PRELIMINARY REGULATORY ECONOMIC ANALYSIS

FOR

PROPOSED RULE ON ASBESTOS EXPOSURE LIMIT

RIN: 1219-AB24

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

July 2005

Table of Contents

I. EXECUTIVE SUMMARY

INTRODUCTION

We, the Mine Safety and Health Administration (MSHA), are proposing to revise our existing health standards for metal and nonmetal (M/NM) mines, and surface coal mines (including surface areas of underground coal mines) to reduce the permissible exposure limit for asbestos. Exposure to asbestos has been associated with lung and other cancers, mesothelioma, and asbestosis. This proposed rule would help assure that no miners who work in an environment where asbestos is present would suffer material impairment of health or functional capacity over their working life.

Based on our analysis of compliance costs, we have determined that this standard would not have an annual impact of $100 million or more on the economy and, 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 Preliminary Regulatory Economic Analysis (PREA), the lowering of the permissible exposure limit (PEL) would prevent between 1 and 19 deaths caused by occupational exposure to asbestos. We expect this lowering of the death rate due to the decrease in occupational exposure to asbestos to occur during a period between 10 and 65 years after the implementation.

COMPLIANCE COST SUMMARY

The proposed rule would result in total yearly costs for both coal and M/NM mines, of about $136,000 per year. For M/NM mines, the cost would be about $92,000 and, for coal mines, about $45,000. These costs amount to less than 0.001 percent of the yearly revenues of the mines covered by this proposed rule.

REGULATORY FLEXIBILITY CERTIFICATION AND ANALYSIS

In accordance with section 605 of the Regulatory Flexibility Act, we certify that the proposed rule would 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 Regulatory Flexibility Act, we must include in the proposed rule a factual basis for this certification. The Agency must also publish the regulatory flexibility certification statement in the Federal Register, along with the factual basis, followed by an opportunity for the public to comment. 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 proposed rule for publication in the Federal Register. We have consulted with the Small Business Administration's (SBA's) Office of Advocacy and believe that the analysis provides a reasonable basis for this certification.

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.

The value of the U.S. mining industry's 2002 coal and metal and nonmetal (M/NM) production was estimated to be about $57.6 billion, or 0.5 percent of 2002 Gross Domestic Product (GDP). Coal mining contributed about $19.6 billion to the GDP,[1] while the M/NM mining sector contributed about $38.0 billion.[2]

STRUCTURE OF THE MINING INDUSTRY

MSHA divides the mining industry into two major sectors based on commodity: (1) coal mines and (2) M/NM 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 this proposed rule, MSHA has categorized mines into three groups. These are mines that employ: fewer than 20 workers; 20 to 500 workers; and more than 500 workers. For the past 20 years, for rulemaking purposes, the Agency has consistently defined a small mine to be one employing fewer than 20 employees and a large mine to be one employing 20 or more employees. However, to comply with the requirements of the Small Business Regulatory Enforcement Fairness Act (SBREFA) amendments to the Regulatory Flexibility Act (RFA), MSHA must use the Small Business Administration's (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 presents the three mine size categories based on employment: (1) fewer than 20 employees (MSHA's traditional small mine definition); (2) 20 to 500 employees; and (3) more than 500 employees. In addition, it shows that, of all coal mines, about 34 percent are underground mines employing 52 percent of miners, while about 66 percent are surface mines employing 48 percent of miners.

---

[1] Coal production data are from U.S. Department of Labor Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2002 data. The average U.S. price of coal is from the Department of Energy, Energy Information Administration, *Annual Coal Report 2002*, Table 28, page 52.

[2] U.S. Department of the Interior, U.S. Geological Survey, *Mineral Commodities Summaries 2004*, January 2003, p. 7.

Table II-1: Distribution of Coal Operations and Employment (Excluding Contractors) by Mine Type and Size, 2002

	Size of Coal Mine *									All Coal Mines		
	< 20 Employees			20 to 500 Employees			> 500 Employees					
Mine Type	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.
Underg.	270	2,728	71	424	31,649	818	7	3,841	117	701	38,218	1,006
Surface	879	5,363	428	472	28,633	1,944	3	1,879	51	1,354	35,875	2,423
Total	1,149	8,091	499	896	60,282	2,762	10	5,720	168	2,055	74,093	3,429

*Based on MSHA's traditional definition, small mines are those in the <20 employees category. Based on SBA's definition, small mines are those in the <20 employees and 20 to 500 employees categories.

Source: U.S. Department of Labor Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2002 data.

Table II-2 presents corresponding data on the number of independent coal contractors and their employment. Table II-2 shows that, of all coal contractor firms, about 29 percent operate in underground mines and employ 30 percent of contractor employees (excluding office employment), while about 71 percent operate at surface mines and employ 70 percent of contractor employees (excluding office employment).

Table II-2: Distribution of Coal Contractors and Contractor Employment by Size of Operation, 2002

	Size of Coal Contractor *									All Coal Contractors		
	< 20 Employees			20 to 500 Employees			> 500 Employees					
Contr. Type	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.	Mines	Miners	Office Emp.
Underg.	712	3,151	236	105	5,958	400	0	0	0	817	9,109	636
Surface	1,743	7,354	550	256	13,901	934	0	0	0	1,999	21,255	1,484
Total	2,455	10,505	786	361	19,859	1,334	0	0	0	2,816	30,364	2,120

* Based on MSHA's traditional definition, small contractors are those in the <20 employees category. Based on SBA's definition, small contractors are those in the <20 employees and 20 to 500 employees categories.

Source: U.S. Department of Labor Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2002 data, and U.S. Department of Labor, Mine Safety and Health Administration, 2002 Final Data, CT441 Report, cycle 2002/381.

Table II-3 presents the total number of small and large mines and their employment, excluding contractors, for the M/NM mining segment. The table presents the three mine size categories based on employment: (1) fewer than 20 employees (MSHA's traditional small mine definition); (2) 20 to 500 employees; and (3) more than 500 employees. The M/NM 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, about 98 percent of all M/NM mines are surface mines, and these mines employ some 91 percent of all M/NM miners, excluding office workers.

Table II-3: Distribution of M/NM Mine Operations and Employment (Excluding Contractors) by Size of Operation, 2002

	Size of M/NM Mine *									All M/NM Mines		
	< 20 Employees			20 to 500 Employees			> 500 Employees					
Contr. Type	Firms	Emp.	Office Emp.	Firms	Emp.	Office Emp.	Firms	Emp.	Office Emp.	Firms	Emp.	Office Emp.
Underg.	110	853	146	118	9,288	888	4	3,006	178	232	13,147	1,212
Surface	10,580	51,774	9,758	1,609	74,855	12,983	14	10,473	1,499	12,203	137,102	24,240
Total	10,690	52,627	9,904	1,727	84,143	13,871	18	13,479	1,677	12,435	150,249	25,452

* Based on MSHA's traditional definition, small contractors are those in the <20 employees category. Based on SBA's definition, small contractors are those in the <20 employees and 20 to 500 employees categories.

Source: U.S. Department of Labor Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2002 data.

Table II-4 presents corresponding data on the number of independent M/NM contractors and their employment. Table II-4 shows that, of all M/NM contractor firms, about 10 percent operate in underground mines and employ 7 percent of contractor employees (excluding office employment), while about 90 percent operate at surface mines and employ 93 percent of contractor employees (excluding office employment).

Table II-4: Distribution of M/NM Mine Contractor Employment by Size of Operation, 2002

Contr. Type	Size of M/NM Contractor * < 20 Employees Firms	Emp.	Office Emp.	20 to 500 Employees Firms	Emp.	Office Emp.	> 500 Employees Firms	Emp.	Office Emp.	All M/NM Contractors Firms	Emp.	Office Emp.
Underg.	359	997	53	4	1,768	69	0	0	0	363	2,765	122
Surface	3,233	15,189	701	398	19,914	910	0	0	0	3,631	35,103	1,611
Total	3,592	16,186	754	402	21,682	979	0	0	0	3,994	37,868	1,733

* Based on MSHA's traditional definition, small contractors are those in the <20 employees category. Based on SBA's definition, small contractors are those in the <20 employees and 20 to 500 employees categories.

Source: U.S. Department of Labor Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2002 data, and U.S. Department of Labor, Mine Safety and Health Administration, 2002 Final Data, CT441 Report, cycle 2002/381.

STRUCTURE OF THE COAL MINING INDUSTRY

Agency data in Table II-1 indicate that there were 2,056 coal mines that reported production during some portion of calendar year 2002. When applying MSHA's small mine definition (fewer than 20 workers), 1,150 (about 56 percent) were small mines and 906 (about 44 percent) were large mines. Using SBA's small mine definition, 10 mines (0.5 percent) were large mines and the rest were small mines.

Coal mine employment in 2002 was 77,522, of which 74,093 were miners and 3,429 were office workers. Based on MSHA's small mine definition, 8,091 coal miners (11 percent) in 2002 worked at small mines and 66,002 miners (89 percent) worked at large mines. Using SBA's small mine definition, 68,373 coal miners (92 percent) worked at small mines and 5,720 coal miners (8 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 73 miners. Using SBA's small mine definition, on average, each small coal mine employs 33 miners and each large coal mine employs 572 miners.

ECONOMIC CHARACTERISTICS OF THE COAL MINING INDUSTRY

MSHA classifies the U.S. coal mining sector into two major commodity groups: bituminous and anthracite. The former is further divided into sub-bituminous and lignite. The bituminous category produced about 99% of total coal production. The remaining 1% of coal mining production is anthracite.[3]

The U.S. coal sector produced approximately 1.093 billion short tons of coal (0.739 billion tons at surface mines and 0.354 billion tons at underground mines) in 2002. The average price of coal at surface and underground mines was $13.65 and $26.68 per

[3] U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2002* DOE EIA-0384(2002), October 2003, Table 7.2, p. 203.

ton, respectively.[4] Surface coal mines accounted for $10.1 billion of revenues and underground coal mines accounted for $9.5 billion, for a total of $19.6 billion. Based on MSHA's definition, small mines produced 28.2 million tons, valued at about $0.5 billion. Based on SBA's definition, small mines produced 906 million tons, valued at $16.4 billion, or about 83% of coal production and about 84% of coal revenues. [5]

Mines east of the Mississippi River accounted for about 45 percent of coal production in 2002. For the period 1949 through 2002, coal production east of the Mississippi River ranged from a low of 395 million tons in 1954 to a high of 630 million tons in 1990; 2002 production was estimated at 492 million tons. During this same period, however, coal production west of the Mississippi increased each year from a low of 20 million tons in 1959 to an estimated record high of 601 million tons in 2002.[6] Growth in western coal mines is due, in part, to environmental concerns that increase demand for low-sulfur coal, which is in abundance in the West. In addition, surface mining, with its higher average productivity, is much more prevalent in the West.

