table 22. The average percent fruit set for the 'Royal Ann' orchards was 15.9, 18.9, and 20.4 for the three years respectively (Table 23). The average percent fruit set for the 'Bing' variety was 18.2, 19.2, and 17.8 for the three years respectively (Table 24).

The parameters distance, direction, and distance x direction were found to be good predictors of the fruit set values found in all three years (Table 23). Patterns for the three years were similar. As distance from the aluminum plant increased fruit set increased, and as direction increased

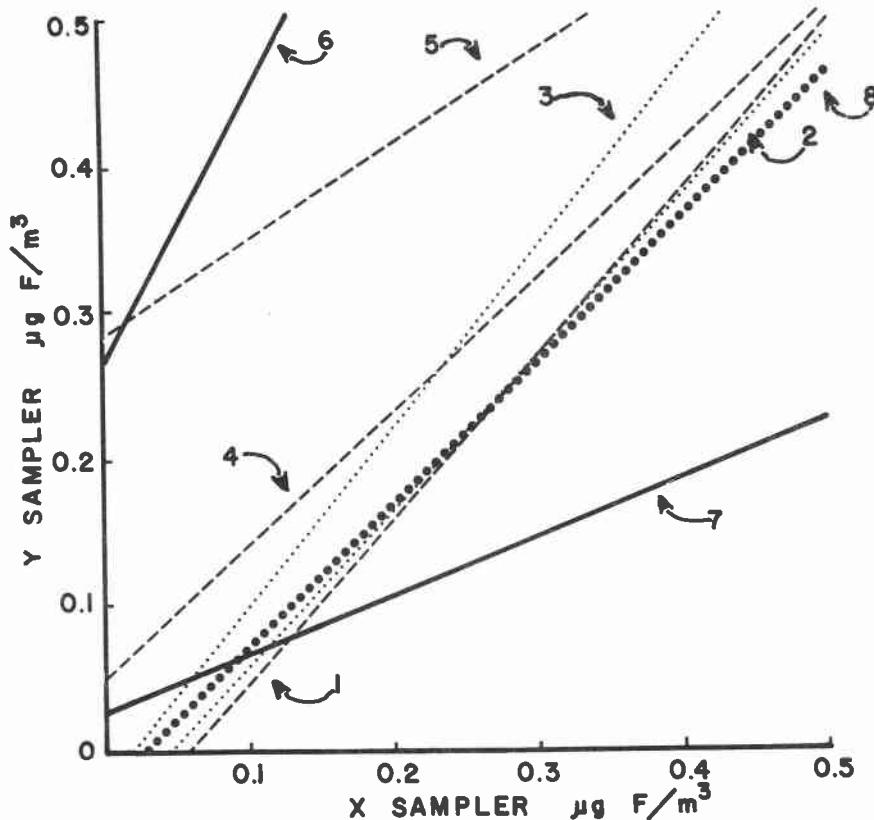


Figure 3. Fluoride sampler comparison regression lines. Line equations and r values are given in Table 21. Values used were daily averages in $\mu\text{gF}/\text{m}^3$ collected at Sample Site E, The Dalles, Oregon.

(based on East = 0 degrees) fruit set decreased. Models for 1969 and 1970 were significant. Other factors including orchard elevation, slope, and frost drainage made no further improvement on the models with respect to the patterns, although higher r^2 values were found. Three years' data were combined in an adjusted model (Table 22) and the predicted sets for this and the other individual year models are shown in Table 23.

