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A Review of Standards of Performance for New Stationary Sources - Coal Preparation Plants

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A Review of Standards of Performance for New Stationary Sources - Coal Preparation Plants

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1. EXECUTIVE SUMMARY

The New Source Performance Standards (NSPS) for the coal preparation industry were promulgated by the Environmental Protection Agency (EPA) on January 15, 1976. These standards affect thermal dryers, pneumatic coal cleaning equipment, coal processing and conveying equipment, coal storage systems, and coal transfer and loading facilities. Affected facilities are those facilities which commenced construction or modification after October 24, 1974.

The objective of this report is to review and determine the need for revision of the NSPS for coal preparation plants. The review includes new developments in control technology, coal preparation process technology, projected growth, and other considerations affecting air emissions in the industry.

1.1 BEST DEMONSTRATED CONTROL TECHNOLOGY

The current NSPS specifies emission limits for thermal dryers and pneumatic coal cleaning equipment based on concentration loadings. Emissions from thermal dryers are not to contain particulate matter in excess of 0.070 grams per dry standard cubic meter (0.031 grains per dry standard cubic foot) and shall not exhibit 20 percent or greater opacity. Emissions from pneumatic coal cleaning equipment are not to contain particulate matter in excess of 0.040 grams per dry standard cubic meter (0.018 grains per dry standard cubic foot) and shall not exhibit 10 percent or greater opacity.

No changes have occurred in control technology for thermal dryers and pneumatic cleaning equipment since promulgation of the standards of performance. The best available control technology (BACT) for thermal dryers consists of primary control using centrifugal collectors. Secondary control is accomplished by the use of high-efficiency venturi wet scrubbers. BACT for pneumatic coal cleaning equipment consists of primary control using centrifugal collectors and secondary control using fabric filtration.

Control of fugitive emissions within the coal preparation process is accomplished by prevention and not by the utilization of control devices. The current NSPS regulates fugitive emissions from coal processing and conveying equipment, coal storage systems, and coal transfer and loading systems. Emissions from these sources shall not exhibit 20 percent or greater opacity. Methods of control include wet suppression and enclosing sources of potential fugitive particulate emissions.

1.2 INDUSTRIAL TRENDS

In 1979 there were approximately 488 coal preparation plants operating in the United States. It is estimated that by 1985 there will be approximately 40 new or modified facilities to accommodate the projected increase in the production of domestic coal.

The use of pneumatic coal cleaning is diminishing due to low cleaning efficiencies (as compared to wet cleaning processes) and problems associated with high moisture content in raw coal. The number of pneumatic cleaning facilities in the United States decreased from 37 facilities in 1972 to 30 in 1979. Three pneumatic cleaning facilities have been constructed since the NSPS became effective in October 1974. It is projected that 2 additional pneumatic cleaning facilities could be constructed by 1985.

The number of thermal dryers in the United States has declined since 1972. In 1972 there were 184 thermal dryers in operation. This decreased to 114 in 1977. Seventeen thermal dryers have been constructed since the standards of performance became effective. This represents approximately a 3 percent annual growth rate in new facilities. Based on this growth rate, 24 additional new thermal dryers are expected to become operational by 1985.

1.3 CURRENT PARTICULATE MATTER LEVELS WITH BEST DEMONSTRATED CONTROL TECHNOLOGY

There has been general compliance with the NSPS fugitive emission standard for coal processing and conveying equipment, coal storage systems, and coal transfer and loading systems.

Three pneumatic coal cleaning operations have been constructed since the NSPS became effective. The three facilities utilized BACT and all were found to be in compliance with standards of performance, with particulate emissions ranging from 0.011 to 0.022 grams per dry standard cubic meter (0.005 to 0.010 grains per dry standard cubic foot).

Seventeen thermal dryers have been constructed since the NSPS became effective. All thermal dryers have controlled emissions using BACT. Thirteen of the NSPS-affected thermal dryers achieved compliance with the standards of performance, with particulate emissions ranging from 0.016 to 0.070 grams per dry standard cubic meter (0.007 to 0.031 grains per dry standard cubic foot). Of the 4 facilities not within compliance, one was able to comply with the NSPS during a subsequent performance test. Venturi pressure drops for the thermal dryers in compliance ranged from 5.5 to 10.4 kilopascals (22 to 42 inches H_2O), with an average of 8.5 kilopascals (34.2 inches H_2O).

1.4 SULFUR DIOXIDE EMISSIONS FROM THERMAL DRYERS

Sulfur dioxide (SO_2) emissions are produced from the combustion of coal in thermal dryer furnaces. The emissions of SO_2 are a function of the sulfur content of coal burned in the combustion furnace.

Performance tests have been conducted on 3 thermal dryers to determine SO_2 emission rates. SO_2 emissions ranged from 0.57 to 4.3 grams per second (4.54 to 34.5 pounds per hour) with estimated annual emissions ranging from 6.2 to 46.9 megagrams per year (6.81 to 51.75 tons per year). These emissions are well under the emission limitation of 90.7 megagrams per year (100 tons per year) stated in the 1977 Clean Air Act Amendments for major sources. As a result, these emissions do not indicate the need to control SO_2 emissions in standards of performance. However, any future attempt to include SO_2 emissions in standards of performance must include a detailed assessment of the associated costs of SO_2 control technology for thermal dryers.

1.5 REVISIONS TO NSPS

There has been general compliance with the current NSPS for thermal dryers and pneumatic coal cleaning equipment with achievability of existing standards adequately demonstrated. It is recommended that standards of performance for pneumatic coal cleaning equipment and thermal dryers remain unchanged.

1.6 FUTURE ADDITIONS TO THE STANDARD

The current NSPS governing fugitive emissions was developed to include contained coal storage systems, specifically exempting open coal storage piles. Open storage piles are potential sources of significant fugitive emissions. Research is needed to quantify the impact of fugitive emissions from open coal storage piles to assess the need for future regulation.

A significant source of potential fugitive emissions not regulated by current NSPS are coal "unloading" or "receiving" systems. These systems are considered to be in a category other than coal preparation, and EPA is considering whether to list them as a source category.

Chemical coal cleaning will become a commercial industry in the next 5 to 10 years. Potential pollutants from the chemical coal cleaning processes need to be assessed to determine the need for future standards of performance.

2. INTRODUCTION

On October 24, 1974 (39 FR 37922), under Section 111 of the Clean Air Act, the Environmental Protection Agency (EPA) proposed standards of performance for new and modified coal preparation plants. In accordance with Section 111 of the Act, as amended, these regulations were promulgated on January 15, 1976, prescribing standards of performance for coal preparation plants. The regulations applied to thermal dryers, pneumatic coal cleaners, coal processing and conveying equipment, coal storage systems, and coal transfer and loading systems, the construction or modification of which commenced after October 24, 1974.

The Clean Air Act Amendments of 1977 require the Administrator of the EPA to review and, if appropriate, revise established standards of performance for new stationary sources at least every 4 years. The purpose of this report is to review and assess the need for revision of the existing standards for coal preparation plants based on developments that have occurred or are expected to occur within the coal preparation industry. The information presented in this report was obtained from reference literature, discussions with industry representatives, trade associations, control equipment vendors, EPA regional offices, and state agencies.

2.1 BACKGROUND INFORMATION

Coal preparation is a beneficiation process. The purpose of the coal preparation industry is to improve the characteristics of mined coal to meet market demands of industry. The degree of preparation varies widely, and the processes used range from simple mechanical removal of rock and dirt to complex coal beneficiation plants for the removal of potential pollutants. The type of cleaning process and the extent of cleaning depends of the type of coal, the method of mining, and the end use of the coal. The specific characteristics of coal which may be altered by coal preparation include the following:

- Size reduction
- Ash removal
- Sulfur content reduction
- Foreign materials removal
- Surface moisture reduction.

The relative amount of contaminants, the manner in which they are part of the coal structure, and the degree to which they can be removed, vary widely with different coals.

It is estimated that at least 55 percent of the coal mined in the United States is subject to some type of preparation process.[1] Presently, all domestic commercial coal preparation plants use physical coal cleaning techniques which are primarily designed to remove mineral matter and mining residue. These physical coal cleaning techniques also increase the energy content of the coal on a dry basis and reduce the ash content. Coal is physically cleaned by crushing run-of-the-mine (ROM) coal to the point at which a portion of the mineral impurities are removed from the coal structure. The mineral and coal fragments are then separated by techniques which utilize the differences in the specific gravity or surface properties of the particles.[2]

The existence of state and Federal sulfur dioxide (SO_2) emission regulations has created interest in the sulfur reduction potential of the coal preparation process. The only sulfur removal coal preparation plant presently operating is located in Homer City, Pennsylvania.[2,3] It was designed to provide low-sulfur (2.24 percent sulfur) coal to fuel 2 existing 600 megawatt generating units at the adjacent power plant as well as ultra-low-sulfur (0.88 percent sulfur) coal for a new 650 megawatt unit. The selected design utilizes a broad spectrum of conventionally applied coal cleaning equipment, working to its best advantage on a preprocessed feedstock. This system is known as the Multi-Stream Coal Cleaning System (MCCS). This process selectively removes the pyrite sulfur from the coal stream, dramatically reducing the sulfur content of the coal.[2] Two additional sulfur removal preparation plants are being planned by the Tennessee Valley Authority (TVA).[2]

Chemical coal cleaning processes are also being developed to provide improved techniques for desulfurizing coal employed for steam generation and metallurgical purposes. Chemical coal cleaning processes vary substantially due to the different chemical reactions which can be used to remove the sulfur and other contaminants from the coal. Chemical coal processes usually entail grinding the coal into small particles followed by treatment using acid, alkaline, and oxidation reaction methods. It has been estimated that several chemical processes could be ready for commercial demonstration in 5 to 10 years.[4] The specific intent of chemical coal cleaning is to produce desulfurized coals for use in complying with SO_2 emission standards. If inexpensive processes can be developed that reduce sulfur content as well as achieve high Btu yields, the vast eastern coal reserves would hold greater potential use to industry because compliance with New Source Performance Standards (NSPS) could be more readily and economically achieved. Because chemical cleaning is still in the development stage, it is uncertain which processes will prove commercially viable. This report deals exclusively with the available technology of physical coal preparation.

2.2 THE PREPARATION PROCESS

The physical preparation of coal may be categorized into 5 general processes:[5]

1. Plant feed preparation.
2. Raw coal size reduction and screening.
3. Raw coal cleaning (removal of impurities, including ash and pyrite)
4. Product dewatering and/or drying.
5. Product storage and shipping.

The processing sequence of a typical coal preparation plant is illustrated in Figure 2-1.[6]

2.2.1 Plant Feed Preparation

The first step in the coal preparation process is the delivery of ROM coal to the plant site. Coal is transported by railroad cars, trucks, or conveyors from both surface and underground mines.[5] When ROM coal is delivered to the preparation site, it is dumped into a surge bin

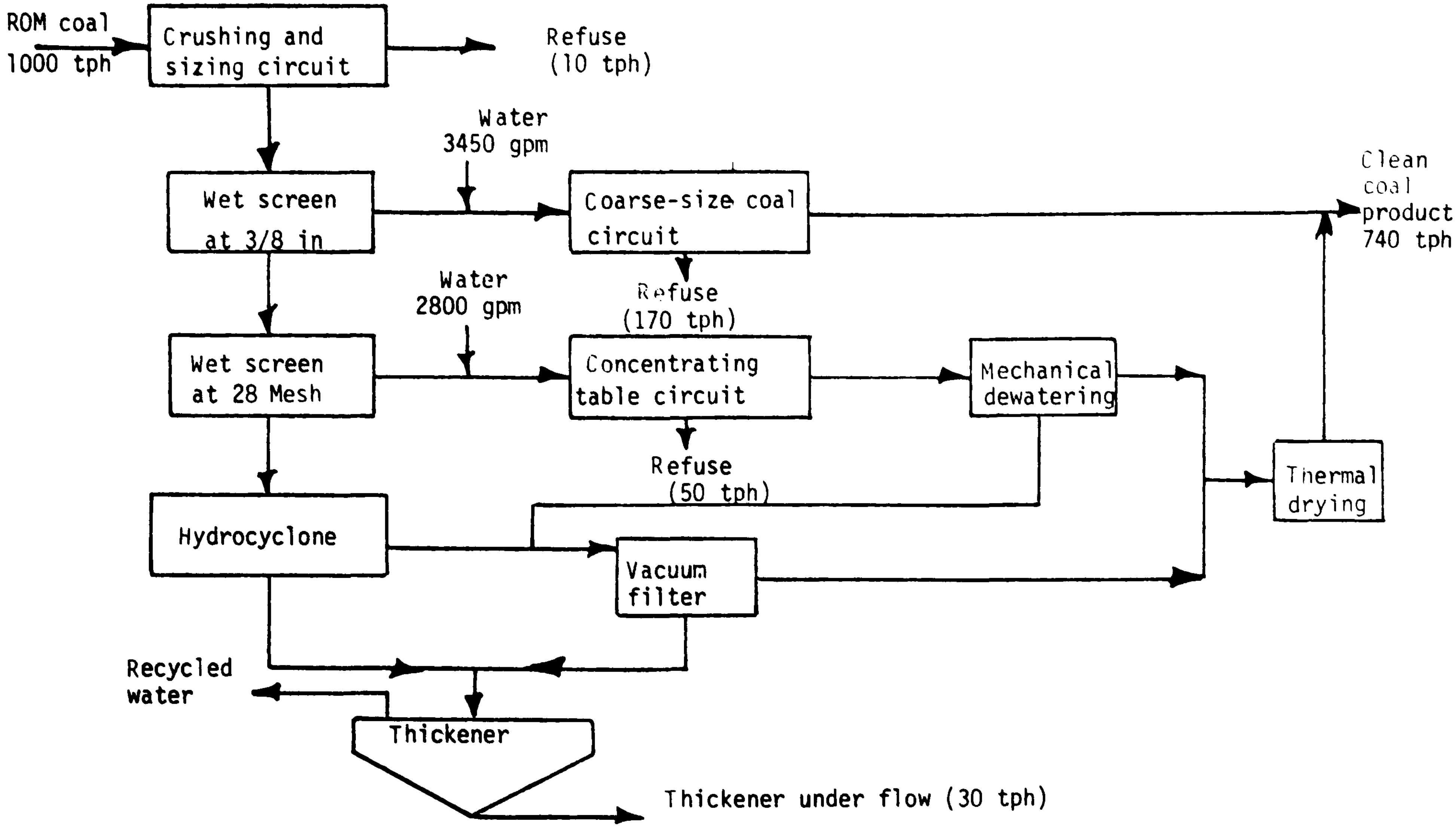

Figure 2-1. Flow diagram and material balance of typical concentrating table and hydrocyclone plant handling 1,000 tons per hour of raw coal.[6]

or surge feeder. The coal is then processed by a ROM scalper to remove large pieces of coal and rock. The method of mining affects the material size analysis of the feed to the ROM scalper. The ROM scalper is usually a heavy-duty, mechanically vibrated, single deck, inclined-type screen.[5,7]

In the second step, the ROM coal is reduced in size to render it suitable for further processing. There are two fundamental objectives for the reduction of the size of coal: to reduce it to sizes suitable for cleaning, and to meet market specifications for certain sizes. The production of fines is considered undesirable; hence, crushers are designed to produce minimal amounts of undersize material. ROM coal is broken into increasingly smaller sizes by staged reduction. The first stage, primary breaking, reduces the raw coal to 100 to 200 millimeters (4 to 8 inches).[1] The various sizes are then screened and sent to washing units or to secondary crushers. The secondary crushers reduce the product to a top size of 45 millimeters (1.75 inches).[1] The final step in the plant feed preparation process entails storage of the raw coal. The storage of raw coal has become an increasingly important operation in new, large preparation facilities because it:

- limits interruptions of feedstock to the preparation plant;
- improves efficiency by allowing a controlled feed rate; and
- facilitates in blending various ROM coals to produce the desired properties of the feedstock.

Raw coal can be stored either in open areas or closed bins. Open outside storage is usually chosen; however, there are drawbacks to this method. Outside coal storage is a potential environmental problem due to wind and rainfall erosion. Prevailing winds remove particulate matter from the storage pile, and rainfall can also leach pollutants from this pile which end up in "run-off" water. The storage of coal in closed bins, however, minimizes the potential for airborne pollutants and run-off. Various types of bunkers, silos, and bins are also available. Storage bins are usually cylindrical in shape and constructed of steel or concrete.[5]

2.2.2 Raw Coal Size Reduction and Screening

Raw coal sizing consists of a primary and secondary size check, causing separation of the product into coarse, intermediate, or fine sizes.

Primary sizing, typically accomplished by screens, separates coal into coarse and intermediate sizes. The coarse fraction is reduced in size as necessary and returned to the sizing operation. The second size check, generally a wet or dry vibrating screen, separates the intermediate sizes from the fines and directs the product to the raw coal cleaning stage.[5]

2.2.3 Raw Coal Cleaning

The raw coal cleaning stage determines product quality. Although many different coal cleaning techniques exist, most processes are based upon gravity separation methods. The decision concerning which separation process should be utilized is generally based on the size grouping (fine, intermediate, coarse) of the raw coal. Table 2-1 shows size ranges of coal.[8] Table 2-2 summarizes the types of equipment used for raw coal cleaning.[1]

2.2.4 Product Dewatering and/or Drying

The wet types of coal cleaning operations require some type of product dewatering and/or drying stage. Removal of excess moisture from coal decreases shipping costs, increases the heating value of the coal, and prevents freezing problems in cold climates. Moisture reduction can be accomplished by either mechanical or thermal drying processes. Table 2-3 summarizes the product coal moisture ranges which can be achieved by various dewatering and drying methods on coal which is 9.5 x 0 millimeters (0.375 x 0 inch) in size.[1]

The decision of which moisture reduction scheme to utilize is primarily dependent on coal particle size. Coarse particles greater than 6.4 millimeters (0.25 inch) offer comparatively small surface areas for moisture adhesion and can be dewatered by mechanical means to 5 percent moisture content or less. Fine coals, 12.7 x 0.09 millimeters (0.5 inch x 28 mesh), have a considerably larger surface area in proportion to weight and require more sophisticated mechanical dewatering techniques to reduce moisture content to below 10 percent. Advanced dewatering techniques include processes such as high performance centrifuges and vacuum filters. Very fine coals, 6.4 x 0.09 millimeters (0.25 inch x 28 mesh), represent the greatest problem, and often may only be adequately dryed by thermal (evaporative) means. The energy requirements of dewatering and drying

Table 2-1. COMMON COMMERCIAL SIZES OF BITUMINOUS COAL[8]

Type	Size mm	Size inches	Usage
Run-of-the-mine (ROM)	--	--	Shipped without screening. Used for both domestic heating as well as steam production.
Run-of-the-mine (ROM)	203.2	(8)	Overside lumps are crushed.
Lump	127.0	(5)	Used for hand firing and domestic purposes. Will not go through a round (5-inch) hole.
Egg	127.0 x 50.8	(5 x 2)	Used for hand firing, gas producers, and domestic firing. Goes through a round (5-inch) hole but is retained on round (2-inch) hole screens.
Nut	50.8 x 31.75	(2 x 1.25)	Used for small industrial stokers, gas producers, and hand firing.
Stoker coal	31.75 x 19.05	(1.25 x 0.75)	Used for small industrial stokers and domestic firing.
Slack	<19.05	(<0.75)	Used for pulverizers, cyclone furnaces, and industrial stokers.

