Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Background Report Reference

AP-42 Section Number: 9.9.7

Background Chapter: 4

Reference Number: 1

Title: Documentation for AP-42 Emission Factors: Section 6.4, Grain Elevators and Processing Plants

G. LaFlam

Pacific Environmental Services, Inc.

AP-42 Section 9.9.7
Reference
Report Sect. 4
Reference 1

DOCUMENTATION FOR AP-42 EMISSION FACTORS:

SECTION 6.4, GRAIN ELEVATORS AND PROCESSING PLANTS

by

Greg LaFlam
Pacific Environmental Services, Inc.
1905 Chapel Hill Road
Durham, North Carolina 27707

Contract No. 68-02-3887
Work Assignment No. 54

EPA Project Officer: Frank M. Noonan

Prepared for

U.S. Environmental Protection Agency
Office of Air, Noise and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

September 1987

A. Introduction

The EPA's Air Management Technology Branch (AMTB) has the responsibility for maintaining the document Compilation of Air Pollutant Emission Factors, AP-42, which is a basic source of emission factor information. This document is used in the preparation of State implementation plans, review of Prevention of Significant Deterioration applications, and a multitude of other emissions estimating efforts. The emission factors are updated periodically to reflect new data that may characterize emissions from an industry or process operation. A recent focus of the Agency has been the characterization of emissions of fine particulate matter, which has specific adverse effects on health related to its respirability. In this revision effort, both total particulate and size-specific emission factors for the grain handling and processing industries have been compiled. Section B discusses the origin of the particle size distributions and size-specific emission factors developed for four operations, and Section C documents the total particulate factors developed for six operations. Appendices A and B contain the reference information from which the emission factors in Sections B and C, respectively, were developed. Appendic C documents the emission factors that were previously in the AP-42 Section. Appendix D contains the revised AP-42 Section 6.4.

In order to impart information on the reliability and accuracy of the emission factors in Section 6.4, the factors and size distribution information have been letter rated to reflect the amount and quality of the data used to develop the factors. In this system, emission factors based on more tests of better quality are given a higher letter, such as A or B. Conversely, factors based on only one or two tests, or on tests performed using nonstandard methods, are assigned ratings of C, D or E. Generally, factors based on several tests at facilities representing a good cross-section of the industry would receive an A rating. Factors rated B are somewhat less representative of the industry or reflect fewer tests. The emission factor tables in Section 6.4 have been assigned overall ratings reflecting a subjective evaluation of the average rating of all the factors in the table. Individual factors may vary somewhat from this overall rating.

The grain distribution and processing industry moves grain (wheat, corn, soybeans, etc.) from its origin at farms through various storage points (elevators) to the processing plants and mills where grain products (flour, starch, animal feed, etc.) are produced. Grain elevators can be classified as country (near farms), inland terminal, or export (marine) elevators. At elevators, incoming grain is unloaded, transferred on conveyors, and stored in silos. The processes are reversed for outgoing shipments. An elevator may also clean and dry the grain before storage. A mill or processing plant performs most of these same steps, as well as manufacturing some type of final product from the grain. Therefore, the additional steps of grinding, blending, cooling, and pelletizing may occur at these plants. Each step of handling, transfer, and processing of dry grain or grain products generates particulate emissions. These two industry segments, grain elevators and grain processing plants, are presented in two distinct subsections within Section 6.4 of AP-42.

B. Particle Size Distributions

Particulate size distribution data for four grain handling and processing operations have been included in the revised AP-42 Section 6.4. While other distributions were found and examined, none of them was completely enough described, or test methods were inadequate, to justify their incorporation into the Section. The four operations for which sizing data were available are:

1. Barge unloading and conveyor transfer (corn and soybeans)
2. Loading of ships (wheat)
3. Rice dryer
4. Carob kibble roaster

The data for operation no. 1 were located in an EPA test report, and represent the outlet stream from a fabric filter control system at an export elevator. The data for the second export elevator operation were contained in two EPA reports, and reflect a combination of sizing tests performed on three different types of uncontrolled shiploading operations. Tests of the two grain processing operations, rice drying and carob roasting, were performed by KVB, Inc., for the State of California. These data are contained in EPA's computerized Fine Particle Emission Information System (FPEIS). The following subsections describe the sizing data and contain the plots of particle size and size-specific emission factors.

1. Barge Unloading and Conveyor Transfer

These were EPA tests on the outlet of a control system (fabric filter) for unloading of grain from barges. Grain is unloaded from barges by a "marine leg" bucket elevator. The buckets discharge the grain into a surge bin which continuously feeds it onto a conveyor belt. The grain is transferred from two short conveyors to a final conveyor that carries it to the elevator. The control system aspirates dusty air from the front and back of the leg, the surge bin, and the conveyor transfer points. During the testing, corn and soybeans were unloaded.

Reference report: EPA:EMB Test No. 74-GRN-7 (January 1974).

Table 5 of the reference report (see Appendix A) shows Particle Size Results for two test runs.

Run 1

Particulate catch = 22,450 ug (probe & cyclone) + 2,070 ug (sizing stages)

= 24,520 ug.

Stage	Particle size, um	Weight each stage, ug	Cumulative weight, ug	Cumulative weight % < stated size
Total catch	--	--	24,520	100
1	3.14	1,480	2,070	8.44
2	1.63	190	590	2.41
3	1.10	210	400	1.63
4	0.57	120	190	0.77
5	0.33	70	70	0.29

Run 2

Particulate catch = 44,900 ug (probe & cyclone) + 1,440 ug (sizing stages)

= 46,340 ug.

Stage	Particle size, um	Weight each stage, ug	Cumulative weight, ug	Cumulative weight % < stated size
Total catch	--	--	46,340	100
1	3.14	1,260	1,440	3.1
2	1.63	90	180	0.39
3	1.10	30	90	0.19
4	0.57	40	60	0.13
5	0.33	20	20	0.04

The size plot (Figure 1) is based on the average of the two runs. Thus,

Particle size, um	Avg. cumulative wt. % < stated size
0.33	0.17
0.57	0.45
1.10	0.91
1.63	1.4
3.14	5.8