For each of the years 1967 through 1971 at least one sampler site recorded a maximum day fluoride level high enough that when expressed on a dose basis ($\mu\text{gF}/\text{m}^3$ times duration exposure in hours) the values were in the range of doses used experimentally where a reduction in pollen tube

Table 22. Regression models and r^2 values for percent 'Royal Ann' fruit set patterns
(The Dalles, 1967, 1969, and 1970)¹

Regression models	r^2 value
Percent fruit set 1967 = $19.24 + 0.13 \text{ distance} - 0.048 \text{ direction} + 0.00026 \text{ distance} \cdot \text{direction}$	0.0566
Percent fruit set 1969 = $29.49 + 0.64 \text{ distance} - 0.14 \text{ direction} - 0.0055 \text{ distance} \cdot \text{direction}$	0.2998**
Percent fruit set 1970 = $4.74 + 7.16 \text{ distance} + 0.19 \text{ direction} - 0.093 \text{ distance} \cdot \text{direction}$	0.1943*
<i>Adjusted model—three years combined</i>	
Percent fruit set = $5.97 + 9.2 \text{ distance} + 0.25 \text{ direction} - 0.10 \text{ distance} \cdot \text{direction}$	0.3111**

¹ Level of significance: * $p = 0.05$, ** $p = 0.01$. In regression models, distance is direction from the aluminum plant, based on East = 0 degrees. Direction is straight line, in miles, from the aluminum reduction plant.

growth, *in vivo*, of sweet cherry was found (Facteau, Wang, Rowe, 1973). Samples through 1969 were all AA samples and were approximately 60 percent gas. Assuming that only the gaseous fluorides affect sweet cherry fruit set, examples of dose values from The Dalles that were in the range of experimental doses affecting pollen tubes are:

1967, Station M, April 5 to April 6: $2.9 (60\% 4.8) \times 24 \text{ hours} = 69.6$
(See Figure 4, Compton et al., 1968);

1968, Station J, March 30 to March 31: $2.4 (60\% 4.05) \times 24 \text{ hours} = 57.6$;

1969, Station J, April 11 to April 12: $3.1 (60\% 5.15) \times 24 \text{ hours} = 74.4$;

1970, Station J, April 12 to April 13: $0.53 \times 24 \text{ hours} = 12.7$; and

1971, Station J, April 13 to April 14: $0.72 \times 24 \text{ hours} = 17.2$.

The dose values were also in the range of dosages where a reduction in percent 'Royal Ann' fruit set was found (Mid-Col. Expt. Sta., unpub. data). Others have not found this to be the case (Dinh, Buchloh, and Oelschlager, 1973) but methods, times, and conditions of their observations were not clear. Our evidence thus indicates that fluorides in the area of The Dalles could account for the patterns of fruit set.

Growth pattern survey

While the growth pattern survey represents data for only one year, the information indicates that the variables used in the multiple regression analysis (distance, distance², direction, and leaf fluoride levels) had a relationship to the growth parameter studied (Table 25). On a single variable basis, as distance from the aluminum plant increased, annual growth and the number of buds, spurs, and flowers increased. As a single variable, direction from the aluminum plant did not appear to be im-

Table 23. Actual percent fruit set and predicted percent fruit set for 'Royal Ann' sample orchards (The Dalles, 1967, 1969, and 1970)