Average domestic coal prices (nominal and real prices) for the period 1950-2002 are presented in Table II-3. The nominal price is the price not adjusted for inflation. The real price is the price of coal after it has been adjusted for inflation by using constant dollars from a particular year (in Table II-3, the real price is in terms of 1996 dollars). During this period the inflation-adjusted, or real, price of coal has generally declined. The one exception was a spike in coal prices during the OPEC petroleum price increases in the 1970s. The real price of coal per ton in 2002 was approximately 46 percent lower than in 1950.[7] The real price of coal per Btu was approximately 34 percent lower in 2002 than in 1950, which has caused coal to become the least expensive of the major fossil fuels in terms of cost per Btu.[8]

---

[4] Coal prices are the average open market sales prices for 2002. U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2002*, Table 28, p.52.

[5] Coal production obtained from U.S. Department of Labor, Mine Safety and Health Administration, Directorate of Program Evaluation and Information Resources, 2002 data. Average U.S. coal price estimates obtained from the Department of Energy, Energy Information Administration, *Annual Coal Report 2002*, Table 28, p. 52. Underground and surface coal revenues were separately computed, then summed to obtain total coal revenue.

[6] US Department of Energy, Energy Information Administration, *Annual Energy Review 2002*, October 2003, DOE EIA-0384 (2002), Table 7.2, p. 203 .

[7] US Department of Energy, Energy Information Administration, *Annual Energy Review 2002*, October 2003, DOE EIA-0384 (2002), Table 3.1, p. 71 and Table 7.2, p. 203.

[8] Ibid.

Table II-3: Coal Prices 1950-2001
(Dollars per Short Ton or per Million BTU)

Year	Nominal Price ($ per Short Ton)	Real Price (1996 $ per Short Ton)	Nominal Price ($ per Million BTU)	Real Price (1996 $ per Million Btu)
1950	5.19	29.74	0.21	1.19
1955	4.69	23.71	0.19	0.94
1960	4.83	21.77	0.19	0.87
1965	4.55	19.13	0.18	0.77
1970	6.34	21.82	0.27	0.92
1975	19.35	48.34	0.85	2.11
1980	24.65	43.22	1.10	1.93
1985	25.20	34.20	1.15	1.56
1990	21.76	25.15	1.00	1.15
1991	21.49	23.97	0.99	1.11
1992	21.03	22.90	0.97	1.06
1993	19.85	21.11	0.93	0.99
1994	19.41	20.22	0.91	0.95
1995	18.83	19.19	0.88	0.90
1996	18.50	18.50	0.87	0.87
1997	18.14	17.79	0.85	0.84
1998	17.67	17.12	0.83	0.80
1999	16.63	15.89	0.79	0.75
2000	16.78	15.68	0.80	0.74
2001	17.38	15.88	0.85	0.78
2002*	17.80	16.09	0.86	0.78

Source: US Department of Energy, Energy Information Administration, *Annual Energy Review 2002*, October 2003, DOE EIA-0384(2002) Table 7.8, p. 215; Table 3.1, p.71.

* Preliminary data.

COAL MINING INDUSTRY OUTLOOK

The U.S. coal industry enjoys a fairly constant domestic demand. About 92 percent of U.S. coal demand was accounted for by electric power producers in 2002.[9] Domestic coal demand is projected to increase because of growth in coal use for electricity generation. Coal consumption for electricity generation is projected to increase as the utilization of existing coal-fired generation capacity increases and as new capacity is added. The average utilization rate is projected to increase from 69 percent in 2001 to 83 percent in 2025. The amount of U.S coal exported in 2001 was 49 million tons (about 5 percent of production). These exports are projected to decline in the future, to about 26 million tons by 2025.[10]

[9] US Department of Energy, Energy Information Administration, *Annual Energy Review 2002*, October 2003, DOE EIA-0384 (2002), Table 7.3, p. 205.

[10] U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2003*. January 2003, pp. 89, 90.

THE STRUCTURE OF THE METAL/NONMETAL MINING INDUSTRY

The M/NM mining sector consists of about 80 different commodities including industrial minerals. There were 12,435 M/NM mines in the U.S. in 2002, of which 10,690 (86%) were small mines and 1,745 (14%) were large mines, using MSHA's traditional definition of small and large mines. Based on SBA's definition, however, only 18 M/NM mines (0.15%) were large mines.[11]

The data in Table II-3 indicate that employment at M/NM mines in 2002 was 175,701, of which 62,531 workers (36%) were employed by small mines and 113,170 workers (64%) were employed by large mines (excluding contractor workers), using MSHA's definition. Based on SBA's definition, however, 160,545 workers (91%) were employed by small mines and 15,156 workers (9%) were employed by large mines (excluding contractor workers). Using MSHA's definition, the average employment is 6 workers at a small M/NM mine and 65 workers at a large M/NM mine. Using SBA's definition, there is an average of 13 workers in each small M/NM mine and 842 workers in each large M/NM mine.[12]

Metal Mining

There are about 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 diesel-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 M/NM mines and employ 17 percent of all M/NM miners. Under MSHA's traditional definition of a small mine, 51 percent of metal mines are small, and these mines employ 3 percent of all miners working in metal mines. Using SBA's definition, 95 percent of metal mines are small, and they employ 57 percent of all miners working in metal mines.[13]

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. Diesel-powered haulage is used to transfer the broken rock from the quarry to the mill where crushing and sizing are done.

---

[11] U.S. Department of Labor Mine Safety and Health Administration, Directorate of Program Evaluation and Information Resources, calendar year 2002 data.

[12] Ibid.

[13] Ibid.

Stone mines constitute 35 percent of all M/NM mines, and they employ 45 percent of all M/NM miners. Using MSHA's definition of a small mine, 75 percent of stone mines are small, and these mines employ 31 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.[14]

<u>Sand & Gravel Mining</u>

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 diesel-powered machines, such as 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 57 percent of all M/NM mines, and they employ 25 percent of all M/NM miners. Using MSHA's definition of a small mine, 95 percent of sand and gravel mines are small, and these mines employ 75 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 approximately 35,714 miners.[15]

<u>Other Nonmetal Mining</u>

For enforcement and statistical purposes, MSHA separates stone and sand and gravel mining from other nonmetal mining. There are about 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. 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.

As with underground mining, there is a wide range of mining methods utilized in extracting minerals by surface mining. In addition to drilling and blasting, other mining methods, such as evaporation and dredging, are also utilized, depending on the ore formation.

"Other" nonmetal mines comprise 6 percent of all M/NM mines, and they employ 13 percent of all M/NM miners. Using MSHA's definition of a small mine, 70 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 90 percent of all miners working in these nonmetal mines.[16]

---

[14] Ibid.

[15] Ibid.

[16] Ibid.

ECONOMIC CHARACTERISTICS OF THE METAL/NONMETAL MINING INDUSTRY

The value of all M/NM mining output in 2002 was estimated at $37.9 billion. Metal mines, which include copper, gold, iron, lead, silver, tin, and zinc mines, contributed $7.9 billion.[17] Nonmetal production was valued at $30 billion: $9.3 billion from stone mining, $6.4 billion from sand and gravel, and $14.3 billion from other nonmetals such as potash, clay, and salt.[18]

The end uses of M/NM 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.

---

[17] U.S. Department of Interior, U.S. Geological Survey, *Mineral Commodity Summaries 2003,* January 31, 2003, p. 7.

[18] Ibid., pp.142, 144, 158, 160.

III. BENEFITS

INTRODUCTION

The benefits of a rulemaking addressing asbestos exposure limits would be the reduction or elimination of asbestos-related diseases arising from exposure to asbestos. The introduction of asbestos into the body can result in an increase of material impairment of health and a decrease in functional capacity. The development of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis is associated with exposure to airborne asbestos. Other associated adverse health effects include cancers of the larynx, pharynx, and kidneys.

The proposed asbestos rule is intended to reduce the incidence of adverse health effects among miners as a result of occupational exposure to asbestos. The benefits of reducing the levels of exposure to asbestos include a reduction in the incidence of illness and premature death, and a reduction in the attendant costs to the miners' employers, their families, and society at large. We anticipate that lowering the permissible exposure limits will limit the amount of asbestos miners take off mine property, thus reducing the risk of secondary asbestos exposure to others.[19]

This benefit analysis quantifies the reduction in the number of deaths to miners resulting from reduced occupationally-related exposure to airborne asbestos. The benefit is 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 and by replacing the short-term excursion limit of 10 f/cc for 15 minutes with an excursion limit (EL) of 1 f/cc over a minimum sampling measured time of 30 minutes. We are aware that these changes would not completely eliminate the risk of asbestos-related material impairment of health.

By lowering the TWA PEL from 2 f/cc to 0.1 f/cc, we estimate a reduction of between 9 and 84 percent in miner deaths caused by asbestos exposures. The deaths that could be prevented by lowering the 2 f/cc PEL are likely to occur between 10 and 65 years from now. This equates to between approximately 1 and 19 deaths that would be avoided within the 55 year period.

The reduction in risk of death from lung cancer, mesothelioma, or gastrointestinal cancer attributable to the proposed EL equates to 1.24 additional deaths avoided for every 1,000 exposed miners within the same 55 year period. This benefit is a result of decreasing miners' exposure to short-term bursts of airborne asbestos not covered by the proposed 0.1 f/cc. We are unable to estimate the absolute number of miner fatalities avoided by the proposed reduction to the EL because we have no empirical evidence on which to estimate the frequency and concentrations of short-term bursts of airborne asbestos.

