COAL PREPARATION PLANT THERMAL DRYERS

Coal is screened, classified, washed and dried at coal preparation plants. The major source of air pollution is the exhaust from the thermal coal dryer.

Seven types of thermal dryers are presently used:

Rotary - There are two kinds; double shell indirect heated and outer shell only with lifting vanes inside.

Screen - Moisture is evaporated by hot gases passing through coal conveyed on a reciprocating screen.

Cascade - Coal is dried by flowing through a series of stationary or revolving shelves.

Continuous Carrier - Coal is moved through the dryer on a wire mesh belt.

Flash or Suspension - Coal is fed into a stream of hot gases where instantaneous drying occurs. The dried coal and wet gases are drawn up a drying column and into the cyclone for separation.

Multilouver - Hot gases are passed through falling curtains of coal. The coal is raised by flights of a specially designed conveyor.

Fluidized Bed - The coal is suspended and dried in a fluid state above a perforated plate by rising hot gases.

The fluidized bed type has been the most popular in recent years. The gas volumes from this type of dryer ranges from 50,000 to 250,000 acfm. The exit gas temperature will be about 200 degrees F. Dust concentrations in the gases from the dryer are unusally high - 100 to 300 grains per actual cubic foot (gr/acf). A typical particle size analysis of feed to the fluidized bed dryer is listed in Table 1.

It is assumed that all the minus 200 mesh material is carried to the cyclones. This means as much as 35 to 40% of the total feed to the dryer is carried over to the primary collectors.[1]

Table I Typical Particle Size Analyses of Feed to a Fluidized Bed Dryer[1]

Particle Size, microns	% by Weight less than Stated Size
500 (32 mesh)	98%
300	90%
200	78%
100	43%
75 (Approximate 200 mesh)	28%
40	7%
20	1%

this will doesn't require collection devices

Table II is a listing of typical particle size analyses of material vented from several types of dryers to primary collectors.

Table II Typical Particle Size Analyses of Material to the Cyclones[1]

Particle Size, microns	% by Weight less than Stated Size		
	Flash Dryer*	Fluidized Bed	Cascade and Multilouvered
60	98	20	70
40	96	14	50
20	90	5	42
10	80	2	25
5	65	0.5	10
2	40	0.1	2.5

NOTE: The average dust concentration from each dryer type:

Flash - 2 gr/acf
Cascade and Multilouvered - 20 gr/acf
Fluidized Bed - 200 gr/acf

*Outlet from main cyclone.

EMISSIONS

West Virginia, which is the largest coal producing state in the Union, has adopted Regulation V for the control of thermal coal dryers. The maximum allowable emission, for a dryer exhausting 110,000 cfm or less, is 0.10 grains per standard cubic foot (gr/scf). After September 1, 1971 the limit will be 0.09 gr/scf.

However, it has been reported that to obtain a "clear stack" - no visible emission of coal dust fines; the particulate concentration must be below 0.038 gr/scf.[1]

In one case, a particulate grain loading of 0.047 gr/scf, in the effluent gases from a thermal coal dryer stack, produced an evident gray coal dust plume.[2] After installation of a venturi scrubber system, the outlet grain loading of 0.023 gr/scf produced a plume with no visible emission of coal dust fines. For the particular unit which was tested, the first grain loading corresponded to an emission rate of 38 lbs/hr and the second concentration corresponded to a rate of 15 lbs/hr. The concentration, quantity and particle size range of emissions depend upon the type of collection equipment used to reduce particulate emissions from the dryer stack. Some typical grain loadings from various control equipment are:

Type of Control	Outlet Grain Loading, gr/scf
Cyclones (product recovery)	6-9 gr/scf
Multiple cyclones (product recovery)	2.5-3.5 gr/scf
Water sprays*	0.7-1.5 gr/scf
Wet scrubber*(pressure drop less than 5 inches H_2O)	0.1-0.2 gr/scf
Wet scrubber*(pressure drop 8-15 inches H_2O)	0.035-0.05 gr/scf
Wet scrubber*(pressure drop greater than 20 inches H_2O)	0.02-0.03 gr/scf

*Following product recovery systems on the thermal dryer effluent.

Practically, to meet the present regulations and public demands wet scrubbers must be employed to control the emissions from thermal coal dryers. With wet scrubbers, the outlet grain loading and thus collection efficiency are inversely related to the energy expended in the scrubber, which is measured by the scrubber pressure drop. Simply the greater the pressure drop; the smaller the outlet grain loading.

uncontrolled

Table III—Emission Factors for Thermal Coal Dryer lbs of Particulate per ton of Coal Dried

what cause. make emission diff.

Type of Thermal Dryer	Particulate Emission from Product Recovery System
Fluidized Bed	6
Flash	5
Multilouvered	7.5

The scarcity of adequate published data, make selection of emission factors tenuous.

FACTORS AFFECTING EMISSIONS

The manner in which the scrubber is operated will affect the emissions. If a venturi system is used, the pressure drop must be regulated and maintained. scrubbers a certain critical speed for impingement must be maintained. Controlling the emissions from a thermal coal dryer means employing an adequate collection device and using the equipment properly.

There is no correlation between percentage of fines in the dryer feed or product and dust emissions. No relationship exists between dryer product moisture and dust emissions. Increasing the amount of coal filter coke in the feed has no effect upon particulate emissions.

RANK THE ABOVE FACTORS - 1/40

APPENDIX - THERMAL COAL DRYERS

Type of Thermal Dryer	Emission Factor* lbs of particulate/ ton of coal dried	Reference Number
Fluidized Bed	5	2
	4	2
	10	3
Flash	4.5-8	2
	3.8	3
	4.7	3
Multilouvered	6.5	4
	8.5	4

*Particulate Emission Factor is the particulate from cyclone collector.

was data from reference 4 - used as lb/ton - no other calculations needed.

100,000

$\sqrt{N}(0.3) = 6$

20 15 30

12 20 20 6 4 20 - 30

5 12 20 17

70%

REFERENCES

1. Walling, John C. "Air pollution control systems for thermal dryers". Coal Age. September 1969. p. 74-79.

2. Pennsylvania Department of Health, Bureau of Air Pollution Control Stack Test Results.

3. "Amherst's answer to air pollution laws". Coal Mining and Processing. February 1970. p. 26-29.

4. Jones, Donald W. "Dust Collection at Mass No. 3". Mining Congress Journal. July 1969. p. 53-56.