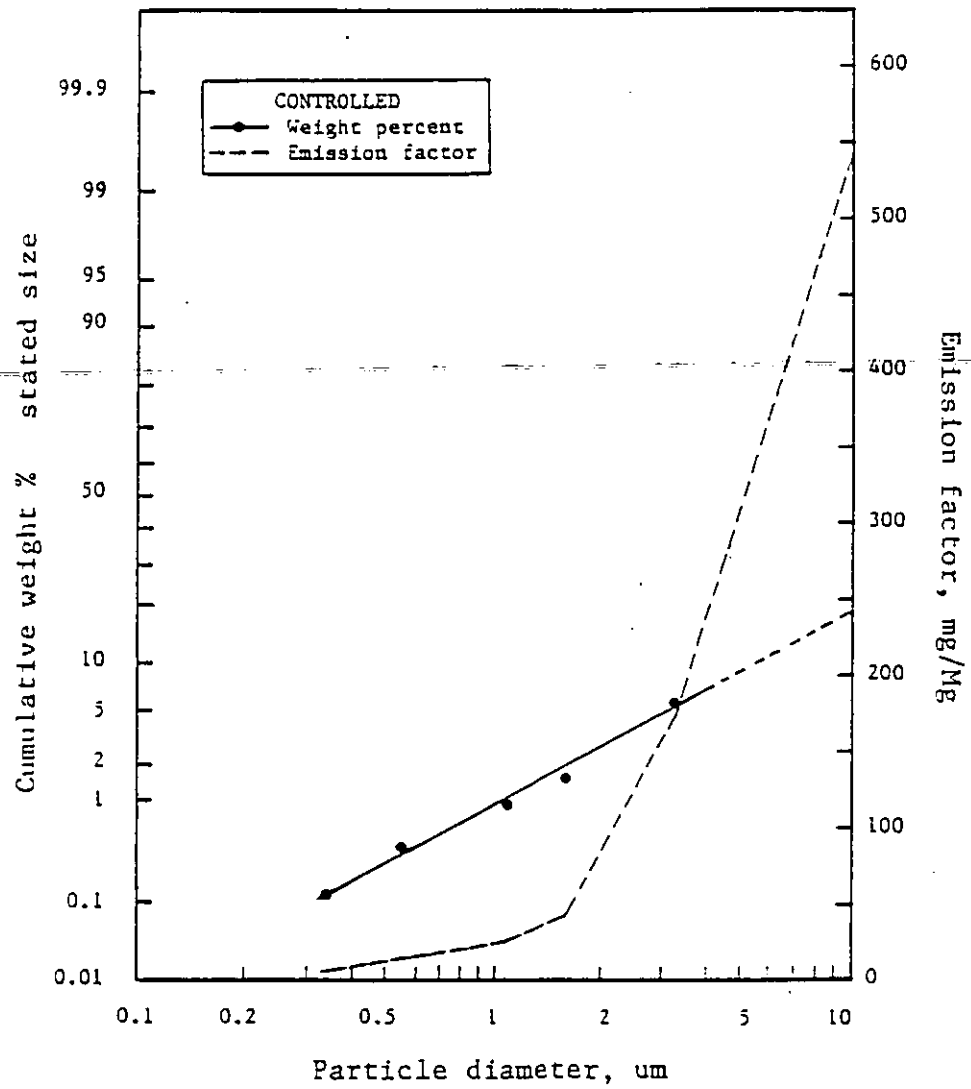

Figure 1. Barge Unloading/Conveying at Export Elevators: Particle Size Distribution and Emission Factor

Emission Factor Table

Parameters measured in tests:

Run No.	Process Rate, Mg/hr	Particulate Rate, kg/hr Control Inlet	Control Outlet	Emission factor, kg/Mg Uncontrolled	Controlled
1	1,307	362	3.0	a	0.002
2	1,494	1,259	5.0	0.84	0.004
3	1,206	1,045	3.3	0.87	0.003

[a]Run No. 1 inlet test was 19.5% isokinetic; therefore, it was disregarded.

Average uncontrolled emission factor = 0.85 kg/Mg.
Average controlled emission factor = 0.003 kg/Mg.

$$\text{Control system collection efficiency} = \frac{0.85 - 0.003}{0.85} \times 100\% = 99.6\%.$$

The measured emission factor of 0.85 kg/Mg for uncontrolled unloading/conveying is similar to the factors in Table 6.4-1 of AP-42 for Unloading (receiving), 0.5 kg/Mg; Removal from bins (tunnel belt), 0.7 kg/Mg; and Headhouse (legs), 0.8 kg/Mg. Therefore, none of these emission factors was revised on the basis of the two inlet test runs. The table below shows size-specific emission factors for the controlled operation, based on a total emission factor of 0.003 kg/Mg. Note that units are mg/Mg (mg = 10^{-6} kg).

Particle diameter, um	Cumulative weight % < stated size	Emission factor, mg/Mg
	Controlled	Controlled
0.33	0.17	5.1
0.57	0.45	13.5
1.10	0.91	27.3
1.63	1.4	42
3.14	5.8	174
10.0[a]	18.0	540

[a]Extrapolated data point.

2. Shiploading of Grain at Export Elevators

The particulate size distributions of dust emissions from grain loading at several export elevators in Portland, Oregon, were measured in 1978. Two types of systems were used to reduce or control emissions: 1) aspirated tent system and 2) dead-box system; and one elevator was uncontrolled at the time of the tests. A probe consisting of an Andersen cascade impactor, a cyclonic pre-separator, and a glass fiber filter was used to determine the size distribution.

Reference reports:

1. W. Battye and R. Hall. Particulate Emission Factors and Feasibility of Emission Controls for Shiploading Operations at Portland, Oregon Grain Terminals - Volume I. GCA Corporation for U.S. EPA. EPA Contract No. 68-01-4143. June 1979.

2. Emission Factor Development for Ship and Barge Loading of Grain. GCA Corporation for U.S. EPA. EPA Contract No. 68-02-3510. October 1984.

Table 2 in Reference 2 shows the impactor size data. Figure 10 (Ref. 2) and Figure 5 (Ref. 1) show plots of these data (see Appendix A for Table 2 and Figure 5). Since these data plot close together and overlap one another, a decision was made in the interest of clarity to not retain these individual plots for AP-42 Section 6.4 Further, no consistent trends differentiating the three loading methods are apparent. Therefore, all six tests were averaged to produce a single size distribution. This distribution represents uncontrolled emissions because measurements were made at the loading point, upstream of the fabric filter used to capture emissions.

Table 1 shows cumulative weight percentages for each particle size, as well as averages for each of these particle sizes. The particle sizes used in this table are the midpoints of the size ranges in the reference Table 2 in Appendix A. Each concentration in Table 2 was first converted to a percentage of the total measured concentration for each test, and then these percentages were cumulated to produce the individual values for Table 1.

Emission Factor Table

The emission factor for loading (shipping) at export elevators is 0.5 kg/Mg, as shown in Table 6.4-1 of AP-42. In order to calculate

Table 1. PARTICLE SIZING DATA FOR SHIPLOADING TESTS

Test	Total Concentration (mg/m^3)	Cumulative Weight % < Stated Size								
		Total	12.8 um	9.4 um	6.9 um	4.2 um	2.5 um	1.4 um	0.9 um	<0.71 um
1. Bunge (tent)	89	100	38.4	33.0	24.7	16.0	8.0	2.4	0.7	0.7
2. Dreyfus (tent)	200	100	33.6	24.3	16.4	11.4	6.2	3.8	2.1	1.6
3. Cargill-1 (dead-box)	9.3	100	36.9	35.0	23.0	21.0	15.3	11.5	5.8	1.9
4. Cargill-2 (dead-box)	95	100	66.5	56.5	43.5	34.5	7.5	3.6	2.4	2.0
5. Columbia-1 (no control)	104	100	61.9	47.9	37.9	22.9	11.9	2.9	0.4	0
6. Columbia-2 (no control)	135	100	54.7	47.3	32.3	22.3	13.4	6.7	2.4	0.5
Average[a]		100	48.7	40.7	29.6	21.4	10.4	5.2	2.3	1.1

[a]These values represent arithmetic averages of the six test values for each particle size.

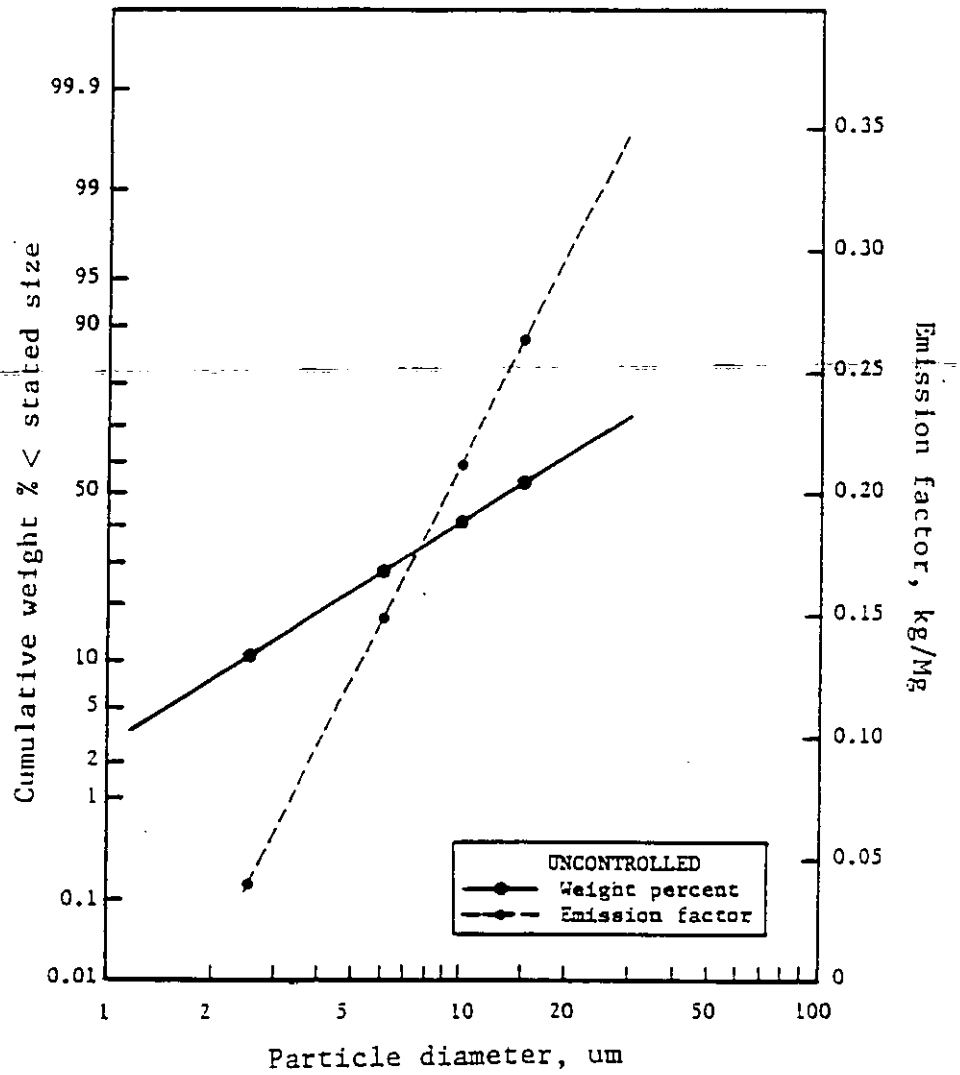

Figure 2. Shiploading at Export Elevators:
Particle Size Distribution and Emission Factor

