Appendix 3.1f: Calculation of Dust Suppression Efficiency

Equation (3-2) in the attached *Control of Open Fugitive Dust Sources Final Report* was adopted for estimating the dust suppression rates with the following assumptions:

p = Potential average hourly daytime evaporation rate = 0.25916 mm/hr

d = Average hourly daytime traffic rate per hour = 37/hr

i = Application intensity = 0.9205 L/m^2

Note:

(a) p = 0.0049 x 52.8898 inch where 52.8898 inch is equivalent to the total evaporation of 1343.4 mm obtained from Hong Kong Observatory's website (http://www.weather.gov.hk/cis/normal/1971_2000/normals_e.htm).

(b) d was estimated by Engineer with the maximum of approximately 37 vehicles per hour at an active construction site.

(c) The assumptions provided above are for the purpose of assessment predictions only. Actual figures would be defined by the detailed design stage.

By applying the Equation (3-2) with the above assumptions,

Dust suppression efficiency = 100 – 0.8 x 0.25916 x 37 x t / 0.9205

where t = time between application, hr

Therefore,

For a water spraying frequency of 8 times per day, t = 12/8 = 1.5 hr and therefore the estimated dust suppression efficiency is 87.5%.

For a water spraying frequency of 4 times per day, t = 12/4 = 3 hr and therefore the estimated dust suppression efficiency is 75.0%.

EPA-450/3-88-008

CONTROL OF OPEN FUGITIVE DUST SOURCES

FINAL REPORT

by

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EPA Contract No. 68-02-4395
Work Assignment 14
MRI Project 8985-14

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September 1988

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ACKNOWLEDGMENTS

We wish to acknowledge the significant contributions of a number of individuals to the success of this project. Much of the information contained in this report was developed at a cooperative working session attended by U. S. Environmental Protection Agency (EPA), State, local program, and contractor personnel. Without their cooperation in sharing data, discussing control strategies, and reviewing document drafts, this study would not have been possible. The individuals who made significant contributions and their organizational affiliations are listed below.

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TABLE OF CONTENTS

		Page
SECTION 1.0	INTRODUCTION	1-1
	1.1 CONTROL OPTIONS	1-1
	1.2 SCOPE OF THE DOCUMENT	1-3
SECTION 2.0	PAVED ROADS	2-1
	2.1 PUBLIC PAVED ROADS	2-3
	2.1.1 Estimation of Emissions	2-4
	2.1.2 Demonstrated Control Techniques for Public Paved Roads	2-6
	2.2 INDUSTRIAL PAVED ROADS	2-10
	2.2.1 Estimation of Emissions	2-10
	2.2.2 Demonstrated Control Techniques for Industrial Paved Roads	2-11
	2.3 EVALUATION OF ALTERNATIVE CONTROL MEASURES	2-11
	2.3.1 Preventive Measures	2-11
	2.3.1.1 Salting/Sanding for Snow and Ice	2-14
	2.3.1.2 Carryout from Unpaved Areas and Construction Sites	2-16
	2.3.1.3 Other Preventive Control Measures	2-17
	2.3.2 Mitigative Measures	2-17
	2.3.2.1 Broom Sweeping of Roads	2-18
	2.3.2.2 Vacuum Sweeping of Roads	2-22
	2.3.2.3 Water Flushing of Roads	2-25
	2.4 EXAMPLE DUST CONTROL PLAN	2-28
	2.5 POTENTIAL REGULATORY FORMATS	2-29
	2.5.1 General Guidelines	2-29
	2.5.2 Example SIP Language for Reduction of Public Paved Road Surface Contaminants	2-32
	2.6 REFERENCES FOR SECTION 2	2-35
SECTION 3.0	UNPAVED ROADS	3-1
	3.1 ESTIMATION OF EMISSIONS FROM UNPAVED ROADS	3-2
	3.2 DEMONSTRATED CONTROL TECHNIQUES FOR UNPAVED ROADS	3-6

TABLE OF CONTENTS (continued)

