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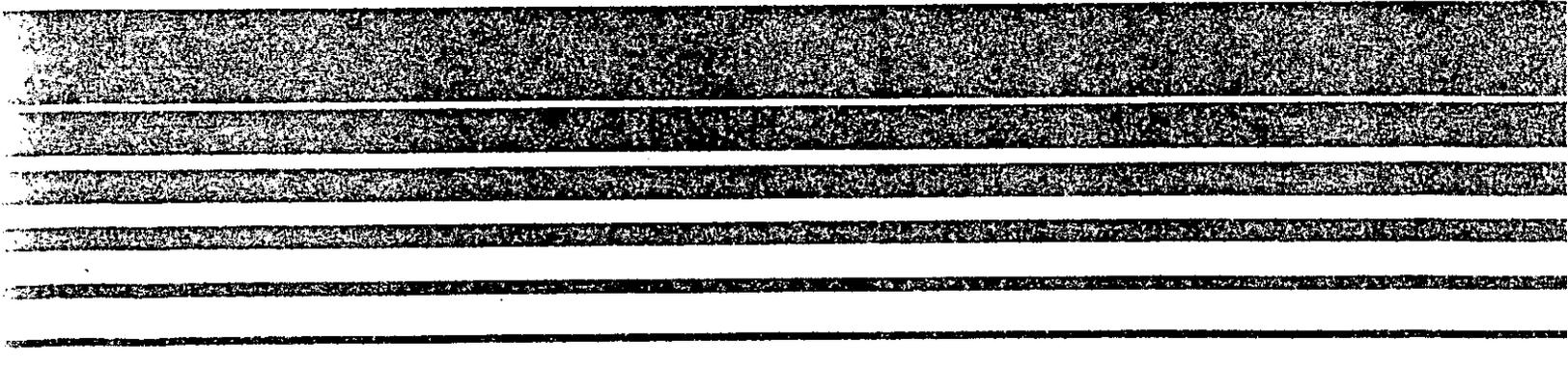
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# Assessment of Fugitive Particulate Emission Factors for Industrial Processes

*6.4 GRAIN ELEVATORS*



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EPA-450/3-78-107

# Assessment of Fugitive Particulate Emission Factors for Industrial Processes

by

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## 1.0 SUMMARY

### 1.1 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has called for revisions of State Implementation Plans (SIP's) in areas where the total suspended particulate (TSP) standard is being exceeded. An integral part of the SIP's is the TSP emission inventory, which is necessary to identify areas requiring emission control. Deficiencies in some state inventories must be corrected before strategies can be developed. One of these deficiencies is the lack of reliable emission factor data for TSP resulting from fugitive emissions from industrial processes.

The purpose of this assessment is to develop a priority listing of fugitive industrial processes on which source sampling is needed and to provide EPA with recommendations and support documentation for the development of fugitive TSP emission factors for industrial processes.

The industries covered are those whose processes contribute to fugitive particulate emissions. This study also includes an update of data found in the manual, Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions.<sup>1</sup>

Fugitive dust sources such as storage piles, vehicular traffic, and windblown dust are not included in this study.

NOTE

### 1.2 PRIORITY LISTING

Two criteria were used for the priority listing of industrial categories that require source sampling of fugitive process emissions: 1) adequacy of currently available fugitive emission factor data, and 2) total potential uncontrolled fugitive particulate emissions (industrywide). The priority listing is presented in Table 1-1.