size-specific emission factors, the cumulative weight percentages at several particle sizes were multiplied by this total factor. The results, which are plotted as a straight line in Figure 2, are shown in the emission factor table following the figure.

Particle diameter, um	Cumulative weight % < stated size	Emission factor, kg/Mg
	Uncontrolled	Uncontrolled
2.5	10.4	0.05
4.2	21.4	0.11
6.0	27.0	0.13
10	42.0	0.21
15	53.0	0.26

3. Rice Dryer

Test by California Air Resources Board, 10/11/77. Appendix A contains pertinent material from FPEIS printout, Series No. 228.

Reference report:

L.J. Shannon, et al., Emissions Control in the Grain and Feed Industry: Volume II - Emission Inventory, EPA-450/3-73-003b, MRI for U.S. EPA, September 1974.

Calculations for Sample 1

Total mass of sample collected = 590.7 mg
Volume of sample collected = 27.9 m^3

Therefore, concentration = 590.7/27.9 = 21.2 mg/m^3
= 21,200 ug/m^3

Also, T = 94°C = 201°F, P = 758 mm Hg = 29.84" Hg, W.V. = 2.3%.

Converting to standard conditions:

$$21{,}200\ ug/m^3 \times \frac{661}{530} \times \frac{29.92}{29.84} \times \frac{100}{100 - 2.3} = 27{,}100\ ug/dnm^3.$$

Size Distribution

Particle diameter, um	Cumulative mass conc. (ug/dnm^3)	Cumulative % < stated size
0.625	missing	--
1.0	missing	--
1.25	missing	--
2.5	202	0.7
6	991	3.7
10	2,950	10.9
15	6,590	24.3
20	10,200	37.6

Calculations for Sample 2

Total mass of sample collected = 190.3 mg
Volume of sample collected = 5.46 m^3

Thus,

Concentration = 34.9 mg/m^3 = 34,900 ug/m^3.

T = 96°C, P = 758 mm Hg, W.V. = 3.3%.

At standard conditions, C = 45,300 ug/dnm^3.

Size Distribution

Particle diameter, um	Cumulative mass conc. (ug/dnm^3)	Cumulative % < stated size
0.625	133	0.3
1.0	195	0.4
1.25	231	0.5
2.5	386	0.9
6	626	1.4
10	2,020	4.5
15	11,200	24.7
20	19,900	43.9

The size plot (Figure 3) is based on the average of the two runs. Therefore,

Particle diameter, um	Avg. cumulative % < stated size
0.625	0.3
1.0	0.4
1.25	0.5
2.5	0.8
6	2.6
10	7.7
15	24.5
20	40.8

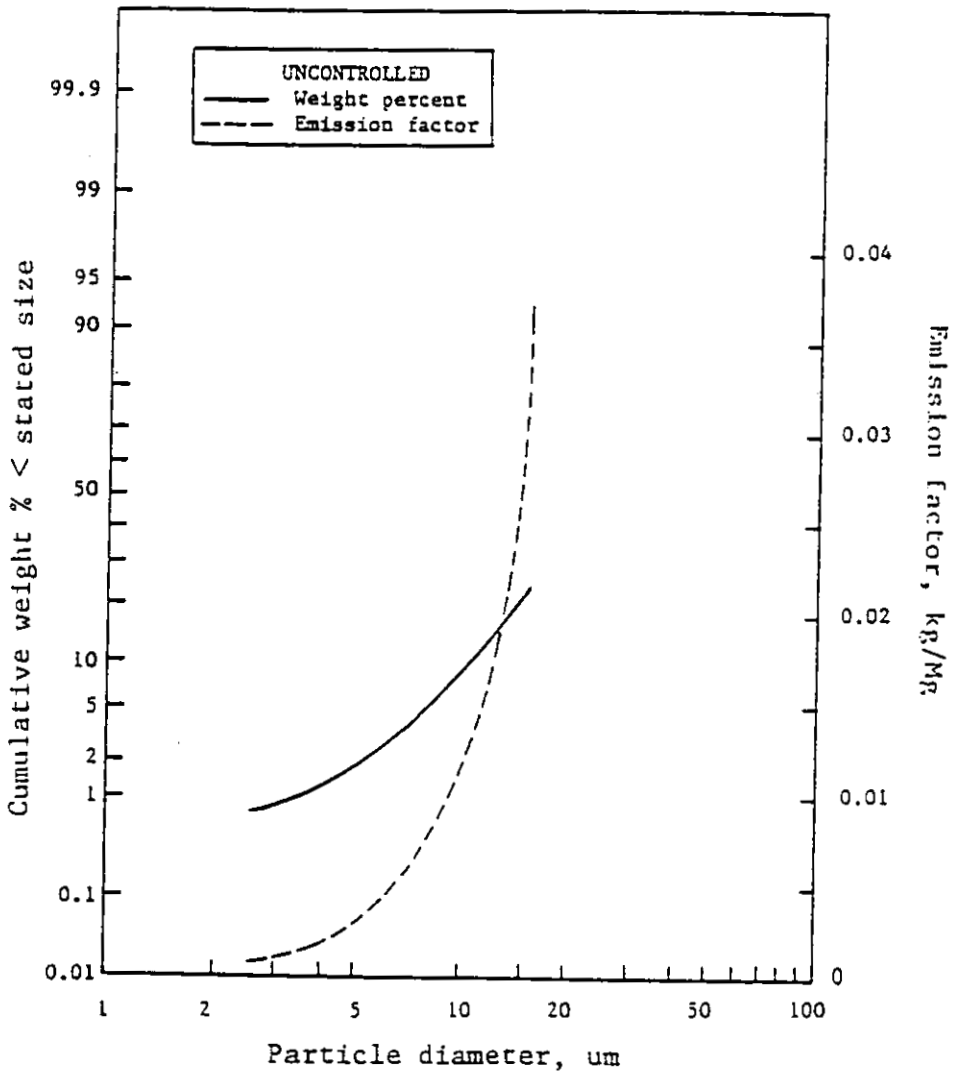

Figure 3. Rice Dryer: Particle Size Distribution and Emission Factor

Emission Factor Table

Total particulate emission factor = 0.15 kg/Mg rice dried (column dryers) from reference report. To obtain size-specific emission factors, multiply the total factor by the cumulative weight percent for each particle size.

Particle diameter, um	Cumulative weight % < stated size	Emission factor, kg/Mg
	Uncontrolled	Uncontrolled
0.625	0.3	0.0004
1.0	0.4	0.0006
1.25	0.5	0.0008
2.5	0.8	0.0012
6	2.6	0.0039
10	7.7	0.012
15	24.5	0.037
20	40.8	0.061

4. Carob Kibble Roaster

Test by KVB, Inc. for California Air Resources Board, 3/23/78. Appendix A contains pertinent material from FPEIS printout, Series No. 229.

Calculation of sample concentration at STD conditions

Total mass of sample collected = 1.07 g
Volume of sample collected = 6.65 m^3

Thus, concentration = 1.07 g/6.65 m^3 = 0.161 g/m^3
= 161,000 ug/m^3

Also, T = 204°C = 399°F, P = 765 mm Hg = 30.12" Hg, W.V. = 8.2%.