Table 2-2. SUMMARY OF PHYSICAL COAL CLEANING UNIT OPERATIONS[1]

Unit operation	Description	Remarks
Jigging	A pulsating fluid stratifies coal particles in increasing density from top to bottom. The cleaned coal is overflowed at the top.	Most popular and least expensive coal washer available, but may not produce the desired separation. Sizes: 3.4 to 76 mm (6 mesh to 3 inches).
Tables	Pulverized coal and water are floated over a table vibrating in a reciprocating motion. The lighter coal particles are separated to the bottom of the table, while the heavier, larger, impure particles move to the sides.	Sizes: 0.15 to 6.4 mm (100 mesh to 0.25 inches).
Dense media	Coal is slurried in a medium with a specific gravity close to that at which the separation is to be made. The lighter, purer coal floats to the top and is continuously skimmed off.	Advantages: Ability to make sharp separations at any specific gravity within the range normally required; ability to handle wide range of sizes; relatively low capital and operating costs when considered in terms of high capacity and small space requirements; ability to handle fluctuations in feed quantity and quality. Sizes: 0.59 to 200 mm (28 mesh to 8 inches).

(continued)

Table 2-2. Continued

Unit operation	Description	Remarks
Hydrocyclones	The separating mechanism is described as taking place in the ascending vortex. The high and low specific gravity particles moving upward in this current are subjected to centrifugal forces effecting separation.	If maximum pyrite reduction and maximum clean coal yield are to be obtained, supplemental processes such as cyclone classifying, fine mesh screening and froth flotation are necessary (on stream process). Hydrocyclones are presently used in the United States to clean flotation-sized coal, but can be used for coal as coarse as 64 x 0 mm (0.25 x 0 inches).
Humphrey spiral	Coal-water slurry is fed into a spiral conduit. As it flows downward, stratification of the solids occurs with the heavier particles concentrated in a band along the spiral. An adjustable splitter separates the stream into 2 products--a clean coal and the middlings.	Has shown significant ash and sulfur reduction on 0.42 x 0 mm (35 x 0 mesh) Middle Kittanning coal.
Launder-type coal	Raw coal is fed into the high end of a trough with a stream of water. As the stream of coal and water flows down the incline, particles having the highest settling rate settle into the lower strata of the stream. These are the middling or refuse particles. The clean coal particles gravitate into the upper strata before separation.	Three types of launders are recognized based upon mode of transport. Sizes: 4.76 x 76 mm (4 mesh to 3 inches).

(continued)

Table 2-2. Concluded

Unit operation	Description	Remarks
Pneumatic	Coal and refuse particles are stratified by means of pulsating air. The layer of refuse formed travels forward into pickets or wells from which it is withdrawn. The upper layer of coal travels over the refuse and is removed at the opposite end.	Most acceptable preparation method from the standpoint of delivered heating value cost. Sizes: up to 6.4 mm (0.25 inches).
Froth flotation	A coal slurry is mixed with a collector to make certain fractions of the mixture hydrophilic. A frother is added and finely disseminated air bubbles are passed through the mix. Air-adhering particles float to the top of the remaining slurry and then removed as a concentrate.	Froth flotation is used to reduce pyrite in English coals; the flotation of coal refuse to obtain salable pyrite is uneconomical in view of today's poor sulfur market; if ethylxanthate is used as the collector, it is absorbed onto coal pyrite in such a manner as to make it ineffective for flotation. Sizes: 1.17 to 0.044 mm (14 to 325 mesh).

Table 2-3. TYPICAL MOISTURE CONTENT OF PRODUCTS BY EQUIPMENT OR PROCESS[1]

Type of equipment/process	Discharge product
Dewatering screens	8 to 20 percent moisture
Centrifuges	10 to 20 percent moisture
Filters	20 to 50 percent moisture
Hydraulic cyclones	40 to 60 percent solids
Static thickeners	30 to 40 percent solids
Thermal dryers	6 to 7.5 percent moisture
Oil agglomeration processes	8 to 12 percent moisture

are directly related to the size of the feed and the percent moisture reduction desired.[1]

2.2.5 Product Storage and Shipping

Coal preparation plants must be capable of providing specific quantities of cleaned coal at specified times. Sometimes it is not feasible to load clean coal at the rate of production of the coal preparation plant. As a result, clean coal storage has become an economic necessity. Several important reasons for storing clean coal are:[5]

- to quickly and economically load unit trains, barges, and other intermittent bulk transport conveyances;
- to facilitate the attainment of maximum product uniformity; and
- to eliminate the dependency on preparation plant production.

Cleaned coal may be stored in open, uncontrolled storage piles or in enclosed silos or bins. In contrast to open storage facilities, enclosed storage facilities eliminate blowing dust and wind losses as well as protect the clean coal from the elements.[5]

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3. CURRENT STANDARDS FOR COAL PREPARATION

3.1 AFFECTED FACILITIES

The existing standards of performance apply to coal preparation plants processing more than 181.4 megagrams (200 tons) of coal per day. The specific processes affected by the New Source Performance Standard (NSPS) are thermal dryers, pneumatic coal cleaning equipment (air tables), coal processing and conveying equipment (including breakers and crushers), coal storage systems, and coal transfer and loading facilities. The standards governing thermal dryers and pneumatic coal cleaning equipment apply only to facilities processing bituminous coal. The regulation limiting emissions from coal processing and conveying equipment, coal storage systems and coal transfer and loading facilities, however, applies to bituminous as well as nonbituminous coal. Coal storage and transfer operations are governed by the NSPS only if they form a part of the coal preparation facility; isolated coal storage and transfer stations are excluded. Open coal storage piles are currently excluded from the definition of coal storage systems.[1,2,3]

3.2 CONTROLLED POLLUTANTS AND EMISSION LEVELS

The coal preparation plant pollutant controlled by the NSPS is particulate matter. The standards are as follows:[1]

- Thermal dryer. Exhaust gases discharged to the atmosphere shall not contain particulate matter in excess of 0.070 grams per dry standard cubic meter (g/dscm) or 0.031 grains per dry standard cubic foot (gr/dscf), and shall not exhibit 20 percent or greater opacity.[1]
- Pneumatic coal cleaning equipment (air tables). The gases emitted to the atmosphere shall not contain particulate matter in excess of 0.040 grams per dry standard cubic meter (0.018 grains per dry

standard cubic foot), and shall not exhibit 10 percent or greater opacity.[1]

- Other facilities. Gases emitted into the atmosphere from any coal processing and conveying equipment, coal storage system, or coal transfer and loading facility shall not exhibit 20 percent or greater opacity.[1]

3.3 STATE REGULATIONS

A survey was conducted of current state air quality regulations controlling coal preparation plants. State standards governing existing coal preparation plants are generally less stringent than the Federal NSPS. An exception is large capacity thermal dryers in the Commonwealth of Pennsylvania. State opacity standards are also less stringent.

State regulations have been developed in accordance with State Implementation Plans (SIPs) governing existing as well as new and modified facilities.[4] The intent of the state regulations survey was to compare control levels specified by the states with the current NSPS of 0.070 grams per dry standard cubic meter (0.031 grains per dry standard cubic foot) for thermal dryers and 0.040 grams per dry standard cubic meter (0.018 grains per dry standard cubic foot) for pneumatic coal cleaning equipment.

Most states do not have separate emission regulations for coal preparation plants. Coal preparation facilities are usually regulated by general process emission regulations.[3] Some states have fugitive emission regulations which are based upon particulate loadings compiled by high-volume samplers. Of the 25 coal producing states surveyed, 7 states have adopted their own regulations for coal preparation plants. A comparison of these standards of performance for coal preparation plants is presented in Table 3-1.[5-9]

West Virginia and Pennsylvania have adopted emission standards based on the particulate loading (gr/dscf) at the stack exit, which vary according to plant volumetric flow rate as expressed in standard cubic feet per minute (scfm).[6,7] Arizona, Illinois, and Oklahoma have emission standards derived from an allowable emission formula based on processing rate.[5] The State of Virginia has both a standard based on processing

Table 3-1. STATE STANDARDS OF PERFORMANCE FOR COAL PREPARATION PLANTS

State	Description of plants or process affected	Plant rate or plant flow rate	Allowable emissions	Definition of terms
Arizona	Existing plants outside of Phoenix/Tuscon region (all processes)	<30 tons coal per hour ≥30 tons coal per hour	$E = 4.10\ P^{0.67}$ $E = 55.0\ P^{0.11}$	E = maximum allowable particulate rate (lb/hr)
	Existing plants in Phoenix/Tucson region (all processes)	<30 tons coal per hour ≥30 tons coal per hour	$E = 3.59\ P^{0.62}$ $E = 16.31\ P^{0.16}$	P = process weight rate (tons/hr)
Illinois	General state particulate standard	N/A[a]	$E = 2.54\ P^{0.534}$	
Oklahoma	General state particulate standard	<30 tons coal per hour ≥30 tons coal per hour	$E = 4.10\ P^{0.67}$ $E = 55.0\ P^{0.11}$	
Pennsylvania	Thermal dryers and air tables	<150,000 scfm >300,000 scfm 150,000 scfm ≤E≤300,000 scfm	0.04 gr/dscf 0.04 gr/dscf linear inter pola-tion between above particulate con-centrators	
Virginia	Thermal dryers	<100 tons coal per hour >200 tons coal per hour 150,000≤E≤200 tons per hour	45 lbs/hour 105 lb/hour linear inter pola-tion between above emissions rates	
West Virginia	Thermal dryers installed before March 1, 1970	<120,000 scfm 172,000 scfm 245,000 scfm 351,000 scfm >500,000 scfm	0.12 gr/dscf 0.11 gr/dscf 0.10 gr/dscf 0.09 gr/dscf 0.03 gr/dscf	
	Thermal dryers installed after March 1, 1970	<75,000 scfm 111,000 scfm 163,000 scfm >240,000 scfm	0.10 gr/dscf 0.09 gr/dscf 0.08 gr/dscf 0.07 gr/dscf	
New Mexico	All processes	N/A	No qualitative limits	
NSPS	Thermal dryers	>200 tons coal per day	0.031 gr/dscf	
	Air tables	>200 tons coal per day	0.018 gr/dscf	

[a]N/A - Not applicable.

rate (for thermal dryers) and a standard based on particulate loading (for air tables).[8,9] New Mexico regulations require good control of coal processing and conveying operations, however, do not specify quantitative limits.[5]

State standards governing existing preparation plants are generally less stringent than the Federal NSPS. The only possible exceptions are for plants with very large capacities. In Arizona, for instance, using the allowable emissions formula for existing plants inside the Phoenix/Tucson Region, a 454 megagrams per hour (500 tons per hour) thermal dryer would have a maximum allowable particulate emission rate of 21.21 kilograms per hour (46.78 pounds per hour). Based on average emission factors for fluidbed dryers with high efficiency venturi-type wet scrubbers for secondary control, the corresponding particulate concentration would be 0.063 grams per dry standard cubic meter (0.028 grains per dry standard cubic foot).[10] This is slightly less than the thermal dryer NSPS.

As shown in Table 3-1, the only other instance where a state standard is more restrictive than the NSPS is with large capacity thermal dryers in Pennsylvania. A thermal dryer with a plant flow rate exceeding 142 standard cubic meters per second (300,000 standard cubic feet per minute) must comply with a 0.45 grams per dry standard cubic meter (0.02 grains per dry standard cubic foot) particulate standard.

State opacity standards have not been identified which are more stringent than the NSPS opacity limits.[5]

3.4 PSD REGULATIONS

Prevention of significant deteriortation (PSD) regulations define a major source as a stationary source of air pollutant which emits, or has the potential to emit, (a) 90.7 megagrams per year (mg/yr) (100 tons per year) of any pollutant regulated under the Act for any source on a list of 28 categories, or (b) 226.7 Mg/yr (250 tons/yr) for any other source type. Air pollutants regulated under the act are: (a) sulfur dioxide (SO_2), particulate matter (PM), nitrogen oxides (NOx), carbon monoxide (CO), hydrocarbons (HC); (b) hazardous pollutants, and, (c) hydrogen sulfide (HS), total reduced sulfur (TRS), fluorides, and sulfuric acid mist. The preconstruction review and BACT requirements of PSD apply to coal cleaning plants with thermal dryers - included in the above list of 28 sources. BACT controls may not be less stringent than either state SIP emissions requirements, NSPS, or National Emission Standards for Hazardous Pollutants (NESHAP). Both new stationary sources and modifications to existing sources are subject to the review requirements. As a result of a 1979 court decision, applicability is based on sources of emissions calculated with control equipment in place. In addition, modifications will be subject to review only if the sum of contemporaneous increases and decreases occurring at the source exceed a specified amount. Thus, a source may offset increased emissions with reductions achieved elsewhere at the plant. There are several important elements to a PSD review:

1. a case-by-case determination of controls required by BACT;
2. an ambient impact analysis to determine whether the source might violate applicable increments or air quality standards;
3. an essessment of effects on visibility, soils, and vegetation;
4. submission of monitoring data; and
5. full public review.

An important aspect of the PSD program involves protection of Class I areas. A Class I area designation permits only limited industrial growth in vicinities considered "pristine". These areas include: (1) existing international parks, (2) national parks over 24.3 square kilometers (6,000 acres), (3) national wilderness areas, and (4) memorial parks over 20.2 square kilometers (5,000 acres).[4]

Sources must be able to demonstrate that they will not violate the relatively stringent Class I increments, or convince the Federal Land Manager responsible for administering the area that the air quality related values of the area will not be adversely affected.

3.5 REFERENCES FOR CHAPTER 3

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4. STATUS OF CONTROL TECHNOLOGY

4.1 COAL PREPARATION INDUSTRY STATISTICS

4.1.1 Number of Plants and Geographic Distribution

It has been estimated that there are approximately 488 existing coal preparation plants operating in the United States.[1] The locations of these plants are widely distributed; however, the majority are situated in West Virginia, Kentucky, Pennsylvania, Illinois, and Virginia. Over 75 percent of the domestic plants are located in these 5 states.[1]

Large coal preparation plants are located in mining areas to accomodate one or more mines. They are concentrated near the highest quality coals because of process economics and marketing factors. Washing plants are located near river loading sites and are supplied with raw coal by railroads. Coal screening and crushing plants are sited at such locations as coke plants, coal yards, power plants, industrial plants, and synthetic fuel conversion plants.

A comprehensive list of existing coal preparation plants in the United States is provided in Appendix A of this report.

4.1.2 Industrial Trends

By 1985, it is projected approximately 40 new or modified facilities will be in operation. New thermal drying units are estimated at 24 facilities while air tables will be utilized at 2 new facilities. The remaining units would be replacements. These estimates reflect the trends of the previous 8 years.

The annual domestic coal production in 1979 was nearly 658 teragrams (725 million tons). By 1985, it has been estimated that annual production will increase to greater than 942 teragrams (1 billion tons) of coal.[3] Because Congress passed the 1978 Fuel Use Act to phase out utilization of oil and natural gas as industrial fuels by 1990, coal production is expected to increase to support the fuel demands. Coal demand is expected to be 1,200 teragrams (1.3 billion tons) by 1990.[4] With an estimated 271 new coal-fired power plants planned to go on-line in the next ten years, utilities alone will consume approximately 1,000 teragrams (1.1 billion tons) of coal annually.[4] Such increases in national production will have a direct impact on the coal preparation industry.

A comparison between total domestic coal production and production from the amount of coal cleaned at coal preparation plants is shown in Figure 4-1. Historically, nearly half of the nation's coal output has undergone some type of preparation process. In 1979, approximately 306 teragrams (337 million tons) of mined coal were cleaned. By 1985, it is projected that 438 teragrams (483 million tons) of mined coal will be cleaned.[3] Such an increase in production will require significant financial investments in new plant construction and alterations of existing facilities.

Figure 4-2 illustrates trends in the number of coal preparation plants which have existed in the United States since 1964. A conservative projection has also been made of the number of new and modified facilities which will be required through 1985. The 1977 percentage of total coal production mechanically cleaned was used to project the number of preparation plants through 1985. This is a conservative estimate as trends indicate that there will be growth in the coal preparation industry. Table 4-1 lists specific numbers of coal preparation plants by state together with estimates for future construction.[2] Approximately 40 new or modified facilities will be constructed between 1977 and 1985 to accommodate the increased production of domestic coal.

