REGULATORY ECONOMIC ANALYSIS

FOR

FINAL RULE ON ASBESTOS EXPOSURE LIMIT

RIN: 1219-AB24

U.S. Department of Labor
Mine Safety and Health Administration
Office of Standards, Regulations, and Variances

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I. EXECUTIVE SUMMARY

INTRODUCTION

The Mine Safety and Health Administration (MSHA) is revising its existing health standards for metal and nonmetal mines, and surface coal mines (including surface areas of underground coal mines) to reduce the permissible exposure limits (PELs) for asbestos. Exposure to asbestos has been associated with lung and other cancers, mesothelioma, and asbestosis. The final rule will help assure that no miners who work in an environment where asbestos is present will suffer material impairment of health or functional capacity over their working life.

Based on the Agency's analysis of compliance costs, MSHA has determined that the rule will not have an annual impact of $100 million or more on the economy and that, therefore, it is not an economically significant regulatory action pursuant to § 3(f)(1) of Executive Order 12866.

BENEFITS SUMMARY

As discussed in Chapter III of this Regulatory Economic Analysis (REA), the lowering of the permissible exposure limit (PEL) will prevent one death that would have occurred based on existing exposure levels. In addition, lowering the excursion limit will prevent one death for every 1,000 miners exposed to brief, high-concentration fiber releases. MSHA expects this lowering of the death rate due to the decrease in occupational exposure to asbestos to occur between 10 and 65 years after the implementation of the final rule.

COMPLIANCE COST SUMMARY

The final rule will result in total yearly costs, combined for coal and metal and nonmetal mines, of approximately $201,000 per year. For metal and nonmetal mines, the cost will be approximately $156,000 and, for coal mines, approximately $45,000. These costs amount to less than 0.001 percent of the yearly revenues of the mines covered by the final rule.

REGULATORY FLEXIBILITY CERTIFICATION AND ANALYSIS

In accordance with section 605 of the Regulatory Flexibility Act (RFA), MSHA certifies that the final rule will not have a significant economic impact on a substantial number of small entities. Under the Small Business Regulatory Enforcement Fairness Act (SBREFA) amendments to the RFA, MSHA must include in the final rule a factual basis for this certification. The Agency must also publish the regulatory flexibility certification statement in the Federal Register, along with its factual basis. The analysis that provides the factual basis for this certification is discussed in Chapter V of this document and is included in the preamble to the final rule for publication in the Federal Register. MSHA believes that the analysis provides a reasonable basis for this certification. MSHA also has consulted with the Small Business Administration's (SBA's) Office of Advocacy.

II. INDUSTRY PROFILE

INTRODUCTION

This industry profile provides information concerning the structure and economic characteristics of the mining industry, which includes data about the number of mines and miners by type and size of mine. These data are from the U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2006 data.[1]

The value of the U.S. mining industry's 2006 coal and metal and nonmetal production was estimated to be approximately $91.4 billion, or 0.69 percent of the U.S. 2006 Gross Domestic Product (GDP).[2] Coal mining contributed approximately $27.0 billion to the GDP, while the metal and nonmetal mining sector contributed approximately $64.4 billion.[3]

STRUCTURE OF THE MINING INDUSTRY

MSHA divides the mining industry into two major sectors based on commodity: (1) coal mines and (2) metal and nonmetal mines. These two sectors are further divided by operation type (e.g., underground mines or surface mines). The Agency maintains its own data on the number of mines and on mining employment by mine type and size. MSHA also collects data on the number of independent contractors and contractor employees by mining sector.

MSHA categorizes mines by size based on employment. For purposes of the final rule, MSHA has categorized mines into three groups. These are mines that employ: 1-19 employees; 20-500 employees; and 501+ employees. For the past 20 years, for rulemaking purposes, the Agency has consistently defined a small mine to be one with fewer than 20 employees and a large mine to be one with 20 or more employees. However, to comply with the requirements of the SBREFA amendments to the RFA, MSHA must use the SBA's criteria for a small entity when determining a rule's economic impact. For the mining industry, SBA defines a small mine as one employing 500 or fewer employees and a large mine as one that employs more than 500 workers. Thus, combining the first two MSHA mine categories noted above will meet the SBA's definition of a small mine.

Table II-1 presents the number of small and large coal mines and their employment, excluding contractors, for the coal mining sector by mine type. The table

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[1] 7/11/07 Teradata run.

[2] The average U.S. price of underground and surface coal for 2005 is from the Department of Energy (DOE), Energy Information Administration (EIA), *Annual Coal Report 2005*, October 2006, Table 28, page 56.

[3] U.S. Department of the Interior, U.S. Geological Survey, *Mineral Commodity Summaries 2007*, January 2007, pp. 7-8.

presents the three mine size categories based on employment: (1) 1-19 employees (MSHA's traditional small mine definition); (2) 20-500 employees; and (3) 501+ employees. In addition, it shows that, of all coal mines, 32 percent are underground mines employing 52 percent of miners, while 68 percent are surface mines employing 48 percent of miners.

Table II-1: Distribution of Coal Mine Operations and Employment (Excluding Contractors) by Mine Type and Size, 2006

Mine Type	Size of Coal Mine: 1-19 Employees			20-500 Employees			501+ Employees			All Coal Mines		
	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.
Underg.	236	2,313	73	420	32,808	973	13	7,490	146	669	42,611	1,192
Surface	937	5,947	427	502	29,818	2,026	5	3,609	63	1,444	39,374	2,516
Total	1,173	8,260	500	922	62,626	2,999	18	11,099	209	2,113	81,985	3,708

Table II-2 presents the total number of small and large mines and their employment, excluding contractors, for the metal and nonmetal mining segment. The metal and nonmetal mining segment consists of metal mines (copper, iron ore, gold, silver, etc.) and nonmetal mines (stone including granite, limestone, dolomite, sandstone, slate, and marble; sand and gravel; and others, such as clays, potash, soda ash, salt, talc, and pyrophyllite.) As Table II-3 indicates, 98 percent of all metal and nonmetal mines are surface mines employing 91 percent of all metal and nonmetal employees, while 2 percent are underground mines employing 9 percent of all employees (excluding office employment).

Table II-2: Distribution of Metal and Nonmetal Mine Operations and Employment (Excluding Contractors) by Size of Operation, 2006

Contr. Type	Size of Metal and Nonmetal Mine: 1-19 Employees			20-500 Employees			501+ Employees			All Metal and Nonmetal Mines		
	Firms	Emp.	Office Emp.	Firms	Emp.	Office Emp.	Firms	Emp.	Office Emp.	Firms	Emp.	Office Emp.
Underg.	121	789	141	130	10,356	1,325	5	3,202	181	256	14,347	1,647
Surface	10,835	53,708	10,348	1,664	77,041	13,071	17	12,754	1,661	12,516	143,503	25,080
Total	10,956	54,497	10,489	1,794	87,397	14,396	22	15,956	1,842	12,772	157,850	26,727

Table II-3 presents data on the number of independent coal and metal and nonmetal contractors, and their employment. Table II-3 shows that, of all contractor firms, approximately 37 percent are coal contractors and 63 percent are metal and nonmetal contractors; and of all contractor employment (excluding office employment), approximately 40 percent are coal employees and 60 percent are metal and nonmetal employees.

Table II-3: Distribution of Coal and Metal and Nonmetal Mine Contractor Employment by Size of Operation, 2006

Contr. Type	Size of Contractor									All Contractors		
	1-19 Employees			20-500 Employees			501+ Employees					
	Firms	Non-Office Emp.	Office Emp.	Firms	Non-Office Emp.	Office Emp.	Firms	Non-Office Emp.	Office Emp.	Firms	Non-Office Emp.	Office Emp.
Coal	2,314	11,048	621	410	24,417	1,196	0	0	0	2,724	35,465	1,817
Metal and Nonmetal	4,091	19,700	838	592	31,825	1,517	3	0	108	4,686	53,482	2,463
Total	6,405	30,748	1,459	1,002	56,242	2,713	3	0	108	7,410	88,947	4,280

STRUCTURE OF THE COAL MINING INDUSTRY

Agency data in Table II-1 indicate that there were 2,113 coal mines that reported production during some portion of calendar year 2006. When applying MSHA's small mine definition (1-19 employees), 1,173 (approximately 56 percent) were small mines and 940 (approximately 44 percent) were large mines. Using SBA's small mine definition, 18 mines (0.8 percent) were large mines and the rest were small mines.

Coal mine employment in 2006 was 85,693, of which 81,985 were miners and 3,708 were office workers. Based on MSHA's small mine definition, 8,260 coal miners (approximately 10 percent) in 2006 worked at small mines and 73,725 miners (approximately 90 percent) worked at large mines. Using SBA's small mine definition, 70,886 coal miners (approximately 86 percent) worked at small mines and 11,099 coal miners (approximately 14 percent) worked at large mines. Based on the Agency's small mine definition, on average, each small coal mine employs 7 miners and each large coal mine employs 78 miners. Using SBA's small mine definition, on average, each small coal mine employs 34 miners and each large coal mine employs 617 miners.

ECONOMIC CHARACTERISTICS OF THE COAL MINING INDUSTRY

MSHA classifies the U.S. coal mining sector into three major commodity groups: bituminous, lignite, and anthracite.[4] Bituminous operations represent approximately 91 percent of coal mining operations, employ 94 percent of all coal miners, and account for 93 percent of total coal production. Lignite operations represent approximately 1 percent of coal mining operations, employ 4 percent of all coal miners, and account for 7 percent of total coal production. For the purpose of this analysis, MSHA combines lignite coal with bituminous coal. Anthracite operations represent approximately 8 percent of coal mining operations, employ 1 percent of all coal miners, and account for 0.1 percent of total coal production.