---

[19] Peipins, L.A., Lewin, M., Campolucci, S., Lybarger, L.A., Miller, A., Middleton, D., Weis, C., Spence, M., Black, B., Kapil, V. "Radiographic Abnormalities and Exposure to Asbestos-Contaminated Vermiculite in the Community of Libby, Montana, USA." *Environmental Health Perspectives* 111:1753-1759.

We do not specify the dynamic response rate of a decreasing incidence of morbidity or mortality due to lowering the exposure limit. In most cases of asbestos-related illness resulting in death (i.e., lung cancer or mesothelioma), the duration of illness would be relatively brief—on average, perhaps two years or so after diagnosis. Asbestosis and other asbestos-related lung diseases, also occurring after a latency period, would generally lead to a material impairment of human health or functional capacity. These non-malignant adverse health effects are considered irreversible and would persist for the remainder of the miner's life.

Miners encounter asbestos during various occupational tasks. Miners who work with 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 bulk ore containing asbestiform minerals into potentially respirable 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 valuable ore. It is more difficult to manage the hazard in this type of situation. As long as miners are likely to encounter asbestos, miners and mine operators will need to follow adequate procedures to ensure a reduction of exposures. We anticipate risk reduction to occur through the use of engineering controls and accepted industrial hygiene administrative controls that effectively avoid disturbing asbestos on mine property.

OVERVIEW OF RISK MODELS DEVELOPED BY OSHA

We use OSHA's linear no-threshold dose-response risk assessment model to calculate the reduction of death as a result of lowering the permissible exposure limit from 2 to 0.1 f/cc.[20] Based on its critical review of scientific studies relating adverse health effects and exposures to asbestos, OSHA (51 FR 22631) concluded—

> … asbestos exposure causes lung disease, respiratory cancer, mesothelioma, and gastrointestinal cancer. … excess disease risk has been observed at cumulative exposures at or below those permitted by the existing OSHA 8-hour permissible exposure limit [PEL] of 2 f/cc. In addition, OSHA has made risk estimates of the excess mortality from lung cancer, mesothelioma, gastrointestinal cancer, and the incidence of asbestosis using mathematical models …

The risk assessment model used for the OSHA asbestos rulemakings is generally accepted and we believe is reasonable and well-supported. The assumption of linearity between exposure to airborne asbestos and the adverse health effects of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis is justified by the scientific health studies used in the risk assessment developed by Nicholson for OSHA. OSHA estimated cancer mortality rates for workers exposed to asbestos based on for cumulative exposures

---

[20] 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.

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. It is clear from these calculations that the estimated mortality from asbestos-related cancer decreases significantly by lowering exposure. The relationship between fiber concentrations and excess mortality is nearly linear. According, we interpolate linearly when considering concentrations between the previously published values. Although excess relative risk is linear in dose, the excess mortality rates are not strictly linear in dose.[21] This non-linearity is due in part to the age distribution and duration of exposures that integrate with the risk model.

OSHA initially developed the quantitative risk assessment for its 1986 asbestos rule lowering the PEL to 0.2 f/cc.[22] The risk assessment justified the 1988 final rule establishing an excursion level and the 1994 final rule establishing the PEL at 0.1 f/cc. OSHA, in its risk assessment, estimated the lifetime risk of three kinds of cancer (lung cancer, mesothelioma, and gastrointestinal cancer) for 1, 20 and 45 years of exposure. We apply these estimated lifetime risks to our estimates of miners' exposure to asbestos.

Explanation of Risk Models

Based on the epidemiological evidence, the risk assessment presents estimates of the potency of asbestos with respect to causing lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis. For epidemiological studies with individual exposure data, the authors derived coefficients defining the relationship between exposure and outcomes; for studies presenting an overall risk estimate and average estimate of exposure, the authors used this single point in the determination of coefficients. The following equations are from OSHA's risk assessment and describe the dose-response for the cancers and asbestosis:

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), and

d_{t-10} = Duration of the exposure (subtracting 10 years to account for latency).

Gastrointestinal Cancer:

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

$R_G = 0.1 \times R_L$,

[21] Nicholson, October 1983, p. 53.

[22] Ibid.

Where:

R_G = Predicted gastrointestinal cancer mortality.

R_L = Predicted lung cancer mortality.

Mesothelioma (Absolute Excess Risk Model):

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

$AR_M = f \times K_M \times (t-10)^3$, when $(10+d > t > 10)$,

$AR_M = 0$, when $(10 > t)$,

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) ($K_M = 1 \times 10^{-8}$), and

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) would continue to accumulate to some specified moment.

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), and

d = Duration of the exposure.

Based on Finkelstein's data, the slope of the linear regression is 0.055.[23] This model assumes a no-threshold dose-response relationship.

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. The following discussion of the benefits associated with a further reduction in exposures focuses on the number of cancer cases avoided within the exposed mining work force. We express the results in terms of deaths avoided because these cancers almost always result in death. The benefit of the proposed PEL of 0.1 f/cc with respect to a reduced incidence of asbestosis is not determined for this proposed rule.

---

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

Excess Mortality Rates Derived from Risk Models

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—

- Specified fiber concentrations,
- Exposure time periods of 1, 20 and 45 years,
- Dose-response models, and
- 1977 U.S. male background lung cancer mortality rates.

The range of exposures defined in the risk assessment cover 0.0 f/cc to 10.0 f/cc for durations of 1, 20, and 45 years. Also, the rates were determined as if the first exposure to asbestos occurs at age 25. We estimated the benefits of reduced exposure by comparing two groups of workers under the assumption that they either—

- Have always been exposed to the current levels described in Table III-1 , or
- Would 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.[24]

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

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	Mesothelioma	Gastro-Intestinal	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 subsequent rulemakings.

The concentrations of personal exposures to airborne fibers during mining operations are variable. Concentrations range between 0.0 and 38.1 f/cc within the most recent four-year exposure measurement period. Samples taken at the wollastonite mine are the only ones having fiber concentrations (determined using the PCM methodology) above 10.0 f/cc, the highest dose-response level in Table III-1. The constraint of the upper limit of the quantitative risk assessment determines the maximum possible risk characterization in terms of excess mortality. We, therefore, limit our calculations using an upper exposure limit of 10 f/cc and impose this bound because the range of information derived from the epidemiological studies used to determine the dose-response relationship in the risk assessment is equally limited.

Supplemental examination of the personal samples using transmission electron microscopy (TEM) indicates that not all fibers counted by PCM are the currently regulated minerals. The proportion of mineral fibers which are not asbestos is particularly high at operations mining and processing wollastonite. In this part of the benefits analysis, we do not distinguish between different mineralogical fibers and apply results from PCM analyses directly to the dose-response models. However, later in this chapter, we further discuss the implication of the supplemental TEM analyses.

To calculate the benefits of this proposed rule we use an 8-hour shift-weighted average (SWA) as a measure of personal exposures to airborne fibers. Here, fibers are defined by the shape and size of the particles—

- greater than 5 microns in length and
- with an aspect ratio (length to width) of at least 3:1 in accordance with the applicable phase contrast microscopy (PCM) based OSHA ID160 or equivalent NIOSH 7400 method that was used by our contract laboratory.

This benefits analysis uses the measured concentrations of asbestos from personal exposure assessments taken during inspections to represent the concentrations on workdays we do not perform assessments.

EXPLANATION OF EXPOSURE DATASET

We used the four most recent and complete calendar years of exposure assessment data derived from our mine safety and health inspection program. Beginning in January 2000, we initiated a focused effort to determine the extent of asbestos exposure among miners. The data used for the calculation of benefits of our proposed asbestos rule result from the sampling efforts through December 31, 2003 and were used for the calculation of benefits of our proposed asbestos rule. We selected 125 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.

Inspection protocols and sampling procedures for asbestos are well documented and readily available.[25] The sampling data can be found on our web site at www.msha.gov.

To estimate the duration and intensity of exposure to airborne asbestos, we reviewed the results of 706 full-shift personal exposure samples, comprised of 2,184 filter-cassettes. We calculated an 8-hour shift weighted average (SWA) from the full-shift exposure measurements. Typically, three filters were used for each miner sampled per shift. The filters collected in series covered the complete work shift the miner actually worked. Industrial hygienists, as well as inspectors, used multiple filters during the personal exposure sampling process to minimize the chance of overloading and obscuring the filter with material making it difficult or impossible to analyze.

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

These data cover 163 industrial hygiene personal air sampling visits at 125 mines, including an asbestos mine and mill that are now closed and one coal mine. The single asbestos mine and its associated mill closed in 2003. We exclude the asbestos mining operation data in our analysis because the mine is unique with respect to the mineral composition and no longer presents a hazard to miners. We expect that no asbestos mines will be open in the United States in the future and therefore, do not include them in this benefits analysis. The remaining sampled mines are more likely to be operating in the anticipated future.

Two of the 125 mines visited by us during the four years did not have results for the full-shift samples, because of overloaded filters, and were not included. We excluded another sample from the analysis due to an air pump malfunction. Consequently, 658 8-hour SWA results for airborne fibers were included for analysis. The results from the remaining mines represent the 123 non-asbestos mines in the seven commodity groups and collectively employ 12,363 miners. Four full-shift samples were from a coal mine. The remaining samples were from metal and non-metal mines. The benefits analysis focuses on the operations likely to be operating in the future and for which we have information about miners' previous exposure and potential future exposure to asbestos. Eighteen mines (15 percent) had at least one miner with an 8-hour SWA greater than 0.1 f/cc. Within the total of 658 valid personal exposure measurements, 56 (nine percent) indicate that an exposure over 0.1 f/cc had occurred.

Additional analyses using transmission electron microscopy (TEM, NIOSH 7402) are available for filters with a fiber concentration over 0.1 f/cc determined by PCM. The additional TEM results help characterize mineral types more accurately and are useful for providing a lower estimate of benefits. The discussion of a lower estimate of benefits occurs later in this chapter.