Table 4-2 provides specific information concerning production and cleaning within the coal preparation industry. Present coal preparation methods only involve mechanical coal cleaning processes. There is no existing commercial chemical coal cleaning industry. Mechanical cleaning may be accomplished by wet or pneumatic cleaning methods. As shown in Table 4-2, most processed coal is cleaned utilizing wet methods. In 1974, for instance, less than 2 percent of all domestic coal was cleaned by pneumatic processes.[2]

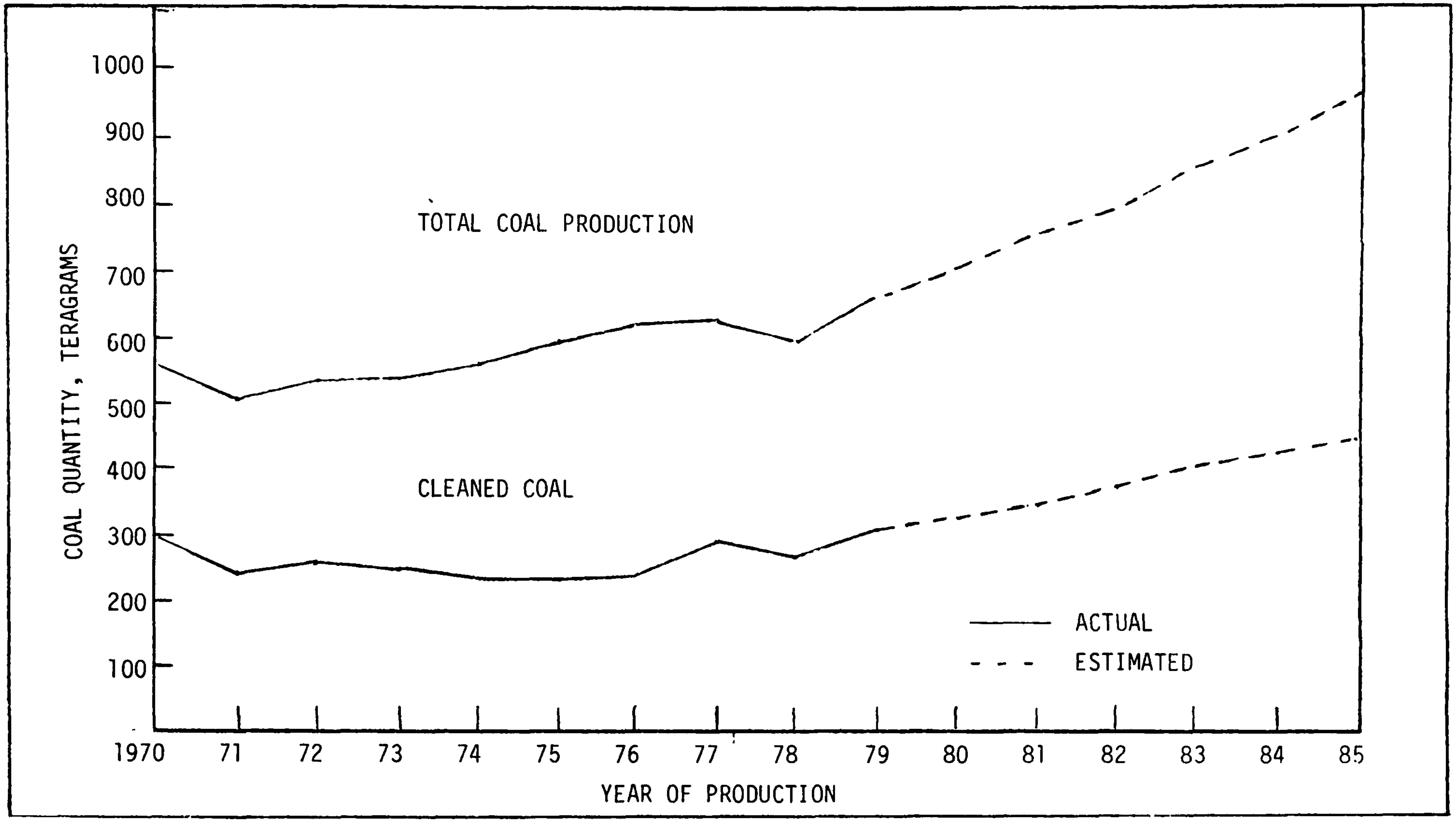

Figure 4-1. Coal production in the United States.[2]

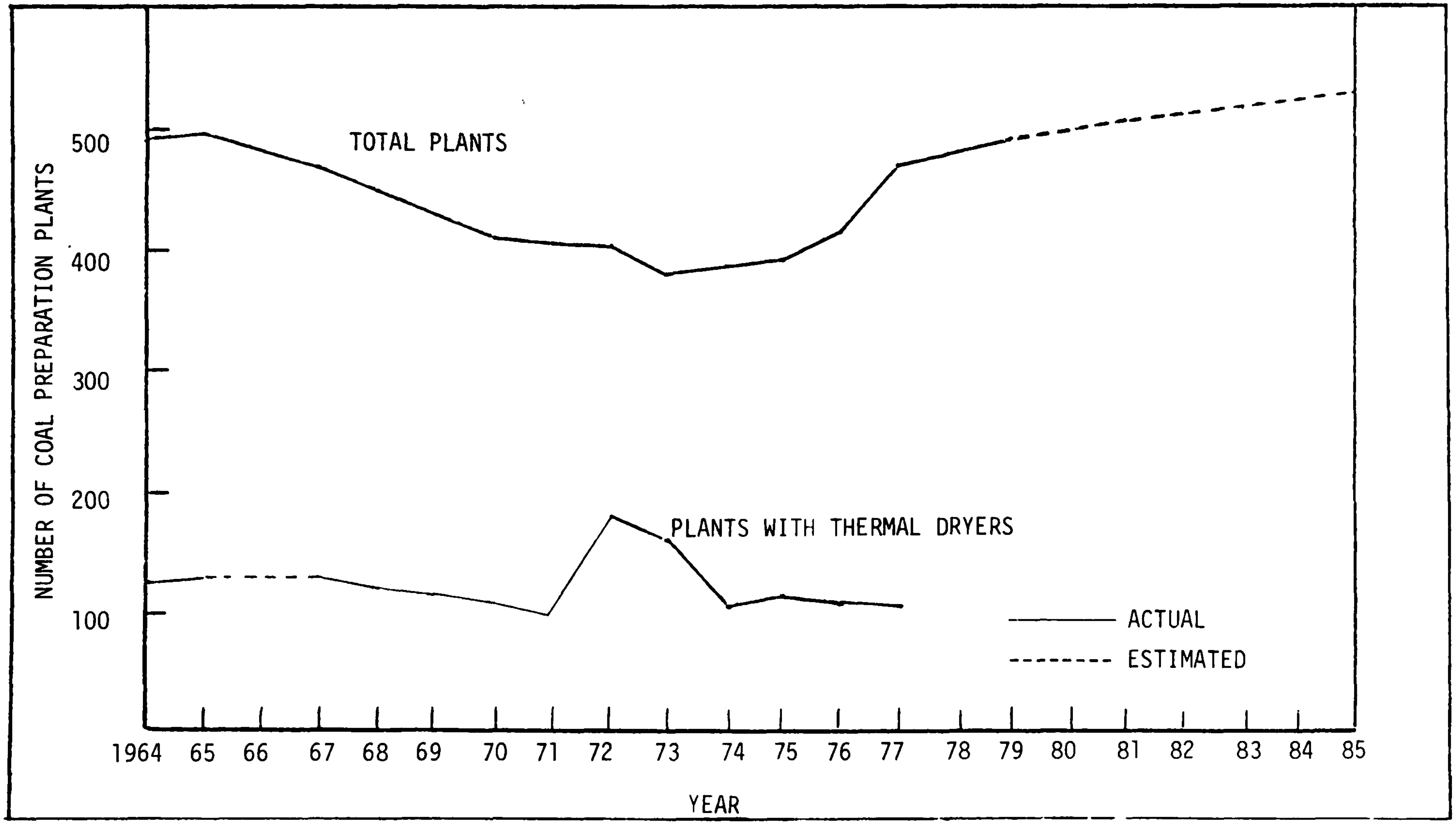

Figure 4-2. Coal cleaning plants in the United States.[2,3]

Table 4-1. NUMBER OF COAL PREPARATION PLANTS BY STATE[1,2]

	1970	1971	1972	1973	1974	1975	1976	1977	1978	*1979	*1980	*1981	*1982	*1983	*1984	*1985
Alabama	22	22	20	19	22	21	29	38	38	39	40	40	40	40	41	41
Alaska	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Arizona	-	-	1	1	1	1	1	1	2	2	2	2	2	2	2	2
Arkansas	1	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1
Colorado	3	3	3	3	3	3	4	4	4	4	5	6	6	7	7	8
Illinois	39	40	38	36	36	34	37	39	40	44	47	50	52	54	55	57
Indiana	12	11	11	10	11	11	14	16	16	16	16	17	17	17	18	18
Iowa	-		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Kansas	3	2	1	1	1	1	1	1	1	2	2	2	2	2	2	2
Kentucky	49	50	50	51	62	62	64	78	78	79	79	79	79	79	79	80
Maryland	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Missouri	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Montana	-	-	1	1	1	1	1	1	1	1	1	2	2	2	2	2
New Mexico	1	1	1	1	1	1	1	1	2	2	2	3	3	3	4	4
North Dakota	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
Ohio	18	20	21	17	17	19	18	20	21	21	21	22	22	22	22	22
Oklahoma	4	4	6	3	2	3	3	3	3	4	4	4	4	4	4	4
Pennsylvania	74	68	71	68	68	64	66	64	65	65	65	66	66	66	66	66
Tennessee	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Texas	-	-	1	1	1	1	1	1	1	2	2	2	3	3	4	4
Utah	7	7	7	7	6	6	7	10	11	12	15	17	17	18	19	19
Virginia	33	30	31	32	19	23	24	27	28	28	28	28	28	28	28	28
Washington	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
West Virginia	136	142	136	124	126	124	135	151	153	156	158	159	159	159	159	159
Wyoming	1	1		1	1	1	1	1	1	2	2	2	2	3	3	3
TOTAL	[illegible]	[illegible]	[illegible]	395	[illegible]	385	416	465	474	488	498	510	513	519	525	529

* Figures for these years have been estimated

Table 4-2. COAL PREPARATION INDUSTRY STATISTICS [1,2,3,7,8]

Year	Production (10^6 metric tons)	Mechanical cleaning (10^6 metric tons)	Percentage of total production: mechanically cleaned	Percentage of total production: thermally dried	No. of cleaning plants	With thermal dryers	Mechanical cleaning (10^6 metric tons): by wet methods	Mechanical cleaning (10^6 metric tons): by pneumatic methods	No. of mines
1958	372	235	63.1	7.7	573	100	218	17.1	8,264
1959	374	245	65.5	8.7	555	104	228	16.6	7,719
1960	377	248	65.7	9.1	535	108	231	16.5	7,865
1961	366	240	65.7	9.8	503	110	224	16.0	7,648
1962	383	246	64.3	11.1	508	117	229	17.0	7,740
1963	416	263	63.1	11.0	499	122	244	18.1	7,940
1964	442	281	63.7	12.1	495	128	262	19.4	7,630
1965	464	301	64.9	12.8	497	133	278	23.0	7,228
1966	484	309	63.8	NA	NA	NA	287	22.0	6,749
1967	501	317	63.2	13.5	471	132	298	19.3	5,873
1968	495	309	62.5	13.4	454	125	294	15.2	5,327
1969	508	304	59.7	12.0	435	119	286	17.4	5,118
1970	547	293	53.6	10.6	415	111	277	16.2	5,601
1971	501	246	49.1	8.7	411	103	233	13.2	5,149
1972	540	266	49.2	8.9	409	184	255	10.6	4,879
1973	537	262	48.8	7.8	385	162	253	9.5	4,744
1974	547	240	43.9	6.0	387	106	234	6.9	5,247
1975	588	242	41.2	5.2	385	119			6,168
1976	616	244	39.6	5.5	416	115			6,161
1977	627	292	46.5		465				6,180
1978	593	275	46.5		474				6,237
1979	658	306	46.5		488				6,317
1980*	706	328	46.5		498				6,384
1981*	753	350	46.5		510				6,428
1982*	800	372	46.5		513				6,464
1983*	848	394	46.5		519				6,494
1984*	895	416	46.5		525				6,520
1985*	942	438	46.5		529				6,544

*Figures for these years have been estimated.

NA - not available

Pneumatic processes are generally utilized to handle coal of 25.4 millimeters (0.5 inch) or less in size. Raw coal is often screened ahead of the cleaning plant so that oversize coal may be cleaned by a wet process and undersize coal by pneumatic means. For successful results by pneumatic means, the feed coal should have a uniformly low surface-moisture (3 to 6 percent) content.[5] The use of pneumatic cleaning methods is expected to diminish due to both low process efficiencies and the problems associated with high moisture content in raw coal. The number of pneumatic cleaning operations in the United States decreased from 37 facilities in 1972 to 30 in 1979.[1]

Thermal dryers are used for fine coal to reduce surface moisture content to low percentages which are unattainable by mechanical de-watering methods. Drying in a thermal dryer is achieved by direct contact between wet coal and hot combustion gases from a coal-fired furnace. A multitude of factors affect the performance capability of a thermal coal dryer: drying temperature, furnace fuel, combustion gas, inlet temperature, air volume flowrate and dryer size. However, the greatest single factor affecting performance is temperature. Drying zone temperatures need to be as high as safety permits. Lower temperatures mean reduced thermal efficiency, higher fuel and power requirements, and increased amounts of dust carryout.[6]

The survey of new thermal dryers outlined in Section 5 has indicated that 17 units have been constructed since standards of performance became effective in October 1974. This is equivalent to approximately 3 new facilities being constructed annually. Based on the number of thermal dryers in operation in 1977, this represents a 3 percent average annual growth rate in new facilities. In 1974, the EPA projected a growth rate of 9 thermal dryers per year. The actual growth has been substantially less than those original projections of 5 dryers per year in 1977 and 1978.[5]

As is documented in Table 4-2 (also see Figure 4-2), the total number of thermal dryers in the country has been declining since 1972. The number of dryers being shutdown has exceeded the 3 percent average annual growth rate for new facilities. Because the historical rate of replacement for thermal dryers has been 4 to 5 percent per year, in many cases old units may not have been replaced.[5]

One reason behind the general reduction in thermal dryers is that the energy costs associated with thermal drying are high. Energy savings associated with the elimination of thermal dryers are on the order of 1 percent of the coal production per day.[7] That is, for a facility processing 454 megagrams (500 tons) of coal per hour, the equivalent of 4.5 megagrams (5 tons) of coal is necessary to operate the dryers. Another reason for this declining trend may be the current ambient air quality standards and the Prevention of Significant Deterioration (PSD) Regulations. Most new dryers are situated at mine-mouth preparation plants usually located in valleys of mountainous regions. The proposed thermal drying units may thus become precluded by stringent ambient standards.[7,8] If the proposed thermal drying unit is located in an area where the National Ambient Air Quality Standards (NAAQS) is not being met for total suspended particulate (TSP) emissions, modelling is used to account for the increases in ambient air concentration from this proposed source. The modelling also shows the offsetting decreases in ambient air concentrations being proposed for this source. Air quality modelling is also used in attainment areas to show that emissions from the new (or modified) source will not cause ambient air quality to exceed either the increment concentration or the NAAQS for TSP.

Declining use of thermal drying has led to a greater dependence on mechanical dewatering. Over the past few years, several sophisticated mechanical drying processes have been introduced to the industry. The new processes are able to achieve greater reduction in surface moisture content than previously possible by mechanical methods. This provides a significant advantage because the energy benefits of removing excess moisture, in terms of avoiding transportation and evaporation penalties, are much greater than the energy requirements for mechanical dewatering. The trend towards improving this technology is expected to continue, with emphasis being placed on reducing the surface moisture of fine size coal particles.[6,7]

With the increased demand on the nation to use coal instead of oil or natural gas for fuel, the number of synthetic coal fuel plants will be increasing. Synthetic fuel conversion plants may use coal preparation techniques to prepare their feed coal for processing. Equipment selection differs somewhat from that used in conventional plants as particle size distribution must be closely controlled. Particle size control also requires close coordination between the mine and the synfuel plant.[9]

Another significant processing trend has been in the area of chemical cleaning technology. As many processes are still in the pilot plant or development stage, performance and cost comparisons are relatively uncertain at this time. These processes vary greatly in their approach because of the possible reactions which can be used to effectively remove sulfur and other reactive impurities in the coal. Most chemical processes under development remove over 90 percent of the pyrite sulfur and several also are reported to remove up to 40 percent of the organic sulfur.[6] These new processes have been developed to maximize the reduction of sulfur content (pyrite) in metallurgical coals and boiler fuels which must comply with sulfur dioxide (SO_2) emission regulations.

4.1.3 Preparation of Nonbituminous Coals

Coal preparation and beneficiation in the United States is practiced almost exclusively on bituminous coals. The following, however, is a brief discussion on nonbituminous coal preparation.[5]

Anthracite production in the United States was less than 5.4 teragrams (6 million tons) in 1975. This represents less than 1 percent of the total United States annual coal production. The preparation process for anthracite is comparable to that of bituminous coal preparation. The principle consumer of anthracite is the metallurgical industry.[10]

Lignite production in 1975 was approximately 181.4 teragrams (200 million tons). All lignite is strip mined from seams and is relatively free of extraneous rock, shale, and similar impurities. Due to the physical properties of lignite, crushing is the only preparation process normally practiced. Most lignite is consumed by power generating plants at mine-mouth locations.[10]

The largest deposits of subbituminous coals are found in Montana, Wyoming, Colorado, New Mexico and Arizona. As with lignite, most subbituminous coal seams are relatively free of gross impurities. Preparation generally consists of crushing to the extent necessary to facilitate transportation and handling. Because the moisture content is mostly inherent, subbituminous coals appear very dry and dusty during handling and transportation.[10] Because of the potential that exists for the utilization of subbituminous coal, fugitive emissions from the preparation of the coal may increase in significance.

4.2 EMISSIONS FROM COAL PREPARATION PLANTS

There are 4 principle sources of air pollution existing within the coal preparation process. These sources are the following:[11]

1. crushing and sizing;
2. pneumatic cleaning;
3. coal storage, transportation, and handling; and
4. thermal drying.

The emissions from each of these sources vary somewhat, but certain generalizations can be made regarding their characteristics, as indicated in Table 4-3.

Crushing and sizing operations produce dry, small particulates (0.5 to 6.0 micrometers) at ambient temperatures. The quantity of particulate generated depends on the coal type, moisture level, and type of sizing and screening operations.[11]

Of the coal cleaning (separation) processes, only pneumatic cleaning operations contribute to air pollution. Emissions from pneumatic cleaning consist of particulates only, because ambient air is used to separate coal from refuse. The quantity and pressure of the air used depends on the size of coal to be cleaned. For pneumatic cleaning of coal less than 9.37 millimeters (0.375 inch), an average volume of exhaust air is about 435 cubic meters per metric ton of feed coal (14,100 cubic feet per ton of feed coal). The exhaust air usually picks up about 65 to 70 percent of the less than 0.52 millimeter (48 mesh) material in the feed coal, and about 20 percent of the less than 9.37 millimeters (0.375 inch) coal is smaller than 0.52 millimeter (48 mesh). Therefore, the

Table 4-3. TYPICAL CHARACTERISTICS OF DUST FROM EMISSION SOURCES[11]

Emission source	Typical characteristics of dust
Crushing and sizing operations	Dry, submicron up to about 6 microns in size; light dust load, ambient temperature.
Pneumatic cleaners	Dry, submicron up to 48 mesh in size, heavy dust load (>100 gr/dscf), ambient temperature.
Thermal dryer	High humidity, submicron up to about 100 microns in size, heavy loadings up to 200 gr/dscf, temperature 200°F to 250°F.

uncontrolled exhaust air contains 130 to 140 kilograms of dust per metric ton of coal feed (260 to 280 pounds of dust per ton of coal feed) treated or 292 to 316 grams of dust per dry cubic meter (128 to 138 grains of dust per dry cubic foot).[12] For a representative air table having a design capacity of 11.3 kilograms per second (50 tons per hour), uncontrolled particulate emissions could be as high as 1.75 kilograms per second (14,000 pounds per hour).[13,14] Annual uncontrolled particulate emissions (based on a 3,000 hour operating year) would be 19 megagrams per year (21,000 tons per year).