The U.S. coal sector produced approximately 1.16 billion short tons of coal (0.804 billion tons at surface mines and 0.359 billion tons at underground mines) in 2006. The

[4] This categorization is based on MSHA-collected data grouped by SIC code description. Some publications of the U.S. Department of Energy further divide the bituminous group into bituminous coal and sub-bituminous coal.

average price of coal at surface and underground mines was $17.37 and $36.42 per ton, respectively. The average open market U.S. sales price of underground and surface coal for 2005 is from the Department of Energy (DOE), Energy Information Administration (EIA), *Annual Coal Report 2005*, October 2006, Table 28, page 56. Underground and surface coal revenues were computed separately, then summed to obtain total coal revenue. Surface coal mines accounted for $14 billion of revenues and underground coal mines accounted for $13 billion, for a total of $27 billion. Based on MSHA's definition, small mines produced 28.8 million tons, valued at approximately $0.649 billion. Based on SBA's definition, small mines produced 818 million tons, valued at $18.6 billion, or approximately 70 percent of coal production and approximately 70 percent of coal revenues.

THE STRUCTURE OF THE METAL/NONMETAL MINING INDUSTRY

The metal and nonmetal mining sector consists of approximately 80 different commodities including industrial minerals. Agency data in Table II-2 indicate that there were 12,772 metal and nonmetal mines in the U.S. in 2006, of which 10,956 (86 percent) were small mines and 1,816 (14 percent) were large mines, using MSHA's traditional definition of small and large mines. Based on SBA's definition, only 22 metal and nonmetal mines (0.17 percent) were large mines.

Employment at metal and nonmetal mines in 2006 was 184,577, of which 64,986 workers (35 percent) were employed by small mines and 119,591 workers (65 percent) were employed by large mines (excluding contractor workers), using MSHA's definition. Based on SBA's definition, 166,779 workers (90 percent) were employed by small mines and 17,798 workers (10 percent) were employed by large mines (excluding contractor workers). Using MSHA's definition, the average employment is 6 workers at a small metal and nonmetal mine and 66 workers at a large metal and nonmetal mine. Using SBA's definition, there is an average of 13 workers in each small metal and nonmetal mine and 809 workers in each large metal and nonmetal mine.

Metal Mining

There are approximately 24 metal commodities mined in the U.S. Underground metal mines use a few basic mining methods, such as room and pillar and block caving. All these mines, small and large, rely heavily on powered production and support equipment. Surface metal mines normally include drilling, blasting, loading, and hauling; such processes are typical in all surface mines, irrespective of commodity types. Surface metal mines in the U.S. rank among some of the largest mines in the world.

Metal mines constitute 2 percent of all metal and nonmetal mines and employ 18 percent of all metal and nonmetal miners. Under MSHA's traditional definition of a small mine, 56 percent of metal mines are small, and these mines employ 3 percent of all miners working in metal mines. Using SBA's definition, 94 percent of metal mines are small, and they employ 54 percent of all miners working in metal mines.

Stone Mining

In the stone mining subsector, there are eight different stone commodities, of which seven are further classified as either dimension stone or crushed and broken stone. Stone mining in the U.S. is predominantly done by quarrying, with only a few slight variations. Crushed stone mines typically drill and blast, while dimension stone mines generally use channel burners, drills, or wire saws. Powered haulage is used to transfer the broken rock from the quarry to the mill where crushing and sizing are done.

Stone mines constitute 36 percent of all metal and nonmetal mines, and they employ 45 percent of all metal and nonmetal miners. Using MSHA's definition of a small mine, 76 percent of stone mines are small, and these mines employ 32 percent of all miners working in stone mines. Using SBA's definition, 99.98 percent of stone mines are small, and they employ 99 percent of all miners working in stone mines.

Sand & Gravel Mining

Sand and gravel, for construction, is generally extracted from surface deposits using dredges or draglines. Further preparation involves washing and screening. As in other surface mining operations, sand and gravel uses front-end loaders, trucks, and bulldozers for haulage. The preparation of industrial sand and ground silica involves the use of crushers, ball mills, vibrating screens, and classifiers.

The sand and gravel subsector represents the single largest commodity group in the U.S. mining industry based on the number of mining operations. Sand and gravel mines comprise 56 percent of all metal and nonmetal mines, and they employ 25 percent of all metal and nonmetal miners. Using MSHA's definition of a small mine, 95 percent of sand and gravel mines are small, and these mines employ 74 percent of all miners working in sand and gravel mines. Using SBA's definition, 100 percent of sand and gravel mines are small, and they employ 46,361 miners.

Other Nonmetal Mining

For enforcement and statistical purposes, MSHA separates stone and sand and gravel mining from other nonmetal mining. There are approximately 35 other nonmetal commodities, not including stone and sand and gravel. Nonmetal mining uses a wide variety of underground mining methods such as continuous mining (similar to coal mining), in-situ retorting, block caving, and room and pillar. As with underground mining, there is a wide range of mining methods used by surface mining in extracting minerals. In addition to drilling and blasting, other mining methods, such as evaporation and dredging, are also used. The mining method is dependent on the geologic characteristics of the ore and host rock. Some nonmetal operations use kilns and dryers in ore processing. Ore crushing and milling are processes common to both nonmetal and metal mining.

"Other" nonmetal mines comprise 6 percent of all metal and nonmetal mines, and they employ 12 percent of all metal and nonmetal miners. Using MSHA's definition of a small mine, 69 percent of other nonmetal mines are small, and they employ 14 percent of all miners working in these nonmetal mines. Using SBA's definition, 99.6 percent of other nonmetal mines are small, and they employ 91 percent of all miners working in these nonmetal mines.

ECONOMIC CHARACTERISTICS OF THE METAL/NONMETAL MINING INDUSTRY

The value of all metal and nonmetal mining output in 2006 was estimated at $64.4 billion. Metal mines, which include copper, gold, iron, lead, silver, tin, and zinc mines, contributed $23.5 billion. Nonmetal production was valued at $40.9 billion: $13.4 billion from stone mining, $8.7 billion from sand and gravel, and $18.8 billion from other nonmetals such as potash, clay, and salt.[5]

The end uses of metal and nonmetal mining output are diverse. For example, iron and aluminum are used to produce vehicles and other heavy duty equipment, as well as consumer goods, such as household equipment and soft drink cans. Other metals, such as uranium and titanium, have more limited uses. Nonmetals, like cement, are used in construction while salt is used as a food additive and for road de-icing in the winter. Soda ash, phosphate rock, and potash also have a wide variety of commercial uses. Stone and sand and gravel are used in numerous industries and extensively in the construction industry.

[5] U.S. Department of Interior, U.S. Geological Survey, *Mineral Commodity Summaries 2007,* January 12, 2007, pp. 8, 138, 140, 154, and 156.

III. BENEFITS

INTRODUCTION

The final rule will reduce diseases arising from exposure to asbestos, and the associated costs to employers, miners' families, and society at large. Exposure to asbestos can cause lung cancer; mesothelioma; gastrointestinal cancer; cancers of the larynx, pharynx, and kidneys; asbestosis; and other respiratory diseases. These asbestos-related diseases cause a material impairment of human health or functional capacity.

This benefits analysis quantifies the reduction in expected deaths to miners resulting from reduced exposure to airborne asbestos. The benefits are a result of reducing the 8-hour time weighted average (TWA) permissible exposure limit (PEL) from 2 fibers per cubic centimeter (f/cc) to 0.1 f/cc. MSHA acknowledges that this change will not eliminate the risk of asbestos-related material impairment of health. (See Table III-1.)

Based on MSHA's sampling data, MSHA estimates that one death (5 deaths per 1,000 exposed miners) could be prevented, a reduction of 12 percent in expected miner deaths based on existing exposure levels. This death would have been likely to occur between 10 and 65 years from now, a 55-year period. MSHA has no empirical data on short-term asbestos exposures. Based on theoretical models, however, MSHA has estimated that by lowering the excursion limit, one additional death could be prevented within the same 55 year period for every 1,000 miners exposed to short-term bursts of airborne asbestos.

Miners encounter asbestos during various occupational tasks. Miners who work near ore or surrounding earth that contains asbestos may cause the asbestos to become airborne simply by disturbing the ore or surrounding earth. Further, milling operations may transform asbestiform minerals in bulk ore into airborne fibers. In some geologic formations, naturally occurring asbestos may be found in isolated pockets and can be avoided using selective general mining strategies. In other geologic formations, asbestos may be evenly distributed throughout the ore. It is more difficult to manage the hazard in this type of situation.

OVERVIEW OF DOSE-RESPONSE MODELS DEVELOPED FOR OSHA'S ASBESTOS RISK ASSESSMENT

Based on epidemiological studies, OSHA's risk assessment presents estimates of asbestos potency with respect to causing lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis. OSHA initially developed its quantitative risk assessment in 1983 for its 1986 asbestos final rule, which lowered the PEL to 0.2 f/cc.[6] The risk assessment supported the 1988 final rule establishing an

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[6] Nicholson, W. J., *Quantitative Risk Assessment for Asbestos-Related Cancers*. Prepared for the United States Department of Labor Occupational Safety and Health Association. Contract J.9.F.2.0074. Washington, D.C., 1983. OSHA's 1986 Final Rule on Asbestos 51 FR 22612; OSHA's 1988 Final Rule on Asbestos 53 FR 35609; OSHA's 1994 Final Rule on Asbestos 59 FR 40964; and Benefits Assessment of Emergency Temporary and Proposed Asbestos Standard, JRB Associates, November 3, 1983.

excursion level and the 1994 final rule establishing the PEL at 0.1 f/cc. MSHA applies these estimated lifetime risks to its estimates of miners' asbestos exposures. MSHA believes that the risk assessment model used for the OSHA asbestos rulemakings is generally accepted, reasonable, and well-supported.

Cancer

MSHA used OSHA's linear no-threshold, dose-response model to calculate the reduction of asbestos-related cancer deaths among miners as a result of lowering the PEL.[7] OSHA estimated cancer mortality rates for workers exposed to asbestos based on cumulative exposures to varying concentrations of asbestos, by age and duration of exposure. These data were published in OSHA's 1986 final rule (51 FR 22644), and are reproduced in Table III-1. The data reveal that the estimated mortality from asbestos-related cancer is nearly linear, i.e., as exposure decreases, disease incidence goes down proportionately.[8] Accordingly, MSHA interpolates linearly when considering a concentration between the values published in Table III-1.