TABLE 1-1. PRIORITY LISTING OF INDUSTRIAL CATEGORIES

Industrial category	Adequacy of emission data ranking <sup>a</sup>	Uncontrolled fugitive particulate emissions <sup>b</sup>		Percent of total plant uncontrolled particulate emissions	Total priority ranking <sup>d</sup>
		Mg/yr	(tonn/yr) rankings <sup>c</sup>		
1. Foundries	5	106,719	(117,872)	50.3	9
2. Portland cement	4	697,589	(768,961)	5.7	9
3. Minerals extraction and beneficiation	4	688,401	(714,096)	100.0	9
4. Iron production	4	99,450	(110,070)	0.9	8
5. Secondary lead	5	4,250	(4,684)	6.2	7
6. Primary aluminum	4	52,470	(57,890)	24.4	7
7. Asphaltic concrete	4	46,845	(51,638)	0.7	7
8. Lime manufacturing	4	44,824	(49,410)	1.3	7
9. Coke manufacturing	3	131,700	(145,400)	100.0	7
10. Secondary aluminum	5	1,808	(1,995)	5.6	6
11. Secondary brass/bronze	5	766	(842)	10.9	6
12. Secondary zinc	5	429	(472)	6.9	6
13. Lumber and furniture	4	8,665	(9,549)	52.9	6
14. Concrete batching	3	31,026	(34,200)	100.0	6
15. Primary copper	3	19,977	(22,024)	22.0	6
16. Grain elevators	1	1,238,129	(1,364,803)	100.0	6 <sup>e</sup>
17. Primary zinc	4	1,806	(1,991)	2.1	5
18. Primary lead	3	11,742	(12,945)	6.1	5
19. Steel manufacturing	2	61,520	(68,250)	2.8	5 <sup>e</sup>

<sup>a</sup>Ranking definitions: 5 - very poor; 4 - poor; 3 - fair; 2 - good; and 1 - very good.

<sup>b</sup>See Section 2 for detailed descriptions of potential emission sources, their respective emission factors, and emission estimates within each industry.

<sup>c</sup>Sources with the highest emissions receive the highest ranking.

<sup>d</sup>Source categories with greatest total ranking deserve highest priority for emission sampling.

<sup>e</sup>Since emission factor ranking is good or very good, sampling for emission factor development is not required.

### 1.2.1 Rating Criteria

The detailed supporting data and analysis of the rating criteria are contained in Section 2 of this report. The emission calculations represent the total uncontrolled fugitive particulate emissions from industrial processes. These calculations were used as a rating criterion since they indicate the potential fugitive emission levels of each industrial category. Actual fugitive emissions cannot readily be calculated because industrywide fugitive control levels have not been documented.

Table 1-1 also presents the adequacy of currently available fugitive emission factor data. The sources of available factors (or estimates) are given in Section 2, along with the method used to develop the factors. Thus, a factor based on an estimate of 5 percent of the uncontrolled process emission rate found in the Compilation of Air Pollutant Emission Factors (AP-42) is less adequate than a fugitive emission rate based on sampling.

### 1.2.2 Ranking System

The emission estimates and adequacy of the emission factor analysis are numerically ranked by industrial category. The emission estimates are ranked from one to five, with one representing the lowest fugitive emission rate and five the highest.

The adequacy of the fugitive emission factors also are ranked from one to five. The industrial categories with the least adequate data are assigned a ranking of five, whereas the categories with the best data are assigned a one. The adequacy of emission factor rankings is defined as follows:

- 5 Very poor. Based only on estimates or assumed values, or the development is unknown.
- 4 Poor. Based on engineering judgment, related factors from other industries, or material balance.
- 3 Fair. Based on engineering judgment and limited tests.
- 2 Good. Based on incomplete test data.
- 1 Very good. Based on complete test data.

A material balance is much less accurate for use in arriving at a fugitive particulate emission factor than it is for other applications, such as determining the sulfur emissions from a boiler based on fuel flow rate and sulfur content. Hence it is considered a "poor" rating for developing fugitive emission factors. All emission factors for each industry were considered in determining the overall adequacy ranking, which represents the status of emission factor development for that industry.

The rankings for both criteria are summed for each industrial category and listed in numerical order. The sources with the highest ranking totals have top priority in a sampling program to measure the fugitive particulate emissions from industrial processes. The industries with lower ranking totals have a corresponding lower priority of fugitive emission factor development. As can be seen from Table 1-1, the industries with equal total priority rankings are rated based on the adequacy of emission data rankings. When the adequacy rankings are equal, the industry with the highest annual fugitive emissions is given highest priority.

### 1.3 FUGITIVE PARTICULATE EMISSIONS BY PROCESS TYPE

Industries that produce or manufacture completely unrelated products will often have several very similar processes that have the potential to generate fugitive emissions. Approximately 39 types of processes have been identified as contributors to fugitive emissions from the industries covered in this report.<sup>1</sup> Table 1-2 presents the major sources of fugitive particulate emissions within each industry.