Particulate matter in the form of fugitive coal dust is emitted from storage, transportation, and handling operations. The amount of particulate generated varies widely, depending on such factors as climate, topography, and coal characteristics including moisture content. For example, the handling of thermally dried coal results in more particulate than undried coal because the moisture content has been lowered. It has been estimated that 36 kilograms of coal per metric ton (80 pounds of coal per ton) are lost as fugitive particulate during transportation and handling operations. A particulate emission factor from coal storage piles has been estimated at 0.41 milligrams per kilogram per year (0.0018 pounds per ton per year).[12]

Air emissions from thermal dryers include particulates from the drying process as well as particulates from the coal-fired furnace that supplies the drying gases. Uncontrolled particulate emissions from thermal dryers range from 111 to 444 grams per dry standard cubic meter (50 to 200 grains per dry standard cubic foot).[11] An uncontrolled particulate emissions factor for fluidbed thermal dryers has been estimated to be 10 kilograms per metric ton (20 pounds per ton) of coal dried.[15] Based on this factor, a 126 kilograms per second (500 tons per hour) furnace would have an uncontrolled emission rate of 1.3 kilograms per second (10,000 pounds per hour). For a 3,000 hour operating year, uncontrolled annual particulate emissions would be 13.6 megagrams per year (15,000 tons per year).

Gaseous emissions from thermal dryers include carbon monoxide (CO), carbon dioxide (CO_2), hydrocarbons (HC), sulfur dioxide (SO_2), and nitrogen oxides (NO_x). All of these are furnace combustion products.[12] Table 4-4 shows typical uncontrolled emission ranges of some of the gaseous emissions.[5]

The emissions of SO_2 from thermal dryers are a function of the sulfur content of the coal burned in the combustion furnace. Figure 4-3 illustrates this relationship for bituminous coal rated at 29,055 joules per gram (12,500 Btu per pound).[9] Using this figure, potential emissions of SO_2 may be calculated for thermal dryer furnaces. For example, a typical furnace using coal with 1 percent sulfur has a sulfur dioxide emission factor of 0.69 kilogram per gigajoule (1.6 pounds SO_2 per million Btu).[16] Based on this estimate, a 106 gigajoule per hour (100 million Btu per hour) furnace has the potential for emitting 73 kilograms (160 pounds) of SO_2 per hour. Annual emissions (based on a 3,000 hour operating year) of SO_2 would be 218 megagrams per year (240 tons per year).

It should be noted that in actuality, SO_2 emission levels from thermal dryers are not as high as these calculated levels indicate. Source tests conducted by the EPA have reported emission rates from thermal dryers in the range of 0 to 0.04 kilograms per gigajoule (0 to 0.09 pounds SO_2 per million Btu).[5] Based on this factor, a 106 gigajoule per hour (100 million Btu per hour) furnace, would have a maximum SO_2 emission of 4.1 kilograms of SO_2 per hour (9 pounds of SO_2 per hour). Corresponding maximum annual emissions (based on a 3,000 hour operating year) would be 12.2 megagrams per year (13.5 tons per year). This represents less than 6 percent of the SO_2 emission estimate using calculated values based on emission factors for thermal dryers. Further source test data on SO_2 emissions are reported in Section 5.

At this time, the reason for the disparity between actual and calculated SO_2 emission levels is unclear. It appears that SO_2 is being removed during the thermal drying process, possibly during the secondary wet scrubbing process.[5] In the case of fluidbed thermal dryers, a percentage of SO_2 may be adsorbed by the coal due to the reaction of SO_2 with flue gas oxygen and water which forms sulfuric acid in the coal pores.[17,18,19] Incomplete combustion of coal in the dryer furnace may

Table 4-4. COMBUSTION PRODUCT EMISSIONS FROM WELL-CONTROLLED THERMAL DRYERS[11]

Pollutant	Emission rate		Concentration
	Kg/GJ	($lb/10^6$ Btu)	ppm
NO_x	0.17 to 0.30	(0.39 to 0.68)	40 to 70
CO	<0.13	(<0.30)	<50
HC (as methane)	0.03 to 0.16	(0.07 to 0.35)	20 to 100

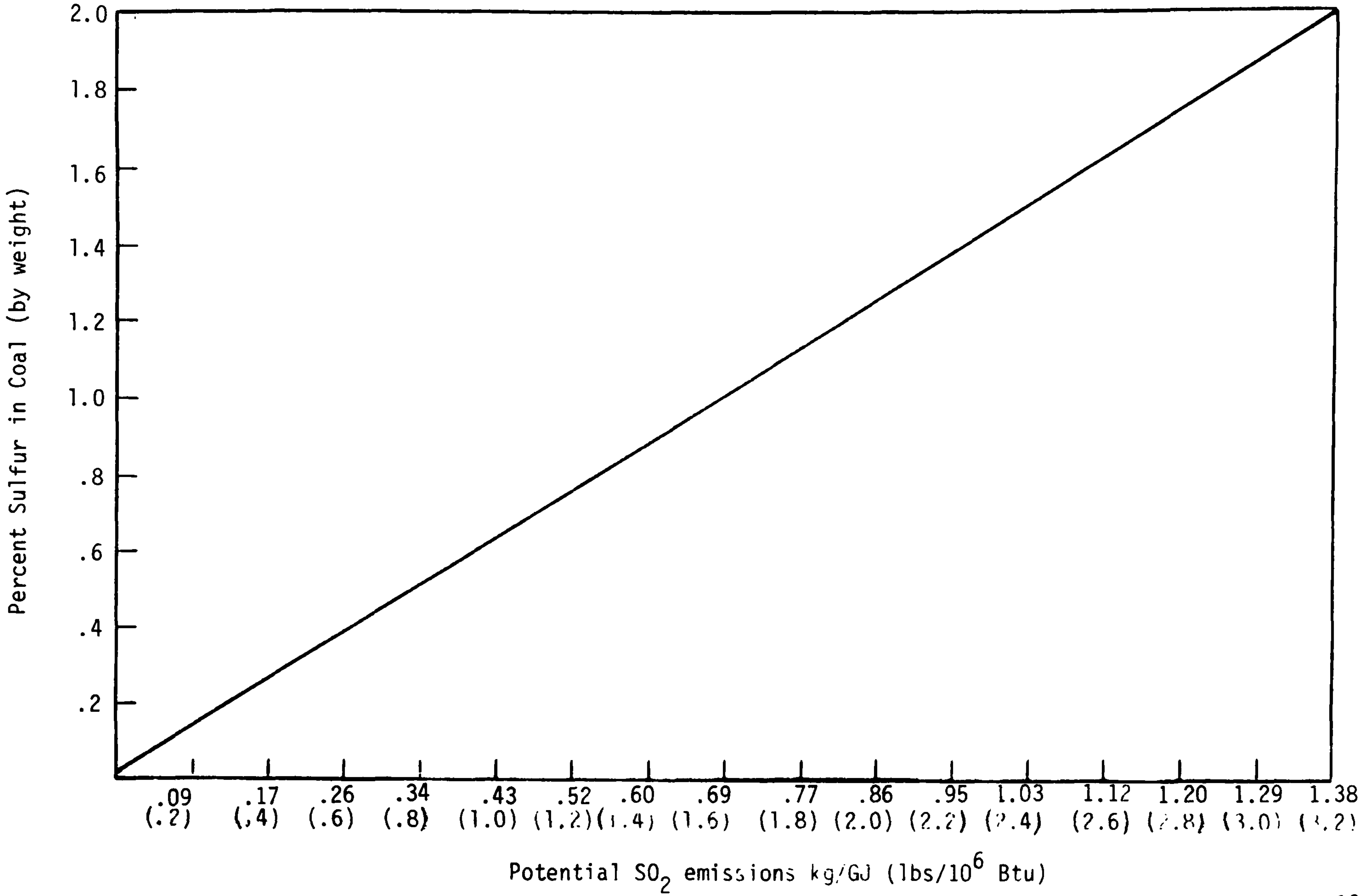

Figure 4-3. Potential SO_2 emissions kg/GJ (lbs/10^6 Btu) for 29,055 J/g (12,500 Btu/lb) coal [12]

also account for the difference in actual and calculated SO_2 emission levels.

4.2.1 NSPS Control Techniques

Several types of air pollution control devices are available to coal cleaning facilities. The choice of control device is dependent upon the pollutant, the properties of the pollutant, and the properties of the conveying medium. Particulate control devices are broadly classified as dry inertial collectors, filters, and wet scrubbers. Dry inertial collectors (cyclones) are characterized by moderate removal efficiencies, low energy requirements, low capital and operating costs, and an ability to accommodate high inlet particulate loadings, and operate at high temperatures. The major disadvantage of cyclone utilization is the low collection efficiencies of minus 10 micrometer (0.39 inch) particles.[11] Fabric filters are regarded as one of the simplest and most reliable high efficiency dry collector devices, capable of 99.9 percent removal of submicrometer-size particles.[11] Fabric filters are suitable for a wide variety of dry particulate removal applications, although excessive moisture tends to blind the fabric. The advantages of wet scrubbers are the high removal efficiencies, ability to remove gaseous pollutants, tolerance of moisture in the gas, and the relatively low capital costs. The major disadvantage of wet scrubbers is the high energy requirements.

4.2.1.1 Thermal drying. Exhaust air from thermal dryers has high moisture content and temperatures up to 367 K ($200^{o}F$). Particulate levels are characteristically high due to the entrainment of fine coal particles during the drying process.[20] Fabric filters are not used as control devices on thermal dryers due to the high moisture content of the exhaust air. Excessive moisture blinds the fabric filter, i.e. excessive particulate is irreversibly retained within the fabric pores making the gas flow resistance prohibitively high.

The primary control device for thermal dryers is a dry centrifugal collector. Centrifugal collectors collect up to 95 percent of entrained particulate matter which is returned to the coal product. These devices have low collection efficiencies with particles smaller than 10 micrometers (0.39 inch).[20]

Secondary particulate emission control for thermal dryers is accomplished with high efficiency venturi type wet scrubbers. The venturi collector can be fabricated in a number of shapes and designs with great flexibility of operating pressure drops and efficiency. Venturi type wet scrubbers associated with thermal dryers normally operate at pressure differentials of 3.7 to 8.0 kilopascals (15 to 32 inches water gauge). The equipment requires 11.3 to 37.8 liters (3 to 10 gallons) of water per 0.47 cubic meters per second (1,000 cubic feet per minute) of gas cleaned. Water entrained by exhaust gases from the scrubbers is removed using mist eliminators.[5,11,20] This is illustrated in Figure 4-4.

Approximately 75 percent of the thermal dryers in operation are the fluidbed type.[6] An average emission for fluidbed dryers without secondary control is 6.9 grams per dry standard cubic meter (3.0 grains per dry standard cubic foot). Well-controlled thermal dryers with high efficiency venturi type wet scrubbers, reduce particulate emissions to less than or equal to the standard of performance, which is 0.070 grams per dry standard cubic meter (0.031 grains per dry standard cubic foot). This value is equivalent to a 99 percent control efficiency.[5]

4.2.1.2 Pneumatic cleaning. Emissions from pneumatic coal cleaning equipment consist entirely of particulate matter. As depicted in Figure 4-4, the commonly used air emission control strategy includes centrifugal collection as primary control, and secondary treatment using fabric filtration. In tests conducted by the EPA, particulate emissions from representative pneumatic cleaning operations having primary and secondary control ranges from 0.009 to 0.025 grams per dry standard cubic meter (0.004 to 0.011 grains per dry standard cubic foot).[5] The existing standard of performance for pneumatic coal cleaning equipment is 0.040 grams per dry standard cubic meter (0.018 grains per dry standard cubic foot).[21]

4.2.1.3 Storage, transportation and handling. Coal processing and conveying equipment, storage systems, and transfer and loading facilities are subject to the general opacity standard. Fugitive emissions from these sources may not exhibit 20 percent or greater opacity. Normally, the practical way of controlling fugitive emissions is prevention and not by the utilization of control devices. Table 4-5 describes the probable sources of fugitive emissions together with methods for potential control.[20]

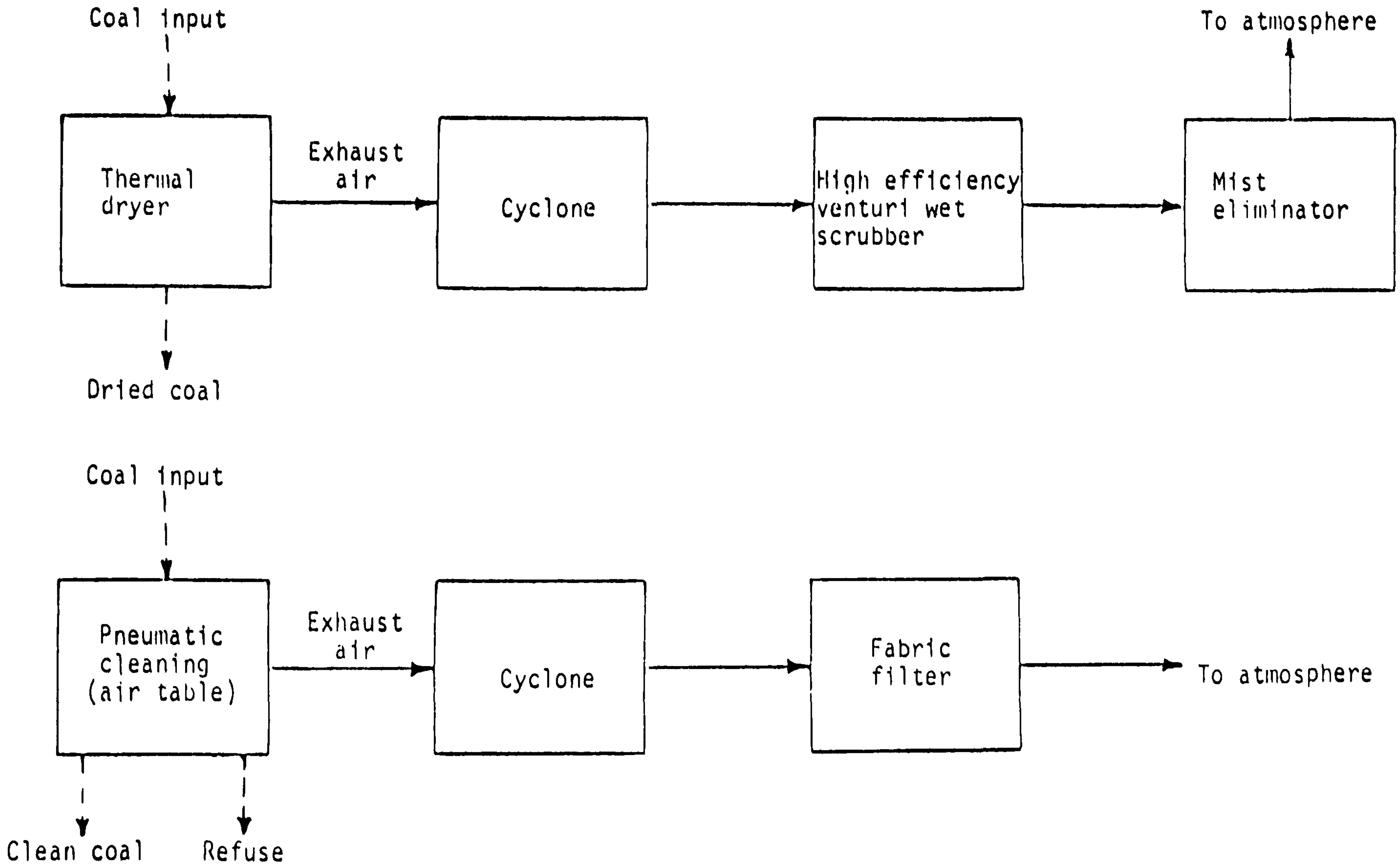

Figure 4-4. Best demonstrated emission control for thermal dryers and pneumatic cleaning operations.

4.2.2 Controls Which Exceed NSPS

Several control techniques have been identified which have the potential for surpassing the NSPS for affected facilities:

- Indirect thermal drying.
- Venturi wet scrubber operation with greater pressure drops.
- Lime scrubbing for SO_2 removal.
- Improved wet suppression for fugitive emission control.

For indirect thermal drying, the coal being processed does not come in contact with the hot furnace gases. Heat is transferred to the moist coal through contact with previously heated elements, such as screws, fins, paddles, steel balls and chains.[11] The principle advantages of indirect thermal drying is its potential for reducing particulate emissions. There are several disadvantages of indirect thermal drying, including high operating costs and limited feed capacities, as well as combustion products emitted by the dryer furnace (usually oil-fired).[10,11,22] No domestic, commercial, indirect thermal dryers were found presently in operation, thus operating characteristics could not be quantified.

Operating wet scrubbers at increased levels of pressure loss would provide a further reduction of particulate emissions. The highest pressure loss which has been demonstrated for achieving the standards of performance (0.070 grams per dry standard cubic meter) on a thermal dryer is 10.4 kilopascals (42 inches water gauge).[23] Lowering the standards would require a greater pressure drop and hence would be imprudent because energy consumption would be excessive. This is because the energy requirements for air pollution control equipment are exponentially related to control level such that a level of diminishing return is reached. Additionally, at the existing level of particulate control required by standards of performance, the trade-off between control of emissions at the thermal dryer versus the increase of emissions at the power plant supplying the energy is favorable even though the mass increments of all air pollutants emitted by the power plant (SO_2, NO_x and particulate matter) are compared only to the reduction in thermal dryer particulate matter emissions.[21]

As mentioned in Section 4.2, gaseous emissions from thermal dryers include sulfur dioxide (SO_2). These emissions are not regulated by

Table 4-5. FUGITIVE EMISSIONS FROM COAL PREPARATION PLANTS[15]

Probable source	Potential control methods
Coal transport to and from plant	Cover rail cars, trucks or conveyors.
Coal storage piles	Use silos, wet suppression, build windbreakers.
Stack/reclaimer	Cover conveyor, hood reclaim.
Coal conveyors	Cover conveyors, hood transfer.
Crushing and screening building	Enclose and treat building vents, hood transfer points.
Waste fines transfer	Cover conveyors, hood transfer points.
Waste storage	Use silos, wet suppression, build windbreakers, use vegetative cover.

standards of performance. Removal of SO_2 can be accomplished by a process of wet absorption, such as with a lime/limestone based scrubbing system. Removal efficiencies range from 70 to 90 percent SO_2 in inlet gas.[11] Although these operations have achieved commercial status in flue gas desulfurization for utility and industrial boilers, installation and operating costs are high. Table 4-6 compares the relative costs of current control for the existing particulate standard to that of SO_2 control.[12,24]

New types of wet suppression techniques have been developed which eliminate fugitive particulate emissions on conveyor systems and stockpile areas without greatly increasing the moisture content of the coal product. Chemicals effectively reduce the surface tension of water to increase wetting power to control particulates with as little as 0.5 to 1 percent moisture. These operations allow for compliance with the existing NSPS fugitive emission standard without the deterioration of product quality.[25]

Table 4-6. ESTIMATED COSTS OF AIR POLLUTION CONTROL EQUIPMENT FOR COAL CLEANING PLANTS[12]

Plant type and emission	Applicable control equipment	Installed cost of control equipment, dollars (1977)/tph of coal processed		Annual operating cost of control equipment,[a] cents/ton of coal processed	
		500 tons/hr	1000 tons/hr	500 tons/hr	1000 tons/hr
Thermal dryers associated with fine size coal beneficiation	Primary cyclones with high efficiency wet scrubbers	270	250	12.5	12.2
	Primary cyclones with high efficiency wet scrubbers followed by limestone scrubbers for SO_2 control.	9,450	9,250	93.8	93.8

(a) Excludes capitalization, depreciation, and interest. Based on 180 (2-shift) days.