Table III-1 shows the predicted excess lifetime risk of asbestos-related lung cancer, mesothelioma, and gastrointestinal cancer. OSHA derived the excess mortality rates using—

- Fiber concentrations of 0.1, 0.2, 0.5, 2, 4, 5, and 10 f/cc,
- Exposure time periods of 1, 20, and 45 years,
- First exposure to asbestos occurring at age 25,
- Dose-response models, and
- 1977 U.S. male background lung cancer mortality rates.

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[7] Nicholson, 1983.

[8] Nicholson, 1983, p. 53.

Table III-1: Estimated Asbestos-Related Cancer Mortality per 100,000 by Number of Years Exposed and Exposure Level*

Asbestos Fiber Concentration (fiber/ml)	Cancer Mortality per 100,000 Exposed			
	Lung[A]	Mesothelioma[B]	Gastrointestinal[C]	Total
1-year exposure				
0.1	7.2	6.9	0.7	14.8
0.2	14.4	13.8	1.4	29.6
0.5	36.1	34.6	3.6	74.3
2.0	144	138	14.4	296.4
4.0	288	275	28.8	591.8
5.0	360	344	36.0	740.0
10.0	715	684	71.5	1,470.5
20-year exposure				
0.1	139	73	13.9	225.9
0.2	278	146	27.8	451.8
0.5	692	362	69.2	1,123.2
2.0	2,713	1,408	271.3	4,392.3
4.0	5,278	2,706	527.8	8,511.8
5.0	6,509	3,317	650.9	10,476.9
10.0	12,177	6,024	1,217.7	13,996.7
45-year exposure				
0.1	231	82	23.1	336.1
0.2	460	164	46.0	670.0
0.5	1,143	407	114.3	1,664.3
2.0	4,416	1,554	441.6	6,411.6
4.0	8,441	2,924	844.1	12,209.1
5.0	10,318	3,547	1,031.8	14,896.8
10.0	18,515	6,141	1,851.5	26,507.5

* Originally published in 51 FR 22644 as a part of OSHA's asbestos risk assessment and used in subsequent rulemakings.

[A] *Lung Cancer (Relative Risk Model):*

$R_L = R_E \times [1 + (K_L \times f \times d_{t-10})]$

Where:

R_L = Predicted lung cancer mortality.
R_E = Expected lung cancer mortality in the absence of asbestos exposure.
K_L = Slope of the dose-response relationship for lung cancer ($K_L = 0.01$).
f = Asbestos fiber concentration (f/cc).
d_{t-10} = Duration of the exposure (subtracting 10 years to account for latency).

[B] *Mesothelioma (Absolute Excess Risk Model):*

When $t > 10+d$, $AR_M = f \times K_M \times [(t-10)^3 - (t-10-d)^3]$
When $10+d > t > 10$, $AR_M = f \times K_M \times (t-10)^3$
When $10 > t$, $AR_M = 0$

Where:

AR_M = Excess mortality from mesothelioma.

f = Asbestos fiber concentration (fibers/cc).
K_M = The proportionality constant that is a measure of the mesothelioma carcinogenic potency (slope of the dose-response curve) ($K_M = 1 \times 10^{-8}$).
d = Duration of exposure in years.
t = Time after first exposure in years.

Note that "d" and "t" represent different periods of time. The duration of exposure (d) may stop after a few years and remain constant thereafter, while the time after first exposure (t) will continue to accumulate.

c *Gastrointestinal Cancer:*

OSHA estimated the risk of gastrointestinal cancer to be 10 percent of the lung cancer risk.

$R_G = 0.1 \times R_L$

Where:
R_G = Predicted gastrointestinal cancer mortality.
R_L = Predicted lung cancer mortality.

Asbestosis

Initially, federal exposure limits to asbestos targeted the reduction of asbestosis. The reduction of asbestosis, associated with exposure to relatively high levels of asbestos, results in workers living long enough to develop cancer. Based on Finkelstein's data, the slope of the linear regression is 0.055 for asbestosis.[9] This model assumes a no-threshold, dose-response relationship.

Asbestosis (Lifetime Incidence Model):

$R_A = m \times f \times d$

Where:
R_A = Predicted lifetime incidence of asbestosis.
m = Slope of the linear regression.
f = Asbestos fiber concentration (fibers/cc).
d = Duration of the exposure.

The following discussion of the benefits associated with a further reduction in exposures focuses on cancer cases prevented within the exposed mining work force. MSHA has not projected benefits of the final rule on reduced cases of asbestosis.

MSHA'S APPLICATION OF OSHA'S RISK ASSESSMENT

MSHA estimated the benefits of reduced exposure by comparing two groups of workers under the assumption that they either have always been exposed to the levels described in Table III-1, or will be exposed to the lowest levels of asbestos currently observed in specific mines. This approach parallels a common method used in the field of economics called comparative statics analysis, which compares two equilibrium positions when it is not analytically possible to examine the full dynamics of a process over time.[10]

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9 Finkelstein, M. M., "Asbestos in Long-Term Employees of an Ontario Asbestos-Cement Factory," *American Review of Respiratory Disease*. 125:496-501, 1982.

10 Nicholson, Walter. 1972. *Microeconomic Theory*. Hinsdale, Illinois: Dryden Press. Pages 71-72.

Exposures to airborne fibers during mining operations are variable. Based on MSHA's sampling data, concentrations ranged between 0.0 and 38.1 f/cc over the past seven and a quarter years. The highest concentration level in Table III-1 is 10 f/cc. MSHA's calculations, therefore, use an upper exposure limit of 10 f/cc. Samples with exposure concentrations above 10 f/cc are included in this benefits analysis as 10 f/cc.

Because of the limitations of PCM analysis, i.e., not distinguishing fiber mineralogy, MSHA conducts further analysis of personal exposure samples using transmission electron microscopy (TEM). TEM analysis indicates that relatively few of the fibers counted by PCM are regulated by MSHA's existing standard. Later in this chapter, MSHA will discuss the implication of the TEM analysis.

To calculate the benefits of the final rule, MSHA uses a shift-weighted average (SWA) as a measure of personal exposures to airborne fibers taken during inspections. Fibers are defined by their shape and size. For the final rule, fibers are particles greater than 5 microns in length and with an aspect ratio (length to diameter) of at least 3:1 in accordance with the applicable PCM-based OSHA ID-160 or equivalent NIOSH 7400 method that was used by MSHA's contract laboratory.

This benefits analysis includes the measured concentrations of asbestos from personal exposure samples collected during inspections to represent the concentrations on workdays MSHA does not conduct sampling.

EXPLANATION OF MSHA'S EXPOSURE DATA SET

The data used for the calculation of benefits of MSHA's final asbestos rule are from MSHA's inspection sampling from January 2000 through May of 2007. MSHA selected 206 metal and nonmetal mines and one coal mine for sampling based on the following:

- Geological information linking a higher probability for asbestos contamination with certain types of ores or commodities.
- Historical records identifying locations of potential problem mines.
- Complaints from miners reporting asbestos on mine property.

This benefits analysis focuses on mines likely to be operating in the future and for which MSHA has information about miners' previous exposures and potential future exposures to asbestos. Inspection protocols and sampling procedures for asbestos are well documented and readily available. Mines, as well as miners, were not selected for sampling randomly; rather, they were selected because aspects of their job made the presence of asbestos, and their exposure, more likely.[11]

To estimate the duration and intensity of exposure to airborne asbestos, MSHA reviewed the results of 917 full-shift personal exposure samples and calculated a shift weighted average (SWA). MSHA excluded samples due to overloaded filters and an air pump malfunction. MSHA also excluded samples taken at mines now abandoned. This benefits analysis includes 806 SWA results for airborne fibers from 181 mines within

[11] MSHA Metal/Nonmetal (November, 1990) and Coal (February, 1989) Program Area Handbooks.

five commodity groups (iron, other, rock quarry, vermiculite, wollastonite). Four full-shift samples were from a coal mine. These mines collectively employ 14,131 miners, including 2,168 office workers. Within the total of 806 personal exposure measurements in this analysis, 110 (14 percent) indicated an exposure over 0.1 f/cc, using the PCM-based analytical screening method. Within the total of 181 mines, 29 mines (16 percent) had at least one miner with an SWA exposure greater than 0.1 f/cc.

An additional analysis using TEM (NIOSH 7402) was performed on all filters with a fiber concentration over 0.1 f/cc determined by PCM. In some cases, TEM analysis was performed on an individual filter with a fiber concentration over 0.1 f/cc when the SWA was less than 0.1 f/cc. Analysis using TEM confirmed asbestos exposures exceeding 0.1 f/cc in 23 samples collected at five mines. The additional TEM results help characterize the mineralogy of the fibers on the filters more accurately.

TECHNICAL CONSIDERATION OF THE LIMITS OF DETECTION WHEN DETERMINING AIRBORNE FIBER CONCENTRATIONS

Limit of detection (LOD, detection limit) is the lowest quantifiable measurement of an analysis. In other words, this detection limit is the lowest number of fibers present on a filter that can be reliably detected. Additionally, the *minimal detectable concentration* (MDC) is the lowest concentration of airborne fibers in a given volume of air that can be reliably distinguished from having none. The *limit of detection* describes the lower quantifiable limit for fibers on a filter whereas the *minimal detectable concentration* describes the lower quantifiable limit for fiber concentrations in air. The *minimal detectable concentration* is calculated using the *limit of detection* and the volume of air passed through the filter. (Refer to equations 1 and 2 below.)