Converting to standard conditions:

$$161{,}000\ ug/m^3 \times \frac{859}{530} \times \frac{29.92}{30.12} \times \frac{100}{100 - 8.2} = 282{,}400\ ug/dnm^3.$$

Size Distribution

Particle diameter, um	Cumulative mass conc. (ug/dnm^3)	Cumulative % < stated size
0.625	424	0.2
1.0	1,100	0.4
1.25	1,360	0.5
2.5	1,760	0.6
6	1,870	0.7
10	5,640	2.0
15	32,500	11.5
20	58,400	20.7

Emission Factor Table

Total particulate emission factor = 3.0 kg/Mg carob kibble roasted.* To obtain size-specific emission factors, multiply total factor by the cumulative weight percent for each particle size.

Particle diameter, um	Cumulative weight % < stated size	Emission factor, kg/Mg
	Uncontrolled	Uncontrolled
0.625	0.2	0.006
1.0	0.4	0.012
1.25	0.5	0.015
2.5	0.6	0.018
6	0.7	0.021
10	2.0	0.060
15	11.5	0.35
20	20.7	0.62

Figure 4 shows the size distribution and size-specific emission factors for this category, which has been added to the revised Section 6.4.

*Ref.: H.J. Taback, Fine Particle Emissions from Stationary and Miscellaneous Sources in the South Coast Air Basin, PB 293 923/AS, NTIS, Springfield, VA, February 1979.

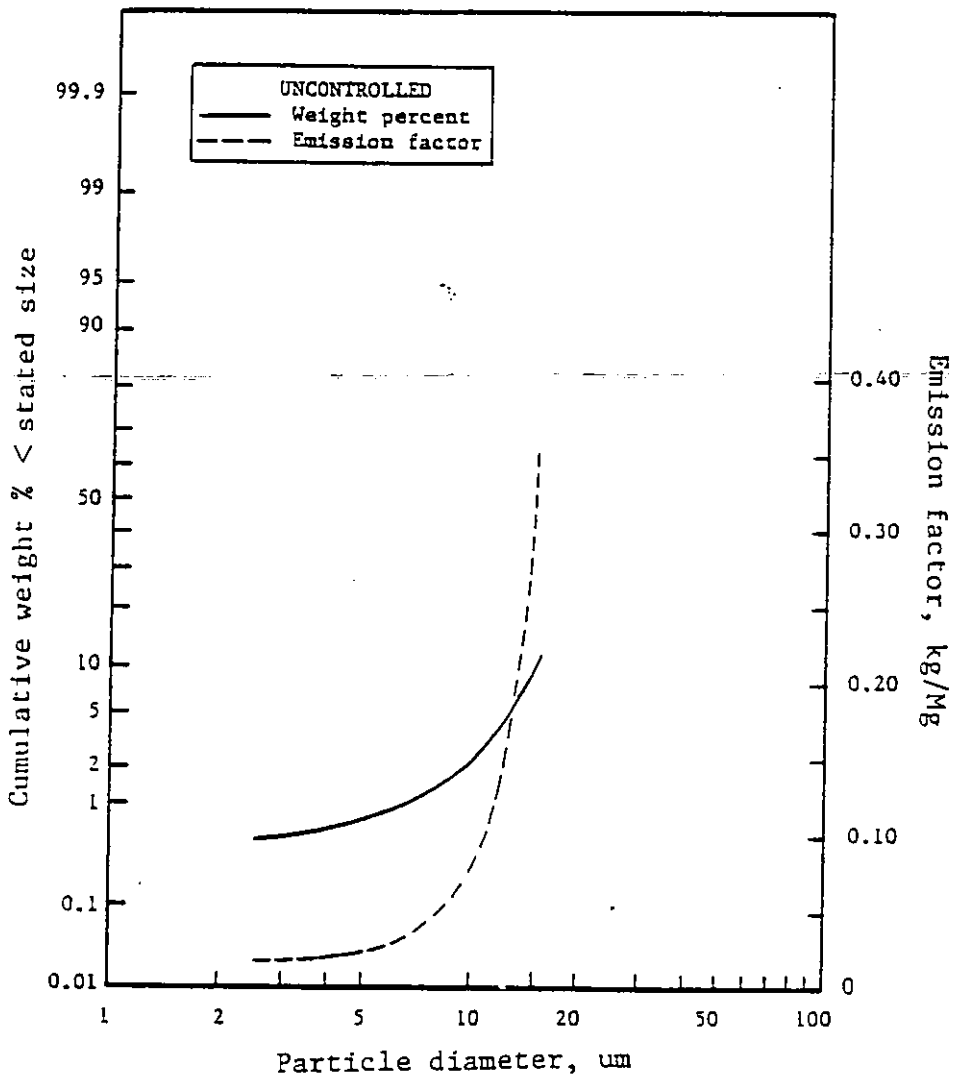

Figure 4. Carob Kibble Roaster: Particle Size Distribution and Emission Factor

C. Emission Factors

Emission factors for six grain processing operations have been added to Table 6.4-3 in AP-42 Section 6.4 (now Table 6.4-6). Of these six, two emission factors replace existing factors in the table. Another factor fills in a blank space in an existing category. The remaining three are entirely new source categories (processing operations) in the table. The six operations for which new or revised emission factors have been developed are:

1. Carob kibble roasting (new category)
2. Wet corn milling - Dryers (new factor in existing category)

   Feed mills (cyclone controlled):

3. Pellet coolers (revises previous factor)
4. Corn cracking (new category)
5. Corn hammermills (revises factor for Grinding)
6. Flaking (corn/barley) (new category)

The data for operation no. 1 were located in a 1983 EPA report completed in California that presents fine particle emission data for several source categories. The data for the second operation are from a 1981 EPA Source Category Survey report on animal feed dryers. The remaining emission test data for feed mills are from a test program performed from 1972 to 1980 (Purina Mills). The following subsections describe the basis for the revised emission factors.

1. Carob Kibble Roasting

Reference reports:

1. H.J. Taback, Fine Particle Emissions from Stationary and Miscellaneous Sources in the South Coast Air Basin, PB 293 923/AS, National Technical Information Service, Springfield, VA, February 1979.

2. Emission test data from Environmental Assessment Data Systems, Fine Particle Emission Information System, Series No. 229, U.S. EPA, Research Triangle Park, NC, June 1983.

The two reference reports contain results from a test performed by the California ARB on March 23, 1978, on a carob kibble roasting process (uncontrolled emissions). This process is very similar to coffee roasting. Carob pods are air-cleaned, roasted, and then cooled and stored until they are ground in preparation for making carob candies.

Reference 1 shows a calculated emission factor from this test of 6.0 lb/ton (3.0 kg/Mg) carob kibble roasted. It also shows a second factor of 7.6 lb/ton, referencing Section 6.2 of AP-42, Second Edition (Coffee Roasting). This AP-42 emission factor relies on information relating to a different (although similar) industry, whereas these test results directly represent the carob roasting process. Therefore, the calculated emission factor for this test has been included in Table 6.4-3 of AP-42.

Emission Factor: 3.0 kg/Mg (6.0 lb/ton).

2. Wet Corn Milling - Dryers

Reference report:

Source Category Survey: Animal Feed Dryers, U.S. EPA, Emission Standards and Engineering Division, EPA-450/3-81-017, December 1981.

Table 7-1 in the reference report presents emission test data from tests at a wet corn milling plant producing animal feed ('Plant C'), between 1977 and 1981. Uncontrolled emission rates from nine tests (39 runs) on rotary steam tube feed dryers are shown, as well as process weight rates during the tests (see Appendix B). The table below shows how these test parameters are used to calculate the average emission factor for this processing operation.

Plant C tests

Test date	Uncontrolled emission rate, kg/h	Process weight rate, Mg/h	Emission factor, kg/Mg	(lb/ton)
1977	0.60	3.96[a]	0.15	0.30
1977	0.72	4.11	0.18	0.35
1977	0.66	4.16	0.16	0.29
1981	0.69	6.15	0.11	0.22
1977	0.69	4.11	0.17	0.34
1981	0.50	4.22	0.12	0.24
1977	0.97	4.04	0.24	0.48
1981	1.50	4.28	0.35	0.70
1980	0.74	1.02	0.72	1.45
		Average =	0.24	(0.48)

[a]Does not agree with value in Table 7-1. See Appendix B for explanation.