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

The lowest concentration of airborne asbestiform fibers reported by laboratories is determined by the limitations of the currently used standardized methodologies. Limit of detection (LOD) is a term used to define the lower quantifiable limit of an analysis. In other words, the LOD is the lowest number of fibers present on a filter that can be reliably detected. In this sense, the LOD defines the lower limit of the quantifiable range of fiber concentrations. 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 LOD describes the lower quantifiable limit for fibers on a filter whereas the MDC describes the lower quantifiable limit for fiber concentrations in air. The LOD, and hence the MDC, is laboratory and analytic method specific and depends on laboratory processing, microscopy specifications, and counting protocols. The MDC is calculated using the LOD and the volume of air passed through the filter. (Refer to equations 1 and 2 below.)

Reporting airborne fibers below a specific concentration is limited to the quantity defined by the MDC because the filter specific MDC is determined by dividing the analytic method LOD by the volume of air that passes through the collection filter. The MDC for the series of filters is dependent on the analytical method LOD, total air volume, and the number of filters in the series. This concept is important because we typically collect multiple samples in series to assess the miner's exposure for the entire work shift.

Using multiple filters in series during a full shift exposure assessment introduces complexity when calculating the 8-hour SWA, increases the MDC, and introduces the potential for systematic bias. If the true concentration is less than the detection limit for one or more filters in a series, a specific concentration for that filter or a complete SWA measurement can not be accurately determined. For a specific filter where the laboratory result is below the LOD, the true concentration is somewhere between 0 f/cc and the LOD.

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

To consistently use either 0 f/cc or the MDC when calculating the SWA would introduce a systematic bias in this exposure assessment. To determine the benefits of our proposed rule, we use a technique described by Hornung and Reed to correct the potential for systematic bias imposed by sampling and analytical methods (see the previous discussion of MDC).[26] To account for the uncertainty of the concentration of respirable asbestos associated with a filter when a result is below the MDC, we use the procedure of dividing the filter-specific MDC by the square root of two. We believe using the square root of two provides a sufficient estimate of the true exposure for purposes of calculating benefits of the rule. The resulting concentration estimate for the segment of the miner's shift represented by the filter is included with the results for the other filters in the series to calculate the 8-hour SWA. Using this adjusted estimate of fiber concentration for any result reported as being below the LOD gives a more accurate estimate of the miner's exposure than using zero or the MDC.

We acknowledge variability of the detection limits between laboratories by using the detection limits reported by laboratories, when available. Otherwise, we assume that the detection limits published in the method protocols are applicable. We use the following parameters to determine the MDC of the analytic methods applicable to Phase Contrast Microscopy (PCM) when the laboratory specific value is not available:

1) Total filter area for a 25-mm diameter filter (385 mm^2),
2) Area of the field of view using a standardized microscope (0.00785 mm^2), and
3) An analytical minimal detectable limit when viewing the collection filter through 100 fields of view.

Our determinations of the MDC use detection limit values of 5.5 fibers and 4.3175 fibers per 100 fields for samples analyzed using NIOSH 7400 and OSHA ID-160 methods, respectively.

Parameters used to calculate the air volume passed through a filter are sample pump flow rate (usually between 1.6 and 2.5 liters of air per minute) and the duration of

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

sampling time for each filter (which is variable and usually between 15 and 600 minutes). The numbers of filters used during personal exposure assessments in the exposure data vary from 1 to 10.

The MDC is lowest when the air volume is large. If the air volume is small, the MDC may not be low enough to determine accurately if a fiber concentration was below a specific quantity, such as an amount specified by an exposure limit. This is an important consideration when a collection time may be only 30 minutes. To obtain the lowest possible MDC for the miner's work shift, the largest volume of air should pass through the fewest number of filters. Using one filter is not always practical. The use of multiple filters can effectively minimize overloading a single filter with material that would otherwise invalidate the series. Using multiple filters during the assessment period effectively reduces the air volume through each filter which increases the MDC. Therefore, the MDC for a series of filters is greater than when only one filter is used for the same collective volume of air.

EQUATIONS USED TO DETERMINE THE 8-HOUR SWA CONCENTRATION

The MDC for each filter is calculated using the following relationship.

Equation 1:

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

The calculation used to determine the MDC for a series of filters is defined as follows:

Equation 2:

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

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

In summary, using the MDC_{Filter} divided by the square root of two and using that result in the appropriate formula will effectively minimize bias introduced otherwise. Therefore, by appropriately replacing TWA_n in Equation 3 with the respective MDC_{Filter} resulting from dividing by the square root of two, we obtain a better estimate of the true exposure.

Equation 3:

Eight-hour SWA = $(TWA_1t_1 + TWA_2t_2 + \ldots + TWA_nt_n)/480$ 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

The following sections explain how we estimate the number of deaths avoided due to a reduction in the airborne asbestos permissible exposure limit.

Exposure Assessment

Industry Sector Groups

We group commodities according to characteristics of mineral deposits, disbursement of asbestiform minerals, and to facilitate a reasonable determination of the number of miners at risk. Combining mines, each employing a few miners, into a single group facilitates a better estimate of risk of exposure for that group of miners. The groups of commodities classifying mines sampled for airborne asbestos are defined as follows—

- Asbestos (Currently all asbestos mines are closed and are not considered in this analysis.),
- Boron
- 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
- Talc
- Vermiculite
- Wollastonite

- Other: coal, common clays, fire clay, gold ore, gypsum, lime, mica, miscellaneous metal ores, miscellaneous nonmetal ores, olivine, perlite, potash, pumice, salt, trona.

Exposure Categories

We use four levels of fiber concentrations to estimate the risk miners face in the workplace. These ranges for the exposure level groups are related to the proposed and current limits as well as divisions observed in the distribution of data. These categories are—

1. Less than 0.1 f/cc,
2. 0.1 to less than 1.0 f/cc,
3. 1.0 to less than 2.0 f/cc,
4. Greater than or equal to 2.0 f/cc.

Examination of laboratory results indicates that concentrations of airborne asbestos are variable between mines and between miners within mines.[27] Table III-2 summarizes the proportional distribution of samples in each of the four exposure ranges. Examination of Table III-2 shows that 90 percent of results are below our exposure limit of 0.1 f/cc.

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

Commodity Group	0 < x < 0.1 f/cc	0.1 <= x < 1.0 f/cc	1.0 <= x < 2.0 f/cc	2.0 <= x f/cc
Boron Mineral	0.56	0.44	0.00	0.00
Iron(taconite)	0.87	0.12	0.01	0.00
Other	0.94	0.04	0.02	0.00
Rock Quarry	0.96	0.04	0.00	0.00
Talc	0.95	0.05	0.00	0.00
Vermiculite	0.96	0.04	0.00	0.00
Wollastonite	0.00	0.22	0.06	0.72
Proportion by Level	0.90	0.07	0.01	0.02

* Totals may be different from the sum of the columns or rows because of rounding. This phenomenon applies to all tables published in the benefits chapter.

Exposure Assessment Results

We report the arithmetic means of fiber concentrations determined by PCM within the 28 commodity-exposure level categories in Table III-3.

[27] Mines, as well as miners, were not randomly selected for sampling, but because of features that made the presence of asbestos more likely.

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

Commodity Group	0 < x < 0.1 f/cc	0.1 <= x < 1.0 f/cc	1.0 <= x <2.0 f/cc	2.0 <= x f/cc	Average by Commodity
Boron Mineral	0.013	0.168			0.082
Iron(taconite)	0.017	0.241	1.270		0.044
Other	0.013	0.117	1.982		0.052
Rock Quarry	0.016	0.182			0.021
Talc	0.012	0.146			0.019
Vermiculite	0.030	0.134			0.035
Wollastonite	0.019	0.531	1.004	15.663	11.486
Level Averages	0.019	0.228	1.419	15.663	0.347

* Averages are rounded to thousandths.

Table III-4 shows the number of mines sampled by commodity group and associated employment levels. The employment levels for the mines reflect the last full reporting year (2002).

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

Commodity Group	Number of Mines with Valid Samples	Miners	Office Workers	Total Employees by Commodity
Boron Mineral	2	714	113	827
Iron (taconite)	14	4,906	582	5,488
Other	24	2,362	306	2,668
Rock Quarry	66	2,310	458	2,768
Talc	12	305	124	429
Vermiculite	4	96	9	105
Wollastonite	1	47	31	78
Totals	123	10,740	1,623	12,363

We distribute the miners represented by these exposure samples into the 28 commodity-exposure level categories according to the proportion of samples (see Table III-2) within the four exposure levels and seven sampled commodity groups. The process of distributing the number of miners at risk among the 28 commodity-exposure level groups using the proportion of sampling results in each group allows a better estimate of exposure and risk for the population of miners sampled. Table III-5 is a summary of the distribution of miners by exposure level and commodity group. We expect that, on average, the frequencies and concentrations shown by the exposure assessments are representative of the sampled mines.

Table III-5: Distribution of Miners by Level of Exposure and Commodity Group*

Commodity Group	0 < x < 0.1 f/cc	0.1 <= x <1.0 f/cc	1.0 <= x < 2.0 f/cc	2.0 <= x f/cc	Total by Commodity Group
Boron Mineral	509.7	317.3	0.0	0.0	827
Iron(taconite)	4,870.2	581.5	36.3	0.0	5,488
Other	2,534.3	89.1	44.6	0.0	2,668
Rock Quarry	2,682.0	86.0	0.0	0.0	2,768
Talc	412.9	16.1	0.0	0.0	429
Vermiculite	101.1	3.9	0.0	0.0	105
Wollastonite	31.0	10.4	2.6	33.9	78
Level Totals	11,141.2	1,104.3	83.5	33.9	12,363

* The estimates of numbers of miners are rounded to tenths.

Benefits of a Reduction in the 8-hour SWA PEL

We limit quantified benefits to estimation of the number of cancer cases avoided. We express the results as "deaths avoided" because these cancers almost always result in premature death. The benefits resulting from a reduction in the PEL depend on several factors including—

- current and projected exposure levels,
- age of the miner at first exposure,
- number of workers exposed, and
- risk associated with each exposure level.

