

EMISSION FACTORS FOR GRAIN RECEIVING & FEED LOADING OPERATIONS AT FEED MILLS

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National Cattleman's Beef Association

by

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EXECUTIVE SUMMARY

The Federal Clean Air Act (FCAA) signed by President Bush in 1990 has impacted the process used by State Air Pollution Regulatory Agencies (SAPRAs) in regulating air pollution attributed to grain handling facilities including feed mills associated with cattle feed yards. The AP-42 total suspended particulate (TSP) uncontrolled emission factors for feed mills published by EPA in 1988 are not accurate. EPA published interim emission factors for grain elevators in 1995. The two operations that will result in particulate entrainment at feed mills and grain elevators are grain unloading and shipping (loading) of grain and feed from the elevator or mill, respectively. Feed mill unloading and loading operations are different. Due to the differences between elevator and feed mill unloading and loading operations and the lack of data on emission rates of feed mills, accurate and scientifically justifiable emission factors for feed mills are required.

The objectives of this feed mill emission factor study were:

- To measure the TSP and PM-10 emission rates resulting from grain unloading and feed loading operations.
- To calculate accurate emission factors for grain unloading and feed loading operations; and
- To propose new emission factors for grain unloading and feed loading operations.

Dust sampling was conducted at three feed mills (located in Nebraska, Kansas and Texas). These mills were representative of small, medium, and large capacity mills associated with the cattle feeding industry.

The sampling protocols included the following:

- (1) Enclosing the area under the grain trucks and above the feed trucks and measuring the total mass of dust suspended in air. The ratio of mass collected to tons of grain or feed, unloaded or loaded, respectively, yielded emission factors.
- (2) The concentration leaving the shed was measured at three different heights (3, 6 and 9 feet). With the concentration measurements and the volumetric rate of flow through the shed during the sampling period, a measurement of particulate mass was obtained. The ratio of particulate mass and tons unloaded or loaded yielded measurements of emission factors.

Table ES1 includes EPA's interim emission factors for unloading and shipping grain and corn at country elevators, and the average and standard deviations of TSP and PM-10 emission factors for grain unloading and feed loading at feed mills determined from this research.

Table ES1: Emission Factors for Grain Unloading and Shipping at Grain Elevators (AP-42, EPA, 1995,) and Emission Factors for Grain Unloading and Feed Loading at Feed Mills Resulting from this Study.

Emission Factor (lbs/ton)	AP-42 Interim for Grain Elevators				Results of this Study for Feed Mills			
	TSP		PM-10		TSP		PM-10	
	general	corn [†]	general	corn [†]	avg	std dev	avg	std dev
Grain Unloading	0.06DR	0.15	0.015DR	0.0375	0.0166	0.0177	0.0025	0.0027
Feed Loading	0.011DR*	0.0275	0.003DR*	0.0075	0.0033	0.0016	0.0008	0.0007

* Emission factor for grain shipping would have been used for feed loading at feed mills since no data for bulk loading at feed mills existed prior to the completion of this research.

[†] Based on a dustiness ratio (DR) for corn of 2.5.

It is recommended that EPA adopt a new model for calculating the emission factors associated with feed mills:

$$EF = F * FFD \quad \text{(EQ ES1)}$$

where, EF = Emission Factor (lbs/ton),
 F = fraction of free fine (less than 100µm) dust present in grain entrained in air, and
 FFD = free fine dust present in grain (lbs/ton).

This model has the advantage of being dependent on measurable properties of the grain or feed. Parnell (1988) measured the FFD of a number of grains and the values closely correspond to the EPA DR values i.e. 2.5 lbs/ton for corn, 1 lbs/ton for wheat, etc. Hence, it is proposed that the DR values be used as the FFD values for different grains.

Table ES2 is our recommendation for emission factors for feed mills associated with cattle feed yards. These values are a sum of the average measured emission factors plus one standard deviation.

Table ES2: Proposed Emission Factors for Unloading Grain and Loading Feed at Feed Mills Associated with Cattle Feed Yards with FFD = DR.

Emission Factors (lbs/ton)	TSP		PM-10	
	General	For Corn [†]	General	For Corn [†]
Grain Unloading	0.016*FFD	0.04	0.0024*FFD	0.006
Feed Loading	0.002*FFD	0.005	0.0006*FFD	0.002

[†] Based on FFD = 2.5 lbs/ton for corn.

Table ES3 illustrates the anticipated emission rates (EQ. ES1) for grain unloading and feed loading at a feed mill for various grains. The FFD contents were assumed to equal the dustiness ratios reported in the AP-42 Interim report.

Table ES3: TSP and PM-10 Emission Factors for Unloading Various Grains and Loading feed at Feed Mills

Grain	Dustiness Ratio (DR)	TSP		PM-10	
		Grain Unloading	Feed Loading	Grain Unloading	Feed Loading
Corn	2.50	0.040	0.005	0.006	0.002
Wheat	1.00	0.016	0.002	0.002	0.001
Milo	1.75	0.028	0.004	0.004	0.001
Soybean	2.50	0.040	0.005	0.006	0.002
Mixed	1.95	0.031	0.004	0.005	0.001