The calculated emission factors are averaged arithmetically to produce an average uncontrolled emission factor for this processing operation.

Emission Factor: 0.24 kg/Mg (0.48 lb/ton).

3. Feed Mills (Pellet coolers, Hammermilling, Flaking, Cracking)

References:

1. Letter and attachment (test data) from Paul Luther, Purina Mills, Inc., St. Louis, MO, to Greg LaFlam, Pacific Environmental Services, Inc., Durham, NC. March 11, 1987.

2. Letter and pellet cooler test data from P. Luther, Purina Mills, to Frank Noonan, U.S. EPA, Research Triangle Park, NC. July 8, 1987.

The reference material contains total particulate test results from four feed mills tested between 1972 and 1980, and from one mill tested in 1987. Pellet coolers at all five mills were tested, and a cracker and hammermill (corn) and a flaking unit (corn/barley) were tested at three of the mills. All process streams tested were controlled by single or multiple cyclones. The table below summarizes the data and shows the calculation of average emission factors (SI units). The data summary sheets from the references are included in Appendix B.

FEED MILL TEST DATA SUMMARY

Pellet Coolers

Plant	A Processed feed rate, Mg/h	B Emission rate, kg/h	C = B ÷ A Controlled emission factor, kg/Mg (lb/ton)
1	10.9	3.0	0.28 (0.55)
	10.9	1.5	0.14 (0.28)
	10.9	5.0	0.46 (0.92)
	10.0	1.8	0.17 (0.32)
2	9.1	0.20	0.02 (0.04)
	16.3	0.84	0.05 (0.10)
3	12.7	3.3	0.26 (0.52)
	13.0	1.8	0.14 (0.28)
	11.4	1.8	0.16 (0.31)
	13.4	3.3	0.25 (0.49)
4	8.8	1.5	0.17 (0.33)
	9.8	1.1	0.11 (0.22)
5	8.4	0.5	0.06 (0.12)
	7.3	0.7	0.10 (0.20)
	5.9	0.5	0.08 (0.16)
		Average =	0.16 (0.32)
		Corn Cracker	
2	3.6	0.04	0.012 (0.024)
		Corn Hammermill	
4	7.3	0.59	0.08 (0.16)
		Flaking Unit (corn/barley)	
1	5.5	0.42	0.08 (0.16)

APPENDIX A

REFERENCE MATERIAL FOR PARTICLE SIZE DISTRIBUTIONS

TABLE 2
Summary of Particulate Results in Metric Units
Inlet

Run Number	1	2	3	Average
Date	10-30-73	10-30-73	10-31-73	
Volume of Gas Sampled - Nm^3 (a)	1.30	2.06	4.16	
Percent Moisture by Volume	0.9	1.0	0.9	
Average Stack Temperature - °C	19.4	20.8	22.3	
Stack Volumetric Flow Rate - Nm^3/min. (b)	1067	1076	1107	1083
Stack Volumetric Flow Rate - m^3/min. (c)	1083	1103	1148	1111
Percent Isokinetic	19.5	92.4	90.7	
Particulates - probe, cyclone, and filter catch				
mg	7,364.0	40,148.0	65,483.0	37,665.0
mg/Nm^3	5,645	19,466	15,706	13,606
mg/m^3	5,561	18,970	15,140	13,224
kg/hr	361	1,256	1,043	887
Particulates - total catch				
mg	7,371.5	40,152.5	65,486.5	37,670.2
mg/Nm^3	5,651	19,469	15,707	13,609
mg/m^3	5,566	18,972	15,141	13,226
kg/hr	362	1,256	1,043	887
Percent impinger catch	0.1	0.0	0.0	0.0

[a] Dry normal cubic meter at 21.1°C, 760mm Hg.

[b] Dry normal cubic meters per minute at 21.1°C, 760mm Hg.

[c] Actual cubic meters per minute

Barge unloading/conveying
From: EPA/EMB Test No. 74-GRN-7

TABLE 4
Summary of Particulate Results in Metric Units
Outlet

Run Number	1	2	3	Average
Date	10-30-73	10-30-73	10-31-73	
Volume of Gas Sampled - Nm^3 (a)	2.38	2.62	2.69	
Percent Moisture by Volume	0.8	0.5	1.1	
Average Stack Temperature - °C	20.4	29.3	29.2	
Stack Volumetric Flow Rate - Nm^3/min. (b)	1024	1069	1097	1063
Stack Volumetric Flow Rate - m^3/min. (c)	1025	1104	1148	1092
Percent Isokinetic	93.5	98.7	98.7	97.0
Particulates - probe, cyclone, and filter catch				
mg	115.5	604.5	135.0	151.7
mg/Nm^3	48.5	77.9	50.1	58.8
mg/m^3	48.4	75.3	47.8	57.2
kg/hr	2.98	5.00	3.30	3.76
Particulates - total catch				
mg	117.0	207.0	137.5	153.8
mg/Nm^3	49.1	78.8	51.0	59.6
mg/m^3	49.0	76.3	48.7	58.0
kg/hr	3.02	5.06	3.36	3.81
Percent impinger catch	1.3	1.2	1.8	1.4

[a] Dry normal cubic meter at 21.1°C, 760mm Hg.

[b] Dry normal cubic meters per minute at 21.1°C, 760mm Hg.

[c] Actual cubic meters per minute

Barge unloading/conveying
From: EPA/EMB Test No. 74-GRN-7

TABLE 5

Particle Size Results

Run 1

Stage	Characteristic Diameter, Dn um	µg	Weight Percent	Cumulative Weight Percent, <Dn
Probe & cyclone		22,450		
1	3.14	1,480	71.5	28.5
2	1.63	190	9.2	19.3
3	1.10	210	10.1	9.2
4	0.57	120	5.8	3.4
5	0.33	70	3.4	
	TOTAL	2,070		

Run 2

Probe & cyclone		44,900		
1	3.14	1,260	87.5	12.6
2	1.63	90	6.3	6.3
3	1.10	30	2.1	4.2
4	0.57	40	2.8	1.4
5	0.33	20	1.4	
	TOTAL	1,440		

Note: Totals indicate sums of numbered impactor stages only, and weight percents are based on these totals. The cumulative values should be shifted as indicated by the dashed lines.

Barge unloading/conveying
From: EPA/EMB Test No. 74-GRN-7

TABLE 2. RESULTS OF ANDERSEN IMPACTOR MEASUREMENTS IN PLUMES GENERATED BY GRAIN LOADING

Test	Test duration (min)	Total measured concentration (mg/m^3)	Size distribution (concentration in size range, mg/m^3)								
			> 13.5 µm	11.2-13.5 µm	7.7-11.2 µm	5.2-7.7 µm	3.3-5.2 µm	1.67-3.3 µm	1.04-1.67 µm	0.71-1.04 µm	< 0.71 µm
Bunge	37	89	54.8	4.8	7.4	7.7	7.1	5.0	1.5	0.0	0.6
Dreyfus	32	200	142	18.6	15.8	10.0	10.4	4.8	3.4	1.0	3.2
Cargill-1	62	9.3	5.9	0.18	1.1	0.19	0.53	0.35	0.53	0.36	0.18
Cargill-2	62	95	33.8	9.7	12.1	8.6	25.4	3.7	1.1	0.38	1.9
Columbia-1	25.4	104	39.3	14.4	10.4	15.6	11.8	9.6	2.6	0.42	0.0
Columbia-2	34	135	60.5	10.0	20.9	13.5	12.0	9.0	5.8	2.6	0.68

Shiploading

From: Emission Factor Development (GCA Corp. for EPA)