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5. COMPLIANCE TEST RESULTS

EPA regional offices, state agencies, and affected facilities were contacted to obtain compliance testing information for new, modified or reconstructed coal preparation plants. Test data for thermal dryers and air tables were specifically requested. These are the only processes currently regulated by mass concentration standards under the standards of performance.

The compliance test survey data supported information found in the reference literature concerning process trends. According to the survey, there have been only 3 new air table facilities and 17 new thermal dryers constructed since the standards of performance became effective in October 1974. EPA estimated in 1974 that 9 new thermal dryers would be constructed per year.[1] The reasons behind this decrease in new construction have been outlined in Section 4.1.2.

5.1 ANALYSIS OF NSPS TEST RESULTS

The results of recent compliance tests, obtained from new, modified or reconstructed coal preparation plants with thermal dryers or air tables, are summarized in Table 5-1.[2-7] The recent compliance test results from 3 air table facilities indicate compliance with NSPS, with particulate emissions ranging from 0.011 to 0.022 grams per dry standard cubic meter (0.005 to 0.010 grains per dry standard cubic foot).[4,5] Thirteen of the 17 thermal drying facilities indicated compliance with the NSPS, with particulate emissions ranging from 0.016 to 0.070 grams per dry standard cubic meter (0.007 to 0.031 grains per dry standard cubic foot). From the test data it can be seen that 3 Oneida Mining Company facilities (Armagh, Brush Valley and Dryer No. 1 at Seward) and an Island Creek Coal Company facility, all located in Pennsylvania, exceeded the emission limits of 0.070 grams per dry standard cubic meter allowable under the current

Table 5-1. COAL PREPARATION COMPLIANCE TEST RESULTS[2-7]

Plant name	Location	Date of test	Process tested	Particulate emissions (g/dscm [gr/dscf])		Process Rate (kg/s [tons/hr])		Venturi pressure drop (kPa [in. H_2O])	
U.S. Steel Concord Mine	Hueytown, Alabama	April 1978	Thermal dryers (fluidbed)	0.045	(0.020)	217.3	(770)	Unknown	
Providence Producers, Inc.	Van Buren, Arkansas	October 1977	Air table	0.022	(0.010)	4.5	(16)	N/A	
Island Creek Coal Company	Turkey Creek, Kentucky	September 1977	Thermal dryer (fluidbed)	0.042	(0.019)	43.2	(153)	9.2	(37)
Delta Coal Sales	Meyersdale, Pennsylvania	August 1979	Air table	0.011	(0.005)	Unknown		N/A	
Doverspike Brothers Coal Company	Dora, Pennsylvania	September 1977	Thermal dryer (fluidbed)	0.042	(0.019)	114.0	(404)	N/A	
Oneida Mining Company	Armagh, Pennsylvania	January 1976	Thermal dryer	0.118	(0.053)	87.5	(310)	8.2	(33)
Oneida Mining Company	Dryer #2 Brush Valley, Pennsylvania	July 1978	Thermal dryer (fluidbed)	0.096	(0.042)	95.9	(340)	7.7	(31)
Oneida Mining Company	Dryer #1 Seward, Pennsylvania	March 1977	Thermal dryer (fluidbed)	0.080	(0.035)	88.0	(312)	8.5	(34)
Oneida Mining Company	Dryer #2 Seward, Pennsylvania	March 1977	Thermal dryer (fluidbed)	0.055	(0.024)	88.0	(312)	8.5	(34)
Island Creek Coal Company	Johnstown, Pennsylvania	May 1975	Thermal dryer (fluidbed)	0.053	(0.024)	51.6	(183)	5.5	(22)

N/A - not applicable

(continued)

Table 5-1. Concluded

Plant name	Location	Date of test	Process tested	Particulate emissions (g/dscm [gr/dscf])		Process Rate (kg/s [tons/hr])		Venturi pressure drop (kPa [in. H_2O])	
Island Creek Coal Company	Tire Hill, Pennsylvania	January 1979	Thermal dryer (fluidbed)	0.032	(0.014)	47.7	(169)	10.4	(42)
Pittson Coal Company	Dante, Virginia	February 1978	Thermal dryer (fluidbed)	0.059	(0.025)	Unknown		Unknown	
Bethlehem Mines	Van, West Virginia	September 1977	Thermal dryer (fluidbed)	0.016	(0.007)	40.9	(145)	9.4	(36)
PA Mines Corp.	Ebensburg, Pennsylvania	December 1977	Thermal dryer (fluidbed)	0.051	(0.023)	160.0	(567)	8.2	(33)
Oneida Mining Company Mine #4	Dryer #1 Seward, Pennsylvania	April 1975	Thermal dryer (fluidbed)	0.070	(0.031)	101.3	(359)	8.7	(35)
Delta Coal Sales Sales	Meyersdale, Pennsylvania	September 1979	Air table	0.015	(0.007)	Unknown		N/A	
Consolidated Coal Co.	Amonate, West Virginia	November 1978	Thermal dryer (fluidbed)	0.049	(0.022)	98.8	(350)	8.0	(32)
Island Creek Coal Co.	Bob White, West Virginia	April 1979	Thermal dryer (fluidbed)	0.049	(0.022)	38.1	(135)	8.2	(33)
Ranger Fuel Co.	Beckley, West Virginia	August 1979	Thermal dryer (fluidbed)	0.016	(0.007)	Unknown		9.5	(38)
Island Creek Coal Company	Johnstown, Pennsylvania	January 1975	Thermal dryer (fluidbed)	0.111	(0.050)	79.6	(282)	6.8	(27.5)

N/A - not applicable

NSPS for thermal dryers.[3] It is uncertain why the Oneida Mining Company dryers were unable to comply with standards of performance. In the case of the Island Creek Coal Company facility, a second performance test was conducted in May 1975, in which the facility complied with NSPS. During the first test the dryer feed rate was 71.1 kilograms per second (282 tons per hour), substantially greater than the feed rate of 34.8 kilograms per second (138 tons per hour) that occurred during the second source test. The greater processing rate may have attributed to increased particulate emissions which resulted in exceeding standards of performance.[3]

The venturi pressure drops for the thermal dryers listed in Table 5-1 ranged from 5.5 to 10.4 kilopascals (22 to 42 inches H_2O). It may be concluded that the higher pressure drops resulted in the best control of particulate emissions. It is difficult to derive further conclusions concerning the emission data due to apparent variations in processing parameters of the facilities. For instance, information concerning the particle size of processed coal is in many cases either unavailable or nonspecific. This is an important factor because the percentage of fines will directly impact particulate emission concentrations. The surface moisture content of the coal was also not specified in a majority of the compliance test reports. Higher moisture percentages resulted in reduced emission rates of particulates. In some of the tests actual feed rates were below design operating rates. The thermal dryer at the Island Creek Coal Company, Turkey Creek, Kentucky plant had a design maximum feed rate of 253 megagrams per hour (279 tons per hour). During compliance testing the dryer was operating at 139 megagrams per hour (153 tons per hour) due to the large amount of reject in the ROM feed to the preparation plant.[7] Operating below design rate may result in lower emission rates being unrepresentative of normal plant operation.[8]

Although opacity data was not submitted with the compliance test data, the general consensus of all parties surveyed was that compliance with the mass concentration standard for air tables and thermal dryers results in compliance with corresponding opacity standards.[2-7] The NSPS for opacity for air tables is 10 percent and for thermal dryers, 20 percent.

For coal conveying, processing, storage, transfer and loading facilities the only applicable NSPS is a general opacity standard of 20 percent governing fugitive emissions. For these cases, this particular opacity standard is the only means of requiring control of the emission sources and has been established at a level consistent with the application of best control technology for those sources. According to state agency officials, regional EPA personnel, and industrial representatives contacted, general compliance has been achieved with this opacity regulation. However, reference was made that enforcing fugitive emissions regulations is difficult when using an opacity standard.

A review of the compliance test reports indicated that no significant problems were encountered during source testing. It is important, however, that the cyclonic flow of exhaust gases be adequately eliminated during performance testing with either temporary or permanent flow straightening devices. The cyclonic flow patterns common to all cylindrical mist eliminators make measurements of particulate emissions difficult without such advice. In spite of these possible inherent source testing difficulties, no problems were reported.

5.2 SULFUR DIOXIDE (SO_2) EMISSIONS FROM THERMAL DRYERS

Sulfur dioxide (SO_2) emission tests were conducted at 4 of the thermal dryer facilities listed in Table 5-1. The emission rates were measured to assist in the computation of expected ambient SO_2 concentrations in accordance with state or Federal ambient air quality regulations. The results of these tests are summarized in Table 5-2.[3,5,7]

Sulfur dioxide emissions from thermal dryers ranged from 0.57 to 4.3 grams per second (4.54 to 34.5 pounds per hour).[3,5,7] For the Island Creek Coal Company dryer, the emission rate for SO_2 was not reported. Instead there is an EPA-PSD requirement stipulating that the sulfur content of coal consumed in the furnace/stoker should be 1 percent or less.[3]

Based on a typical 3,000 hour operating year, annual SO_2 emissions from these dryers ranges from 6.2 to 46.9 megagrams per year (6.81 to 51.75 tons per year). The range of calculated values derived from emission factors provided in Section 4.2 are 0.02 to 1.22 kilograms per gigajoule (0.05 to 2.84 pounds per million Btu).[9]

Table 5-2. COAL PREPARATION SO_2 EMISSIONS[3,5,7]

Plant name	Location	Test date	Process tested	SO_2 emissions g/s (lb/hr)	Process rate kg/s (ton/hr)	% sulfur in coal
Island Creek Coal Company	Turkey Creek, Kentucky	Sept. 1977	Thermal dryer (fluidbed)	NA[a]	32.8 (130)	0.67
Doverspike Brothers Coal Company	Dora, Pennsylvania	Sept. 1977	Thermal dryer (fluidbed)	4.3 (34.5)	101.8 (404)	1.80
Consolidated Coal Company	Amonate, West Virginia	Nov. 1978	Thermal dryer	0.57 (4.54)	88.2 (350)	1.0
Island Creek Coal Company	Bob White, West Virginia	April 1979	Thermal dryer	3.58(28.43)	24.9 (99)	NA[a]

[a]Not applicable.

5.3 REFERENCES FOR CHAPTER 5

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6. CONCLUSIONS AND RECOMMENDATIONS

6.1 NEW SOURCE PERFORMANCE STANDARD REVISIONS

6.1.1 Pneumatic Coal Cleaning Processes

Emissions of particulate matter from pneumatic coal cleaning operations (air tables) are currently regulated by standards of performance. The emissions from these facilities are not to contain particulate matter in excess of 0.040 grams per dry standard cubic meter (0.018 grains per dry standard cubic foot) and shall not exhibit 10 percent or greater opacity.[1]

The use of pneumatic coal cleaning is diminishing due to low cleaning efficiencies (as compared to wet cleaning processes) and problems associated with high moisture content in raw coal. The number of pneumatic cleaning facilities in the United States declined from 37 facilities in 1972 to 30 in 1979.[2] According to the compliance test survey, however, 3 pneumatic cleaning facilities have been constructed since the NSPS became effective. There is still a need, therefore, for an emission standard for this process. All 3 of the pneumatic cleaning operations were in compliance with the current NSPS, with particulate emissions ranging from 0.011 to 0.022 grams per dry standard cubic meter (0.005 to 0.010 grains per dry standard cubic foot). These 3 facilities processed bituminous coal.

Because the utilization of pneumatic cleaning has declined and the available compliance test data indicates that facilities are in accordance with the existing particulate matter standard, it is recommended that the existing NSPS for pneumatic coal cleaning remain unchanged.

6.1.2 Thermal Dryers

Particulate matter from thermal coal drying operations are currently regulated by standards of performance. Emissions from these facilities are not to contain particulate matter in excess of 0.070 grams per dry standard cubic meter (0.031 grains per dry standard cubic foot) and shall not exhibit 20 percent or greater opacity.[1]

Since 1972, the number of thermal dryers in the United States has declined. In 1972, there were 184 thermal dryers in operation, the number dropping to 114 in 1977 with no indications of a subsequent increase. The compliance survey indicated 17 thermal dryers have been constructed since standards of performance became effective. This represents an average of 3 percent annual growth rate in the number of facilities affected by the NSPS.[3]

The compliance survey indicated 13 of the NSPS-affected thermal dryers achieved compliance with the current standards of performance, with particulate emissions ranging from 0.016 to 0.070 grams per dry standard cubic meter (0.007 to 0.031 grains per dry standard cubic foot). Of the 4 facilities not within compliance, one was able to comply with NSPS during a subsequent performance test. No significant problems were encountered with test methods and procedures used during the source testing of any of these facilities.

Emissions of sulfur dioxide (SO_2) are produced from the combustion of coal in thermal dryer furnaces. SO_2 emissions are currently not regulated by standards of performance, however, SO_2 emission data were available on 4 of the NSPS-affected thermal dryers. SO_2 emission levels ranged from 0.57 to 4.3 grams per second (4.54 to 34.5 pounds per hour). Corresponding annual emissions were projected to range from 6.2 to 46.9 megagrams per year (6.81 to 51.75 tons per year).

Because growth rate of NSPS-affected thermal dryers has been below projections made when existing standards of performance were promulgated, and since compliance data have indicated the achievability of existing standards, it is recommended the existing NSPS for particulate matter remain unchanged. Based on existing SO_2 emission data there is no justification to support changing the standards of performance to include emissions of SO_2 from thermal dryers. Any future attempt to regulate SO_2 under standards of performance would have to include a detailed assessment on costs of SO_2 control technology for thermal dryers.

All NSPS-affected thermal dryers processed only bituminous coal and there are no indications of a change in this trend, therefore, there is no need to expand the standards to include facilities processing nonbituminous coals.

6.1.3 Other Affected Facilities

The existing standards of performance govern fugitive particulate emissions from coal processing and conveying equipment, coal storage systems, and coal transfer and loading systems. Fugitive emissions from these sources are not to exhibit 20 percent or greater opacity.[1]

The compliance survey indicated there have been no significant problems reported concerning NSPS compliance. However, the standards of performance do not regulate all potential sources of fugitive emissions within the coal preparation process. One of the unregulated sources of potential significant fugitive emissions are open coal storage piles.[4]

Because existing standards were developed for contained coal storage systems, research is needed to quantify the impact of fugitive particulate emissions from open coal storage piles.

Another unregulated source of fugitive emissions is coal unloading or receiving stations. Although loading systems are included in standards of performance, coal unloading systems were not mentioned as affected facilities. Unloading stations may be significant sources of fugitive dust emissions because of the large volumes of coal handled, often without adequate controls. Many coal preparation plants are served by conveyors from mine mouths, and coal unloading is considered to be in another source category.

Because of the potential for growth within the coal preparation industry, it may prove useful to evaluate the adequacy of opacity standards for enforcing fugitive particulate emissions. The adequacy of the opacity standard could be evaluated by performing a study which involves upwind and downwind high volume (hi-vol) sampling versus opacity readings. The recommended hi-vol sampler should be the modified (two-stage) cascade impactor type which provides for 3 size fractions. These size fractions include greater than 7.0 micrometers, 1.1 to 7.0 micrometers, and cascade impactor. Size classification of particulates would be an important indication as to whether fugitive emissions from the coal preparation industry constitute a potential health hazard.

6.2 FINDINGS AND CONCLUSIONS

In 1979, there were approximately 488 coal preparation plants operating in the United States. By 1985, it is estimated there should be approximately 40 new or modified facilities to accommodate the projected increase in production of domestic coal.[1,2] Of these 40 facilities, it is estimated that 24 facilities will employ new thermal drying units and 2 facilities will employ air tables. The remaining facilities would utilize replacement units. These estimates reflect the apparent trends of the previous 8 years.

At this time, the coal preparation industry is based exclusively on physical coal cleaning processes. The degree of preparation widely varies, and the processes used range from simple mechanical removal of rock and dirt to complex beneficiation plants for the removal of potential pollutants. The type of cleaning process and the extent of cleaning depends on the type of coal, the method of mining, and the end use of the coal. It is estimated that approximately 50 percent of the coal mined in the United States is subjected to some type of preparation process.[5,6]

There has been general compliance with the current NSPS for the coal preparation industry and the achievability of existing standards is adequately demonstrated. Additional sources of fugitive emissions exist which should be regulated by standards of performance.

The current cutoff limit of 181 megagrams per day (200 tons per day) remains appropriate for this industry. As new control technologies are not economically feasible for this small percentage of facilities (less than 2 percent), this limit still is appropriate. As coal conversion technology progresses, however, it may be necessary, during a future review, to re-evaluate this cutoff limit in order to cover coal preparation which may take place at the conversion plants.

There have been several process changes which have occurred within the coal preparation industry over the past few years. Air tables have decreased in number and in 1979, less than 2 percent of domestically cleaned coal was cleaned by pneumatic processes.[2] Thermal drying has been reduced in scope due primarily to economic considerations and air pollution constraints. Technological advances have been in the areas of wet cleaning processes and mechanical dewatering techniques.[5]

6.3 RECOMMENDATIONS

The following recommendations are made regarding the NSPS for the coal preparation industry:

- The standards of performance for pneumatic cleaning equipment (air tables) and thermal dryers remain unchanged because the best demonstrated control technologies for this industry have not changed.