Orchard No. ²	Percent fruit set ¹									
	1967		1969		1970		Combined years		Location ⁴	
	Act.	Pre.	Act.	Pre.	Act.	Pre.	Avg. ³	Pre.	Distance	Direction
1	15.2	17.4	20.7	23.9	17.5	24.5	17.7	22.6	3.9	50
3	12.3	13.8	.....	.....	.....	.....	.....	.....	4.8	130
4	10.0	12.5	.....	.....	.....	.....	.....	.....	4.0	150
5	13.9	14.2	.....	.....	.....	.....	.....	.....	5.0	120
6	5.0	14.2	.....	.....	.....	.....	.....	.....	4.2	120
7	4.7	13.3	.....	.....	.....	.....	.....	.....	2.0	130
8	10.1	12.8	.....	.....	.....	.....	.....	.....	1.8	140
9	18.9	14.3	18.1	14.2	20.5	19.6	19.1	16.9	2.3	110
10	12.8	14.3	13.6	14.2	16.1	20.5	14.1	17.4	2.0	110
11	18.2	13.9	12.2	12.7	20.2	19.4	16.9	17.0	2.3	120
12	21.1	14.4	9.0	14.2	22.0	18.7	17.6	16.3	2.6	110
13	10.0	14.4	15.6	14.2	18.5	19.0	14.4	16.5	2.5	110
14	13.7	14.1	9.1	12.7	22.0	14.6	14.8	13.6	3.5	120
15	20.2	15.0	20.0	15.8	18.1	16.9	19.5	15.6	3.6	100
16	13.7	14.6	6.6	14.2	11.6	15.3	10.8	14.2	3.7	110
17	13.3	15.1	15.3	15.9	18.8	15.9	15.6	15.2	4.1	100
18	24.9	14.6	.....	.....	.....	.....	.....	.....	4.1	110
19	22.4	18.4	28.5	27.3	26.8	29.1	25.7	27.4	4.2	30
20	26.5	14.2	22.3	14.2	25.5	22.1	24.9	18.3	1.5	110
21	18.2	14.2	17.0	14.2	22.4	21.7	19.1	18.2	1.6	110
22	8.4	15.2	12.0	17.2	11.4	20.2	10.5	16.5	2.0	90
23	12.8	14.3	8.8	14.2	16.1	19.9	12.6	17.0	2.2	110
24	16.3	16.9	21.3	22.3	21.8	22.8	19.6	21.2	3.9	60
25	16.0	14.9	22.2	15.8	.....	.....	.....	.....	2.7	100
26	17.7	14.9	19.1	15.8	.....	.....	.....	.....	2.8	100
27	9.7	15.4	20.3	17.3	16.1	19.2	15.0	16.6	2.9	90
28	8.3	15.0	13.3	15.8	15.0	17.6	12.0	15.8	3.3	100
29	22.3	15.0	19.9	15.8	18.3	16.7	20.3	15.5	3.7	100
30	16.8	15.4	30.0	17.4	29.7	18.8	25.0	16.7	3.2	90
31	12.6	15.3	15.7	17.3	.....	.....	.....	.....	2.3	90
32	10.9	15.3	16.0	17.3	22.0	19.4	16.0	16.6	2.7	90
33	17.3	15.8	14.9	18.9	20.1	19.9	17.4	17.0	2.8	80
34	23.1	15.4	.....	.....	.....	.....	.....	.....	3.0	90
35	23.4	15.5	22.9	17.4	27.1	18.4	24.4	16.7	3.5	90
36	18.7	15.8	.....	.....	.....	.....	.....	.....	2.5	80
37	20.5	15.9	38.5	18.9	25.6	19.8	27.8	17.2	3.0	80
38	12.4	16.5	.....	.....	.....	.....	.....	.....	4.3	70
39	7.4	16.3	18.8	20.0	22.6	20.6	15.8	17.8	3.0	70
40	8.9	16.3	13.5	20.5	26.0	20.7	15.7	18.0	3.1	70
41	9.8	16.4	18.4	20.6	7.0	20.9	11.6	18.6	3.4	70
42	15.0	15.9	7.2	19.0	24.4	19.7	15.6	17.6	3.3	80
43	14.9	15.9	12.4	19.0	.....	.....	.....	.....	3.5	80
44	16.8	16.5	16.4	20.7	20.5	21.1	17.8	19.5	3.8	70
45	16.4	16.5	23.0	20.8	.....	.....	.....	.....	4.3	70
46	15.9	16.2	18.0	19.4	19.0	19.2	17.5	20.0	5.4	80
47	24.3	16.3	.....	.....	.....	.....	.....	.....	5.9	80
48	16.4	14.0	5.0	12.7	14.7	17.0	12.3	15.3	2.9	120

Table 23. (Continued)