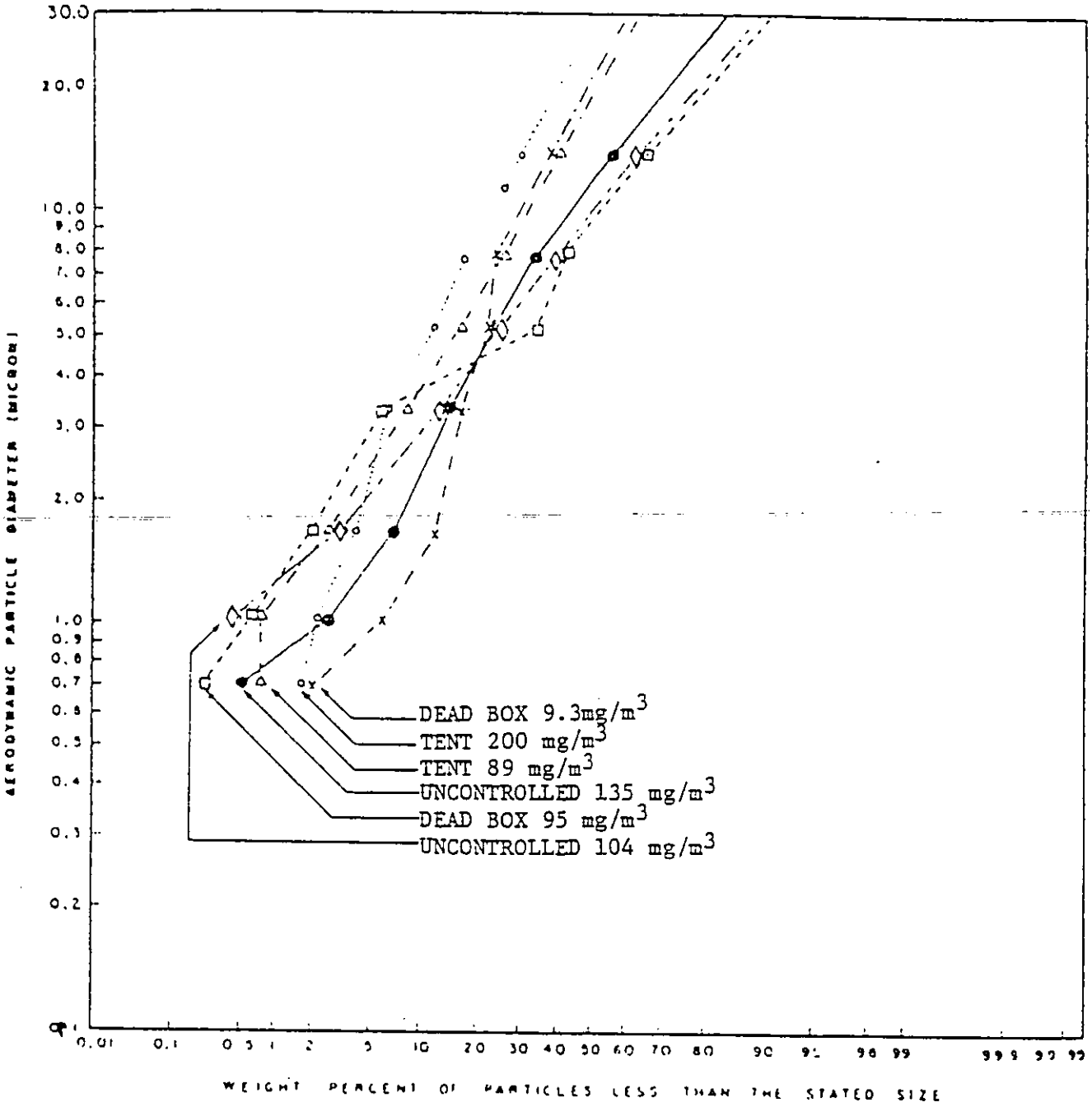

Figure 5. Size distribution of particulate emissions from shiploading, primarily topping-off.

Shiploading

From: Emission Factor Development ...
(GCA Corp. for EPA)

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 PAGE 1 DATE 10/02/86

FPEIS TEST SERIES NO: 220 DESCRIBES SAMPLING AT SITE FROM 10/11/77 TO 10/11/77 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY: FOOD INDUSTRY
SOURCE TYPE: GRAIN MILL PRODUCTS
PRODUCT/DEVICE: RICE
PROCESS TYPE: PROCESSING
DESIGN PROCESS RATE: 90800 KG/HR
FEED MATERIAL CATEGORY: AGRI FEED
PRIMARY CONTROL DEVICE:

SOURCE NAME: CONFIDENTIAL
SITE NAME:
ADDRESS:
LOS ANGELES ,CA 00000

SIC CODE: 2044

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00090 SDDS TSN: FEIS TSN: CHDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN.
TABACK H.J.
KVB REPORT 5806-783 PB 293 923/AS FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL. RICE DRYER IS A HOLLOW,DOUBLE-WALL CYLINDER ENCLOSED IN A BLDG. VENTED THRU 6-4.1M DIA. SCREENS & HEATED BY 4-9.54KJ/HR BURNERS

Rice Dryer

FPEIS TEST SERIES NUMBER: 00228 STREAM NO: 001 TEST ID NO: 1

SERIES FORM C6 DATE 10/02/86

PARTICLE DIAMETERS BASED ON CLASSIC AERODYNAMIC DEFINITION (TASK GROUP ON LUNG DYNAMICS)

PARTICLE SIZE SUMMARY----------

SAMPLE NO.	SAMPLE LOCATIONS DEVICE	SYSTEM	UG/DNM3	PARTICLE DIAMETER IN MICROMETERS 20.0	15.0	10.0	6.0	2.5	1.25	1.0	0.625
01	INLET	I	CUM MASS CONC	1.02E+04	6.59E+03	2.95E+03	9.91E+02	2.02E+02	0.00E+00	0.00E+00	0.00E+00
			DM/DLOG D	2.89E+04	2.72E+04	1.15E+04	6.24E+03	5.85E+02	0.00E+00	0.00E+00	0.00E+00
				EXTRAPOL	EXTRAPOL	EXTRAPOL	INTERPOL	INTERPOL	MISSING	MISSING	MISSING
02	INLET	I	CUM MASS CONC	1.99E+04	1.12E+04	2.02E+03	6.26E+02	3.86E+02	2.31E+02	1.95E+02	1.33E+02
			DM/DLOG D	7.01E+04	6.68E+04	2.99E+04	6.29E+02	6.29E+02	3.97E+02	3.53E+02	0.00E+00
				EXTRAPOL	EXTRAPOL	EXTRAPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL

Rice Dryer

FPEIS TEST SERIES NO: 00228 STREAM NO: 01 TEST ID NO: 1 SAMPLE NO: 01

SERIES FORM 6 DATE 10/02/86

SAMPLING ACTIVITY DESCRIPTION----------

MEASUREMENT INSTRUMENT/METHOD TYPE: I NAME: SASS TRAIN-WITH CYCLONES SAMPLING START TIME: 1702 DURATION: 199 MIN

SAMPLING CONDITIONS-- MASS/VOLUMETRIC FLOWRATE= 59.7 M3/SEC FLOWRATE METHOD: ANEMOMETER TEMPERATURE= 31 C

MOISTURE CONTENT= 2.3 PCT VELOCITY= 5.8 M/SEC PRESSURE= 758 MM HG

SAMPLE DENSITY= 1.0 G/CM3 DENSITY DETERMINATION: ASSUMED

DEVICE SAMPLING LOCATION=INLET DEVICE/PROCESS NUMBER= 1 SAMPLING LOCATION DESCRIPTION: AT SCREEN OUTLET

SYSTEM SAMPLING LOCATION= INLET OR UNCONTROLLED CORRESPONDING SAMPLE NUMBER:

VOLUME OF SAMPLE COLLECTED= 27.90 M3 TOTAL MASS OF SAMPLE COLLECTED= 590.70 MG

MEASUREMENT INSTRUMENT: TEMPERATURE= 94 C INLET PRESSURE= 758 MM HG FLOW RATE= 180.0 L/MIN

ESTIMATED TIME BETWEEN SAMPLING AND CHEM ANALYSIS: DAYS -SAMPLING AND RADIOASSAY: DAYS

COLLECTION SURFACE/SUBSTRATE:

PERCENT ISOKINETIC SAMPLING= 117 GAS ANALYSIS (PCT BY VOLUME)-- CO2= 7.00 CO= . O2= 16.00 N2= 77.00

OTHER TRACE GASES (IN PPM): DILUTION FACTOR= 1.0

PARTICLE MEASUREMENTS WERE MADE ON THE BASIS OF MASS UPPER BOUNDARY DIAMETER= 30.00 UM

PARTICLE DIAMETERS ARE DEFINED ACCORDING TO THE FOLLOWING DEFINITION: CLASSIC AERODYNAMIC

PARTICLE DIAMETERS WERE DETERMINED FROM CALIBRATION

COMMENTS ON THE SAMPLING ACTIVITY----------

OF TOTAL SAMPLE MASS 57.6 MG IS INORGANIC & 94.3 IS ORGANIC
CAUGHT IN THE IMPINGERS, SEE GEDS TSN 80.