REDUCING SYSTEMATIC BIAS DUE TO THE LOWER LIMIT OF DETECTION WHEN DETERMINING AIRBORNE FIBER CONCENTRATIONS

To consistently use either 0 f/cc or the *minimal detectable concentration* when calculating the SWA would introduce a systematic bias into this benefits analysis. MSHA uses a technique described by Hornung and Reed to correct the potential for systematic bias imposed by sampling and analytical methods.[12] Using this adjusted estimate of fiber concentration for any value reported as being below the *limit of detection* gives a more accurate estimate of the miner's exposure than using zero or the *minimal detectable concentration*.

MSHA uses the following parameters to determine the *minimal detectable concentration* of the PCM-based analytic methods when the laboratory specific value is not available:

- Total filter area for a 25-mm diameter filter (385 mm^2).
- Area of the field of view using a standardized microscope (0.00785 mm^2).
- An analytical *limit of detection* of 5.5 fibers per 100 fields using NIOSH 7400 and 4.3175 fibers per 100 fields using OSHA ID-160.

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[12] Hornung, R.W., Reed, L.D., "Estimation of Average Concentration in the Presence of Nondetectable Values." *Applied Occupational and Environmental Hygiene,* 5(1):46-51, 1990.

Parameters used to calculate the air volume passed through a filter are the sample pump flow rate (usually 1.7 liters of air per minute) and the sampling time for each filter (which is variable and usually between 15 and 600 minutes). The *minimal detectable concentration* is lowest (and better) when the air volume is large. If the air volume is small, the *minimal detectable concentration* may not be low enough to determine accurately if the fiber concentration is below the exposure limit. This is an important consideration when a collection time may be only 30 minutes.

The numbers of filters used to calculate a full-shift personal exposure in MSHA's exposure data varied from 1 to 10. Using one filter is not always practical. Using multiple filters can minimize overloading. On the other hand, using multiple filters reduces the air volume through each filter, which increases the *minimal detectable concentration*. The *minimal detectable concentration* for a series of filters is greater than when only one filter is used for the same volume of air.

The *minimal detectable concentration* for each filter and for a series of filters is calculated as follows:

Equation 1: MDC for a Single Filter

$$MDC_{Filter} = \frac{\left[\left(\frac{Filter\,Area}{Area\,Of\,Field\,Of\,View}\right) * \left(\frac{Detection\,Limit\,Of\,Method}{Minimum\,Number\,Of\,Fields\,Of\,View}\right) * 1000\,cc/L\right]}{Flow\,Rate * Filter\,Collection\,Time}$$

Equation 2: MDC for a Series of Filters

$$MDC_{Series} = \frac{\left[\left(\frac{Filter\,Area}{Area\,Of\,Field\,Of\,View}\right) * \left(\frac{Detection\,Limit\,Of\,Method}{Minimum\,Number\,Of\,Fields\,Of\,View}\right) * Number\,Of\,Filters * 1000\,cc/L\right]}{Flow\,Rate * Total\,Collection\,Time\,of\,Series}$$

where filter area, area of field of view, detection limit of method, minimum number of fields of view, and flow rate are constant for each filter in the series.

In summary, using the MDC_{Filter} divided by the square root of two in the appropriate formula will effectively minimize bias and provide a better estimate of the true exposure.

EQUATION USED TO DETERMINE THE SWA CONCENTRATION

Equation 3: Shift-Weighted Average Concentration

$SWA = (TWA_1 t_1 + TWA_2 t_2 + \ldots + TWA_n t_n)/480$ minutes

Where TWA_n is the time-weighted average concentration for filter "n", and t_n is the duration sampled in minutes for filter "n".

APPLICATION OF OSHA'S RISK MODELS TO THE MINING COMMUNITY

Based on existing exposures, MSHA estimates one death caused by asbestos exposure will be prevented by lowering the 8-hour TWA PEL to 0.1 f/cc. Analysis using PCM and TEM shows that 314 miners are exposed to asbestos concentrations exceeding

0.1 f/cc. Alternately, approximately five asbestos-related cancer deaths per 1,000 exposed miners will be prevented by lowering the 8-hour TWA PEL and one cancer death per 1,000 exposed miners will be prevented by lowering the excursion limit PEL. The following sections explain how MSHA estimated the number of deaths that would be prevented by reducing the PELs.

Exposure Assessment

Industry Sector Groups

MSHA grouped mines according to commodities to facilitate a better estimate of risk of exposure for miners. The commodity groups sampled for airborne asbestos are defined as follows:

- Asbestos (Currently all asbestos mines are closed and are not considered in this analysis.);
- Iron (taconite): iron and taconite mines;
- Rock Quarry: aplite, crushed and broken granite, crushed and broken limestone, crushed and broken quartzite, crushed and broken sandstone, crushed and broken slate, crushed and broken stone, crushed and broken traprock, shale, sand and gravel, dimension marble, hydraulic cement plants, quartz-silica;
- Vermiculite;
- Wollastonite; and
- Other: coal, common clays, fire clay, gold ore, gypsum, lime, mica, miscellaneous metal ores, miscellaneous nonmetal ores, olivine, perlite, potash, pumice, salt, trona, boron, talc, feldspar, and alumina.

Exposure Categories

To estimate risk, MSHA first applied the PCM analytical results and then applied the TEM analytical results. Four levels of fiber concentrations are used in the PCM analysis to correspond to the existing and final PELs, as well as divisions observed in the distribution of data. These levels are—

1. Less than 0.1 f/cc,
2. 0.1 to less than 1 f/cc,
3. 1 to less than 2 f/cc,
4. Greater than or equal to 2 f/cc.

Estimates of miners’ exposures using TEM analytical results are in levels 1 and 2.

Laboratory results indicated varied concentrations of airborne asbestos between mines and between miners within mines. Table III-2 summarizes the proportional distribution of samples at each of the four levels and shows that 86 percent are below the 0.1 f/cc PEL.

Table III-2: Proportion of PCM Samples by Level of Exposure and Commodity Group

Commodity Group	0 < x < 0.1 f/cc	0.1 ≤ x < 1 f/cc	1 ≤ x < 2 f/cc	2 ≤ x f/cc
Iron (taconite)	0.79	0.20	0.01	0.00
Other	0.88	0.12	0.00	0.00
Rock Quarry	0.93	0.07	0.00	0.00
Vermiculite	0.91	0.09	0.00	0.00
Wollastonite	0.00	0.22	0.06	0.72
All Commodities	0.86	0.12	0.00	0.02

Exposure Assessment Results

Table III-3 shows the average concentrations of airborne fibers grouped by commodity and exposure level using PCM analytical results.

Table III-3: Average Concentrations of Airborne Fibers Grouped by Commodity and Exposure Level* Using PCM Analysis

Commodity Group	0 < x < 0.1 f/cc	0.1 ≤ x < 1 f/cc	1 ≤ x <2 f/cc	2 ≤ x f/cc	Average by Commodity
Iron (taconite)	0.025	0.280	1.125		0.087
Other	0.016	0.197			0.038
Rock Quarry	0.021	0.220			0.035
Vermiculite	0.032	0.135			0.041
Wollastonite	0.024**	0.531	1.004	15.663	11.486
All Commodities	0.024	0.244	1.084	15.663	0.305

[*] Averages are rounded to thousandths.

** For wollastonite mines, MSHA sampling results all showed concentrations above the 0.1 f/cc exposure level. However, in Table III-5, MSHA included office workers exposed to concentrations below the 0.1 f/cc exposure level. To accommodate the inclusion of office workers, MSHA estimated an exposure of 0.024 f/cc in Table III-3. This represents the average concentration for all commodities below the 0.1 f/cc level.

Table III-4 shows the number of mines sampled by commodity group and their employment. The employment levels reflect the most recently reported quarterly statistics for each sampled mine (4th quarter 2006 through 2nd quarter 2007).

Table III-4: Number of Mines, Miners, and Office Workers by Commodity Group

Commodity Group	Number of Mines with Valid Samples	Miners	Office Workers	Total Employees by Commodity
Iron (taconite)	10	3,960	643	4,603
Other	40	4,341	794	5,135
Rock Quarry	127	3,511	704	4,215
Vermiculite	3	79	12	91
Wollastonite	1	72	15	87
All Commodities	181	11,963	2,168	14,131

Table III-5 is a summary of the distribution of miners by exposure level and commodity group. MSHA believes that this distribution is representative of the exposures of all miners working at the sampled mines.

Table III-5: Distribution of Miners and Office Workers by Level of Exposure and Commodity Group* (using PCM data)

Commodity Group	$0 < x < 0.1$ f/cc	$0.1 \leq x < 1$ f/cc	$1 \leq x < 2$ f/cc	$2 \leq x$ f/cc	Total by Commodity Group
Iron(taconite)	3,768	796	39	0	4,603
Other	4,597	538	0	0	5,135
Rock Quarry	3,978	237	0	0	4,215
Vermiculite	84	7	0	0	91
Wollastonite	15	16	4	52	87
All Commodities	12,442	1,594	43	52	14,131

* The estimates of numbers of miners are rounded to whole numbers. All office workers were placed in the lowest exposure category for all commodity groups.

Benefits of a Reduction in the 8-Hour TWA PEL

MSHA limits the quantified benefits to an estimation of the number of cancer cases prevented. MSHA expresses the results as "deaths prevented" because the cancers associated with asbestos exposure almost always result in premature death.

The benefits resulting from a reduction in the PEL depend on several factors including—

- Existing and projected exposure levels,
- Risk associated with each exposure level.
- Number of workers exposed within each exposure level, and
- Age of the miner at first exposure.

Further, MSHA has no information on asbestos exposures for persons who work in offices on mine property. MSHA estimated that office workers on mine property have exposures at or below the lowest levels observed for other miners within the same commodity. Because these lowest levels are below the final PEL, the benefits of lowering the existing PEL are not likely to impact office workers.

MSHA relies on the lifetime risk of lung cancer, mesothelioma and gastrointestinal cancer estimated by OSHA in Table III-1 for the quantification of benefits of the final rule.[13] MSHA estimates the benefits of the rule by first applying the quantitative effects of exposure to asbestos defined in OSHA's risk assessment to MSHA's estimates of miners' existing exposures and then calculating the reduction in adverse effects resulting from exposures at or below an SWA of 0.1 f/cc. MSHA's estimates of benefits are for miners whose exposures result predominantly from naturally-occurring asbestos. MSHA recognizes that exposures from asbestos-containing building material (ACBM) occur in mining operations; however, Agency experience measuring exposures during construction with or removal of ACBM is limited.