The projected benefits of a reduction in the PEL are dependent on current exposure levels and the number of workers exposed. The risk models for the cancers depend on the age of the miner when first exposed. Our calculations incorporate the same age structure of the workers used to develop Table III-1. The average 8-hour SWA exposure in each commodity group by exposure level category (See Table III-3) represents the average exposure for the miners classified in the same commodity group and level of exposure category (see Table III-2).

We have no information on asbestos exposures for miners while working in offices. We propose that miners working in offices on mine property have exposures at or below the lowest levels observed for other miners within the same commodity. Because office workers are often located in buildings on mine property, we anticipate that they would have exposures similar to the lowest levels of airborne fibers typically measured at the mines. Since these lowest levels are below the proposed 0.1 f/cc PEL, the effects of lowering our current limit are not likely to involve office workers.

For wollastonite, we propose that concentrations similar to the lower concentrations found in the other commodities will occur following implementation of the proposed PEL. We accept the average concentration of 0.019 f/cc for all mines within the 0 to 0.1 f/cc exposure group as an achievable level. We note that 90 percent of measurements are within this exposure group. Therefore, we use the concentration of

0.019 f/cc as the reduced concentration target for wollastonite miners to facilitate the calculation of benefits.

We use the lifetime risk of lung cancer, mesotheliomas, and gastrointestinal cancer estimated by OSHA.[28] OSHA's risk assessment is discussed extensively in reports on the benefits of the OSHA rules and in previously published *Federal Register* documents.[29] We rely on OSHA's risk assessment for the quantification of benefits in this proposed rule.

We estimate the benefits of this rule by applying the quantitative effects of exposure to asbestos defined in OSHA's risk assessment to our estimates of miners' exposures to asbestos and calculate the reduction in adverse outcomes as a result of this proposed rule. These estimates are for miners whose exposures result from naturally-occurring asbestos in the ore body. We recognize that exposures from asbestos containing building material (ACBM) occur in mining operations; however, our experience and data measuring exposures during removal of ACBM is limited.

The greatest threat to human health from exposure to low concentrations of asbestos is death from lung cancer and mesothelioma.[30] We also recognize gastrointestinal cancer as a life-threatening disease caused by exposure to low concentrations of asbestos. This analysis estimates the number of avoidable deaths from lung cancer, mesothelioma, and gastrointestinal cancer at the proposed PEL of 0.1 f/cc. We discuss benefits for the proposed 30-minute 1.0 f/cc EL in a later section.

We use the mortality rates from OSHA's risk assessment (see Table III-1), assuming the age characteristics in today's miners are similar to the ages of workers in general industry when the rates were calculated. Also, we calculate the rate of cancer mortality for fiber concentrations between values published in Table III-1 using linear interpolation.

We assume that miners would experience exposures similar to the group of miners with the lowest average levels documented in our exposure data for their remaining working career after implementing the proposed PEL. The record of evidence indicates that exposures may average significantly below 0.1 f/cc. Approximately 90 percent of observed fiber concentrations are below 0.1 f/cc. Also, the majority of asbestos-exposed miners would experience less than 45 years of exposure at any one concentration. Variations in these estimates directly influence the benefits estimate.

Steps for Calculating Benefits

---

[28] 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.

[29] 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; *Benefits Assessment of Emergency Temporary and Proposed Asbestos Standard*, JRB Associates, November 3, 1983.

[30] Jacob, G., and Anspach, M. "Pulmonary Neoplasia Among Dresden Amosite Workers." *Ann NY Acad Sci* 132:536-548, 1965; Peto, J. "Dose-Response Relationships for Asbestos-Related Disease: Implications for Hygiene Standards, Part II, Mortality." *Ann NY Acad Sci* 330:195, 1979.

Step 1: We first derive from Table III-1 the mortality rates for the average concentrations of exposure in Table III-3. We then multiply these derived mortality rates by number of miners exposed at the corresponding concentrations in Table III-5. This calculation results in an estimate of deaths resulting from lung cancer, mesothelioma, and gastrointestinal cancer due to occupational exposure to asbestos incurred by miners working within current conditions.

Step 2: We then estimate the excess deaths as if the same groups of miners have exposures equal to the lowest exposures specific 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' occupationally related deaths from asbestos induced lung cancer, mesothelioma, or gastrointestinal cancer expected by lowering the PEL from 2.0 f/cc to 0.1 f/cc.

Example

This section describes, step-by-step, the process for calculating benefits using the Rock Quarry commodity group as an example.

Step 1: In the sampled rock quarries, the only exposures over 0.1 f/cc are in the 0.1 to 1.0 f/cc range (Table III-3). The risk associated with an average concentration between these levels is between 231 and 460 deaths per 100,000 miners (Table III-1). The average concentration for Rock Quarry miners in this range is 0.182 f/cc. Interpolating between the risks at 0.1 f/cc and 1.0 f/cc, we estimate that the risk at 0.182 f/cc is about 418 deaths per 100,000 miners. The interpolated risk is then applied to the number of miners at risk to determine the number of avoidable deaths due to lung cancer:

$$\left(\frac{418\ \text{deaths}}{100{,}000\,\text{exposed miners}}\right) * 86\,\text{exposed miners} = 0.36\,\text{deaths.}$$

Step 2: We estimate the number of occupationally related lung cancers expected for these miners if their exposures are reduced to the average concentrations observed below 0.1 f/cc in the same commodity group. The average concentration for Rock Quarry miners is 0.016 f/cc. Again, interpolating between the risk at 0 f/cc and 0.1 f/cc (0 and 231 deaths per 100,000 miners), we estimate the risk at 0.016 f/cc is about 37.7 deaths per 100,000 miners. This interpolated risk is then applied to the number of miners at risk to determine the number of avoidable deaths due to lung cancer:

$$\left(\frac{37.7\ \text{deaths}}{100{,}000\,\text{exposed miners}}\right) * 86\,\text{exposed miners} = 0.03\,\text{deaths.}$$

Step 3: Lastly, we take the difference between these results to calculate a total of 0.36 – 0.03 = 0.33 avoided lung cancer deaths due to reducing exposures below 0.1 f/cc in Rock Quarry mines. This value rounds to 0.3 avoidable deaths and is in Table III-6. We calculate the benefits in this way for each level of the 28 commodity group-exposure level categories. The total benefit of "avoided deaths" is the sum of all avoided deaths within each commodity group. We must emphasize that the estimate of the reduction in avoidable deaths is from a hypothetical situation comparing the current state of miners with a simulated group exposed to our best estimate of the effects of promulgating a PEL of 0.1 f/cc.

Benefits of the Proposed 0.1 f/cc 8-hour Time Weighted Average Permissible Exposure Limit

The total number of cancer deaths avoided by this rule would be the sum of cancer deaths avoided at all the mines included in the exposure data. We estimate there would be up to 13.1 avoided lung cancer deaths due to occupational exposure to asbestos, 4.4 avoided deaths due to mesothelioma, and 1.3 avoided deaths due to a gastrointestinal cancer. In summary, we estimate that approximately 19 deaths from lung cancer, mesothelioma, or gastrointestinal cancer could be avoided. This represents an 84 percent reduction in occupationally-related deaths resulting from exposure to airborne asbestos by lowering the PEL from 2 to 0.1 f/cc. Table III-6, as noted earlier, is a summary of estimated deaths avoided within commodity group and type of cancer.

Table III-6: Miner Cancer Deaths Avoided Due to a Reduction in the Exposure Limit From 2 f/cc to 0.1 f/cc 8-hour TWA

Commodity	Lung	Mesothelioma	Gastrointestinal	Total
Boron Mineral	1.1	0.4	0.1	1.6
Iron(taconite)	4.0	1.4	0.4	5.8
Other	2.1	0.7	0.2	3.1
Rock Quarry	0.3	0.1	0.0	0.5
Talc	0.0	0.0	0.0	0.1
Vermiculite	0.0	0.0	0.0	0.0
Wollastonite	5.5	1.7	0.6	7.8
Total	13.1	4.4	1.3	18.9

Our estimate of the reduction in avoidable deaths is from a hypothetical situation, comparing our estimate of the current level of miners' exposure to a theoretical group exposed to our best estimate of the effects of promulgating a SWA exposure limit of 0.1 f/cc. The reduction in the number of deaths, caused by our implementation of a lower occupational exposure limit to asbestos, will occur over many years. The decrease in the incidence of lung cancer, mesothelioma, or gastrointestinal cancer among miners would not be noticeable in the year immediately following implementation of the lower PELs. The decrease in cancers, however, may become evident as soon as 10 years after lowering the exposures. Most likely, the full benefit will occur 65 years after implementation of the lower PELs. The rate at which the incidence of the cancers decreases depends on several factors. These factors include, but are not limited to, the—

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

It is not possible to accurately quantify the complete dynamics of this process. Therefore, we estimate the upper estimate of the19 death reduction to occur between 10 and 65 years after implementation of the lower 0.1 f/cc 8-hour SWA PEL.

Determination of a Lower Estimate of Benefit Incorporating Information about Fiber Mineralogy

Airborne fibers present at mines can be of other mineralogy not specified in the proposed regulation. It is MSHA's policy to further investigate airborne fiber mineral composition when PCM analysis of an individual filter indicates an airborne fiber concentration equal to or greater than 0.1 f/cc TWA. We use available TEM analyses as supplemental information to compensate for the presence of non-regulated fibrous minerals found in environments of mining operations. Our current policy is to incorporate supplemental TEM analyses when a PCM result indicates an excess of 0.1 f/cc by filter. We combine this supplemental TEM information with the 658 PCM analyses to provide a lower estimate of benefits.

Transmission electron microscopy (TEM) is used to differentiate between mineral compositions of fibers collected for airborne fiber analysis. The TEM analyses are performed according to NIOSH 7402 methodology. The laboratory reports an estimate of the proportion of regulated asbestos fibers (chrysotile and asbestiform amphiboles) to all fibers for the filter associated with the PCM analysis. Between January 2000 and December 2003, supplemental TEM analyses provide 273 results estimating the proportion of asbestos fibers to all fibers. A list of the frequency of results and the average proportion of asbestos fibers to all fibers is provided in Table III-7.