Orchard No. ²	Percent fruit set ¹									
	1967		1969		1970		Combined years		Location ⁴	
	Act.	Pre.	Act.	Pre.	Pre.	Avg. ³	Pre.	Dis- tance	Direction	
49	17.6	16.8	14.0	22.1	16.0	21.7	16.0	19.0	3.2	60
50	25.4	16.9	27.7	22.2	14.1	22.1	22.6	19.6	3.4	60
51	8.9	16.5	.....	.....	.....	.....	.....	.....	3.8	70
52	10.9	16.5	15.0	20.8	.....	.....	.....	.....	4.1	70
53	18.4	16.5	12.1	20.8	11.1	21.4	14.3	20.4	4.2	70
54	6.8	16.0	.....	.....	.....	.....	.....	.....	4.1	80
55	16.2	16.2	25.8	19.3	10.8	19.3	17.5	19.5	5.0	80
56	16.2	17.4	31.6	20.9	15.3	21.8	20.8	21.7	4.8	70
57	13.8	16.6	.....	.....	.....	.....	.....	.....	4.9	70
58	12.1	16.7	25.9	21.1	23.5	22.1	20.0	22.8	5.3	70
59	35.9	16.7	23.6	21.1	31.0	22.2	32.1	23.2	5.5	70
60	10.9	16.7	.....	.....	.....	.....	.....	.....	5.5	70
61	13.9	16.3	.....	.....	.....	.....	.....	.....	5.8	80
62	11.0	17.1	10.9	22.7	.....	.....	.....	.....	4.1	60
63	12.3	17.5	.....	.....	.....	.....	.....	.....	4.6	50
64	21.5	17.0	.....	.....	.....	.....	.....	.....	4.5	60
65	25.5	17.1	.....	.....	.....	.....	.....	.....	4.7	60
66	15.2	16.6	.....	.....	.....	.....	.....	.....	4.7	70
67	15.8	17.6	.....	.....	.....	.....	.....	.....	5.0	50
68	25.8	18.3	41.5	27.1	45.0	26.9	36.8	24.3	3.7	30
69	18.3	18.4	20.0	27.2	30.7	30.8	22.7	26.2	4.0	30
70	26.6	18.4	29.0	27.4	.....	.....	.....	.....	4.5	30
71	28.0	18.6	.....	.....	.....	.....	.....	.....	5.4	30
72	4.6	17.9	.....	.....	.....	.....	.....	.....	4.3	40
73	10.4	19.5	29.0	31.4	.....	.....	.....	.....	5.7	10
75	19.9	18.4	.....	.....	.....	.....	.....	.....	4.5	30

¹ Actual percent fruit set; predicted percent fruit set based on models given in Table 22.² See Figure 1 for orchard location, except for 1967. Refer to literature citation for 1967 orchard location.³ Average of three years percent fruit set.⁴ Straight-line distance, in miles, from the aluminum plant in The Dalles. Direction from the aluminum plant is based on East = 0 degrees.

portant except when the multiple regression analysis was used. However, when annual growth was plotted against direction, an inflection point was found at approximately 70 degrees (based on East = 0 degrees), indicating that growth was greatest in this area. Correlation coefficients were calculated for various baseline values and 70 degrees gave the highest value. A correlation value of 0.4786 was found when the absolute direction was correlated with the average annual growth for the five-year data. This baseline is the direction of the greatest annual growth and also the least leaf fluoride levels (Tables 1-4). Both of these relationships probably exist because this area received less airborne fluorides than other areas in The Dalles. Growth reductions have been found with other plants

Table 24. Percent fruit set of 'Bing' sample orchards (The Dalles, 1967, 1969, and 1970)

Orchard No.	Percent fruit set			Location ¹	
	1967	1969	1970	Miles	Direction
101	8.3	10.1	12.1	2.0	110
102	22.8	28.8	30.8	1.6	110
103	11.6	8.1	17.2	2.5	120
105	23.6	21.8	27.8	3.3	90
106	26.5	42.8	9.0	4.3	70
107	28.4	.....	.....	3.8	100
108	9.8	12.6	19.3	2.7	90
109	13.7	19.0	16.4	4.5	50
110	19.3	18.1	27.2	3.7	30
111	31.8	.....	.....	2.5	80
112	13.9	11.9	5.0	3.1	110
113	18.1	16.8	20.5	3.2	70
114	13.2	15.9	15.8	3.2	60
115	7.7	20.9	15.3	4.9	80
116	24.2	.....	.....	4.8	60
117	17.3	22.6	14.5	4.6	30
118	19.9	.....	.....	4.2	120

¹ Straight-line distance from the aluminum plant (miles); direction from the aluminum plant based on East = 0 degrees.