		Page
	3.3 EVALUATION OF ALTERNATIVE CONTROL MEASURES.......	3-10
	3.3.1 Source Extent Reductions..................	3-10
	3.3.2 Surface Improvements......................	3-10
	3.3.2.1 Paving...........................	3-10
	3.3.2.2 Gravel/Slag Improvements.........	3-11
	3.3.2.3 Vegetative Cover.................	3-11
	3.3.3 Surface Treatments........................	3-12
	3.3.3.1 Watering.........................	3-12
	3.3.3.2 Chemical Treatments..............	3-16
	3.4 EXAMPLE DUST CONTROL PLAN........................	3-23
	3.4.1 Example Water Program.....................	3-23
	3.4.2 Example Chemical Dust Suppressant Program	3-23
	3.5 POTENTIAL REGULATORY FORMATS.....................	3-24
	3.6 REFERENCES FOR SECTION 3.........................	3-29
SECTION 4.0	STORAGE PILES...	4-1
	4.1 ESTIMATION OF EMISSIONS..........................	4-1
	4.1.1 Materials Handling........................	4-3
	4.1.2 Wind Erosion..............................	4-4
	4.1.2.1 Emissions and Correction Parameters.....................	4-4
	4.1.2.2 Predictive Emission Factor Equation......................	4-5
	4.1.3 Wind Emissions From Continuously Active Piles.................................	4-17
	4.2 DEMONSTRATED CONTROL TECHNIQUES..................	4-18
	4.3 EVALUATION OF ALTERNATIVE CONTROL MEASURES.......	4-20
	4.3.1 Chemical Stabilization....................	4-20
	4.3.2 Enclosures................................	4-21
	4.3.3 Wet Suppression Systems...................	4-24
	4.4 EXAMPLE DUST CONTROL PLAN--WATERING OF COAL STORAGE PILE.................................	4-24
	4.5 POTENTIAL REGULATORY FORMATS.....................	4-24
	4.6 REFERENCES FOR SECTION 4.........................	4-24

TABLE OF CONTENTS (continued)

		Page
SECTION 5.0	CONSTRUCTION AND DEMOLITION ACTIVITIES................	5-1
	5.1 ESTIMATION OF EMISSIONS..........................	5-2
	5.1.1 Construction Emissions....................	5-2
	5.1.2 Demolition Emissions......................	5-3
	5.1.2.1 Dismemberment...................	5-3
	5.1.2.3 Debris Loading..................	5-4
	5.1.2.4 Onsite Truck Traffic.............	5-4
	5.1.2.5 Pushing Operations...............	5-4
	5.1.3 Mud/Dirt Carryout Emissions...............	5-5
	5.2 DEMONSTRATED CONTROL TECHNIQUES..................	5-5
	5.2.1 Work Practice Controls....................	5-7
	5.2.2 Traditional Control Technology............	5-8
	5.3 EVALUATION OF ALTERNATIVE CONTROL MEASURES.......	5-9
	5.3.1 Watering of Unpaved Surfaces..............	5-9
	5.3.1.1 Control Efficiency...............	5-9
	5.3.1.2 Control Costs....................	5-13
	5.3.1.3 Enforcement Issues...............	5-13
	5.3.2 Wet Suppression for Materials Storage and Handling...........................	5-14
	5.3.2.1 Control Efficiency...............	5-14
	5.3.2.2 Control Costs....................	5-19
	5.3.2.3 Enforcement Issues...............	5-19
	5.3.3 Portable Wind Screens or Fences...........	5-20
	5.3.3.1 Control Efficiency...............	5-20
	5.3.3.2 Control Costs....................	5-22
	5.3.3.3 Enforcement Issues...............	5-23
	5.3.4 Drilling Control Technology..............	5-23
	5.3.4.1 Control Efficiency...............	5-23
	5.3.4.2 Control Costs....................	5-24
	5.3.4.3 Enforcement Issues...............	5-25
	5.3.5 Control of Mud/Dirt Carryout..............	5-25
	5.3.5.1 Control Efficiency...............	5-25
	5.3.5.2 Control Costs....................	5-27
	5.3.5.3 Enforcement Issues...............	5-27
	5.4 EXAMPLE DUST CONTROL PLAN.......................	5-28
	5.5 POTENTIAL REGULATORY FORMATS.....................	5-28
	5.5.1 Permit System.............................	5-32
	5.5.2 Opacity Standards.........................	5-35
	5.5.3 Other Indirect Measures of Control Performance............................	5-35

TABLE OF CONTENTS (continued)