About 80 percent of the potential uncontrolled fugitive emissions result from the following five process types that, except for the grain elevator headhouse, are common to several industries:

1. Loading and unloading, 800,900 Mg/yr (882,900 tons/yr)
2. Headhouse operations, 602,400 Mg/yr (664,000 tons/yr)

TABLE 1-2. MAJOR SOURCES OF FUGITIVE PARTICULATE EMISSIONS

Industry and total uncontrolled fugitive particulate emissions, Mg/yr (cons/yr)	Major sources of fugitive particulate emissions	Uncontrolled fugitive particulate emissions by source category, Mg/yr		Percent of annual uncontrolled particulate emissions
		Mg/yr	(tons/yr)	
1. Foundries 106,719 (117,872)	Hot metal and slag transfer, casting, and refining	68,856	(76,152)	65
	Metal melting operations	22,436	(24,710)	21
	Core preparation	11,425	(12,584)	11
	Loading, unloading and storage	538,937	(594,077)	77
	Crushing, grinding, and screening	127,421	(142,078)	18
	Crushing, grinding and screening	359,013	(395,387)	55
3. Minerals extraction and beneficiation 648,401 (714,096)	Transfer and conveying	97,206	(107,056)	15
	Drilling and blasting	76,956	(84,752)	12
	Overburden removal	56,903	(62,668)	9
4. Iron production 99,450 (110,070)	Sintering	67,100	(74,000)	67
	Hot metal and slag, transfer, casting, and refining	31,600	(35,200)	32
5. Secondary lead 4250 (4684)	Hot metal and slag, transfer, casting, and refining	3,384	(3,730)	79
	Reverberatory furnace	595	(656)	14
6. Primary aluminum	Reduction cells	24,620	(27,140)	47
	Transfer and conveying	19,000	(21,000)	36
	Crushing, grinding, and screening	5,310	(5,850)	10

(continued)

TABLE 1-2. (continued)

Industry and total uncontrolled fugitive particulate emissions, Mg/yr (tons/yr)	Major sources of fugitive particulate emissions	Uncontrolled fugitive particulate emissions by source category, Mg/yr (tons/yr)		Percent of annual uncontrolled particulate emissions
		Mg/yr	(tons/yr)	
7. Asphaltic concrete 46,845 (51,638)	Transfer and conveying Loading, unloading and storage	28,740 14,370	(31,680) (15,840)	61 31
8. Limestone manufacturing 44,824 (49,410)	Crushing, grinding, and screening Transfer and conveying	36,388 7,653	(40,111) (8,436)	81 17
9. Coke manufacturing 131,700 (145,400)	Charging Quenching Pushing	63,800 38,200 25,500	(70,400) (42,200) (28,100)	48 29 19
10. Secondary aluminum 1808 (1,995)	Fluxing (chlorination) Chip (rotary) dryer	1,425 223	(1,575) (245)	79 12
11. Secondary brass/bronze 766 (842)	Metal melting Insulation burning Rotary dryer	358 275 69	(393) (303) (76)	47 36 9
12. Secondary zinc 429 (472)	Metal melting Crushing, grinding, and screening	290 138	(319) (152)	66 32
13. Lumber and furniture 8,665 (9,549)	Sawing Log debarking Wood waste storage and unloading	7,078 544 425	(7,802) (599) (468)	82 6 5

(continued)

TABLE 1-2. (continued)

Industry and total uncontrolled fugitive particulate emissions, Mg/yr (tons/yr)	Major sources of fugitive particulate emissions	Uncontrolled fugitive particulate emissions		Percent of annual uncontrolled particulate emissions
		Mg/yr	(tons/yr)	
14. Concrete batching 31,026 (34,200)	Loading, unloading, and storage	31,026	(34,200)	100
15. Primary copper 19,977 (22,024)	Metal melting	18,153	(20,675)	94
16. Grain elevators 1,238,127 (1,364,803)	Headhouse (legs)	602,368	(663,996)	49
	Transfer and conveying, Loading, unloading, and storage	378,868 177,704	(417,631) (195,887)	31 14
17. Primary zinc 1806 (1991)	Hot metal and slag transfer, casting, and refining	1,198	(1,321)	66
18. Primary lead 11,742 (12,945)	Sintering	608	(670)	34
	Sintering	6,978	(7,689)	59
	Metal melting	2,326	(2,566)	20
	Crushing, grinding, and screening	692	(763)	6
19. Steel manufacturing 61,520 (68,250)	Silver retort building	551	(608)	5
	Metal melting Hot metal and slag transfer, casting, and refining	51,600 9,600	(57,300) (10,600)	84 15

3. Crushing, grinding, and screening, 569,300 Mg/yr (627,600 tons/yr)
4. Transfer and conveying, 468,000 Mg/yr (515,900 tons/yr)
5. Metal melting operations, 246,200 Mg/yr (271,400 tons/yr)

It should be noted that these are uncontrolled emission estimates, and in cases where emissions are controlled, the rates would be reduced substantially.