Rice Dryer

FPEIS TEST SERIES NO: 00228 STREAM NO: 01 TEST ID NO: 1 SAMPLE NO: 02

SERIES FORM 6 DATE 10/02/06

SAMPLING ACTIVITY DESCRIPTION----------

MEASUREMENT INSTRUMENT/METHOD TYPE: I NAME: OTHER CYCLONES SAMPLING START TIME: 1703 DURATION: MIN

SAMPLING CONDITIONS-- MASS/VOLUMETRIC FLOWRATE= FLOWRATE METHOD: TEMPERATURE= C

MOISTURE CONTENT= 3.3 PCT VELOCITY= M/SEC PRESSURE= MM HG

SAMPLE DENSITY= G/CM3 DENSITY DETERMINATION:

DEVICE SAMPLING LOCATION=INLET DEVICE/PROCESS NUMBER= 1 SAMPLING LOCATION DESCRIPTION:

SYSTEM SAMPLING LOCATION= INLET OR UNCONTROLLED CORRESPONDING SAMPLE NUMBER:

VOLUME OF SAMPLE COLLECTED= 5.46 M3 TOTAL MASS OF SAMPLE COLLECTED= 190.30 MG

MEASUREMENT INSTRUMENT: TEMPERATURE= 96 C INLET PRESSURE= 758 MM HG FLOW RATE= 35.8 L/MIN

ESTIMATED TIME BETWEEN SAMPLING AND CHEM ANALYSIS: DAYS -SAMPLING AND RADIOASSAY: DAYS

COLLECTION SURFACE/SUBSTRATE:

PERCENT ISOKINETIC SAMPLING= 11. GAS ANALYSIS (PCT BY VOLUME)-- CO2= . CO= . O2= . N2= .

OTHER TRACE GASES (IN PPM):

DILUTION FACTOR=

PARTICLE MEASUREMENTS WERE MADE ON THE BASIS OF MASS UPPER BOUNDARY DIAMETER= UM

COMMENTS ON THE SAMPLING ACTIVITY----------

OF TOTAL SAMPLE MASS 6.8 MG IS INORGANIC & 1.9 MG IS ORGANIC
CAUGHT IN THE IMPINGERS, SEE GEDS TSN 80.
THREE CYCLONES WERE FABRICATED AND USED IN SERIES WITH A
JOY TRAIN.

Rice Dryer

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 DATE 10/02/86

FPEIS TEST SERIES NO: 229 DESCRIBES SAMPLING AT SITE FROM 03/23/78 TO 03/23/78 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY: FOOD INDUSTRY
SOURCE TYPE: GRAIN MILL PRODUCTS
PRODUCT/DEVICE: CAROB KIBBLE
PROCESS TYPE: ROASTING
DESIGN PROCESS RATE: 300 KG/HR
FEED MATERIAL CATEGORY: AGRI FEED
PRIMARY CONTROL DEVICE:

SOURCE NAME: CONFIDENTIAL
SITE NAME:
ADDRESS:
LOS ANGELES ,CA 00000

SIC CODE: 2041

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00081 SODS TSN: FEIS TSN: CHDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN.
TABACK H.J.
KVB REPORT 5806-783 PB 293 923/AS FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL. ROASTER HEAT INPUT IS 7951 KJ/HR OF NATURAL GAS.

Carob Kibble Roasting

FPEIS TEST SERIES NUMBER: 00229 STREAM NO: 001 TEST ID NO: 1

SERIES FORM C6 DATE 10/02/86

PARTICLE DIAMETERS BASED ON CLASSIC AERODYNAMIC DEFINITION (TASK GROUP ON LUNG DYNAMICS)

PARTICLE SIZE SUMMARY----------

SAMPLE NO.	SAMPLE LOCATIONS DEVICE	SYSTEM	UG/DNM3	PARTICLE DIAMETER IN MICROMETERS 20.0	15.0	10.0	6.0	2.5	1.25	1.0	0.625
01	INLET	I	CUM MASS CONC	5.84E+04	3.25E+04	5.64E+03	1.87E+03	1.76E+03	1.36E+03	1.10E+03	4.24E+02
			DM/DLOG D	2.07E+05	1.97E+05	8.72E+04	2.65E+02	2.65E+02	2.45E+03	2.87E+03	0.00E+00
				EXTRAPOL	EXTRAPOL	EXTRAPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL

Carob Kibble Roasting

SAMPLING ACTIVITY DESCRIPTION----------

MEASUREMENT INSTRUMENT/METHOD TYPE: I NAME: OTHER CYCLONES SAMPLING START TIME: 1036 DURATION: 233 MIN

SAMPLING CONDITIONS-- MASS/VOLUMETRIC FLOWRATE= 799.0 L/SEC FLOWRATE METHOD: PITOT TUBE TEMPERATURE= 46 C

MOISTURE CONTENT= 8.2 PCT VELOCITY= 12.4 M/SEC PRESSURE= 758 MM HG

SAMPLE DENSITY= 1.0 G/CM3 DENSITY DETERMINATION: ASSUMED

DEVICE SAMPLING LOCATION=INLET DEVICE/PROCESS NUMBER= 1 SAMPLING LOCATION DESCRIPTION: 2.5 M FROM AFTERBURNER INLET.

SYSTEM SAMPLING LOCATION= INLET OR UNCONTROLLED CORRESPONDING SAMPLE NUMBER:

VOLUME OF SAMPLE COLLECTED= 6.65 M3 TOTAL MASS OF SAMPLE COLLECTED= 1.07 G

MEASUREMENT INSTRUMENT: TEMPERATURE= 204 C INLET PRESSURE= 765 MM HG FLOW RATE= 44.5 L/MIN

ESTIMATED TIME BETWEEN SAMPLING AND CHEM ANALYSIS: DAYS -SAMPLING AND RADIOASSAY: DAYS

COLLECTION SURFACE/SUBSTRATE:

PERCENT ISOKINETIC SAMPLING= 122 GAS ANALYSIS (PCT BY VOLUME)-- CO2= 0.40 CO= . O2= 20.20 N2= 79.40

OTHER TRACE GASES (IN PPM): NO CO OR HCN DETECTED DILUTION FACTOR= 1.0

PARTICLE MEASUREMENTS WERE MADE ON THE BASIS OF MASS UPPER BOUNDARY DIAMETER= 30.00 UM

PARTICLE DIAMETERS ARE DEFINED ACCORDING TO THE FOLLOWING DEFINITION: CLASSIC AERODYNAMIC

PARTICLE DIAMETERS WERE DETERMINED FROM CALIBRATION

COMMENTS ON THE SAMPLING ACTIVITY----------

OF TOTAL MASS, 319 MG IS INORGANIC & 174 MG IS ORGANIC CAUGHT IN IMPINGERS, GEDS 81. THREE CYCLONES WERE USED WITH A JOY TRAIN. SASS TRAIN DATA FOR THE AFTERBURNER OUTLET CONDITION WAS UNUSABLE DUE TO A HIGH AFTERBURNER TEMPERATURE OF 360 DEG C.