MSHA uses the mortality rates from OSHA's risk assessment (see Table III-1) and assumes that the age characteristics of today's miners are similar to the ages of workers in general industry when OSHA calculated these mortality rates. In addition, MSHA calculates cancer mortality rates for fiber concentrations between the values published in Table III-1 using linear interpolation.

MSHA assumes that miners will experience exposures similar to those at the lowest exposure level in Table III-3 ($0 < x < 0.1$ f/cc) under a PEL of 0.1 f/cc because MSHA data indicates that exposures average significantly below 0.1 f/cc. In addition, MSHA estimates that the majority of asbestos-exposed miners will experience less than 45 years of exposure at any one concentration. Variations in these estimates directly influence the benefits estimate.

Steps for Calculating Benefits

Step 1: MSHA first derived the mortality rates from Table III-1 for the average concentrations of exposure in Table III-3. MSHA then multiplied these rates by the number of miners exposed at the corresponding concentrations in Table III-5. The result is an estimate of miners' deaths resulting from cancer due to occupational exposure to asbestos under existing standards.

Step 2: MSHA then estimated the expected deaths as if the miners' exposures were equal to the lowest average exposures in Table III-3 (i.e., $0 < x < 0.1$ f/cc) for each commodity group.

Step 3: The difference between these two values summed over all commodity group-exposure level categories is the estimate of the decrease in the miners' deaths from asbestos-induced cancer that the Agency expects from lowering the PEL.

Benefits of the Final PEL Using PCM Analysis

Table III-6 shows that, using PCM analysis, MSHA estimates that 25 cancer deaths will be prevented by the rule. It is important to note that this is an intermediate step prior to the calculation of benefits using the TEM analysis.

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[13] Nicholson, 1983.

Table III-6: Cancer Deaths Prevented Due to Reducing the PEL to an 8-hour TWA of 0.1 f/cc – Considering Information from PCM Results

Commodity	Lung	Mesothelioma	Gastrointestinal	Total
Iron (taconite)	5.5	2.0	0.6	8.1
Other	2.2	0.8	0.2	3.3
Rock Quarry	1.1	0.4	0.1	1.6
Vermiculite	0.0	0.0	0.0	0.0
Wollastonite	8.5	2.7	0.8	12.0
All Commodities	17.3	5.8	1.7	24.9

MSHA estimates that the reduced number of deaths will occur over a 55-year period between 10 and 65 years after lowering exposures. The rate at which the incidence of cancer decreases, however, depends on several factors. These factors include, but are not limited to—

- Latency of onset of cancer,
- Attrition in the mining workforce,
- Changing rates of competing causes of death,
- Dynamics of other risk factors,
- Changes in life expectancy, and
- Advances in cancer treatments.

Benefits of the Final PEL Using TEM Analysis

Under MSHA policy, the Agency conducts an additional analysis on fiber sample filters when the results of PCM analysis indicate an airborne fiber concentration greater than 0.1 f/cc. MSHA uses the additional TEM analysis because it more accurately excludes non-regulated fibrous minerals from the exposure calculation. Applying the TEM analysis to the results from the 806 samples analyzed using PCM provides a lower estimate of benefits.

MSHA contract laboratories use the NIOSH 7402 TEM methodology to differentiate the compositions of mineral fibers. The laboratory reports an estimate of the proportion of regulated asbestos fibers (chrysotile and asbestiform amphiboles) to all fibers for each filter analyzed. There are 162 TEM results from the samples taken between January 2000 and May 2007. These TEM results include some samples that had more than one filter analyzed using TEM. Table III-7 shows the average proportion of asbestos fibers to all fibers for each commodity group.

Table III-7: Average Proportion of Asbestos Fibers to All Fibers by Commodity

Commodity	Average Proportion of Airborne Asbestos Fibers
Iron (taconite)	0.229
Other	0.074
Rock Quarry	0.257
Vermiculite	0.409
Wollastonite	0.013
All Commodities	0.268

Applying the additional TEM analysis, MSHA multiplied the airborne fiber concentrations greater than 0.1 f/cc SWA, as determined by PCM, by the average proportions of asbestos fibers to all fibers within the respective commodity groups and recalculated the average exposure concentrations for each commodity group. Table III-8 shows the miners' average asbestos exposures determined by incorporating the results of TEM analysis.

Table III-8: Average Concentrations of Airborne Asbestos Grouped by Commodity and Exposure Level* Using TEM Analysis

Commodity Group	0 < x < 0.1 f/cc	0.1 ≤ x f/cc	Average by Commodity
Iron (taconite)	0.028	0.161	0.035
Other	0.016		0.016
Rock Quarry	0.022	0.116	0.024
Vermiculite	0.034		0.034
Wollastonite	0.040	0.259	0.149
All Commodities	0.025	0.184	0.030

* Averages are rounded to thousandths.

Table III-9 shows the adjusted proportion of samples in each exposure level and Table III-10 shows the number of miners within the exposure level groups.

Table III-9: Proportion of Samples by Exposure Level and Commodity Group Using Information from TEM Analysis*

Commodity Group	0 < x < 0.1 f/cc	0.1 ≤ x < 1 f/cc
Iron (taconite)	0.946	0.054
Other	1.000	0.000
Rock Quarry	0.982	0.018
Vermiculite	1.000	0.000
Wollastonite	0.500	0.500
All Commodities	0.968	0.032

Table III-10: Distribution of Miners, Including Office Workers, by Exposure Level and Commodity Group Using Information from TEM Analysis*

Commodity Group	0 < x < 0.1 f/cc	0.1 ≤ x f/cc	Total by Commodity Group
Iron (taconite)	4,390	213	4,603
Other	5,135	0	5,135
Rock Quarry	4,150	65	4,215
Vermiculite	91	0	91
Wollastonite	51	36	87
All Commodities	13,817	314	14,131

Using the TEM analysis, the total number of cancer deaths prevented by lowering the PEL will be approximately one (0.96 deaths due to lung cancer, 0.36 deaths due to mesothelioma, and 0.1 deaths due to a gastrointestinal cancer). MSHA estimates that this death represents a 12 percent reduction in miners' asbestos-related deaths. Table III-11 is a summary of estimated deaths prevented within each commodity group by type of cancer, considering the results of TEM analysis.

Table III-11: Miner Cancer Deaths Prevented Due to Reducing the Exposure Limit to 0.1 f/cc 8-hour TWA—Considering Information from TEM Results

Commodity	Lung	Mesothelioma	Gastrointestinal	Total
Iron (taconite)	0.64	0.23	0.06	0.94
Other	0.00	0.00	0.00	0.00
Rock Quarry	0.14	0.05	0.01	0.20
Vermiculite	0.00	0.00	0.00	0.00
Wollastonite	0.18	0.07	0.02	0.27
All Commodities	0.96	0.36	0.10	1.42

In sum, when the results of TEM analysis were incorporated into the exposure estimates, MSHA estimated a reduction of approximately one cancer death (1.42 as reflected in Table III-11) per 314 miners exposed above 0.1 f/cc. This is approximately 5 cancer death prevented per 1,000 miners.

Benefits of Lowering the Excursion Limit

This section estimates the benefits of the excursion limit of 1 f/cc for one 30-minute period per day. The intended effect of the excursion limit is to protect miners from the adverse health risks associated with brief fiber releases. Two 30-minute exposures per day at 1 f/cc will exceed the 8-hour, full shift exposure limit (i.e., 1 f/cc for 48 minutes = 0.1 f/cc for 480 minutes). MSHA believes that miners will be exposed to brief fiber releases even when airborne concentrations of asbestos do not exceed the PEL. However, because MSHA does not have sufficient data regarding the relationship between the frequency of brief fiber releases and adverse health risks, this analysis gives the theoretical benefits from limiting short-term exposures to the excursion limit.

To estimate reduced risk, MSHA notes that the 8-hour TWA exposure corresponding to a single 30-minute exposure at the final excursion limit is 0.063 f/cc. That is, if a worker is exposed to asbestos at the excursion limit of 1 f/cc for 30 minutes and is not exposed to any other asbestos for the remainder of the day, the SWA exposure will be 0.063 f/cc. Thus, the final excursion limit is slightly lower than the final 8-hour TWA PEL by 0.037 f/cc.

From Table III-1, the lifetime risk associated with an exposure to 0.1 f/cc for any of the three types of cancer is 0.00336, if first exposed at age 25 and exposure continues every work day at that level for a duration of 45 years. The risk associated with exposure to 0.063 f/cc using the same age and duration of exposure is 0.00212. The difference in lifetime risk is 0.00124. This risk estimate equates to one death prevented for every 1,000 miners exposed to asbestos at the excursion limit.

BENEFITS SUMMARY OF FINAL RULE

By lowering the PEL to 0.1 f/cc, MSHA estimates the prevention of one occupationally related cancer death caused by asbestos exposure over the 55-year period beginning 10 years after implementation of the final rule. MSHA estimates that there will be additional benefits resulting from lowering the excursion limit, but is unable to quantify these benefits. This analysis underestimates the total benefits of the rule by quantifying only the cancer deaths prevented. The benefits do not include the reduced incidence of asbestosis-related disabilities. Asbestosis cases often lead to tremendous societal costs in terms of health care utilization, loss of worker productivity, and a decrease in the quality of life of the affected individuals.

IV. COST OF COMPLIANCE

INTRODUCTION

In this chapter, MSHA estimates the compliance costs associated with the final asbestos rule. Table IV-1 presents the total yearly compliance costs by compliance strategy, mine type, and mine size. The final rule will result in net costs for mine operators of approximately $201,000 per year. For metal and nonmetal mines, the cost will be approximately $156,000 and, for coal mines, approximately $45,000. All cost estimates are presented in 2006 dollars.