6.4 REFERENCES FOR CHAPTER 6

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APPENDIX A

LIST OF DOMESTIC COAL PREPARATION PLANTS

Table A-1. LIST OF DOMESTIC COAL PREPARATION PLANTS

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Bradford Preparation Plant	Alabama By-Products Corp.		Dixiana ALABAMA	1,000	J
Chetopa Mine	Alabama By-Products Corp.		Graysville		H-CY-W
Maxine Mine	Alabama By-Products Corp.		Quinton	5,000	H-W
Gorgas America No. 7	Alabama By-Products Corp.		Goodsprings		J-F-CY
Mary Lee No. 1	Alabama By-Products Corp.		Goodsprings		J-F-CY
SEGCO No. 1	Alabama By-Products Corp.		Goodsprings		J
Mary Lee No. 2	Alabama By-Products Corp.		Goodsprings		J-F-CY
Cobb Mine	Bankhead Mining Co., Inc.	Northern Energy Resources Co.	Jasper		
Blocton 11 Mine	Black Diamond Coal Mining Co.		W. Blocton	2,250	H-A-W
Black Diamond 3 Mine	Black Diamond Coal Mining Co.		Bessemer	2,100	J
Brilliant Mines	Brilliant Coal Co.	Great Northern Nekoosa Corp.	Glen Allen	4,000	J
Boothton	Burgess Mining & Construction Corp.		Birmingham	3,045	J-CY
Berry Mt. Mines	Calvert & Marsh Coal Co., Inc.		Oneonta	1,300	H-CY-W
County Line Mine	Calvert & Youngblood Coal Co. Inc.		Pinson	900	W
Arkadelphia Mine	Drummond Coal Co.		Bremen		H-W
Kellerman Mine	Drummond Coal Co.		Brookwood	2,000	H-W
Natural Bridge Mine	Drummond Coal Co.		Lynn	1,200	J
Empire Mine	Empire Coke Co.	McWane Cast Iron Pipe Co.	Empire	800	H-W
Mine No. 702	Hoover, Inc.		Nashville	1,000	H-CY
Mulga Mine	Mulga Coal Co.	The Mead Corp.	Mulga	1,000	H-F-CY-T
Concord Mine	US Steel Corp.		Hueytown	12,500	F-CY-T-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Bessie Mine	Jim Walter Resources, Inc.	Jim Walter Corp.	Birmingham ALABAMA	2,600	H-F-CY-W
NEBO Mine	Jim Walter Resources, Inc.	Jim Walter Corp.	Birmingham	3,000	J-F-W
Blue Creek No. 3	Jim Walter Resources, Inc.	Jim Walter Corp.	Adger	10,600	H-F-CT-T-W
Blue Creek No. 4	Jim Walter Resources, Inc.	Jim Walter Corp.	Brookwood	10,000	H-F-CT-T-W
Sugarloaf Mine	National Mines Corp.	National Steel Corp.	Ft. Smith ARKANSAS	600	H-CY-CT-W
Eagle Mine	The Imperial Coal Co.		Erie COLORADO		H-CT
Coal Basin Preparation Plant	Mid-Continent Coal & Coke		Carbondale	400	H-F
Sun Spot Mine	Amax Coal Co.	Amax, Inc.	Vermont ILLINOIS	3,500	H-CY-CT
Leahy Mine	Amax Coal Co.	Amax, Inc.	Campbell Hill	12,000	J-CY-CT
Delta Mine	Amax Coal Co.	Amax, Inc.	Marion	4,750	J-F-CY-CT
Hallidayboro Preparation Plant	Coal Conversion, Ltd.		Nashville	1,000	H
Norris Mine	Consolidation Coal Co.	Continental Oil Co.	Norris	5,000	J
Burning Star No. 2 Mine	Consolidation Coal Co.	Continental Oil Co.	DuQuoin	6,500	J
Burning Star No. 3 Mine	Consolidation Coal Co.	Continental Oil Co.	Sparta	6,500	J
Burning Star No. 4 Mine	Consolidation Coal Co.	Continental Oil Co.	Cutler	7,500	J
Burning Star No. 5 Mine	Consolidation Coal Co.	Continental Oil Co.	DeSoto	7,000	H
Buckheart Mine 17	Freeman United Coal Mining Co.	General Dynamics Corp.	Canton	7,000	H-CT
Orient Mine 3	Freeman United Coal Mining Co.	General Dynamics Corp.	Waltonville	14,000	H-J-F
Orient Mine 6	Freeman United Coal Mining Co.	General Dynamics Corp.	Waltonville	6,000	H-F
Crown II Mine	Freeman United Coal Mining Co.	General Dynamics Corp.	Virden		J-CT
Fidelity Mine 11	Freeman United Coal Mining Co.	General Dynamics Corp.	DuQuoin	7,500	J-CT

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Orient Mine 4	Freeman United Coal Mining Co.		Marion ILLINOIS	7,000	H-J-CT
Harrisburg Mine	Harrisburg Coal Co., Inc.		Marion		H
Inland Mine No. 1	Inland Steel Coal Co.		Sesser		H-F-CY-T
Rapatee Mine	Midland Coal Co.	ASARCO, Inc.	Middlegrove		J-CY-CT
Mecco Mine	Midland Coal Co.	ASARCO, Inc.	Victoria	7,000	J-CY-CT
Elm Mine	Midland Coal Co.	ASARCO, Inc.	Trivoli	7,000	J-CY-CT
Monterey No. 1 Mine	Monterey Coal Co.	The Carter Oil Co.	Carlinville	12,000	J-CY-CT
Monterey No. 2 Mine	Monterey Coal Co.	The Carter Oil Co.	Albers	1,500	J-CY-CT
Wayne Mine	Monterey Coal Co.	The Carter Oil Co.	East Lynn		H-F-CY-CT-T
Morris No. 5	Morris Coal, Inc.	Ada Mining Corp.	Marion	5,000	J-CY
Old Ben No. 21	Old Ben Coal Co.	Sohio Natural Res. Co.	Sesser		H-J-F-CY
Old Ben No. 26	Old Ben Coal Co.	Sohio Natural Res. Co.	Sesser		J-A
Mine No. 10	Peabody Coal Co.		Pawnee	15,500	J
Eagle Surface	Peabody Coal Co.		Shawneetown	2,700	J-CT
Will Scarlet Mine	Peabody Coal Co.		Stonefort	6,500	J
Central Preparation Plant	Sahara Coal Co., Inc.		Harrisburg	12,000	H-CY-CT
Streamline Mine	Southwestern Illinois Coal Corp.	Arch Mineral Corp.	Percy		H-CY
Murdock Mine	Zeigler Coal Co.	Houston Natural Gas Corp.	Murdock	2,600	J-CT
Spartan Mine	Zeigler Coal Co.	Houston Natrual Gas Corp.	Sparta	4,000	J-CY-CT
Mine No. 4	Zeigler Coal Co.	Houston Natural Gas Corp.	Johnston City	6,000	J-CY-CT-W
Mine No. 11	Zeigler Coal Co.	Houston Natural Gas Corp.	Coulterville		J-F-CY-CT

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Chinook Mine	Amax Coal Co.	Amax, Inc.	Staunton INDIANA	5,500	J-CY-CT
Minnehaha Mine	Amax Coal Co.	Amax, Inc.	Sullivan	8,000	J-CY-CT
Ayrshire Mine	Amax Coal Co.	Amax, inc.	Chandler	16,000	J-F-CY-CT
Lynnville Mine	Peabody Coal Co.		Lynnville	7,000	J-W
Squaw Creek Mine	Peabody Coal Co.		Boonville	6,000	H
Chetopa Mine	Bill's Coal Co., Inc.		Chetopa KANSAS	600	H
Ft. Scott, Kansas Mine	Cherokee Coal Co.		Ft. Scott	2,000	J
Clemens Mine 22	Clemens Coal Co.		Pittsburg	1,800	J
Golden Eagle Mine	Fuel Dynamics, Inc.		Cherokee		H
Mine No. 1	Apache Coal Co.		Grundy KENTUCKY	800	J
Stone No. 2, Hignite No. 8, Poplar Lick 4 & Red Springs No. 6	Bell County Coal Corp.	General Energy Corp.	Middlesboro	1,300	H
Mines Nos. 2A, 4D & 1E	Benham Coal Inc.		Benham	3,000	J-F-CT-T-W
Damron Mine No. 29	Beth-Elkhorn Corp.	Bethlehem Steel Corp.	Jenkins	1,000	H-J-F-CT-T
Hendrix Mine No. 22	Beth-Elkhorn Corp.	Bethlehem Steel Corp.	Jenkins		J-CT-W
Elkhorn Div. & Jenkins Preparation Plant	Beth-Elkhorn Corp.	Bethlehem Steel Corp.	Jenkins		H-CT-W
Pike Mine No. 26	Beth-Elkhorn Corp.	Bethlehem Steel Corp.	Jenkins	2,000	H-F-CY-CT-T
Leatherwood Mine 1	Blue Diamond Mining	Blue Diamond Coal Co.	Leatherwood	6,000	H-J-F-CT-T
No. 7 Mine	Broecker, Norris, Rakios Coal Corp. D/B/G, Kentucky Mountain Coal Co.		Wooton	200	H

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
No. 8 Mine	Broecker, Norris, Rakios Coal Corp. D/B/G, Kentucky Mountain Coal Co.		Manchester KENTUCKY	1,000	H
Hance Mine	Brownies Creek Collieries, Inc.		Balken		W
Tejay No. 1 Mine	Brownies Creek Collieries, Inc.		Balken		H
Bevins Branch Tipple	Call & Ramsey Coal Co., Inc.		Meta	4,000	J-CY-CT
Mine No. 2	Canada Coal Co., Inc.		Pikeville	4,000	H-CY-CT
Hytemp Mine	Carr Creek Fuel Co.		Whitesburg	1,500	H-CY-CT
Chapperal No. 2 Mine	Chapperal Coal Corp.		Pikeville	3,000	CT
Volunteer Mine	Cimmaron Coal Corp.		Madisonville	6,500	J-CY-CT
Levisa River Plant	Clintwood Coal Co.		Mouthcard	1,200	H
Mine No. 1	Crescent Industries Inc.		Elkhorn City		J-F-CT-T-W
Baker No. 1 Mine	Eastover Mining Co.		Arjay	3,600	J-CY-CT-T-W
Darby No. 4 Mine	Eastover Mining Co.		Highsplint	9,600	J-CY-T
Brookside No. 3 Mine	Eastover Mining Co.		Brookside	4,000	J-CY-CT
Sapphire Mine	Elkhorn & Jellico Coal Co.		Whitesburg		H-J-CY
Elkhorn Preparation Plant	Elkhorn Processing Corporation	NewEra Resources, Inc.	Whitesburg	1,500	H-CY
Gibraltar Mine	Gibraltar Coal Corp.		Central City	12,000	J
Mine No. 2	Golden Glow Coals Inc.		Harlan	1,500	J-CY
Harlan No. 1	Grays Knob Coal Co.		Grays Knob	1,600	H-CY-T-W
Guaranty Mine	Guaranty Mines Corp.		Drift	2,500	H-CT-W
Mine No. 1 (Darby)	Harlan Central Coal Co.		Grays Knob		H-CY-T-W
Harlan Mines	Harlan Fuel Co.		Harlan	5,760	H-F-CY-CT

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Harold Tipple 1	Harold Fuel Co., Inc.		Harold KENTUCKY	1,000	H
Mine No. 3	Howard Enterprises		Pikeville	1,000	CY-CT
No. 1 Mine	Ikerd & Bandy Co., Inc.	Kaneb Services, Inc.	Somerset		A
Calora Mine	Imperial Elkhorn Coal Co.		Drift	3,000	H-W
Mine No. 7	Indian Head Mining Co.	Pro-Land, Inc.	Hazard		J
Spurlock Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Spurlock	3,000	H
Wheelwright Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Wheelwright	5,000	J-W
Pevler Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Paintsville	13,000	H-CT-W
Big Creek Mine Nos. 1 & 2	Island Creek Coal Co.	Occidental Petroleum Corp.	Turkey Creek		H-F-CY-CT-T
Gund Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Turkey Creek	6,000	H-F-CY-CT-T
Fies Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Fies	7,000	J-CT
Mine No. 9	Island Creek Coal Co.	Occidental Petroleum Corp.	Fies	5,800	CY-CT
Crescent Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Central City	5,000	J-CT
Hamilton Mine No. 1	Island Creek Coal Co.	Occidental Petroleum Corp.	Morganfield	9,200	H-CY-CT
Hamilton Mine No. 2	Island Creek Coal Co.	Occidental Petroleum Corp.	Morganfield	8,400	H-CY-CT
Ohio Mine No. 11	Island Creek Coal Co.	Occidental Petroleum Corp.	Uniontown	4,200	H-CT
Providence No. 1 Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Providence	6,500	H-CY-CT
Glenbrook Mine (No. 12)	Jericol Mining, Inc.		Holmes Mill		J-CY-CT
Glenbrook Darby Mine	Jericol Mining, Inc.		Holmes Mill	650	J-CY-CT-T
Kenmont Tipple	Kenmont Coals Inc.		Hazard		H
Feds Creek Preparation Plant	Kentland-Elkhorn Coal Corp.		Mouthcard	2,500	H-F-CT
Kencar No. 1 & Preparation Plant & Bedcor	Kentucky Carbon Corp.	Carbon Fuel Co.	Phelps	10,000	H-CY-CT-T-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Penny Plant Preparation	Kentucky Elkhorn Coals, Inc.		Virgie KENTUCKY	1,200	J-F-CT-A-W
Chester Preparation Plant	Kodak Mining	Airco Coals, Inc.	Vicco	2,100	H-CY-T
Leslie Mine	Leslie Coal Mining Co.		Sidney	8,700	H-F-CY-CT
Loftis Plant 2	Loftis Coal Co., Inc.		Toler	1,400	J-CY-CT-W
Martiki Mine Nos. 1,2,3 & 4	Martiki Coal Corp.	Mapco, Inc.	Lovely	13,000	H-F-CY-CT-T-W-D
Martin County Mines (1-C, 1-S(d) 1-S(C), 2-S 2-C & 5-B) 1-S(c)	Martin County Coal Corp.		Inez	15,000	H-F-CY-CT-T-W-D
Mary Helen Preparation Plant	Mary Helen Coal Co., Inc.	Basic American Industries, Inc.	Belfry		CY
Beaver Creek Div., (Stinson Mines)	National Mines Corp.	National Steel Corp.	Wayland	10,000	H-F-CY-CT-T-W-D
Ken Mine	Peabody Coal Co.		Beaver Dam	10,000	H
Riverview Mine	Peabody Coal Co.		Hartford	10,000	J
Chisholm Mine	Pikeville Coal Co.		Phelps		H-F-CY-CT-T
Colonial Mine	The Pittsburg & Midway Coal Mining Co.	Gulf Oil Corp.	Madisonville	10,000	J-CY-W
Paradise Mine	The Pittsburg & Midway Coal Mining Co.	Gulf Oil Corp.	Drakesboro	7,000	J
Pontiki Mine	Pontiki Coal Corp.	Mapco, Inc.	Lovely	6,500	H-F-CT-T-W
Raccoon Preparation Plant	Raccoon Elkhorn Coal Co.		Pikeville		F
Republic Mine	Republic Steel Corp.		Elkhorn City	3,500	H-CY-T-W
Richland Preparation Plant	Richland Coal Co.		Barbourville	600	H
Preparation Plant	Russell Fork Coal Co., Inc.		Elkhorn City	4,500	W
Scotia, Smith Creek, Upper Taggart & No. 3 Mines	Scotia Coal Co.	Blue Diamond Coal Co.	Cumberland	5,000	H-F-CY-CT-T-W
Scotts Branch Mine	Scotts Branch Co.		Pikeville	1,800	H-F-CY-CT-T

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation, H-Heavy Media Washer, T-Thickeners, W-Washing Tables, J-Jigs

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Shamrock Nos. 18, 18-1, 18-3	Shamrock Coal Co.		Beverly KENTUCKY	7,000	H-W
Preparation Plant	South East Coal Co.		Irvine	15,000	H-J-F-CY-CT
Mine No. 1	Southern Elkhorn Coal Corp.		Elkhorn City		J-F-CT-T-W
Mine No. 1	Sovereign Coal Co.		Phelps	3,000	J-CY-CT-T-W
Hazard Operations	Tesoro Coal Co.	Tesoro Petroleum Corp.	Hazard	14,000	H-CT
Corbin Cleaning Plant	US Steel Corp.		Corbin	8,000	H-F-CT-T-W
Shamrock Mine	Weirs Creek Coal Co.		Providence		J
Mettiki Mine	Mettiki Coal Co.	Mapco, Inc.	Deer Park MARYLAND		F-CY-CT-T
Bee Vee Mine	Associated Electric Cooperative, Inc.		Macon MISSOURI	3,500	J
Mine Nos. 1,2,3 & 4	Missouri Mining, Inc.	American Industries & Resources Corp.	Unionville	3,000	F-CY-CT
Tebo Mine	Peabody Coal Co.		Calhoun		J
Bee Vee Mine	Peabody Coal Co.		Macon	3,500	J
York Canyon Mine	Kaiser Steel Corp.		Raton NEW MEXICO	6,000	H-F-CY-CT-T
Muskingum Mine	Central Ohio Coal Co.	Ohio Power Co. (AEP)	Cumberland OHIO	11,000	J-CT-T
Georgetown Preparation Plant No. 19	Consolidation Coal Co.	Continental Oil Co.	Cadiz	12,000-14,000	J-CY-CT-W
Vail Mine (Northern Div. Freeport	Island Creek Coal Co.	Occidental Petroleum Corp.	Freeport		H-CT-T