Table III-7: Frequency of TEM Analyses and Average Proportion of Asbestos Fibers to All Fibers by Commodity

Commodity	Number of Filters with Valid TEM Results*	Average Proportion of Airborne Asbestos Fibers
Boron Mineral	9	0.000
Iron (taconite)	84	0.216
Other	9	0.000
Rock Quarry	19	0.297
Talc	0	-
Vermiculite	89	0.435
Wollastonite	63	0.013
All Results	273	0.232

*TEM analyses are performed on filters when PCM results indicate an airborne fiber level greater than 0.1 f/cc.

There are small numbers of observations for the commodities Boron Mineral and Other and no valid asbestos fiber differentiation results within the Talc commodity. None of the TEM analyses for boron mineral and other commodities reported any presence of asbestos fibers. This analysis does not make claim to the asbestos content of the ore bodies in the past, present, or future. Rather, historical airborne asbestos fiber concentrations are determined for estimating miners' exposures for a benefits analysis. Because of the low number of observations in the Boron Mineral and Other commodity groups, the estimate of the proportion of asbestos fibers in these groups should be considered a weak approximation. Therefore the two estimates of zero average proportion of airborne asbestos fibers should be considered approximate. We do not adjust the fiber concentrations within the Talc commodity group because we have no TEM differentiation of asbestos fibers for samples whose fiber counts were above 0.1 f/cc determined by PCM.

The estimation of deaths avoided by lowering the PEL and incorporating the supplemental TEM results uses the same logic and equations defined previously. Airborne fiber concentrations greater than 0.1 f/cc using the 8-hour SWA, as determined by PCM, are multiplied by the average proportions of asbestos fibers to all fibers within the respective commodity groups. The average exposure concentration for each commodity group is recalculated using the adjusted exposure concentrations and reported in Table III-8. This adjustment may provide a closer estimate of the risks associated with the epidemiology and toxicology studies used to develop OSHA's risk assessment.

Table III-8: Average Concentrations of Airborne Fibers Grouped by Commodity and Exposure Level[a] Using TEM Adjusted Measurements

Commodity Group	0 < x < 0.1 f/cc	0.1 <= x f/cc	Average by Commodity
Boron Mineral	0.007		0.007
Iron(taconite)	0.019	0.177	0.022
Other	0.013		0.013
Rock Quarry	0.017	0.115	0.017
Talc	0.012	0.146	0.019
Vermiculite	0.032		0.032
Wollastonite	0.040	0.259	0.149
Level Average	0.020	0.229	0.025

[a] Averages are rounded to thousandths.

The adjusted proportion of samples in each level of exposure is given in Table III-9. The numbers of employees with exposures to concentrations of asbestos within the exposure level groups are given in Table III-10.

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

Commodity Group	0 < x < 0.1 f/cc	0.1 <= x < 1.0 f/cc	1.0 <= x < 2.0 f/cc	2.0 <= x f/cc
Boron Mineral	1.000	0.000	0.000	0.000
Iron(taconite)	0.983	0.017	0.000	0.000
Other	1.000	0.000	0.000	0.000
Rock Quarry	0.996	0.004	0.000	0.000
Talc	0.947	0.053	0.000	0.000
Vermiculite	1.000	0.000	0.000	0.000
Wollastonite	0.500	0.500	0.000	0.000
Proportion by Level	0.979	0.021	0.000	0.000

[*] Totals may be different from the sum of the columns or rows because of rounding. This phenomenon applies to all tables published in the benefits chapter.

Table III-10. Distribution of Miners by Level of Exposure and Commodity GroupUsing Information from TEM Analyses [*]

Commodity Group	0 < x < 0.1 f/cc	0.1 <= x f/cc	Total by Commodity Group
Boron Mineral	827.0	0.0	827
Iron(taconite)	5,405.3	82.7	5,488
Other	2,668.0	0.0	2,668
Rock Quarry	2,758.0	10.0	2,768
Talc	412.9	16.1	429
Vermiculite	105.0	0.0	105
Wollastonite	54.5	23.5	78
Level Totals	12,230.8	132.2	12,363

* The numbers of miners are rounded to tenths.

When considering the differentiation of mineralogy of fibers determined by TEM, the total number of cancer deaths avoided by this rule would be the sum of cancer deaths avoided at all the mines included in the exposure data. We could expect, on average, 0.48

avoided death due to lung cancer, 0.18 avoided death due to mesothelioma, and 0.05 avoided death due to a gastrointestinal cancer. In summary, we estimate that approximately one death from lung cancer, mesothelioma, or gastrointestinal cancer could be avoided using supplemental mineralogical information provided by TEM analyses. The expected reduction would occur between 10 and 65 years after implementation of the lower PEL. This represents a 9 percent reduction in miners' occupationally-related deaths resulting from exposure to airborne asbestos by lowering the PEL from 2 to 0.1 f/cc. Table III-11 is a summary of estimated deaths avoided within commodity group and type of cancer considering the mineralogy of airborne fibers.

Table III-11: Miner Cancer Deaths Avoided Due to a Reduction in the Exposure Limit from 2 f/cc to 0.1 f/cc 8-hour SWA Considering Information from TEM Results

Commodity	Lung	Mesothelioma	Gastrointestinal	Total
Boron Mineral	0.00	0.00	0.00	0.00
Iron(taconite)	0.29	0.10	0.03	0.43
Other	0.00	0.00	0.00	0.00
Rock Quarry	0.02	0.01	0.00	0.03
Talc	0.05	0.02	0.00	0.07
Vermiculite	0.00	0.00	0.00	0.00
Wollastonite	0.11	0.05	0.01	0.18
Total	0.48	0.18	0.05	0.71

In conclusion, the number of avoided deaths due to lung cancer, mesothelioma, and gastrointestinal cancer is likely to be between 1 and 19 upon implementation of a lower PEL of 0.1 f/cc.

Benefits of the Proposed Excursion Limit

We are proposing an excursion limit (EL) of 1.0 f/cc for one 30-minute period per day. This section estimates the benefits of the proposed excursion limit.

The preamble of OSHA's rulemaking for an excursion limit (53 FR 35609) characterizes asbestos exposures due to construction, abatement, and demolition activities for buildings that contain commercial asbestos. The intended effect of the excursion limit is to protect miners from the adverse health risks associated with brief fiber release episodes. This type of exposure can be anticipated and proactively controlled by the use of personal protective equipment (respirators and protective clothing) and by implementing engineering or work practice controls (glove boxes, tents, wet methods).

We anticipate that buildings on mine property will be demolished or refurbished sometime during the life cycle of the mine. Building demolition potentially creates a risk of exposure to commercial asbestos when it is present, either in ACBM or as settled dust-containing asbestos. Mechanics may be inadvertently exposed to airborne asbestos while working on older equipment that may have asbestos-containing parts. We also anticipate that miners may encounter short fiber-releasing episodes while drilling, dozing, blasting, or roof bolting in areas of naturally occurring asbestos. These short spurt exposures can be above 1.0 f/cc. However, when averaged over an 8-hour shift, they fall within the permissible 8-hour SWA limit of 0.1 f/cc.

Two 30-minute excursions per day at 1.0 f/cc would exceed the 8-hour, full shift exposure limit (i.e., 1 f/cc for 48 minutes = 0.1 f/cc for 480 minutes). Because we have little information about the frequency of short-term exposures and their relationship to health outcomes, we justify the benefits of the EL by showing the difference in concentration between the proposed 8-hour SWA and the proposed EL PELs.

To calculate the degree of reduction in risk, we note that the 8-hour SWA exposure corresponding to a single 30-minute episode at the proposed EL 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 would be 0.063 f/cc. For comparison, our current short-term excursion limit of 10 f/cc for 15 minutes is 0.313 f/cc when expressed in SWA terms. Thus, the proposed EL is slightly lower than the proposed SWA exposure limit by 0.037 f/cc.

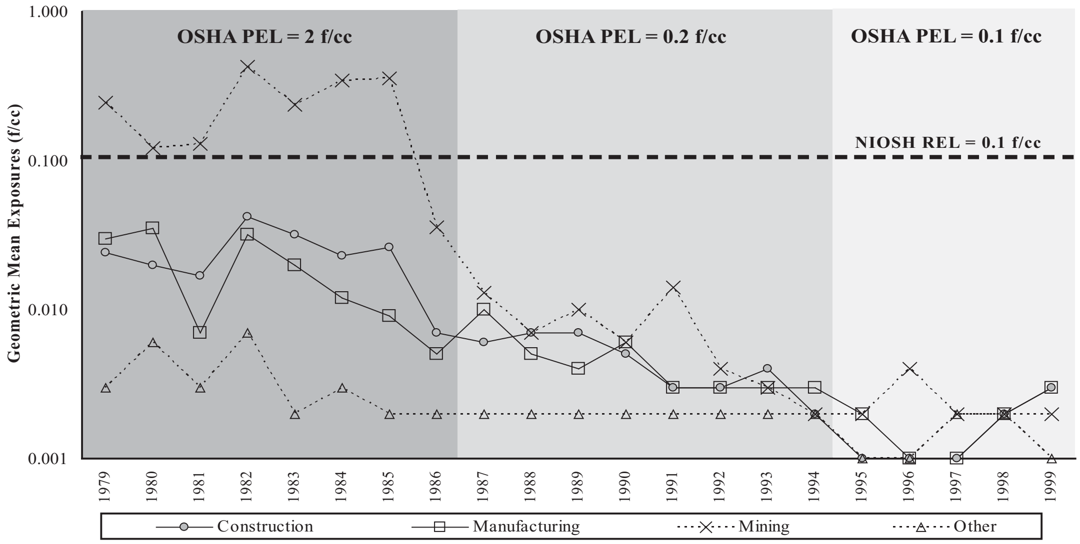
The lifetime risk associated with an exposure to 0.1 f/cc for any of the three types of cancer is 0.00336, if first exposed at age 25 and exposure continues every work day at that level for a duration of 45 years. The risk associated with exposure to 0.063 f/cc using the same age and duration of exposure is 0.00212. The difference in lifetime risk is 0.00124. This risk equates to 1.24 additional avoidable deaths for every 1,000 miners exposed to asbestos at a concentration afforded by the EL rather than that afforded by the proposed 8-hour SWA exposure limit. We anticipate that mining operations will be subject to potential short-term fiber release episodes even after lowering airborne asbestos concentrations to the SWA exposure limit. However, we have insufficient data to obtain a meaningful estimate of the frequency of short-term fiber release episodes and their associated exposures. This analysis only demonstrates the theoretical benefits from limiting short-term occupational exposures to 1.0 f/cc over 30 minutes.