Fugitive emissions from loading and unloading are generated by such operations as loading haul trucks with raw materials at the quarry or mine site, dumping these materials into a primary crusher or storage area, and loading partially processed materials into interim storage prior to loadout for further processing. The portland cement industry is a major contributor of such emissions, primarily because of the large volume of materials (both raw and partially processed) loaded and unloaded. Loading and unloading of raw materials from the quarry and clinker from clinker storage are the major potential fugitive sources within this industry. Although the lime manufacturing, coal mining, and crushed stone industries have similar processes, either the volumes handled or the number of actual loading and unloading operations are on a smaller scale, thereby lessening the total potential fugitive emissions from loading and unloading.

Headhouses at grain elevators are a potentially large source of fugitive particulate emissions. The headhouse is the distribution center of a grain elevator, where the grain is distributed, possibly weighed, and loaded in storage silos. Actual total annual emissions from this source, however, are probably much lower than indicated in this report because emission controls are often used on headhouse operations.

Crushing, grinding, and screening processes, as well as transfer and conveying, are common in industries where raw materials must undergo size reduction at some point to attain the desired product. This is particularly the case in industries involved in the extraction of limestone, dolomite, crushed stone,

metallic ores, and other minerals. The mined raw materials are often in large pieces that must be reduced by crushers. Crushing can involve up to three steps, each successive step further reducing the material size, and screening usually takes place between each crushing operation. The crushing steps often occur at different locations within the facility. Primary crushing may take place at the quarry or mine site, and the product may subsequently be transferred to secondary and tertiary crushing and screening operations at another location within the plant. The transfer process can generate fugitive emissions particularly if there are numerous transfer points along the way. Most industries do not control the emissions generated by these operations. The amount of uncontrolled emissions depends somewhat on the moisture content of the raw material, which can vary greatly within an industry and from one season to another.

A smaller potential source of fugitive emissions is the metals melting industries (ferrous and nonferrous). The major potential source is the melting furnace, particularly the charging and tapping operations, although furnace leakage contributes some emissions. The principal furnace types are reverberatory, blast, electric, basic oxygen, and pot. These furnaces are used in the production of many different metals. Emissions from any one furnace type will vary, depending on the type of metal produced.

#### 1.4 ONGOING FUGITIVE EMISSION PROJECTS

Currently several ongoing or recently completed studies are concerned with the quantification of fugitive emissions from industrial processes. These projects will supply additional information for the development of fugitive emission factors. Table 1-3 lists these projects as well as other pertinent information, such as anticipated completion dates for each project given (so that appropriate personnel can be contacted and information obtained from the particular report).

TABLE 1-3. LISTING OF ONGOING PROJECTS CONCERNED WITH THE QUANTIFICATION OF  
FUGITIVE EMISSIONS FROM INDUSTRIAL PROCESSES

Project title	Contractor	EPA contract no.	EPA Project Officer or contact	Scheduled completion date or report number
1. Survey of Fugitive Dust from Coal Mines	PEDCO Environmental, Inc.	68-01-4489	E. A. Rachel (Region VIII, Air Planning and Operations Section)	EPA-908/ 1-78-003
2. Coke Quench Tower Emission Testing Program	York Research	68-02-1401 68-01-4138	B. Bloom (OE, DSSE)	9/78
3. Study of Fugitive Emissions in the Iron and Steel Industry	Midwest Research Institute	68-02-2120	R. Hendriks (IERL-RTP, Metallurgical Processes Branch)	EPA-600/ 2-78-050
4. Emissions from Iron Ore Mining, Beneficiation, and Pelletizing	Midwest Research Institute	68-02-2113	N. Plaks (IERL-RTP, Metallurgical Processes Branch)	11/78
5. Dust from Western Coal Strip Mines	Mathematica, Inc.	68-03-2226	E. Bates (IERL-CI, Mining and Extraction Division)	2/79
6. Fugitive Dust from Oil Shale Extraction	TRW	68-03-2560 Task T-5002	E. Bates (IERL-CI, Mining and Extraction Division)	1/79
7. Iron and Steel Plant Open Source Fugitive Emission Evaluation	Midwest Research Institute	68-02-2609 Task 3	R. Hendriks (IERL-RTP, Metallurgical Processes Branch)	9/78
8. Coal Refuse Piles and Slurry Ponds	W. A. Mahler	68-03-2344 68-03-2431	E. Bates (IERL-CI, Mining and Extraction Division)	11/78
9. Coal Mine Transfer Points	Not Determined	Not determined	E. Bates (IERL-CI, Mining and Extraction Division)	Not determined