Table 25. Multiple r^2 values and single slope sign values for growth measurements (The Dalles, 1971)

Parameter ¹	Year, r^2 value					Single variable slope	
	1970	1969	1968	1967	1966	Distance	Foliar F
Annual growth	0.3674	0.3563	0.2394	0.1728	0.2366	+	-
No. spurs	0.4762	0.4177	0.2068	0.3165	+	-
No. buds	0.3974	0.4038	0.2076	0.2761	+	-
No. flowers	0.4459	0.4079	0.2296	0.3214	+	-
Spurs/length	0.1774	0.4839	0.2417	0.1773	+	-
Buds/length	0.2549	0.2133	0.2713	0.1872	-	-
Flowers/length	0.3198	0.2152	0.2829	0.1832	+	-
Buds/spurs	0.2649	0.1376	0.2898	0.3509	-	-
Flowers/spur	0.3048	0.2019	0.2824	0.3742	-	-
Flowers/bud	0.3148	0.2902	0.3170	0.4574	+	-

¹ Multiple variables entered: distance from aluminum plant, distance², direction from aluminum plant, leaf F levels for July and Sept., 1967-1970. Distance² not included in last three entries.

(oranges, Brewer et al., 1960, 1969; Leonard and Graves, 1966; apricots, De Ong, 1946), although these results were generally under conditions where leaf area was reduced either by smaller leaf size or leaf drop. No examination was made of leaf size in the growth survey taken in The Dalles.

CONCLUSIONS

Sweet cherry leaf fluoride levels remained fairly constant in The Dalles sample plots during the years 1968-1974. The range and average remained fairly constant since 1966 and were similar to pre-aluminum plant levels although direct comparisons are difficult to make because of differences in sample preparation and possible fluoride leaching (Compton et al., 1968). However, the leaf fluoride levels were patterned so that as distance from the aluminum plant increased, leaf fluoride levels decreased. There was also a pattern relating to the wind direction. Orchard sites downwind (SE-E sector) and nearest the aluminum plant (S-SW sector) had higher fluoride levels than other areas, and this appeared to be related to the air movement patterns in the area.

Air fluoride measurements showed that airborne fluorides were present in The Dalles. The air sampler comparison study indicated that the AA sampler gave comparable results to the gas plus particulate separator sampler, and the gas component percentage of the total fluoride was approximately 58 for 1968-1974.

The fruit set surveys showed that distance and direction from the aluminum plant were good predictors of fruit set. As distance from the aluminum plant increased, fruit set increased and as direction (based on East = 0 degrees, range 0 degrees-140 degrees) increased, fruit set decreased. Experiments on the effects of aqueous fluoride sprays and hydrogen fluoride fumigations (Mid-Col. Expt. Sta., unpub. data) showed that fluoride will adversely affect fruit set of 'Royal Ann' cherries. Published data indicate that relatively low levels of HF can reduce cherry pollen tube growth, a process that is an essential part of fertilization and cherry fruit set (Facteau, Wang, and Rowe, 1973). We conclude, therefore, that the patterns of fruit set in The Dalles were a result of the atmospheric fluoride from the aluminum reduction plant.

The growth pattern study showed a relationship between the distance and direction from the aluminum plant and leaf fluoride levels, annual growth, and number of buds, spurs, and flowers. No evidence has been found to indicate that growth of sweet cherry trees is influenced by elevated fluoride in the air even though growth suppression of other plant species has been reported.

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