Table IV-1: Summary of Costs*

Metal and Nonmetal Mine Size	Compliance Strategy				Total for Metal and Nonmetal Mines
	Selective Mining	Wet Methods	Mill Ventilation	Removal of Introduced Asbestos-Containing Materials	
(1-19) Employees	$2,417	$2,820	$1,619	$1,750	$8,606
(20-500) Employees	$11,242	$19,673	$28,048	$21,000	$79,962
(501+) Employees	$3,747	$6,558	$41,278	$15,750	$67,333
Total	$17,406	$29,050	$70,945	$38,500	$155,901
Coal Mine Size	**Compliance Strategy**				**Total for Coal Mines**
	Selective Mining	Wet Methods	Mill Ventilation	Removal of Introduced Asbestos-Containing Materials	
(1-19) Employees	-	-	-	$875	$875
(20-500) Employees	-	-	-	$12,250	$12,250
(501+) Employees	-	-	-	$31,500	$31,500
Total	-	-	-	$44,625	$44,625

* The total costs come from Table IV-2, Table IV-3, Table IV-4a, Table IV-4b, and Table IV-5.

The total costs reported in Table IV-1, and in all other tables in this chapter, are the Agency's best estimates of the projected costs based on its knowledge, experience, and available information. In some cases, however, the estimates may appear to deviate slightly from the sum or product of their component factors due to rounding.

METHODOLOGY

In determining the effects of the final rule, MSHA estimated the following, as appropriate: (1) one-time or intermittent costs; (2) annualized costs (one-time or intermittent costs amortized over a specific number of years); and (3) annual costs. One-time costs are those that are incurred only once and do not recur. Intermittent costs are those that occur from time to time, but not annually. A capital expenditure, such as the cost of purchasing compliance equipment, is an example of a one-time or intermittent cost. Annual costs are costs that normally recur annually. Two examples of annual costs are refresher training costs and recordkeeping costs.

For the purposes of this REA, one-time costs have been annualized using a (real) annual discount rate of 7 percent, as recommended by the U.S. Office of Management and Budget (OMB), over the investment period using the formula:

$$a = (i * (1 + i)^n) /((1 + i)^n - 1),$$

where "a" is the annualization factor, "i" is the annual discount rate, and "n" is the economic life of the investment. Converting one-time costs to annualized costs allows them to be added to annual costs in order to compute the yearly costs of a rule.[14]

The labor costs used in this analysis are based on the 2006 wage rates for metal/non-metal miners. These wage rates include benefits (e.g., social security, unemployment insurance, and workers' compensation), but do not reflect shift differentials or overtime pay. For convenience, MSHA will refer to miners' "compensation" in this REA as "wages," where that term is understood to include benefits. The wage rates used in this analysis are: [15]

$55.27 per hour for a supervisor;

$23.89 for a metal and nonmetal miner; and

$23.42 for a clerical worker.

MSHA notes that many of the assumptions and estimates of cost components in this chapter rely exclusively on the Agency's own knowledge and experience.

SECTION-BY-SECTION DISCUSSION

The final rule will require mine operators to reduce the permissible exposure limit (PEL) for asbestos in all metal and nonmetal mines, surface coal mines, and surface areas of underground coal mines. Historically, there has been no evidence of coal miners encountering naturally occurring asbestos. The more likely exposure to asbestos in coal mining will occur from introduced asbestos-containing materials.

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[14] Note that many one-time costs, such as labor and testing costs or small capital costs, will not normally be financed by mine operators. Nevertheless, MSHA has annualized all one-time costs so as to be able to provide a simple, single estimate of the cost of an MSHA regulation: its yearly cost. The yearly cost of a regulation converts all of the costs of a regulation, whenever and however frequently they occur, into an equivalent steam of uniform yearly costs.

[15] Wages are derived from *U.S. Metal and Industrial Mineral Mine Salaries, Wages, and Benefits - 2006 Survey Results*, InfoMine USA, Inc., 2006.

§§ 56/57.5001(b)(2) and § 71.702(b) Permissible exposure limits

This provision, the only one changed significantly by the final rule, will lower the 8-hour time-weighted average (TWA) airborne concentration of asbestos to which miners can be exposed to 0.1 fibers per cubic centimeter of air (f/cc) and lower the short-term excursion limit to 1.0 f/cc over a minimum sampling time of 30 minutes. From MSHA's experience, most mines do not have asbestos, and for the few that do, the majority of them are already in compliance with the final PEL. Typically, mine operators have used selective mining, wet methods, ventilation, and removal of introduced asbestos-containing materials to control miners' asbestos exposure. This is not an all-inclusive list of compliance strategies. The actual strategy chosen by the operator will depend on the type of mine, the commodity mined, mining conditions, and how asbestos is found in the mine. Some mines will have to use a combination of these compliance strategies to control asbestos. At most mines where asbestos is present, MSHA believes that operators already have an economic incentive to control asbestos exposures either to avoid liability or to increase the marketability of their product, in addition to protecting the health of their employees. The benefits and costs of these strategies that have already been implemented by most operators with any asbestos onsite are not properly attributable to this final rule and are not, therefore, included in the calculation of compliance impacts.

Below MSHA summarizes the costs for four mines that have been identified to have the potential to exceed the final PEL or excursion limit. MSHA estimates that, for each year that the rule is in effect, one mine will employ mill ventilation, one will employ removal of introduced asbestos-containing materials, and two will use a combination of selective mining and wet methods. On average, MSHA estimates that there will be four mines that are over the PEL each year. For mill ventilation, MSHA estimates that only mine operators who rely on an existing local exhaust ventilation system to control dust will use this type of compliance strategy. MSHA estimates that one mine every five years will use ventilation to help control asbestos exposures. Mine operators employing mill ventilation will upgrade their primary system by adding exhaust fans to the building to meet the new PEL.

Selective Mining

Table IV-2 presents the costs of using selective mining to comply with the final PEL. Selective mining will involve inspecting the production faces to determine whether asbestos-contamination is present. If present, the mine operator will employ an extra miner to remove and safely dispose of the contaminated ore. This will keep the ore from contaminating the mill and other processing facilities. Contaminated ore may enter the mine's product stream; therefore, the cost of selective mining will be the cost of an extra miner to safely dispose of the contaminated ore. MSHA's estimate of this cost is based on the following:

- Two metal and nonmetal mines a year are going to use selective mining method in conjunction with wet method to control asbestos.
- The time per week it will take to dispose of contaminated ore at the face of a mine: for mines with 1-19 employees, it will take one miner 6 hours; and for mines with 20-500 and 501+ employees, it will take 2 miners 4 hours each.

- Number of weeks in operation: mines with 1-19 employees will operate approximately 43 weeks per year; mines with 20-500 and 501+ employees will operate approximately 50 weeks per year.

As shown in Table IV-2, the annual cost to remove and dispose of contaminated ore or waste would be $17,406 per year.

Table IV-2: Cost of Selective Mining to Metal and Nonmetal Mine Operators

Metal Nonmetal Mine Size	Number of Mines	Number of Miner Hours per Week Needed to Dispose of Contaminated Ore	Number of Times per Year That Ore is Disposed of	Annual Number of Miner Hours[a]	Hourly Wage Rate for a M/NM Miner	Total Annual Cost of Selective Mining
(1-19) Employees	0.4	6	43	103	$23.42	$2,417
(20-500) Employees	1.2	8	50	480	$23.42	$11,242
(501+) Employees	0.4	8	50	160	$23.42	$3,747
Total	2.0			743		$17,406

[a] Annual number of miner hours = number of times per year that ore is disposed of x number of miner hours needed to dispose of contaminated ore x number of mines.

Wet Methods

Tables IV-3 presents the costs of using wet methods to comply with the final PEL and excursion limit. Wet methods will involve using a water truck to spray the muck pile at a mine to reduce the concentration of airborne asbestos fibers. MSHA's estimate of the cost of using wet methods is based on the following:

- MSHA assumes that only mines with an existing water truck are going to employ wet methods to spray the muck piles as a means of controlling asbestos.
- MSHA estimates that two mines a year are going to use wet methods in conjunction with selective mining to comply with the PEL.
- It will take one miner one hour to spray the muck pile.
- Annual number of times that muck pile will need to be sprayed: for mines with 1-19 employees, once a day times 301 days (average number of days in operation per year); for mines with 20-500 and 501+ employees, twice per day times 350 days (average number of days in operation per year).

As shown in Table IV-3, the annual cost of using wet methods to control asbestos is $29,050.

Table IV-3: Annual Costs of Wet Methods for Metal and Nonmetal Mines

Metal and Nonmetal Mine Size	Number of Mines	Number of Miner Hours Needed to Spray Muck Pile	Annual Number of Times That Muck Pile Would Need to be Sprayed[a]	Annual Number of Miner Hours[b]	Hourly Wage of Metal/Nonmetal Miner	Total Annual Costs of Wet Methods
(1-19) Employees	0.4	1	301	120	$23.42	$2,820
(20-500) Employees	1.2	1	700	840	$23.42	$19,673
(501+) Employees	0.4	1	700	280	$23.42	$6,558
Total	2			1,240		$29,050

[a] Annual number of times that muck pile would need to be sprayed: for mines with 1-19 employees, once a day X 301 days (average number of days in operation per year); for mines with 20-500 and 501+ employees, twice per day X 350 days (average number of days in operation per year).

[b] Annual number of miner hours = annual number of times that muck pile would need to be sprayed x number of miner hours needed to spray muck pile x number of mines.