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Powhatan No. 6	Nacco Mining Co.		Alledonia OHIO	11,000	J-CY-CT-T
Powhatan No. 1 Mine	North American Coal Corp.		Powhatan Point		H
Powhatan No. 3 Mine	North American Coal Corp.		Powhatan Point		H
Powhatan No. 5 Mine	North American Coal Corp.		Powhatan Point		J-T
Saginaw Mining Co. Mine	Oglebay Norton Co.		St. Clairsville	4,500	H
Sunnyhill Mine	Peabody Coal Co.		New Lexington	6,000	J
Powhatan No. 4 Mine	Quarto Mining Co.	North American Coal Corp.	Powhatan Point	7,500	J-CY-CT-T
Powhatan No. 7 Mine	Quarto Mining Co.	North American Coal Corp.	Powhatan Point	8,400	J-CY-CT-T
Meigs Mine No. 1	Southern Ohio Coal Co.	Ohio Power Co. (AEP)	Athens	18,850	H-CT-T
Raccoon Mine No. 3	Southern Ohio Coal Co.	Ohio Power Co. (AEP)	Athens	7,000	J-CY-CT-T
Allison Mine	Younglogheny & Ohio Coal Co.	Panhandle Eastern Pipeline Co.	Beallsville	10,000	J
Nelms Mine No. 1	Younglogheny & Ohio Coal Co.	Panhandle Eastern Pipeline Co.	Cadiz	7,000	J
Porum Mine	Carbonex Coal Co.	Petroleum Reserve Corp.	Porum OKLAHOMA	500	H-CY
Welch Mine	Cherokee Coal Co.		Welch	600	J
Black Diamond	Fuel Dynamics, Inc.		Chelsea		H
Mine No. 1	Pelton Resources, Inc.	Pelton Enterprises, Inc.	Tulsa	2,000	H-J-F-CY-T
Cadogan Preparation Plant	Allegheny River Mining Co.	Arthur T. Walker Estate Corp.	Kittanning PENNSYLVANIA	2,000	H-CY-CT-T
Russell 2 Mine	Aloe Coal Co.		Imperial	1,400	H-CY-CT-W
Van Tipple	Avery Coal Co. Inc., Affil. Virginia Iron, Coal & Coke Co.	Bates Manufacturing, Inc.	Philipsburg	7,000	J-CT
Cook's Run Tipple	Avery Coal Co. Inc., Affil. Virginia Iron, Coal & Coke Co.	Bates Manufacturing, Inc.	Philipsburg	7,000	J-CY-CT

1 Same as operating/managing company unless otherwise noted

2 A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Lancashire 20 Mine & Preparation Plant	Barnes & Tucker Co.	Alco Standard Corp.	Barnesboro PENNSYLVANIA	3,500	H-F-CY-CT-T
Lancashire 24 B & D Mine & Preparation Plant	Barnes & Tucker Co.	Alco Standard Corp.	Barnesboro	4,000	J-F-CY-CT-T-W
Lancashire 25 Mine & Preparation Plant	Barnes & Tucker Co.	Alco Standard Corp.	Barnesboro	3,500	H-F-CY-CT-T
Preparation Plant No. 3	Benjamin Coal Co.		LaJose	3,500	H-A
Preparation Plant No. 6	Benjamin Coal Co		LaJose	3,500	A
Brookdale No. 77 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Mineral Point	200	F-CY-CT-T
Cambria Slope No. 33 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Ebensburg	5,005	F-CY-CT-T
Butler No. 91 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Saxonburg	700	H-CT-W
Ellsworth No. 51 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Eighty Four	2,300	H-F-CT-T
Marianna No. 58 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Eighty Four	2,800	J-F-CT-T
Somerset No. 60 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Eighty Four	2,100	J-F-CT-T
Bigler Refinery Plant	Bradford Coal Co., Inc.		Bigler	2,500	H
Bull Run Mine Nos. 1164-3,4,5	Bull Run Coal Co.		Clearfield	2,000	CY
Piney Run Tipple	C & K Coal Co.	Gulf Resources & Chemicals Corp.	Clarion	7,000	J-CT
Rimersburg Tipple	C & K Coal Co.	Gulf Resources & Chemicals Corp.	Clarion	7,000	J-CT
Fallentimber Tipple	Cambria Coal Co.		Clarion	7,000	J
David Mine & Canterbury Cleaning Plant	Canterbury Coal Co.		Avonmore	5,000	H-J-F-CY-CT-T
DiAnne Mine & Cleaning Plant	Canterbury Coal Co.		Avonmore	175	H-J-F-CY-CT-T

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
			PENNSYLVANIA		
Strip Mine No. 618-6	The Cardinal Mining Co.		Friedens	2,500	CY-CT-T-W
Mahoning Creek Mines	Carpentertown Coal & Coke Co.	Sharm Steel Co.	Templeton	1,000	H
Rockwood Tipple	Casselman Coal Sales Co.		Rockwood	1,100	F-CY-CT-T
Mine Nos. 343-19, 20, 24, 25 & 1403-3, 4, 5, 6, 8, 9, 10, 12, 15, 17 & 20	Champion Coal Co., Inc.		Punxsutawney	1,200	H
Mine Nos. 1423-1 & 2	Chernicky Coal Co., Inc.		Shippenville	3,000	J-CT
Mine Nos. 45-12, 13, 14, 16 & 17	Coal Junction Coal Co.		Friedens	350	J-CY
Renton Mine	Consolidation Coal Co.	Continental Oil Co.	Renton	2,200	H-J-F-CY-T-W
Champion 1 Plant	Consolidation Coal Co.	Continental Oil Co.	Imperial		J-W
Sugar Camp Mines	Doverspike Bros. Coal Co.		Punxsutawney	5,000	H-F-CT-T
Warwick Mine Nos. 2 & 3	Duquesne Light Co.		Greensboro	18,000	H-CY-CT-T
Colver Mine & Plant	Eastern Assoc. Coal Corp.		Colver	3,000	H-CY-A
Delmont Plant	Eastern Assoc. Coal Corp.		Hunker	2,000	J-A
Strip Mine No. 1	Adam Eidemiller, Inc.		Greensburg	3,000	J-CY-CT-T-W
Plant No. 1	M. F. Fetterolf Coal Co., Inc.	M. F. Land Co., Inc.	Boswell	5,600	H-CT-T-W
Plant No. 3	M. F. Fetterolf Coal Co., Inc.	M. F. Land Co., Inc.	Boswell	7,000	H-F-CY-CT-T
Florence Mine No. 1	Florence Mining Co.	North American Coal Corp.	Seward	2,800	A
Florence Mine No. 2	Florence Mining Co.	North American Coal Corp.	Seward	800	A
Glacial Mine 1, 2, 3, 4, 5, 6 & Washing Facility	Glacial Minerals, Inc.		Clarion	4,800	H-CY-CT
North & South Mines	Greenwick Collieries	Pennsylvania Mines Corp.	Ebensbury	13,000	J-CY-CT-T
Harmar Mine & Preparation Plant	Harmar Coal Co.		Pittsburg	700	H-F-A-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Homer City Mine	Helen Mining Co.	North American Coal Co.	Homer City PENNSYLVANIA	2,400	A
Homer City Coal Cleaning Plant	Iselin Preparation Co.		Homer City	20,000	H-CY-CT-T-W
Bird No. 2 & 3 Mines	Island Creek Coal Co.	Occidental Petroleum Corp.	Tire Hill	4,700	H-F-CY-CT-T-W
Glenside Preparation Plant	James Coal Mining Co.		Starford		A
Eureka Mine No. 40	Jandy Coal Co., Inc.		Scalp Level	1,500	H-CY-CT-T-W
Mine Nos. 1, 2 & Preparation Plant	Johnstown Coal & Coke Co.		Glen Campbell	3,000	H-CT-T-W
Vesta Preparation Plant	Jones & Laughlin Steel Corp.	LTV Corp.	La Belle	16,000	H-F-CY-CT-T-W
Nemacolin Mine & Preparation Plant	Jones & Laughlin Steel Corp.	LTV Corp.	Nemacolin	5,800	H-F
Emerald Mine No. 1 & Preparation Plant	Jones & Laughlin Steel Corp.	LTV Corp.	Waynesburg	1,700	CY-CT-T
Shannopin Mine	Jones & Laughlin Steel Corp.	LTV Corp.	Bobtown	1,200	J
Margaret Refuse Recovery	Kent Coal Mining Co.		Indiana	300	J-CY-CT
Reesedale Preparation Plant	Kitt Coal Co., Inc.		Adrian	2,500	J-CY
Stott No. 1 Mine	Lady Jane Collieries, Inc.		Philipsburg	1,400	J-CY-CT-T
Foster 65 Mine	Leechburg Mining Co.		Leechburg	2,450	H-CY-CT-W
Mathies Mine	Mathies Coal Co.		Washington	4,500	J-F-W
Mine Nos. 210-4A2, 8, 9, 10	Mays Coal Co.		Clarion	150	J
Mears Preparation Plant	Mears Coal Co.	Zapata Fuels, Inc.	Dixonville	4,000	H-CY-T-A-W
Isabella Mine	National Mines Corp.	National Steel Corp.	Isabella	4,000	J-CT
Laurel Mine	National Mines Corp.	National Steel Corp.	Library	1,640	H-F-CY-CT-T
Conemaugh No. 1 Mine	North American Coal Corp.		Seward	2,500	CY-T-A-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges. CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners. W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Oneida 4 Mine	The Oneida Mining Co.	Pennsylvania Mines Corp.	Ebensburg PENNSYLVANIA	5,000	CY-CT-T-W
Peggs Run Mine No. 2 & Cleaning Plant	Peggs Run Coal Co., Inc.		Shippingport	1,300	H-CY
Allegheny No. 2 & Cleaning Plant	Penn Allegh Coal Co., Inc.		Tarenton	1,600	H-F-CT-W
Mine Nos. 651-1, 3, 5, 6, 8, 10, 11 & Cleaning Plant	Penn Pocahontas Coal Co.		Garrett	2,400	J
Reitz Cleaning Plant No. 4	Reitz Coal Co.		Windber	2,500	H-CY-CT-T-A-W
Reitz Cleaning Plant No. 11	Reitz Coal Co.		Windber	2,500	H-CY-CT-T-A-W
Russellton Mine & Plant	Republic Steel Corp.		Russellton	3,000	A
Clyde Mine & Plant	Republic Steel Corp.		Fredericktown	6,000	H-F-CT-W
Banning No. 4 & Plant	Republic Steel Corp.		West Newton	4,000	H-F-CT-W
Rushton Mine	Rushton Mining Co.	Pennsylvania Mines Corp.	Philipsburg	3,500	H-CY-CT-T-A
Shannon Tipple	Shannon Coal Co.	Gulf Resources and Chemical Corp.	Clarion	7,000	J
Que Mahoning Coal Processing Co.	Solar Fuel Co.		Somerset	3,000	CY-CT-T
Stahlman Washery	W. P. Stahlman Coal Co.	Gulf Resources and Chemical Corp.	Clarion	7,000	J
Mine Nos. 278-16A2, 17A, 20	James Stott Coal Co., Inc.		Philipsburg	3,500	H-CY-CT-T-W
Mine Nos. 179-37, 179-31 (A2), 179-30	Sunbeam Coal Corp.		Boyers	7,000	J-F-CY-CT-T-W
Mine Nos. 553-9 (A2 & A3). 10, 12, 15	Svonavec, Inc.		Rockwood	1,920	H-F-CY-CT-T
Nan-Lee Mine	Tesone Coal Co.		Petrolla	400	H
Marion Mine & Cleaning Plant	Tunnelton Mining Co.	Pennsylvania Mines Corp.	Ebensburg	3,000	A

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Robena Mine Nos. 1, 2, 3	U.S. Steel		Greensboro PENNSYLVANIA	20,000	H-CT-T
Maple Creek Mine Nos. 1 & 2	U.S. Steel		New Eagle	15,000	H-F-CY-CT-T
Mine Nos. 1116-1, 3, 4	Universal Minerals, Inc.		Portage	7,000	H-CY-CT-W
Jones Mine Nos. 130-6, 8	Willowbrook Mining Co.		Grove City	1,000	A
Mine No. 2	Clear Creek Coal Co., Inc	Anchor Coal Co.	Monterey TENNESSEE	500	A
Matthews Mine	Consolidated Coal Co.	Continental Oil Co.	Middlesboro	6,000	H-CY-CT-T
Marthann Preparation Plant	Marthann Coal Co., Inc.		Clairfield	220	J
Mine No. 1	S. A. M. Coal Co.		Middlesboro	3,000	F
Mine No. 1	James Spur Coal Co., Inc.		Pruden		A
John Henry Mine	5M Corporation		Hurricane UTAH		J-CY-A
Central Preparation Plant	Kaiser Steel Corp.		Sunnyside	9,000	J-F-CT-T
Star Point Mine Nos. 1 & 2	Plateau Mining Co.	United Nuclear Corp.	Price	5,200	H-CY-CT-T
Gordon Creek Nos. 2 & 3	Swisher Coal Co.	General Exploration Co.	Price	3,200	J-CY-T
King Mine	United States Fuel Co.		Hiawatha	3,800	J
Wellington Preparation Plant E	US Steel Corp.		Wellington	7,500	H-F-CY-CT
Noralla Preparation Plant	Alla Ohio Valley Coals, Inc.		Wise VIRGINIA	6,000	CY-CT
Banner Mine	Banner Splashdam Coal Co., Inc.		Cincinnati	1,250	J
Beatrice Mine	Beatrice Pocahontas Co.		Keen Mountain	8,000	H-J-F-W
Mine No. 1	Black Nugget Coal Co., Inc.		Grundy		H
Mine No. 1	Black Watch/Black Diamond Coal Co.		Grundy	3,000	J-CY-CT-T-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Moss Preparation Plant 1	Clinchfield Coal Co.	Pittston Co.	Clintwood VIRGINIA	9,000	H
Moss Mine No. 2	Clinchfield Coal Co.	Pittston Co.	Dante	5,000	H-W
Moss Preparation Plant 3	Clinchfield Coal Co.	Pittston Co.	Dante	17,500	H-F-W
Virginia No 1 Mine	Eastover Mining Co.		St. Paul	900	H-F-CY-T
Mine No. 3	Harman Mining Corp.		Harman		H-F-CY-CT-T-W
Harman Mine Nos. 5, 5A & 5B	Harman Mining Corp.		Harman	3,500	H-CT-T-W
Kennedy Mine	Holston Corp.		Swords Creek		J
Virginia Pocahontas No. 1 Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Keen Mountain	8,000	H-F-CT-W
Virginia Pocahontas No. 3 Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Keen Mountain	8,000	H-F-CT-W
Virginia Pocahontas No. 4 Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Keen Mountain	8,000	H-F-CT-W
Coronet No. 2	Jewell Coal & Coke Co.		Vansant	7,500	H-F-A
Jewell No. 11 Preparation Plant	Jewell Ridge Coal Corp.	Pittston Co.	Jewell Valley	1,000	H-F-CY-CT-T
Jewell No. 12 Preparation Plant	Jewell Ridge Coal Corp.	Pittston Co	Jewell Valley	3,000	H
Jewell No. 18 Preparation Plant	Jewell Ridge Coal Corp.	Pittston Co.	Jewell Valley	3,000	H-F-CY
Mine No. 3	Lester Coal Co.	South Atlantic	Hurley	2,000	J-W
Premier Mine	New Garden Coal Corp.		Red Ash	600	J-A
Ramsey Plant	Paramont Mining Corp.	Barber Paramont Coal	Wise	12,000	H-F-CY-CT-T
Permac Mine No. 3	Permac, Inc.		Oakwood	5,000	H-F-CY-CT-T-W
Raven Anchor Preparation Plant	Raven Anchor Coal Co.		Oakwood	1,500	H-J-F-CY-CT-W
Wolfpen Mine	Southwestern Virginia Coal Corp.		Grundy	1,800	H
Virginia Coal Division	United Coal Companies		Grundy	1,400	H-F-CY-CT-T-W
Wellmore No. 4 Plant, Mine No. 1505	United Coal Companies		Leetown	2,000	H

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Wellmore No. 7 Plant, Mine No. 1225	United Coal Companies		Big Rock VIRGINIA	1,600	H-F-CY-CT-T
Wellmore No. 8 Plant, Mine No. 1225	United Coal Companies		Big Rock	5,600	H-F-CY-CT-T
Wellmore No. 11 Plant, Mine No. 1934	United Coal Companies		Richards	1,000	H-A
Wellmore No. 14 Plant, Mine No. 1465	United Coal Companies		Conaway	2,500	H
V. P. No. 5 Mine	V. P. -5 Mining Company		Keen Mountain	8,000	H-F-CT-T-W
Dale Ridge Mine	Virginia Iron, Coal & Coke Co.	Bates Manufacturing, Inc.	Coeburn	7,000	J-CT-W
Nora Mine	Virginia Iron, Coal & Coke Co.	Bates Manufacturing, Inc.	Coeburn	2,500	J
Virginia Pocahontas No. 2	Virginia Pocahontas Co.		Keen Mountain	8,000	H-F-CT-W
Richlands Coal Operation	Westbury Development Corp.	Westbury Resources, Inc.	Richlands	5,250	J
Bullitt Mine	Westmoreland Coal Co.		Big Stone Gap	8,000	H-F-CY-CT-T-W
Pine Branch Mine Nos. 1 & 2	Westmoreland Coal Co.		Big Stone Gap	2,000	H-F-CY-CT-T-W
Pine Branch Mine	Westmoreland Coal Co.		Big Stone Gap	2,000	H-F-CY-CT-T-W
Wentz Mine Nos. 1 & 1-B	Westmoreland Coal Co.		Big Stone Gap	4,000	H-F-CY-CT-T-W
Wentz No. 2 Mine	Westmoreland Coal Co.		Big Stone Gap	4,000	H-F-CY-CT-T-W
Landsburg Strip	Palmer Coking Coal Co., Inc.		Black Diamond WASHINGTON	50	H
Centralia Mine	Washington Irrigation & Development Co.	Washington Water Power	Centralia	20,000	J-CY-CT-T
Keystone No. 5 Mine	Affinity Mining Co.	Eastern Associated Coal Corp.	Sophia WEST VIRGINIA	5,000	H-F-CY
Amherst No. 1 Cleaning Plant	Amherst Coal Co.		Lundale	4,000	H-J-F-CY-CT-T-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
McGregor Cleaning Plant	Amherst Coal Co.		Yolyn WEST VIRGINIA	4,200	H-J-F-CY-CT-T-W
Tralee Preparation Plant	Amigo Smokeless Coal Co.	Pittston Co.	Wyco	2,500	H-J-F-W
Preparation Plant	Appalachian Pocahontas Coal Co.		Flat Top	4,800	H-CY
Robin Hood Div. Preparation Plant	Armco, Inc.		Twilight	6,000	H-F-CT-T
Walhonde Div. Montcoal Preparation Plant	Armco, Inc.		Montcoal	6,000	H-F-CT-T-W
Walhonde Div. Mine No. 10A & B	Armco, Inc.		Sundial	6,000	H-F-CY-CT-T
Walhonde Div. Sundial Preparation Plant	Armco, Inc.		Sundial	6,000	H-F-CY-CT-T
Badger Preparation Plant	Badger Coal Co., Inc.		Philippi	5,000	H-CT-W
Grand Badger Mine	Badger Coal Co., Inc.		Philippi		H-F-CY-CT-T
Bolair Mine	Beasley Energy Inc., Beasley Mineral Surveys		Webster Springs	1,500	J
Beckley Mine	Beckley Coal Mining Co.		Glen Daniel	6,500	H-F-T-W
No. 5-F Mine	Belva Coal Co., Inc.	Reading & Bates Offshore Drilling Co.	Van		J
Boone No. 131 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Van	1,200	H-F-CY-CT-T
Shamrock Central Cleaning Plant	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Kayford		H-F-CY-CT-T
Jelly Fork No. 81 Mine	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Drennen	600	J-CT-T
Barrackville No. 41	Bethlehem Mines Corp.	Bethlehem Steel Corp.	Barrackville	900	J-F-CY-CT
Prenter Preparation Plant	Big Mountain Coals, Inc.	Armco, Inc.	Prenter	4,000	H-F-CY-CT-T
Bishop Mines	Bishop Coal Co.	Inland Steel Co./Consol	Bishop	6,500	H-F-CY-CT-T-W
Pickens Cleaning Plant	Boden Mining Corp.		Pickens	1,200	H-CY