The numbers preceding the following brief descriptions of these projects correspond with those in Table 1-3.

1. Survey of Fugitive Dust from Coal Mines - The purpose of this study was to quantify the suspended particulate air pollution emissions from surface coal mining in the West. Five such coal mines were sampled, and fugitive emission factors for the following processes were developed:
  - Dragline
  - Haul roads
  - Shovel/truck loading
  - Blasting  
    coal  
    Overburden
  - Truck dumping
  - Storage pile
2. Coke Quench Tower Emission Testing Program - This sampling and analysis program will determine the nature and amounts of organic pollutants that are emitted during wet quenching of coke and will identify individual compounds.
3. Study of Fugitive Emissions in the Iron and Steel Industry - This report identifies and quantifies fugitive emissions in the iron and steel and gray iron foundry industries and contains original test data for six open dust sources. Control technologies for fugitive sources are described, and a research program is outlined to develop and demonstrate technology for the most important sources.
4. Emissions from Iron Ore Mining, Beneficiation, and Pelletizing - This project is to accomplish the following: to determine the available data regarding atmospheric emissions from the iron ore mining, beneficiation, and pelletizing industries; to perform limited sampling to help complete the emission data picture; and to make recommendations for future projects in those industries. The pollutants to be measured are particulates, SO<sub>x</sub>, NO<sub>x</sub>, CO, and hydrocarbons. Particulates will be analyzed for asbestos and metallics.
5. Dust from Western Coal Strip Mines - This project is specifically designed to evaluate the surface mining methods currently employed in the mining of coals in arid and semiarid regions of the West and to evaluate their effect on the environment.

6. Fugitive Dust from Oil Shale Extraction - The objective of this study is to sample fugitive emissions from the following processes at an oil shale extraction site:
  - Crushers
  - Haul roads
  - Mine adits
  - Spent tailings shale transfer
  
7. Iron and Steel Plant Open Source Fugitive Emission Evaluation - This sampling and analysis project is conducting active field testing of the following open sources at three iron and steel plants:
  - Unpaved roads
  - Paved roads
  - Coal stacking
  - Ore unloading

It is anticipated that emission factors will be generated from this study.

8. Pollution Control Guidelines for Coal Refuse Disposal Sites and Slurry Ponds - This project involves the investigation of acid and heavy metal ion concentrations in water passing through refuse piles, suspended solids in waters from refuse piles and slurry ponds, noxious gases from oxidation and fires in refuse piles, and airborne particulates from dry exposed refuse surfaces.
  
9. Coal Mine Transfer Points - This project, which is still in the early planning stage, involves the determination of emissions from coal mine transfer points. The contractor has not yet been selected, and the project schedule and target completion date have not been determined.

REFERENCES FOR SECTION 1

1. PEDCo Environmental, Inc. Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions. Prepared for Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency. Research Triangle Park, North Carolina. EPA-450/3-77-010. March 1977.

## 2.6 GRAIN ELEVATORS

### 2.6.1 Emissions

Figure 2-14 depicts the general process flow in the grain elevator industry, and Table 2-34 lists the emission sources noted in the process flow diagram. Uncontrolled particulate emission rates reported for country, terminal, and export grain elevators in AP-42<sup>3</sup> were used to estimate the 1973 total uncontrolled fugitive industry emission [1,238,127 Mg (1,364,803 tons)] shown in Table 2-35. Presented within this table are the emission factors, the total domestic grain production (1973), and the estimated particulate generated by specific process (e.g., unloading, loading, drying) operations. Headhouse emissions contribute the bulk of the grain industry elevator uncontrolled emissions (nearly 50 percent), followed by those (nearly 25 percent) generated by grain removal from the bins by tunnel belt.