		Page
	5.5.4 Example Rule	5-36
	5.5.4.1 Conditions for Construction	5-36
	5.5.4.2 Control Mud/Dirt Carryout	5-38
	5.5.4.3 Control of Haul Road Emissions	5-38
	5.5.4.4 Stabilize Soils at Work Sites	5-38
	5.5.4.5 Record Control Application	5-38
	5.5.4.6 Modification of Permit Provisions	5-38
	5.6 REFERENCES FOR SECTION 5	5-41
SECTION 6.0	OPEN AREA WIND EROSION	6-1
	6.1 ESTIMATION OF EMISSIONS	6-7
	6.1.1 "Limited" Erosion Potential	6-7
	6.1.2 "Unlimited" Erosion Potential	6-16
	6.2 DEMONSTRATED CONTROL TECHNIQUES	6-17
	6.3 EVALUATION OF ALTERNATIVE CONTROL MEASURES	6-18
	6.3.1 Chemical Stabilization	6-18
	6.3.2 Wind Fences/Barriers	6-18
	6.3.3 Vegetative Cover	6-21
	6.3.4 Limited Irrigation of Barren Field	6-23
	6.4 EXAMPLE DUST CONTROL PLAN--COVERING UNPAVED PARKING LOT WITH LESS ERODIBILE SURFACE MATERIAL	6-23
	6.5 POTENTIAL REGULATORY FORMATS	6-25
	6.6 REFERENCES FOR SECTION 6	6-29
SECTION 7.0	AGRICULTURE	7-1
	7.1 ESTIMATION OF EMISSIONS	7-1
	7.1.1 Tilling	7-1
	7.1.2 Wind Erosion	7-2
	7.1.2.1 Simplified Version of Wind Erosion Equation	7-2
	7.1.2.2 New Wind Erosion Prediction Technology	7-19
	7.2 DEMONSTRATED CONTROL TECHNIQUES	7-20
	7.2.1 Tilling	7-20
	7.2.2 Wind Erosion	7-23

TABLE OF CONTENTS (continued)

		Page
	7.3 EVALUATION OF ALTERNATIVE CONTROL MEASURES.......	7-24
	7.3.1 Tilling..................................	7-24
	7.3.2 Wind Erosion.............................	7-24
	7.3.2.1 Vegetative Cover.................	7-24
	7.3.2.2 Tillage Practices................	7-25
	7.3.2.3 Windbreaks and Wind Barriers.....	7-27
	7.3.2.4 Strip-Cropping...................	7-28
	7.3.2.5 Limited Irrigation of Fallow Field.........................	7-28
	7.4 POSSIBLE REGULATORY FORMATS......................	7-29
	7.5 REFERENCES FOR SECTION 7.........................	7-30
APPENDIX A	OPEN DUST SOURCE CONTROL EFFICIENCY TERMINOLOGY.......	A-1
APPENDIX B	ESTIMATION OF CONTROL COSTS AND COST EFFECTIVENESS....	B-1
APPENDIX C	METHODS OF COMPLIANCE DETERMINATION FOR OPEN SOURCES..	C-1
APPENDIX D	PROCEDURES FOR SAMPLING SURFACE/BULK MATERIALS........	D-1
APPENDIX E	PROCEDURES FOR LABORATORY ANALYSIS OF SURFACE/BULK SAMPLES..	E-1
APPENDIX F	FUGITIVE EMISSIONS PUBLICATIONS CURRENTLY ON FILE.....	F-1
APPENDIX G	EXAMPLE REGULATIONS..................................	G-1
APPENDIX H	FOOD SECURITIES ACT..................................	H-1

3.3.3 Surface Treatments

3.3.3.1 Watering. The control efficiency of unpaved road watering depends upon (a) the amount of water applied per unit area of road surface, (b) the time between reapplications, (c) traffic volume during that period, and (d) prevailing meteorological conditions during the period. While several investigations have estimated or studied watering efficiencies, few have specified all the factors listed above.

An empirical model for the performance of watering as a control technique has been developed.[8] The supporting data base consists of 14 tests performed in four states during five different summer and fall months. The model is:

$$C = 100 - \frac{0.8\ p\ d\ t}{i} \qquad (3\text{-}2)$$

where: C = average control efficiency, percent

P = potential average hourly daytime evaporation rate, mm/h

d = average hourly daytime traffic rate, (h^{-1})

i = application intensity, L/m^2

t = time between applications, h

Estimates of the potential average hourly daytime evaporation rate may be obtained from

$$p = \begin{cases} 0.0049 \times \text{(value in Figure 3-2) for annual conditions} \\ 0.0065 \times \text{(value in Figure 3-2) for summer conditions} \end{cases}$$

An alternative approach (which is potentially suitable for a regulatory format) is shown as Figure 3-3. This figure is adapted from 11 field tests conducted at a coal-fired power plant. Measured control efficiencies did not correlate well with either time or vehicle passes after application. However, this is believed due to reduced evening evaporation (logistics delayed the start of testing until 3 p.m. and testing continued through the early evening). Surface moisture grab samples were taken throughout the testing period, and not surprisingly, these show a strong correlation with control efficiency.

Figure 3-3 shows that between the average uncontrolled moisture content and a value of twice that, a small increase in moisture content results in a large increase in control efficiency. Beyond this point, control efficiency grows slowly with increased moisture content. Although