[1] Same as operating/managing company unless otherwise noted
[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Mine No. 5	Brady Cline Coal Co.		Summersville WEST VIRGINIA	150	H-F-CY-CT-T-W
Mine No. 8	Brady Cline Coal Co.		Summersville	50	H-F-CY-CT-T-W
Bronco Mine & Preparation Plant	Bronco Mining Co., Inc.		Kingwood	9,100	F-CY-CT-T
Lorado Preparation Plant	Buffalo Mining Co., Inc.	Pittston Co.	Lorado	4,500	J
Mark Mine	Buffalo Mining Co., Inc.	Pittston Co.	Lyburn		H-CY
K & M Mine	Burdettes Creek Coal Corp.		Rupert	200	A
Lady Dunn Preparation Plant Kanawha Div.	Cannelton Industries, Inc.	Algoma Steel Corp. Ltd	Cunnelton	7,000	H-F-A
Pocahontas Div. Preparation Plant	Cannelton Industries, Inc.	Algoma Steel Corp. Ltd	Superior	2,500	
Morton Mine, Eagle Plant and No. 43 Mine	Carbon Fuel Co.		Winifrede	5,500	H-F-CY-CT-T-W
Winifrede Nos. 6, 31, & 49, Betty Lou & Crimson Plant	Carbon Fuel Co.		Winifrede	5,300	H-F-CY-CT-T-W
Carbon Nos. 9, 20A, 27, 36, 46 and Central Cleaning Plant	Carbon Fuel Co.		Decota	7,500	H-CY-CT-T-W
Coalburg No. 2	Central Appalachian Coal Co.	Appalachian Power Co.	Montgomery	2,175	H-CT
Mine No. 2A	Chafin Coal Co.		Logan		H-CY-CT-W
Mine No. 1	Clear Creek Fuel Corp.		Rupert		A
Arkwright Mine,	Consolidation Coal Co.	Continental Oil Co.	Osage	17,200	H
Humphrey No. 7 Mine (Mt. Morris & Bowers Portals)	Consolidation Coal Co.	Continental Oil Co.	Osage	15,700	H
Blacksville No. 1 Mine	Consolidation Coal Co.	Continental Oil Co.	Wana	3,100	H-CT-T
Blacksville No. 2 Mine	Consolidation Coal Co.	Continental Oil Co.	Wana	1,000	H-CT-T

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Mine No. 95-Robinson Run	Consolidation Coal Co.	Continental Oil Co.	Shinnston WEST VIRGINIA	12,000	H-F-CT-T-W
Loveridge Mine No. 22	Consolidation Coal Co.	Continental Oil Co.	Fairview	13,000	J-CT-T-W
Mine No. 9	Consolidation Coal Co.	Continental Oil Co.	Farmington	500	J-CT-T-W
Mine No. 20-O'Donnell	Consolidation Coal Co.	Continental Oil Co.	Four States	4,200	J-CT-T-W
Williams-Mine No. 98	Consolidation Coal Co.	Continental Oil Co.	Worthington	2,500	H-CT-T-W
Ireland Mine	Consolidation Coal Co.	Continental Oil Co.	Moundsville	7,500	H-F-CY-T
McElroy Mine	Consolidation Coal Co.	Continental Oil Co.	Moundsville	3,500	H-F-CY-CT-T
Shoemaker Mine	Consolidation Coal Co.	Continental Oil Co.	Moundsville	5,000	H-F-CY-CT-T
Jenkinjones Mine	Consolidation Coal Co.	Continental Oil Co.	Jenkinjones	5,000	H-F-CY-CT-T
Pageton Preparation Plant	Consolidation Coal Co.	Continental Oil Co.	Pageton	3,700	H-CT-W
Crane Creek Mines	Consolidation Coal Co.	Continental Oil Co.	McComas	4,500	H-F-CY-CT-T-W
Turkey Gap Mine	Consolidation Coal Co.	Continental Oil Co.	Dott	3,000	H-F-CY-CT-T-W
Rowland Mine	Consolidation Coal Co.	Continental Oil Co.	Beckley	6,300	H-F-CY-CT-T-W
Amonate Mine	Consolidation Coal Co.	Continental Oil Co.	Amonate	6,600	H-F-CY-CT-T
Sycamore Mine	Crystal Alma Corp.		Williamson	1,800	H
Crystalee Mine & Preparation Plant	Crystalee Coal Co.		Sarah Ann	1,000	H-CY
Horner No. 1	D L M Coal Corp.	General Energy Corp.	Buckhannon	1,600	J-CY-CT
Mine Nos. 46-76S & 219-74S	Eagle Coal Dock Co.		Stickney		H-CY-CT
Harris Mine Nos. 1 & 2	Eastern Assoc. Coal Corp.		Bald Knob	10,000	H
Wharton No. 2 Mine	Eastern Assoc. Coal Corp.		Barrett	6,000	H-J-F
Wharton No. 4 Mine	Eastern Assoc. Coal Corp.		Barrett		F-CY-CT-T
Federal Mine 1	Eastern Assoc. Coal Corp.		Grant Town	12,500	H-J-F-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Joanne Mine	Eastern Assoc. Coal Corp.		Rachel WEST VIRGINIA	6,500	J-F-W
Keystone Mine 1	Eastern Assoc. Coal Corp.		Keystone	5,000	H-CY-CT
Federal Mine 2	Eastern Assoc. Coal Corp.		Fairview	12,500	H-CT
Keystone Mine 4	Eastern Assoc. Coal Corp.		Stotesbury	4,000	H-F-CY-CT
Sterling Smokeless Mine & Preparation Plant	Eastern Assoc. Coal Corp.		Whitby	4,000	H
Keystone Mine 2	Eastern Assoc. Coal Corp.		Herndon	4,500	H-F-CY-CT
Kopperston Mine 1 & Cleaning Plant	Eastern Assoc. Coal Corp.		Kopperston	12,000	H-J-F-CT-W
Rum Creek Preparation Plant	Elkay Mining Co.	Pittston Co.	Lyburn		H-F-CY-CT-T-W
Elkay Preparation Plant	Elkay Mining Co.	Pittston Co.	Lyburn		J
Mine 2	Gilbert Imported Hardwoods, Inc.		Gilbert	2,000	J
Lyburn Mine	Guyan Eagle Mining Co., Inc.		Huntington	800	J-CY
Mine No. 52-77S	John B. Harris, Inc.		Quinwood		H-CY-CT-W
Blue Boy Opers.-Preparation Plant	Hawley Coal Mining Corp.		Bradshaw	4,000	H-J-CT-T-W
Empire Opers.-Preparation Plant	Hawley Coal Mining Corp.		Keystone	200	H-A-W
Raleigh Preparation Plant	Hawley Coal Mining Corp.		Beckley	1,500	J-CT-W
Imperial Mine 19	Imperial Colliery Co.		Burnwell	60	H-CY-CT
Imperial Mine 11	Imperial Colliery Co.		Eskdale	150	H-F-CY-CT-T-W-W
Pond Fork Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Bob White	5,000	H-F-CY-CT-T-W
Elk Creek No. 10	Island Creek Coal Co.	Occidental Petroleum Corp.	Emmett	2,000	H-CY-CT-T-W
Guyan Mine No. 5	Island Creek Coal Co.	Occidental Petroleum Corp.	Amherstdale	4,000	J-CY-CT

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process
Coal Mountain Mine 98	Island Creek Coal Co.	Occidental Petroleum Corp.	Coal Mountain WEST VIRGINIA	4,000	H-F-W
Coal Mountain Mine 12	Island Creek Coal Co.	Occidental Petroleum Corp.	Coal Mountain	3,000	H-CY-CT-T
Mine No. 29	Island Creek Coal Co.	Occidental Petroleum Corp.	Holden	750	J
Alpine Mine Nos. 1 & 2	Island Creek Coal Co.	Occidental Petroleum Corp.	Bayard	3,500	H-F-CY-CT-T
Donegan No. 1 Plant	Island Creek Coal Co.	Occidental Petroleum Corp.	Craigsville		H-F-W
Gauley Eagle Plant No. 4	Island Creek Coal Co.	Occidental Petroleum Corp.	Craigsville	8,000	H-F-CY
North Branch Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Bayard	6,000	H
Tioga Mine	Island Creek Coal Co.	Occidental Petroleum Corp.	Craigsville	600	H-CY-CT-W
Itmann Mines	Itmann Coal Co.	National Steel/Bethlehem Steel/ Continental Oil	Itmann	9,000	H-F-CY-CT-T-W
Olga Mine & Preparation Plant	Jones & Laughlin Steel Corp.	LTV Corp.	Coalwood	6,000	H-F-CT-T-W
Dehue Mine	Jones & Laughlin Steel Corp.	LTV Corp.	Dehue	4,000	H-J-F-CY-CT-T
Juliana #1 Complex	Juliana Mining Co., Inc.		Kingswood	1,800	H-CT
Madison Mine	Kanawha Coal Co.		Ashford	3,000	H-F-CY-CT-T
Kitchekan Preparation Plant	Kitchekan Fuel Corp.	Hawley Fuel Corp.	Arista	1,600	J-CT-T-W
Preparation Plant No. 1	Leckie Smokeless Coal Co.		Rupert		H-J-W
Ann Lorentz Mine No. 1	Ann Lorentz Coal Co., Inc.		Buckhannon	3,500	H
Mine No. 131-75S	Majestic Mining, Inc.	Perini Corp.	Widen	600	H-CY-CT-T
Mine No. 1	Maple Meadow Mining Co.	Cannelton Industries, Inc.	Fairdale	7,000	H-F-CY-CT-T
Mine No. 2	Margaret Peerless Coal Co.		Summersville		H-F-CY-CT-T-W
Marrowbone Mine	Marrowbone Development Co.		Naugatuck		H-F-CY-CT-T
Hampshire Preparation Plant	Mastellar Coal Co.		Keyser		F-CY-CT-T
Central Plant No. 1	McNamee Resources, Inc.		Williamson	4,000	J-CY-CT-T

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Valley Mining Co. Mine	Mercury Coal & Coke, Inc.		Morgantown WEST VIRGINIA	500	F-CY-CT-T-W
Mine No. 3	Metco Mining Corp.		Logan	2,000	J-CY-CT-T
Milburn Mine 4	Milburn Colliery Co.		Burnwell		J-CY-CT
National Pocahontas Mine	National Mines Corp.	National Steel Corp.	Pineville	5,000	H-F-CY-CT-T
Cheat Bridge Preparation Plant	NewEra Resources, Inc.		Elkms	2,500	H-CY-CT-T
Preparation Plant No. 1	The New River Co.		Mt. Hope	2,000	H-CY-CT
Preparation Plant No. 2	The New River Co.		Mt. Hope	2,000	J
Chesterfield Mine Nos. 1, 3, 4, 5, 6	Omar Mining Co.		Madison	1,000	H-F-CY-CT-T-W
16Kingwood	Patriot Mining Co., Inc.		Kingwood	2,600	F-CY-CT-T
Preparation Plant	Pocahontas Red Ash Mining Co.		Iaeger	200	J
Jane Ann Mines 11, 17, 25 & 31	The Powellton Co.		Mallory	2,500	H
Jane Ann Mines 7b, 15a	The Powellton Co.		Mallory	2,500	H
Beckley No. 1	Ranger Fuel Corp.	Pittston Co.	Beckley	3,500	H-F-CY
Beckley No. 2	Ranger Fuel Corp.	Pittston Co.	Beckley		H-F-CY-CT-T
Bolt Preparation Plant	Ranger Fuel Corp.	Pittston Co.	Bolt	3,000	H-F-CY
Red Jacket Mine	Red Jacket Coal Co., Inc.		Red Jacket	5,000	J-CY-W
Kanes Creek Mines	Reliable Coal Corp.		Reedsville	2,000	H
Nos. 55 & 64 & Ace Mines	Robinson Phillips Coal Co.	A. T. Massey Coal Co.	Pineville	1,500	J
Royal Mine No. 5	Royal Coal Co.	United Pocahontas Coal Co.	Layland		H-F-CY-CT-T-W
Royal Mines 3, 6, 10	Royal Coal Co.	United Pocahontas Coal Co.	Beckley	5,000	H-J-F-CY-CT-T-W
Mine No. 7 & 7B	Royal Coal Co.	United Pocahontas Coal Co.	Beckley	5,000	H-F-CY-CT-T-W
Mine No. 8	Royal Coal Co.	United Pocahontas Coal Co.	Beckley		H-F-CY-CT-T-W
Premier Preparation Plant	Royalty Smokeless Coal		Premier	3,500	J-F-CY-CT-W

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, Cy-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Continued

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Harewood Mine	Semet-Solvay	Allied Chemical Corp.	Longacre WEST VIRGINIA	12,000	H-F-CY-CT-T-W
Shannon Branch Mine	Semet-Solvay	Allied Chemical Corp.	Capels	11,000	H-F-CY
Meadow River Mine & Plant	Sewell Coal Co.		Lookout	6,000	H-F-CT-T-W
Sewell No. 1 Preparation Plant	Sewell Coal Co.		Nettie	3,000	H-CY
Sewell No. 2 Tipple	Sewell Coal Co.		Nettie	1,000	H
Sewell No. 4 Preparation Plant	Sewell Coal Co.		Nettie	3,000	H-A
Central Cleaning Plant	Sharples Coal Corporation		Sharples	6,000	H-J-CT-T
Slab Fork Mine No. 8	Slab Fork Coal Co.		Slab Fork	5,600	H-F-CT-T
Slab Fork Mine No. 10	Slab Fork Coal Co.		Slab Fork	5,600	H-F-CT-T-W
Gaston Mine 2	Slab Fork Coal Co.		Alpoca	1,800	H-F-CT-W
Smith No. 1 Mine	Smith Bros. Construction Co., Inc.		Matewan	1,800	J
Hunter Mine	Smith & Stover Coal Co.		Beckley	600	H
Bull Creek No. 1	Southern Appalachian Coal Co.	Appalachian Power Co.	Marmet	10,400	J-F-CY-CT
Blue Creek Mine 7	Union Carbide Corp.		Clendenin	1,400	H-F-CY-CT-T
Blue Creek Mine 7C	Union Carbide Corp.		Clendenin	700	H-F-CY-CT-T
Algoma Preparation Plant	United Pocahontas Coal Co.		Beckley	2,000	H-F-CY-CT-T-W
Indian Ridge Central Preparation Plant	United Pocahontas Coal Co.		Beckley	2,500	H-F-CY-CT-T
Alpheus Cleaning Plant	US Steel Corp.		Gary	4,000	J-F-CY-CT-T-W
Grapevine Cleaning Plant	US Steel Corp.		Thacker		H-J-F-CY-CT-T
Pinnacle Cleaning Plant	US Steel Corp.		Pineville	3,000	H-F-CY-CT-T-W
Adrian Mine	Upshur Coals Corp.		Buckhannon	2,000	H-F-CT-T-W
Valley Camp No. 1	Valley Camp Coal Co.		Short Creek	2,500	J-CT

[1] Same operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

(continued)

Table A-1. Concluded

Plant name	Operating/managing company	Owners[1]	Location	Capacity tons/day	Process[2]
Valley Camp No. 3	Valley Camp Coal Co.		Triadelphia WEST VIRGINIA	1,500	J-T-W
Alexander Mine	Valley Camp Coal Co.		Moundsville	800	J
Preparation Plant No. 3	Valley Camp Coal Co.		Shrewsbury	6,500	J
Donaldson Mine Co./ Donaldson Prep. Plant	Valley Camp Coal Co.		Shrewsbury	8,000	J-CY-CT-T
Mine No. 4	Virginia Crews Coal Co.		Welch	400	J-F-CY-CT-T-A-W
Mine No. 2	Virginia Crews Coal Co.		Welch	400	J-F-CY-CT-T-W
Blueco No. 2 Mine	Virginia Crews Coal Co.		Welch	400	J-F-CY-CT-T-A-W
Omar Division/Omar Mine	W-P Coal Co.	Consumers Mining Corp.	Omar	4,000	H-F-CY-CT-T
Hampton Div. Mine No. 3	Westmoreland Coal Co.		Clothier	5,900	H-F-CY-CT-T-W
Hampton Div. Mine No. 4	Westmoreland Coal Co.		Clothier	600	J-F-CY-CT-T-W
Ferrell Mine	Westmoreland Coal Co.		Clothier	8,000	H-F-CY-CT-T-W
East Gulf Mine	Westmoreland Coal Co.		Eastgulf		H-J
Eccles Mine No. 5	Westmoreland Coal Co.		Eccles	2,200	H-W
Eccles Mine No. 6	Westmoreland Coal Co.		Eccles	2,000	H-W
MacAlpin Mine	Westmoreland Coal Co.		MacAlpin	1,800	H-CY
Quinwood No. 2 Mine	Westmoreland Coal Co.		Quinwood	5,000	H-J-F-CY-T-W
Clifftop Preparation Plant	Westmoreland Coal Co.		Quinwood	2,500	H-F-CY-W
Mine No. 290-71S	White Ridge Coal Co., Inc.		Shady Spring	1,500	J-CT-W
Beach Bottom Mine	Windsor Power House Coal Co.	Ohio Power Co.	Windsor Heights	2,400	H-J-T
Vanguard No. 2	Energy Development Co.	Iowa Public Service Co.	Hanna WYOMING		H-CY-CT

[1] Same as operating/managing company unless otherwise noted

[2] A-Air Tables, CT-Centrifuges, CY-Cyclones, F-Flotation Units, H-Heavy Media Washer, J-Jigs, T-Thickeners, W-Washing Tables

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This study has reviewed and assessed the need to revise the new source performance standards (NSPS) for coal preparation plants. These standards limited particulate emissions or opacities from pneumatic coal cleaning equipment, coal dryers, coal processing and conveying, coal storage, and coal transfer and loading.

Control device performances have not changed enough to justify changing the particulate standards. Emissions of SO_2 are too small to justify setting standards for this pollutant. EPA plans to investigate coal storage piles and unloading stations as unregulated sources of potential particulate fugitive emissions.

17. KEY WORDS AND DOCUMENT ANALYSIS

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