### 2.6.2 Adequacy of Emission Factor Data

Grain elevators are classified as country, terminal, and export, according to their purpose and location. Country elevators operate principally during harvest season and hold grain only till a market is found to sell to terminals, exporters, and/or processors. Terminal elevators are large elevators that operate the year round. Export elevators are similar to terminals except that their main function is to load grain onto ships for export. Grain elevator particulate emissions (considered wholly fugitive) can occur from many different operations within any of the three elevator types described, including unloading (receiving), loading (shipping), drying, cleaning, headhouse (bags), tunnel belt, gallery belt, and belt trippers. Emission factors<sup>3</sup> determined for these operations are presented in Table 2-36, along with the incorporated multipliers that were used to represent a typical ratio of throughput to the amount of grain

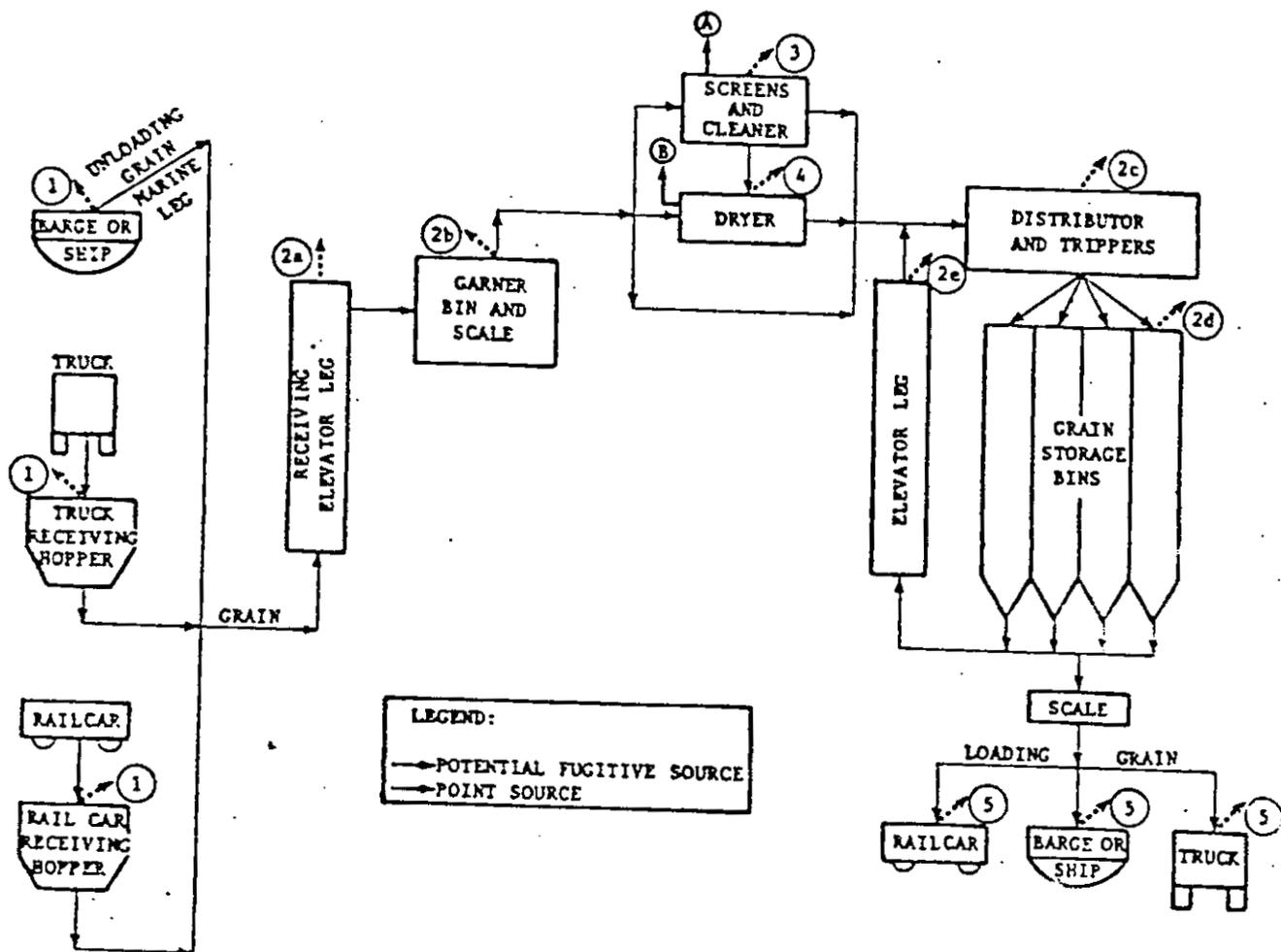


Figure 2-14. Process flow diagram for country and terminal grain elevators, showing origins of fugitive industrial process and point source particulate emissions.

Table 2-34. IDENTIFICATION OF EMISSION SOURCES SHOWN ON  
THE GRAIN ELEVATOR INDUSTRY PROCESS FLOW DIAGRAM<sup>a</sup>

Fugitive emission sources	
I. Terminal Elevators	
1. Receiving  Truck unloading Railcar unloading Barge unloading  3. Screening and cleaning  4. Drying  5. Shipping	2. Transferring and conveying  2a. Receiving elevator leg and elevator head 2b. Garner and scale vents 2c. Distributor, trippers 2d. Storage bin vents 2e. Turning
II. Country Elevators	
1. Receiving  Truck unloading Railcar unloading Barge unloading  3. Screening and cleaning  4. Drying  5. Shipping  Truck loading Railcar loading Barge loading	2. Transferring and conveying which includes following:  2a. Receiving elevator leg and head 2b. Garner and scale vents 2c. Distributor, trippers and spouting 2d. Storage bin vents 2e. Turning