Mill Ventilation

Local exhaust ventilation is one of the most effective methods used to control asbestos. MSHA estimates that mine operators relying on an existing local exhaust ventilation system to control dust will add supplemental ventilation to help control asbestos exposure. For example, mine operators employing mill ventilation will upgrade their primary system by adding exhaust fans to the building to meet the new PEL. The average cost will be approximately $13,234.[16] The compliance strategy will also impose a stream of operating costs (as shown in Table IV-4a) for each mine that adopts this compliance strategy. This stream of operating costs for each mine is presented in Table IV-4a as its discounted present value. MSHA estimates that one additional mine every five years will adopt this compliance strategy in response to the final rule and incur the upgrade costs and the discounted present value of the stream of operating costs (as shown in Table IV-4b). These cost estimates are based on the following:

- Electricity needed per shift to operate a mill ventilation system: 300 kilowatt-hours for a mine employing fewer than 20 miners and 420 kilowatt-hours for a mine employing 20 or more miners.
- Number of mill ventilation systems needed to control asbestos exposures: one ventilation system for a mine employing 500 or fewer miners and two ventilation systems for a mine employing more than 500 miners.
- The cost per kilowatt-hour is $0.0525.[17]

[16] This cost estimate is from Cecala *et al*., 1993. "Reducing Respirable Dust Concentrations at Mineral Processing Facilities Using Total Mill Ventilation Systems." *Report of Investigations (RI 9469)*, United States Department of Interior, Bureau of Mines. MSHA adjusted this cost for inflation.

[17] U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2006*, Table 8.10, p.257.

Table IV-4a: Annual Operating Costs of Mill Ventilation for Metal and Nonmetal Mines

Metal and Nonmetal Mine Size	Number of Mines	Number of Ventilation System(s) Needed for One Shift	Electricity Used (in kilowatt hours) to Operate Ventilation System(s) for One Shift	Number of Shifts per Year[a]	Total Annual Electricity Used[b]	Cost per kilowatt hour[c]	Annual Cost of Electricity for Mill Ventilation[d]	Total Discounted Stream of Electricity Costs for Mill Ventilation[e]
(1-19) Employees	0.02	1	300	301	1,806	$0.053	$95	$1,355
(20-500) Employees	0.12	1	420	700	35,280	$0.053	$1,852	$26,460
(501+) Employees	0.06	2	840	1,050	52,920	$0.053	$2,778	$39,690
Total	0.20				90,006			$67,505

[a] Mines with 1-19 employees would operate one shift a day times 301 days (average number of days in operation per year). Mines with 20-500 employees would operate 2 shifts a day 350 days (average number of days in operation per year). Mines with 501+ employees would operate three shifts a day 350 days (average number of days in operation per year).

[b] Total annual electricity used = number of mines x electricity used for one shift x number of shifts per year.

[c] US Dept. of Energy, *Annual Energy Review* 2006, Table 8.10, p.257.

[d] Annual cost of electricity for mill ventilation = (total annual electricity used x cost per kilowatt hour).

[e] Total discounted stream of electricity costs for mill ventilation = (annual cost of electricity for mill ventilation) / 0.07, where 0.07 is the annual discount rate.

Table IV-4b: Annual Cost of Mill Ventilation for Metal and Nonmetal Mines

Metal and Nonmetal Mine Size	Number of Mines	Number of Ventilation System(s) Per Mine	Average Cost to Upgrade a Ventilation System	Total Cost to Upgrade Ventilation Systems[a]	Discounted Stream of Operating Costs[b]	Yearly Cost of Mill Ventilation Systems[c]
(1-19) Employees	0.02	1	$13,234	$265	$1,355	$1,619
(20-500) Employees	0.12	1	$13,234	$1,588	$26,460	$28,048
(501+) Employees	0.06	2	$13,234	$1,588	$39,690	$41,278
Total	0.20			$3,441	$67,505	$70,945

[a] Total cost to upgrade ventilation systems = number of mines x number of ventilation systems per mine x average cost to ugrade a ventilation system.

[b] Source: Table IV-4a estimates annual operating costs (AOC). The discounted stream of operating costs = (AOC)/0.07, w here 0.07 is the annual discount rate.

[c] Yearly cost of mill ventilation systems = total cost to upgrade ventilation systems + discounted stream of operating costs.

As shown in Table IV-4b, the total yearly cost of using mill ventilation system to control asbestos is $70,945.

Removal of Introduced Asbestos-Containing Materials

Both coal and metal and nonmetal mine operators might find it necessary to remove introduced asbestos (e.g., pipe or roof insulation). Although MSHA has no evidence of asbestos exposure above the new PEL in coal mines, the Agency anticipates that some coal mines will encounter asbestos from asbestos containing materials (ACM) brought onto mine property. Operators at these coal mines may have to take corrective action. MSHA's estimate of the cost of removing introduced asbestos is based on the following:

- As a result of the final rule, MSHA estimates that one metal and nonmetal mine and one coal mine a year are going to remove introduced asbestos.
- The cost of removing one square foot of asbestos-containing insulation is $17.50.
- On average, mines with 1-19 employees will need to remove approximately 1,000 square feet of introduced asbestos due to demolition, remodeling, or deterioration. Mines with 20-500 employees will need to remove approximately 2,000 square feet and mines with over 500 employees will need to remove approximately 3,000 square feet.

Based on these estimates, the annual cost of removing introduced asbestos for metal and nonmetal and coal mines combined is $83,125 as shown in Table IV-5.

Table IV-5: Annual Cost of Removing Introduced Asbestos-Containing Materials

Metal and Nonmetal Mine Size	Number of Mines	Cost of Removing One Square Foot of Asbestos	Average Area (Square Feet) Removed	Annual Cost to Remove Introduced Asbestos
(1-19) Employees	0.1	$ 17.50	1,000	$1,750
(20-500) Employees	0.6	$ 17.50	2,000	$21,000
(501+) Employees	0.3	$ 17.50	3,000	$15,750
Total	1			$38,500
Coal Mine Size	**Number of Mines**	**Cost of Removing One Square Foot of Asbestos**	**Average Area (Square Feet) Removed**	**Annual Cost to Remove Introduced Asbestos**
(1-19) Employees	0.05	$ 17.50	1,000	$875
(20-500) Employees	0.35	$ 17.50	2,000	$12,250
(501+) Employees	0.60	$ 17.50	3,000	$31,500
Total	1			$44,625

FEASIBILITY

MSHA has concluded that the requirements of the final rule are both technologically and economically feasible.

The final rule is not a technology-forcing standard and does not involve activities on the frontiers of scientific knowledge. A variety of dust control strategies and control methods are already available in the marketplace and have been used successfully by the U.S. mining community to control asbestos exposures. Therefore, MSHA has concluded that the final rule is technologically feasible.

As previously estimated, the mining industry will incur costs of approximately $201,000 yearly to comply with the final rule. These compliance costs represent well less than 0.001 percent of the yearly revenues of the mines covered by the rule (approximately $64.4 billion for metal and nonmetal mines and $27.0 billion for coal mines) and provide convincing evidence that the final rule is economically feasible.

V. REGULATORY FLEXIBILITY CERTIFICATION

INTRODUCTION

Pursuant to the RFA of 1980 as amended, MSHA has analyzed the impact of the final rule on small entities. Based on the analysis, MSHA certifies that the final rule will not have a significant economic impact on a substantial number of small entities. The factual basis for this certification is presented below.

DEFINITION OF A SMALL MINE

Under the RFA, in analyzing the impact of a rule on small entities, MSHA must use the SBA definition for a small entity or, after consultation with the SBA Office of Advocacy, establish an alternative definition for the mining industry by publishing that definition in the *Federal Register* for notice and comment. MSHA has not taken such an action and, hence, is required to use the SBA definition. The SBA defines a small entity in the mining industry as an establishment with 1-500 employees (13 CFR 121.201).

MSHA has also examined the impacts of its rules on a subset of mines with 1-500 employees—those with 1-19 employees, which the mining community refers to as "small mines." These small mines differ from larger mines not only in the number of employees, but also, among other things, in economies of scale in material produced, in the type and amount of production equipment, and in supply inventory. Therefore, their costs of complying with MSHA rules and the impact of MSHA rules on them will also tend to be different. It is for this reason that "small mines," as traditionally defined by the mining community, are of special concern to MSHA.

This analysis complies with the legal requirements of the RFA for an analysis of the impacts on "small entities" while continuing MSHA's traditional definition of "small mines." MSHA concludes that it can certify that the rule will not have a significant economic impact on a substantial number of small entities that are covered by this rulemaking.

FACTUAL BASIS FOR CERTIFICATION

General Approach

The Agency's analysis of impacts on "small entities" begins with a "screening" analysis. The screening compares the estimated compliance costs of a rule for small entities to the estimated revenues for those small entities. When estimated compliance costs are less than 1 percent of the estimated revenues, the Agency believes it is generally appropriate to conclude that the rule will not have a significant economic impact on a substantial number of small entities. When estimated compliance costs equal or exceed 1 percent of revenues, it tends to indicate that further analysis may be warranted.

Derivation of Costs and Revenues

The compliance costs noted in this chapter were previously presented in Chapter IV of this document along with an explanation of how they were derived. In determining revenues for coal mine operators, MSHA multiplied their production data (in tons) by the 2005 price per ton of the commodity ($17.37 for surface production). The production data were obtained from MSHA's Program Evaluation and Information Resources (PEIR) data,[18] and the price estimates were obtained from the Department of Energy.[19]

MSHA obtained 2006 revenues for metal and nonmetal mines ($64.4 billion), from the U.S. Geological Survey *Mineral Commodity Summaries 2007*. Since MSHA does not collect tonnage figures for metal and nonmetal production, but does collect data on hours worked, MSHA estimated the revenues for particular mine-size categories based on hours worked. MSHA estimates that, on average, each hour of work produces $176.54 worth of ore in the metal and nonmetal mining industry.[20] MSHA has assumed that tonnage is proportional to employee hours (rather than employees) because employee hours are a better measure of total labor input.

Results of Screening Analysis

Table V-1 shows that compliance cost as a percentage of yearly revenues for small metal and nonmetal mines, using MSHA's traditional definition, is less than 0.0001 percent.

TABLE V-1: The Impact of Final Rule on M/NM Mining Sector by MSHA Size Categories

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
1-19	$ 8,110	$ 19,217,028,690	0.0000%
20+	$ 138,882	$ 45,182,971,310	0.0003%

[a] Estimated Net Cost is derived from Table IV-1.