BENEFITS SUMMARY OF PROPOSED RULE

We acknowledge that mining operations whose ore contains naturally occurring asbestos seem to have reduced exposures of their miners, perhaps due in part to their awareness of the lower exposure limits promulgated by OSHA in the 1980s.[31]

[31] US Department of Health and Human Services, National Institute of Occupational Safety and Health, *WoRLD Surveillance Report 2002*, May 2003 pp. 16-17, 19-23.

Chart III-1: Industry Trends of Airborne Asbestos Concentrations



Source: US Department of Health and Human Services, National Institute of Occupational Safety and Health, *WoRLD Surveillance Report 2002*, May 2003.

We believe that the pressure of public scrutiny and government intervention can prompt mine operators to take precautionary measures to limit miners' exposures to asbestos. If public pressures were to subside, and we did not have a regulation limiting exposures to 0.1 f/cc over an 8-hour shift, we would not have a means to enforce the same level of protection provided in other industries.

This analysis overstates health benefits to the extent that we do not account for—

- Differential risks posed by different types of fibers indistinguishable by PCM,
- Differences in the cancer mortality risk for asbestos-exposed workers who smoke and those who do not.

The estimates of the cancer deaths avoided by reducing the PELs understate the total amount of benefits gained from this rule. These 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 in the decrease in the quality of life of the affected individual. Similarly, MSHA's analysis does not quantify benefits among groups incidentally exposed, such as miners' family members. We note that several published articles document and discuss the health effects resulting from exposure to asbestos incident to living with a miner.[32]

[32] US Department of Health and Human Services, National Institute of Occupational Safety and Health, *Publication No. 2002-113*, May 2002.

Finally, enforcement of the lower PELs together with the direct support from the federal government in education, identification, and elimination of the asbestos hazard would increase awareness of and attention to the presence of asbestos on mine property. These activities help focus efforts on preventing exposures, thus providing miners with added health benefits.

By lowering the 8-hour SWA PEL from 2 f/cc to 0.1 f/cc, we estimate a reduction of between 9 and 84 percent in occupationally related deaths caused by asbestos exposures. Comparing the expected deaths from occupational exposure under each limit, we estimate between 1 and 19 deaths could be avoided by lowering the 8-hour SWA PEL to 0.1 f/cc over a 55 year period. The reduction in risk of death from lung cancer, mesothelioma, or gastrointestinal cancer attributable to the proposed excursion limit (EL) equates to 1.24 additional avoidable deaths for every 1,000 miners exposed to asbestos. This reduction in fatalities is the result of decreasing miners' exposure to short-term bursts of airborne asbestos unaccounted for by the proposed 8-hour SWA PEL.

IV. COST OF COMPLIANCE

INTRODUCTION

In this chapter, we estimate the compliance costs associated with the proposed asbestos rule. Table IV-1 presents the total yearly compliance costs by compliance strategy, mine type, and mine size. The proposed rule would result in net costs for all mine operators, both coal and M/NM, of about $136,000 per year. For M/NM mines, the cost would be about $92,000 and, for coal mines, about $45,000. All cost estimates are presented in 2002 dollars.

Table IV-1: Summary of Costs*

	Compliance Strategy				
M/NM Mine Size	Selective Mining	Wet Methods	Mill Ventilation	Removal of Introduced Asbestos	Total for M/NM Mines
Small (< 20)	$1,058	$1,235	$747	$1,750	$4,790
Large (20-500)	$4,922	$8,614	$12,916	$21,000	$47,452
Large (>500)	$1,641	$2,871	$19,001	$15,750	$39,264
Total	$7,622	$12,721	$32,664	$38,500	$91,506
	Compliance Strategy				
Coal Mine Size	Selective Mining	Wet Methods	Mill Ventilation	Removal of Introduced Asbestos	Total for Coal Mines
Small (< 20)	-	-	-	$875	$875
Large (20-500)	-	-	-	$12,250	$12,250
Large (>500)	-	-	-	$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 our knowledge, experience, and available information. In some cases, however, our estimates may appear to deviate slightly from the sum or product of their component factors due to the fact that the component factors have been rounded in the tables for purposes of readability.

METHODOLOGY

In determining the effects of the proposed rule, we 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. Capital expenditures, such as the cost of purchasing compliance equipment, is an example of a one-time or intermittent cost. For the purposes of this analysis, one-time costs have been annualized using a (real) annual discount rate of 7%, as recommended by the U. S. Office of Management and Budget (OMB), over an infinite (or, at least, indefinite) 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. As "n" becomes large, the value of "a" approaches the discount rate. Therefore, for one-time costs with an infinite life, MSHA has applied an annualization factor equal to the annual discount rate of 7% (that is, the annualized cost is equal to 7% of the one-time cost). Unless otherwise specified, all first year costs in this PREA were annualized using a 7 percent annualization factor.

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.[33] Annual costs are costs that normally recur annually. Two examples of annual costs are (annual) refresher training costs and recordkeeping costs.

The labor costs used in this analysis for metal/non-metal miners are based upon their 2002 wage rates. The wage rates used in this analysis are:

$47.58 per hour for a supervisor;

$20.51 for a metal/non-metal miner; and

$19.06 for a clerical worker.[34]

These wage rates include benefits (which include social security, unemployment insurance, and workers' compensation), but do not reflect shift differentials or overtime pay. For convenience, MSHA will refer to miner "compensation" in this PREA as "wages," where that term is understood to include benefits.

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

SECTION-BY-SECTION DISCUSSION

This proposed rule would require mine operators to reduce the permissible exposure limit (PEL) for asbestos in both M/NM and surface coal mines (including

---

[33] Note that many one-time costs, such as labor and testing costs or small capital costs, would not normally be financed by mine operators. Nevertheless, we have 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.

[34] Wages are derived from U.S. Metal and Industrial Mineral Mine Salaries, Wages, and Benefits 2002 Survey Results, Western Mine Engineering, 2002.

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 would occur from introduced asbestos-containing materials.

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

This provision, the only one changed by the proposed rule, would 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 EL 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 proposed PEL. Typically, mine operators have used selective mining, wet methods, mill ventilation, and removal of introduced asbestos to control asbestos exposure. How asbestos is found in the mine would dictate the compliance strategy utilized by the operator. At most mines where asbestos is present, we believe that operators already have an economic incentive to use these methods either to avoid liability or to increase the marketability of their product (as well as to protect the health of their employees).[35] Those that do not, we expect, either have a short time horizon, few or no assets, or operate in a state that does not recognize employer liability under the "dual capacity doctrine" in cases where an employee is injured by a product manufactured by the employer.[36] Below we summarize the cost of the four compliance strategies identified above (i.e. selective mining, wet methods, mill ventilation, and removal of introduced asbestos) for mines that are currently above the proposed PEL or EL.[37] We estimate that, for each year that the rule is in effect, each one of these strategies, except for mill ventilation, will be adopted by one mine. For mill ventilation, we expect that only mine operators relying on an existing local exhaust ventilation system to control dust would use this type of compliance strategy by adding supplemental ventilation to help control asbestos exposure and that only one mine every ten years would use mill ventilation to achieve compliance. Mine operators employing mill ventilation would upgrade their primary system by adding exhaust fans to the building to meet the new PEL and EL. We assume that the mine operators that adopt these strategies only after the promulgation of this proposed rule are uncharacteristic of the majority of mines in the industry. We seek information, data, and comments on these assumptions and on the following cost estimates.

[35] The benefits and costs of these strategies which have already been implemented by most operators with any asbestos onsite are not properly attributable to this proposed rule and are not, therefore, included in the calculation of compliance impacts.

[36] In this sense, the employer as manufacturer would be treated as a third party to the employer/employee relationship and would thus be considered to be outside the protection of the workers' compensation exclusivity clause. See Ashford and Caldart (1996), *Technology, Law, and the Working Environment*, p. 469.

[37] This is not an all-inclusive list of compliance strategies. The actual strategy chosen will depend on the type of mine, the commodity mined, and mining conditions.

Selective Mining

Table IV-2 presents the costs of using selective mining to comply with the proposed PEL and EL. Selective mining would entail inspecting the faces of a mine to determine whether asbestos-contaminated ore is present. If present, the mine operator would employ an extra miner to remove and safely dispose of the contaminated ore. This would keep the ore from contaminating the mill and other processing facilities. In the absence of this proposed rule, this contaminated ore would enter the mine's product stream. Therefore, the cost of selective mining would be the cost of the extra miner to safely dispose of the contaminated ore. MSHA's estimate of this cost is based on the following:

- As a result of the proposed rule, MSHA estimates that one mine a year is going to use selective mining methods to control asbestos.
- The time per week it would take to dispose of contaminated ore at the face of a mine: for small mines (<20), it would take one miner 6 hours; and for large mines (20-500 and >500), it would take 2 miners 4 hours each.
- Number of weeks in operation: small mines (<20) would operate about 43 weeks per year; large mines (20-500 and >500) would operate about 50 weeks per year.

As shown in Table IV-2, the cost to remove and dispose of contaminated ore would be $7,622 per year.