Point sources	
A. Screens and cleaners	B. Dryers

<sup>a</sup> Numeral and letter denotations refer to emission sources on the previous figure.

Table 2-35. ESTIMATED UNCONTROLLED FUGITIVE PARTICULATE EMISSIONS  
FROM DOMESTIC FEED AND GRAIN ELEVATORS

Emission source	Uncontrolled fugitive particulate emission factors <sup>a</sup>		1973 U.S. grain production <sup>b</sup>		Estimated uncontrolled emissions	
	kg/Mg	lb/ton	1000 Mg	1000 tons	Mg/yr	tons/yr
<u>Terminal elevators</u>						
Unloading (receiving)	0.5	1.0 <sup>c</sup>	47,762	52,649	23,881	26,325
Loading (shipping)	0.15	0.30	47,762	52,649	7,164	7,897
Removal from bins (tunnel belt)	1.4	2.8	47,762	52,649	66,867	73,709
Drying	0.05	0.10	47,762	52,649	2,388	2,632
Cleaning	0.3	0.6	47,762	52,649	14,329	15,795
Headhouse (legs)	2.25	4.50	47,762	52,649	107,465	118,460
Tripper (gallery belt)	0.85	1.70	47,762	52,649	40,598	44,752
<u>Country elevators</u>						
Unloading (receiving)	0.3	0.6	157,335	173,432	47,201	52,030
Loading (shipping)	0.15	0.30	157,335	173,432	23,600	26,015
Removal from bins	1.05	2.10	157,335	173,432	165,202	182,104
Drying	0.1	0.2	157,335	173,432	15,734	17,343
Cleaning	0.15	0.30	157,335	173,432	23,600	26,015
Headhouse (legs)	2.35	4.70	157,335	173,432	369,737	407,565
<u>Export elevators</u>						
Unloading (receiving)	0.5	1.0	75,858	83,619	37,929	41,810
Loading (shipping)	0.5	1.0	75,858	83,619	37,929	41,810
Removal from bins (tunnel belt)	0.85	1.70	75,858	83,619	64,479	71,076
Drying	0.005	0.010	75,858	83,619	379	418
Cleaning	0.3	0.6	75,858	83,619	22,757	25,086
Headhouse (legs)	1.65	3.30	75,858	83,619	125,166	137,971
Tripper (gallery belt)	0.55	1.10	75,858	83,619	41,722	45,990
Total					1,238,127	1,364,803

<sup>a</sup>Reference 3. Factors are expressed as units per weight of grain received or shipped.