[b] U.S. Department of the Interior, U.S. Geological Survey, *Mineral Commodity Summaries 2007* , January 2007, p. 8.

MSHA used a similar approach to analyze the impact of the final rule on small mines as defined by SBA. Table V-2 shows that compliance cost as a percentage of yearly revenues for small metal and nonmetal mines is approximately 0.0001 percent.

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[18] 7/11/07 Teradata run.

[19] Department of Energy, Energy Information Administration, *Annual Coal Report 2005*, October 2006, Table 28, page 56.

[20] ($64.4 billion revenue) ÷ (364,781,739 hours) ≈ ($176.54 revenue per hour).

TABLE V-2: The Impact of Final Rule on M/NM Mining Sector by SBA Size Categories

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
1-500	$ 83,664	$ 57,956,507,944	0.0001%
501+	$ 63,327	$ 6,443,492,056	0.0010%

[a] Estimated Net Cost is derived from Table IV-1.

[b] U.S. Department of the Interior, U.S. Geological Survey, *Mineral Commodity Summaries 2007* , January 2007, p. 8.

Table V-3 shows that compliance cost as a percentage of yearly revenues for small coal mines, using MSHA's traditional definition, is approximately 0.0001 percent.

TABLE V-3: The Impact of Final Rule on the Coal Mining Sector by MSHA Size Categories*

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
1-19	$ 875	$ 648,786,530	0.0001%
20+	$ 43,750	$ 26,381,162,745	0.0002%

[a] Estimated Net Cost is derived from Table IV-1.

[b] Coal production data are from U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2006 data, 7/11/07 Teradata run. The average U.S. price of underground and surface coal for 2005 is from the Department of Energy (DOE), Energy Information Administration (EIA), *Annual Coal Report 2005* , October 2006, Table 28, page 56.

Table V-4 shows that compliance cost as a percentage of yearly revenues for small coal mines, when applying the SBA definition, is approximately 0.0001 percent.

TABLE V-4: The Impact of Final Rule on the Coal Mining Sector by SBA Size Categories*

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
1-500	$ 13,125	$ 19,500,597,646	0.0001%
501+	$ 31,500	$ 7,529,351,629	0.0004%

[a] Estimated Net Cost is derived from Table IV-1.

[b] Coal production data are from U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2006 data, 7/11/07 Teradata run. The average U.S. price of underground and surface coal for 2005 is from the Department of Energy (DOE), Energy Information Administration (EIA), *Annual Coal Report 2005* , October 2006, Table 28, page 56.

Whether applying the MSHA or SBA definition of a small mine, the estimated compliance costs of the final rule are substantially less than 1 percent of estimated revenues. Accordingly, MSHA has certified that the rule will not have a significant economic impact on a substantial number of small entities.

VI. OTHER REGULATORY CONSIDERATIONS

THE UNFUNDED MANDATES REFORM ACT OF 1995

MSHA has reviewed the final rule under the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1501 *et seq.*). MSHA has determined that the final rule does not include any Federal mandate that may result in increased expenditures by State, local, or tribal governments, nor does it increase private sector expenditures by more than $100 million in any one year or significantly or uniquely affect small governments. Accordingly, the Unfunded Mandates Reform Act requires no further Agency action or analysis.

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA)

MSHA has reviewed the final rule in accordance with the requirements of NEPA of 1969 (42 U.S.C. 4321 *et seq.*), the regulations of the Council on Environmental Quality (40 CFR part 1500), and the Department of Labor's NEPA procedures (29 CFR part 11) and has assessed the environmental impacts. The Agency found that the final rule will have no significant impact on air, water, or soil quality; plant or animal life; the use of land; or other aspects of the human environment.

THE TREASURY AND GENERAL GOVERNMENT APPROPRIATIONS ACT OF 1999: ASSESSMENT OF FEDERAL REGULATIONS AND POLICIES ON FAMILIES

Section 654 of the Treasury and General Government Appropriations Act of 1999 (5 U.S.C. 601 note) requires agencies to assess the impact of Agency action on family well-being. MSHA has determined that the final rule will have no affect on family stability or safety, marital commitment, parental rights and authority, or income or poverty of families and children. Accordingly, MSHA certifies that the final rule will not impact family well-being.

EXECUTIVE ORDER 12630: GOVERNMENT ACTIONS AND INTERFERENCE WITH CONSTITUTIONALLY PROTECTED PROPERTY RIGHTS

The final rule does not implement a policy with takings implications. Accordingly, E.O. 12630 requires no further Agency action or analysis.

EXECUTIVE ORDER 12988: CIVIL JUSTICE REFORM

The final rule was written to provide a clear legal standard for affected conduct and was carefully reviewed to eliminate drafting errors and ambiguities, so as to minimize litigation and undue burden on the Federal court system. Accordingly, the final rule meets the applicable standards provided in section 3 of E.O. 12988.

EXECUTIVE ORDER 13045: PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS

The final rule has no adverse impact on children. Accordingly, E.O. 13045 requires no further Agency action or analysis.

EXECUTIVE ORDER 13132: FEDERALISM

The final rule does not have "federalism implications," because it does not "have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government." Accordingly, E.O. 13132 requires no further Agency action or analysis.

EXECUTIVE ORDER 13175: CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENTS

The final rule does not have "tribal implications," because it does not "have substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes." Accordingly, E.O. 13175 requires no further Agency action or analysis.

EXECUTIVE ORDER 13211: ACTIONS CONCERNING REGULATIONS THAT SIGNIFICANTLY AFFECT ENERGY SUPPLY, DISTRIBUTION, OR USE

Executive Order 13211 requires agencies to publish a statement of energy effects when a rule has a significant energy action that adversely affects energy supply, distribution or use. MSHA has reviewed the final rule for its energy effects because it applies to the coal mining sector. MSHA has concluded that the final rule is not a significant energy action because will result in yearly costs of approximately $45,000 to the coal mining industry, relative to annual revenues of $27.0 billion in 2006, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Accordingly, E.O. 13211 requires no further Agency action or analysis.

EXECUTIVE ORDER 13272: PROPER CONSIDERATION OF SMALL ENTITIES IN AGENCY RULEMAKING

MSHA has thoroughly reviewed the final rule to assess and take appropriate account of its potential impact on small businesses, small governmental jurisdictions, and small organizations. As discussed in the preamble to the final rule, MSHA has determined and certified that the final rule would not have a significant economic impact on a substantial number of small entities. Accordingly, E.O. 13272 requires no further Agency action or analysis.

PAPERWORK REDUCTION ACT OF 1995

The Agency has determined that there are no additional paperwork burden hours and related costs associated with the final rule.

REFERENCES

1. Ashford, N.A. and C.C. Caldart (1996). *Technology, Law, and the Working Environment*. Washington, D.C.: Island Press.
2. JRB Associates. *Benefits Assessment of Emergency Temporary and Proposed Asbestos Standard*, November 3, 1983.
3. Cecala *et al*. "Reducing Respirable Dust Concentrations at Mineral Processing Facilities Using Total Mill Ventilation Systems." *Report of Investigations (RI 9469)*, United States Department of Interior, Bureau of Mines, 1993.
4. Dodson, Ronald F. and Samuel P. Hammar (2005). *Asbestos, Risk Assessment, Epidemiology, and Health Effects*. Taylor & Francis Group. New York.
5. Finkelstein, M. M. "Asbestos in Long-Term Employees of an Ontario Asbestos-Cement Factory." *American Review of Respiratory Disease*. 125:496-501, 1982.
6. Hornung, R.W., and L.D. Reed. "Estimation of Average Concentration in the Presence of Nondetectable Values." *Applied Occupational and Environmental Hygiene*. 5(1):46-51, 1990.
7. Jacob, G., and M. Anspach. "Pulmonary Neoplasia among Dresden Amosite Workers." *Ann NY Acad Sci*. 132:536-548, 1965.
8. MSHA Metal/Nonmetal (April 2003) and Coal (February 1989) Program Area Handbooks.
9. Nicholson, W. (1972). *Microeconomic Theory*. Hinsdale, Illinois: Dryden Press.
10. Nicholson, W. J. *Quantitative Risk Assessment for Asbestos-Related Cancers*. Prepared for the United States Department of Labor, Occupational Safety and Health Association. Contract J.9.F.2.0074. Washington, DC, 1983.
11. OSHA's 1986 Final Rule on Asbestos (51 FR 22612); OSHA's 1988 Final Rule on Asbestos (53 FR 35609); OSHA's 1994 Final Rule on Asbestos (59 FR 40964).
12. Peto, J. "Dose-Response Relationships for Asbestos-Related Disease: Implications for Hygiene Standards, Part II, Mortality." *Ann NY Acad Sci* 330:195, 1979.
13. Peipins, L.A., M. Lewin, S. Campolucci, L.A. Lybarger, A. Miller, D. Middleton, C. Weis, M. Spence, B. Black, and V. Kapil. "Radiographic Abnormalities and Exposure to Asbestos-Contaminated Vermiculite in the Community of Libby, Montana, USA." *Environmental Health Perspectives*. 111:1753-1759, November 2003.
14. U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2005*, October 2006.
15. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2006,* June 2007.

16. U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2007*, February 2007.

17. U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, *Protecting Workers' Families: A Research Agenda: Report of the Workers' Family Protection Task Force,* DHHS (NIOSH) Publication No. 2002-113, May 2002.

18. U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, Division of Respiratory Disease Studies. *Work Related Lung Disease Surveillance Report 2002 [WoRLD 2003]*, DHHS (NIOSH) Publication No. 2003 111, May 2003.

19. U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2006 data, 7/11/07 Teradata run.

20. U.S. Department of the Interior, U.S. Geological Survey, *Mineral Commodities Summaries 2007*, January 2007.

21. *U.S. Metal and Industrial Mineral Mine Salaries, Wages, and Benefits 2006 Survey Results*, InfoMine USA, Inc., 2006.