Carob Kibble Roasting

APPENDIX B

REFERENCE MATERIAL FOR REVISED EMISSION FACTORS

TABLE 7-1. EMISSION TEST DATA[a]

Industry/Plant	Date of test	No. of tests	Dryer type	Control type	Dryer process weight rate Mg/h (tons/h)	Stack gas flow rate rate m^3/s (acfm)	Uncontrolled emission rate g/m^3 (gr/dscf)	Uncontrolled emission rate kg/h (lb/h)	Controlled emission rate g/m^3 (gr/dscf)	Controlled emission rate kg/h (lb/h)	Allowable emissions kg/h (lb/h)
Wet corn milling (SIC 2046)											
Plant A	1976	3	Direct-fired rotary	Cyclone[b]	9.4 (10.4)	8.44 (17,880)	0.055 (0.024)	1.25 (2.76)	--	--	8.99 (19.7)
Plant B[c]	1979	3	4 Direct-fired rotary	Scrubber-venturi	N/A	82.54 (174,900)	--	--	0.163 (0.0713)	27.2 (60)	72.6[d] (160)[d]
	1979	3	4 Direct-fired rotary	Scrubber-venturi	N/A	94.24 (199,700)	--	--	0.185 (0.0809)	37.2 (82)	72.6[d] (160)[d]
	1980	3	4 Direct-fired rotary	Scrubber-venturi	N/A	75.27 (159,500)	--	--	0.195 (0.085)	33.1 (73)	472.6[d] (160)[d]
	1980	3	3 Direct-fired rotary)	Scrubber-venturi	N/A	75.36 (159,700)	--	--	0.146 (0.064)	24.9 (55)	54.4 (120)[e]
Plant C[c]	1977	3	Rotary steam tube (No. 7)	--	40[g] (4.36)	3.12 (6,621)	0.140 (0.061)	0.60 (1.33)	--	--	5.0 (11.0)
	1977	3	Rotary steam tube (No. 8)	--	4.11 (4.53)	3.08 (6,517)	0.167 (0.167)	0.72 (1.59)	--	--	5.2 (11.4)
	1977	3	Rotary steam tube (No. 9)	--	4.16 (4.59)	3.36 (7,119)	0.144 (0.063)	0.66 (1.33)	--	--	52.2 (11 4)
	1981	3	Rotary steam tube (No. 5)	--	6.15 (6.78)	2.73 (5,785)	0.220 (0.096)	0.69 (1.53)	--	--	6.7 (14.8)
	1977	9	Rotary steam tube	Mill cyclone,[b]	4.11 (4.53)	5.68 (12,032)	0.014 (0.006)	0.69 (0.53)	--	--	5.1 (11.3)
	1981	3	Rotary steam tube	Mill cyclone,[b]	4.22 (4.66)	5.39 (11,431)	0.003 (0.013)	0.50 (1.10)	--	--	5.2 (11.5)
	1977	9	Rotary steam tube (+ Hammermill)	Product cyclone,[b]	4.04 (4.45)	5.40 (11,437)	0.055 (0.024)	0.97 (2.14)	--	--	5.0 (11.1)
	1981	3	Rotary steam tube (+ Hammermill)	Product cylone,	4.28 (4.72)	4.79 (10,154)	0.096 (0.042)	1.50 (3.30)	--	--	5.3 (11.6)
	1980	3	Rotary steam tube	--	1.02 (1.12)	2.06 (4,366)	0.215 (0.094)	0.74 (1.63)	--	--	2.0 (4 4)
Alfalfa dehydrators (SIC 2048-9)											
Plant D	1976	2	Direct-fired rotary + hammermill	Cyclones[b]	3.10 (3.42)	10.24 (21,690)	0.616 (0.269)	20.55 (45.3)	--	--	5.8 (12.7)
Plant E	1974-1976	57	Direct-fired rotary	Multiple configurations	--	--	--	2.1-13.7 (4.6-30.2)	--	--	5.0-15.0 (11.0-33.1)

(continued)

TABLE 7-1. (continued)

Industry/Plant	Date of test	No. of tests	Dryer type	Control type	Dryer process weight rate Mg/h (tons/h)	Stack gas flow rate rate m^3/s (acfm)	Uncontrolled emission rate g/m^3 (gr/dscf)	Uncontrolled emission rate kg/h (lb/h)	Controlled emission rate g/m^3 (gr/dscf)	Controlled emission rate kg/h (lb/h)	Allowable emissions kg/h (lb/h)
Beet sugar (SIC 2063)											
Plant F	1977	5	Rotary kiln (lignite-fired)	Cyclone,[b] skimmer	200 (211)	6.47 (13,700) (dscfm)	0.149 (0.065)	3.45 (7.6)	--	--	19.5 (43.0)
Plant G	1980	3	Direct-fired rotary drum	--	65.5 (72.2)	13.07 (27,700)	0.311 (0.136)	7.53 (16.6)	--	--	13.9 (30.4)
	1980	3		--	41.9 (46.2)	13.35 (28,300)	0.389 (0.170)	9.03 (19.9)	--	--	11.1 (24.4)
Plant H	1980	3	Direct-fired rotary drum	--	30.4 (33.5)	14.06 (29,800)	0.254 (0.111)	6.1 (13.5)	--	--	13.7 (30.3)
	1980	3		--	20.3 (22.4)	15.86 (33,600)	0.215 (0.094)	6.8 (15.1)	--	--	11.2 (24.6)
Plant I	1980	3	Direct-fired rotary drum	--	43.9 (48.4)	12.88 (27,300)	0.366 (0.160)	7.7 (17.0)	--	--	14.6 (32.1)
	1980	3		--	43.9 (48.4)	9.25 (19,600)	0.378 (0.165)	5.7 (12.5)	--	--	14.6 (32.2)
Plant J	1977	4	Indirect-fired rotary	Cyclone	22.7 (25)	N/A	--	--	0.183 (0.08)	11.8 (26.1)	16.1 (35.4)
Animal and marine fats and oils (SIC 2077)											
Plant K	1978	N/A	1 Ring; 1 Rotary steam tube	2 cyclones in parallel[b]	3.7 (4.1)	N/A	0.641 (0.28)	1.1 (2.5)	--	--	3.9 (8.5)
Malt beverages (SIC 2082)											
Plant L	1978	3	2 direct-fired rotary drums	2 wet fan collectors	3.8 (4.2)	6.8 (13,300)	--	--	0.112 (0.049)	1.23[f] (2.72)	4.9 (10.8)

N/A = Data not available.
[a]Source sampling reports provided by the plants and by State and local air pollution control agencies.
[b]Based on process description or manufacturing practice, this control equipment is used primarily for product recovery.
[c]Emission rate calculated using front-half and back-half catch, as per Iowa regulation.
[d]Allowable emissions for the 4 dryers.
[e]Allowable emissions for the 3 dryers.
[f]Each dryer.
[g]The value of 40 Mg/h appears to be an error. Assuming 4.36 ton/h for this test is correct, then the equivalent in SI units is 4.36 x 0.908 = 3.96 Mg/h.

PELLET MILL/COOLER STACK TEST SUMMARY

Plant	Feed	Collector	Processed Feed Rate lb/hr	Air Flow SCFM	Emission Rate lb/hr
No. 1	Steer	Longhorn Cyclone	24,000	10,100	6.6
	Steer	Carter Day Cyclone	24,000	10,850	3.4
	Poultry	Cyclones	24,00	10,450	11.0
	Poultry	Cyclones	24,000	14,325	3.9
No. 2	Mixed	Cyclone	20,000	16,735	0.44
	Mixed	Cyclone	36,000	25,580	1.85
No. 3	Poultry	Cyclone	27,900	25,240	7.2
	Poultry	Cyclone	28,700	25,350	4.0
	Steer	Cyclone	25,200	21,850	3.9
	Steer	Cyclone	29,500	30,430	7.3
No. 4	Dairy	Single Cyclone	19,300	16,130	3.2
	Turkey	Single Cyclone	21,600	16,060	2.4

CRACKER STACK TEST SUMMARY

No. 2	Corn	Cyclone	8,000	3,130	0.097

HAMMERMILL STACK TEST SUMMARY

No. 4	Corn	Dual Cyclone	16,000	5,760	1.3

FLAKING STACK TEST SUMMMARY

No. 1	Corn/Barley	Single Cyclone	12,000	3,910	0.93

Feed mills (Pellet coolers, Cracking, Grinding and Flaking)

From: Purina Mills, Inc. test data, March 11, 1987

Pellet Mill/Cooler Stack Test Results

Plant	Feed	Collector	Processed Feed Rate lb/hr	Air Flow SCFM	Emission Rate lb/hr
No. 5	Hog	Triple Cyclone	18,500	19,900	1.1
	Horse	Triple Cyclone	16,000	20,000	1.6
	Horse	Triple Cyclone	13,000	19,700	1.1

From: Purina Mills, Inc. test data, July 8, 1987

APPENDIX C

SUPPORT INFORMATION FOR EXISTING EMISSION FACTORS IN SECTION 6.4

The information in this appendix is copied directly from:

Source Test Evaluation for Feed and Grain Industry, EPA-450/3-76-043, MRI for U.S. EPA, Research Triangle Park, NC, Contract No. 68-02-1403, December 1976.

This material describes the development of emission factors in the previous Section 6.4 dated 4/77.