<sup>b</sup>Of the 280,955,114 Mg (309,700,000 tons) total domestic grain produced (1973), 56, 17, and 27 percent was handled by country elevators, inland terminals, and port (or export) terminals, respectively. 1, 2

Table 2-36. PARTICULATE EMISSION FACTORS FOR GRAIN ELEVATORS BASED ON AMOUNT OF GRAIN RECEIVED OR SHIPPED<sup>a</sup>

Type of source	Emission factor, lb/ton processed	x	Typical ratio of tons processed to tons received or shipped <sup>d</sup>	x	Emission factor, lb/ton received or shipped
<b>Terminal elevators</b>					
Unloading (receiving)	1.0		1.0		1.0
Loading (shipping)	0.3		1.0		0.3
Removal from bins (tunnel belt)	1.4		2.0		2.8
Drying <sup>c</sup>	1.1		0.1		0.1
Cleaning	3.0		0.2		0.6
Headhouse (legs)	1.5		3.0		4.5
Tripper (gallery belt)	1.0		1.7		1.7
<b>Country elevators</b>					
Unloading (receiving)	0.6		1.0		0.6
Loading (shipping)	0.3		1.0		0.3
Removal from bins	1.0		2.1		2.1
Drying <sup>b</sup>	0.7		0.3		0.2
Cleaning <sup>c</sup>	3.0		0.1		0.3
Headhouse (bags)	1.5		3.1		4.7
<b>Export elevators</b>					
Unloading (receiving)	1.0		1.0		1.0
Loading (shipping)	1.0		1.0		1.0
Removal from bins (tunnel belt)	1.4		1.2		1.7
Drying <sup>b</sup>	1.1		0.01		0.01
Cleaning <sup>c</sup>	3.0		0.2		0.6
Headhouse (legs)	1.5		2.2		3.3
Tripper (gallery belt)	1.0		1.1		1.1

<sup>a</sup> Assume that over a long term the amount received is approximately equal to amount shipped.

<sup>b</sup> Emission factors for drying are based on 1.8 lb/ton for rack dryers and 0.3 lb/ton for column dryers prorated on the basis of distribution of these two types of dryers in each elevator category.

<sup>c</sup> Emission factor of 3.0 for cleaning is an average value which may range from 0.5 for wheat up to 6.0 for corn.

<sup>d</sup> Ratios shown are average values taken from a survey of many elevators across the U.S. These ratios can be considerably different for any individual elevator or group of elevators in the same locale.

shipped or received at each operation. These factors (extensively developed through source test evaluation by Midwest Research Institute) are quite reliable for each of the individual operations, and no further emissions investigation should be necessary for revision to AP-42.

REFERENCES FOR SECTION 2.6

1. Grain Handling and Milling Industry, Background Information for Establishment of National Standards of Performance for New Sources. Environmental Engineering, Inc. EPA Contract No. CPA 70-142. Task Order No. 4. July 15, 1971. Draft. 60 p.
2. Standard Support and Environmental Impact Statement: Standards of Performance for the Grain Elevator Industry. Environmental Protection Agency. Office of Air and Waste Management. Office of Air Quality Planning and Standards. Emission Standards and Engineering Division. July 1976.
3. Compilation of Air Pollutant Emission Factors, Second Edition. U.S. Environmental Protection Agency, Office of Air and Water Programs, Office of Air Quality Planning Standards. Publication No. AP-42. Research Triangle Park, North Carolina. April 1977.

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*(Please read Instructions on the reverse before completing)*

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**16. ABSTRACT**

This document provides a priority listing of industrial processes emitting fugitive particulates and which are in need of source sampling. Criteria for priority listing are total potential uncontrolled fugitive particulate emissions (industry-wide), and adequacy of currently available fugitive emission factor data.

Each emission factor was evaluated for its adequacy for inclusion into AP-42. Adequacy of factors ranged from very poor (based on estimates, assumed values, or unknown development) to very good (based on complete test data). An appendix contains the fugitive particulate emission factors in a format suitable for input into AP-42. Also included in the appendix is particle size information.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Control	Emission Factors, State Implementation Plans	13B
Dust	Fugitive Dust, Particle Size	11G
Industrial Processes	Airborne Wastes	13H
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