APPENDIX D

ARB CONTROL EFFICIENCY EVALUATION

Background

This appendix contains the ARB staff evaluation of the results of the emissions testing program conducted by Desert Research Institute (DRI) of Reno, Nevada to estimate the effectiveness of Soil-Sement® in controlling PM_{10} emissions from Fields Road in Merced County, California. The ARB staff used Fields Road test data (obtainable from DRI) to conduct its evaluation.

DRI conducted three intensive studies on Fields Road periods between July 1995 to June 1996 to estimate the control efficiency of Soil-Sement® on PM_{10} emissions. The summary of DRI test data can be found in Appendix C of this report. The sampling results are contained in DRI's Field Evaluation of Soil-Sement® (DRI Document No. 685-5200.1F1), December 31, 1996.

Fields Road is a public unpaved road in Merced County. The road is graded twice a year to reduce dust emissions. Principal users of Fields Road are ranchers who live and work in the area and golfers traveling to a golf course located to the northeast. The road was treated with a single application of Soil-Sement® concentrate for a total rate of 0.28 gallons per square yard. Traffic during the sampling period primarily consisted of light duty vehicles traveling between 40 and 55 miles per hour. PM_{10} samples were obtained from monitors placed at elevations of 1.3, 2.0, 2.5, 5.0, and 10.0 meters above the test portions of the road.

DRI completed a total of 34 PM_{10} sampling runs—17 runs from a portion of the road treated with Soil-Sement® and 17 runs from a portion of the untreated road. A summary of the DRI test data for each of the runs is contained in Table C-1 of Appendix C.

Desert Research Institute Control Efficiency Methodology

Control By Vehicle Distance Traveled

As shown in Table D-1, DRI calculated the PM_{10} control efficiencies for each of the runs using a "gram per vehicle kilometer traveled" approach. Control efficiency is defined as the percent reduction in emissions between the treated and untreated sections:

Control Efficiency = [1 – {(Treated Emission Rate) / (Untreated Emission Rate)}] x 100%

Unfortunately, the upwind PM_{10} concentrations for four sampling run 1, 4, 6, and 10 were higher than the downwind concentrations (Appendix C, Table C-1). DRI postulated that this anomaly could be caused by a shift of wind direction or wind turbulence induced by vehicles. Because of the anomalies in Intensive-1 and Intensive-2, the ARB staff evaluated only the six runs from Intensive-3 for Midwest Industrial Supply, Inc. claim verification process. The DRI calculation

showed an average PM_{10} control efficiency of approximately 85.5 percent based on the above equation.

Table D-1. DRI Estimated PM_{10} Control Efficiency
(Control by Vehicle Distance Traveled)

Run for Intensive-3	Untreated Upwind gPM_{10}/vkt*	Treated Downwind gPM_{10}/vkt	Days After Treatment	Vehicle Passes After Treatment[a]	PM_{10} Control Efficiency (%)
12	189	19	334	6680	90
13	751	83	335	6700	89
14	190	24	336	6720	87
15	300	68	337	6740	77
16	122	17	338	6760	86
17	516	82	339	6780	84

* **gPM_{10}/vkt = grams per vehicle kilometer traveled.**

[a] Normalized average of 20 vehicles per day (6,780 vehicles/339 days)

ARB Control Efficiency Methodology

Although the ARB staff was able to confirm the control efficiencies calculated by DRI, our evaluation suggested that there were limitations in the test design, particularly in the limited number of treated and untreated runs. Therefore, the ARB staff used another method to identify control efficiency sufficiently supported by the test data. The ARB staff calculated the control efficiencies using Mass Concentration Approach to verify the control efficiencies. Using this approach, the ARB staff obtained consistent results with the control efficiencies calculated by DRI. ARB averaged the six Intensive-3 runs providing an average 84 percent control efficiency.

Mass Concentration Approach

The ARB staff calculated the instantaneous control efficiency for each run using the ratio of treated to untreated PM_{10} mass concentrations reported in micrograms per cubic meter ($\mu g/m^3$). The ARB staff calculated the control efficiency as follows:

$$\text{Control Efficiency} = \frac{[\text{Untreated (downwind} - \text{upwind) Conc.} - \text{Treated (downwind} - \text{upwind) Conc.}]}{\text{Untreated (downwind} - \text{upwind) Conc.}}$$

Using the method shown in the following sample calculation for run 12, the ARB staff calculated the PM_{10} control efficiencies in Table D-2 for each of the treated runs for Intensive-3.

$$\text{Control Efficiency} = \frac{[(147.2 - 11.8) - (43.9 - 26.8)]}{(147.2 - 11.8)} = 87.4\%$$

Table D-2. Estimated PM_{10} Control Efficiency
(Mass Concentration Approach)

Run For Intensive-3	Untreated Downwind PM_{10} Conc. $\mu g/m^3$	Untreated Upwind PM_{10} Conc. $\mu g/m^3$	Treated Downwind PM_{10} Conc. $\mu g/m^3$	Treated Upwind PM_{10} Conc. $\mu g/m^3$	Days After Treatment	Vehicle Passes After Treatment[a]	PM_{10} Control Efficiency (%)
12	147.2	11.8	43.9	26.8	334	6680	87.4
13	242.7	31.3	49.6	26.3	335	6700	89.0
14	183.1	37.4	52.1	31.8	336	6720	86.1
15	287.0	54.7	72.1	24.1	337	6740	79.3
16	151.9	26.8	45.2	25.2	338	6760	84.0
17	209.5	16.8	69.6	35.2	339	6780	82.1

[a] Normalized average of 20 vehicles per day (6,780 vehicles/339 days)