Table IV-2: Cost of Selective Mining to M/NM Mine Operators

M/NMMine Size	Number of Mines	Number of Miner Hours per Week Needed to Dispose of Contaminated Ore[a]	Number of Times per Year That Ore is Disposed of	Annual Number of Miner Hours[b]	Hourly Wage Rate for a M/NM Miner	Total Annual Cost of Selective Mining
Small (< 20)	0.2	6	43	52	$20.51	$1,058
Large (20-500)	0.6	8	50	240	$20.51	$4,922
Large (> 500)	0.2	8	50	80	$20.51	$1,641
Total	1.0			372		$7,622

[a] For small mines (<20), it would take a miner 6 hours to control dispose contaminated ore per week. It would take 2 miners 4 hours to dispose contaminated ore at large mines (20-500 and >500) per week.

[b] 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 proposed PEL and EL. Wet methods would 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.
- As the result of the proposed rule, MSHA estimates that one mine a year is going to use wet methods to comply with the PEL and EL.
- It would take 1 miner 1 hour to spray the muck pile.
- Annual number of times that muck pile would need to be sprayed: for small mines (<20), once a day times 301 days (average number of days in operation per year); for large mines (20-500 and >500), twice per day times 350 days (average number of days in operation per year).

Table IV-3: Annual Costs of Wet Methods for M/NM Mines

M/NM Mine Size	Number of Mines	Number of Miner Hours Needed to Spray Muck Pile[a]	Annual Number of Times That Muck Pile Would Need to be Sprayed[b]	Annual Number of Miner Hours[c]	Hourly Wage of Metal/Non metal Miner	Total Annual Costs of Wet Methods
Small (< 20)	0.2	1	301	60	$20.51	$1,235
Large (20-500)	0.6	1	700	420	$20.51	$8,614
Large (> 500)	0.2	1	700	140	$20.51	$2,871
Total	1			620		$12,721

[a] It would take 1 miner 1 hour to spray the muck pile.

[b] Annual number of times that muck pile would need to be sprayed: for small mines (<20), once a day X 301 days (average number of days in operation per year); for large mines (20-500 and >500), twice per day X 350 days (average number of days in operation per year).

[c] 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

Only mine operators relying on an existing local exhaust ventilation system to control dust would use this type of compliance strategy by adding supplemental ventilation to help control asbestos exposure. Mine operators employing mill ventilation would upgrade their primary system by adding exhaust fans to the building to meet the new PEL and EL. The average cost would be about $12,400.[38] The compliance strategy would also impose a stream of operating costs (as shown in Table IV-4b). MSHA assumes that every ten years, in response to the proposed rule, one (additional) mine will adopt this compliance strategy and incur the upgrade costs and (discounted) stream of costs (as shown in Table IV-4a). These cost estimates are based on the following:

- Electricity needed to operate a ventilation system: a small mine's mill ventilation system would require 300 kilowatt-hours to operate per shift, and each large mine's mill ventilation system would require 420 kilowatt-hours to operate per shift.
- Number of ventilation system(s) needed to control asbestos in a mill per shift: small (<20) and large (20-500) mines would need one ventilation system; and large (>500) would need two ventilation systems.
- The cost per kilowatt-hour is $0.0483.[39]
- One mine every ten years would be affected.

[38] 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. We have adjusted this cost for inflation.

[39] U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2002*, p.241.

Table IV-4a: Annual Cost of Mill Ventilation for M/NM Mines

M/NM 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]
Small (< 20)	0.01	1	$12,400	$124	$623	$747
Large (20-500)	0.06	1	$12,400	$744	$12,172	$12,916
Large (>500)	0.03	2	$12,400	$744	$18,257	$19,001
Total	0.10			$1,612	$31,052	$32,664

[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-4b for annual operating costs (AOC). The discounted stream of operating costs = (AOC)/0.07, where 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.

Table IV-4b: Annual Operating Costs of Mill Ventilation for one M/NM Mine

M/NM 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]	Total Discounted Stream of Annual Electricity Costs of Mill Ventilation[d]
Small (< 20)	0.01	1.0	300	301	903	$0.048	$623
Large (20-500)	0.06	1.0	420	700	17,640	$0.048	$12,172
Large (>500)	0.03	2.0	840	1,050	26,460	$0.048	$18,257
Total	0.10				45,003		$31,052

[a] Small mines would operate one shift a day times 301 days (average number of days in operation per year). Large mines (20-500) would operate 2 shifts a day 350 days (average number of days in operation per year). Large mines (>500) 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* 2002.

[d] Total discounted stream of annual electricity costs of mill ventilation = (total annual electricity used x cost per kilowatt hour) / 0.07, where 0.07 is the annual discount rate.

The total yearly cost of using mill ventilation system to control asbestos is $32,664.

Removal of Introduced Asbestos

Both coal and M/NM mine operators might find it necessary to remove introduced asbestos (e.g., pipe or roof insulation). MSHA's estimate of the cost of removing introduced asbestos is based on the following:

- As a result of the proposed rule, MSHA estimates that one M/NM 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, small mines would need to remove about 1,000 square feet of introduced asbestos due to demolition, remodeling, or deterioration. Large mines (20-500) would need to remove about 2,000 square feet of introduced asbestos. Large mines (>500) would need to remove about 3,000 square feet of introduced asbestos.

Therefore, as shown in Table IV-5, the annual cost of removing introduced asbestos for M/NM and coal mines combined is $83,125.[40]

Table IV-5: Annual Cost of Removing Introduced Asbestos

M/NM Mine Size	Number of Mines	Cost of Removing One Square Foot of Asbestos	Average Area (Square Feet) Removed	Annual Cost to Remove Introduced Asbestos
Small (< 20)	0.1	$ 17.50	1,000	$1,750
Large (20-500)	0.6	$ 17.50	2,000	$21,000
Large (>500)	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**
Small (< 20)	0.05	$ 17.50	1,000	$875
Large (20-500)	0.35	$ 17.50	2,000	$12,250
Large (>500)	0.60	$ 17.50	3,000	$31,500
Total	1			$44,625

[40] $83,125 ≈ $38,500 (for M/NM mines) + $44,625 (for coal mines)

FEASIBILITY

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

This proposed rule is not a technology-forcing standard and does not involve activities on the frontiers of scientific knowledge. All devices that would be required by the proposed rule are already available in the marketplace and have been used either in the U.S. or in the international mining community. Therefore, we have concluded that this proposed rule is technologically feasible.

As previously estimated in this chapter, the mining industry would incur costs of approximately $136,000 yearly to comply with this proposed rule. That these compliance costs represent well less than 0.001 percent of the yearly revenues of the mines covered by this rule (about $38.0 billion for the M/NM mining industry and $10.1 billion for the surface coal mining industry) provides, we believe, convincing evidence that the proposed rule is economically feasible.

V. REGULATORY FLEXIBILITY CERTIFICATION

INTRODUCTION

Pursuant to the Regulatory Flexibility Act of 1980 as amended, MSHA has analyzed the impact of the proposed rule on small businesses. Further, MSHA has made a determination with respect to whether or not the Agency can certify that the rule would not have a significant economic impact on a substantial number of small entities that are covered by this rulemaking. Under the Small Business Regulatory Enforcement Fairness Act (SBREFA) amendments to the Regulatory Flexibility Act (RFA), MSHA must include in the rule a factual basis for this certification. If the proposed rule has a significant economic impact on a substantial number of small entities, then the Agency must develop an initial regulatory flexibility analysis.

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 500 or fewer employees (13 CFR 121.201). All of the mines affected by this rulemaking fall into this category. Consequently, they can be viewed as sharing the special regulatory concerns which the RFA was designed to address.

Traditionally, the Agency has also looked at the impacts of its rules on a subset of mines with 500 or fewer employees—those with fewer than 20 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 still complies with the legal requirements of the RFA for an analysis of the impacts on "small entities" by examining small entities with 500 or fewer employees. MSHA concludes that it can certify that the rule would 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 in the sector affected by the rule 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 there is no 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.[41]

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 2002 price per ton of the commodity ($13.65 for surface production). The production data were obtained from MSHA's Program Evaluation and Information Resources (PEIR) data,[42] and the price estimates were obtained from the Department of Energy.[43]

We obtained 2002 revenues for M/NM mines ($38 billion), from the Mineral Commodity Summaries 2003.[44] Since MSHA does not collect tonnage figures for M/NM production, but does collect data on hours worked, MSHA estimates the revenues for particular mine-size categories based on hours worked. MSHA estimates that, on average, each hour of work produces $110.96 worth of ore in the M/NM mining industry.[45]

MSHA has assumed that tonnage is proportional to employee hours (rather than employees) because employee hours are a better measure of total labor input then number of employees.

---

[41] MSHA has traditionally used a revenue screening test—whether the yearly costs of a regulation equal or exceed 1 percent of revenues—to determine whether the regulation might possibly have a significant economic impact on a substantial number of small entities. The Agency recognizes the theoretical usefulness of evaluating the effects of a regulation on profits (rather than on revenues). MSHA is currently investigating the future use of profitability analysis to evaluate whether its rules will have a significant impact on a substantial number of small entities. However, given that the yearly net costs of the proposed rule are less than 0.001 percent of yearly industry revenues both for small mines with fewer than 20 employees and those with 500 or fewer employees, MSHA is confident that, given the selection and use of any reasonable profitability test, the proposed rule would not have a significant economic effect on a substantial number of small entities.

[42] U. S. Department of Labor, Mine Safety and Health Administration, Program Evaluation and Information Resources, Calendar Year 2002 data.

[43] U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2002*.

[44] U.S. Department of Interior, U.S. Geological Survey, *Mineral Commodity Summaries 2003,* p.7.

[45] ($38 billion revenue) ÷ (342,468,280 hours) ≈ ($110.96 revenue per hour).

Results of Screening Analysis

Table V-1 shows that compliance cost as a percentage of yearly revenues for small M/NM mines, using MSHA's traditional definition of a small mine (fewer than 20 employees), is less than 0.0001 percent.

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

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
Small (< 20)	$ 4,790	$ 11,723,385,260	0.0000%
Large (≥ 20)	$ 86,716	$ 26,276,895,088	0.0003%

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

[b] Data for revenues derived from: U.S. Department of Labor, Mine Safety and Health Administration 2002 Program Evaluation and Information Resources; U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2002*; and U.S.G.S. *Mineral Commodity Summaries 2003*.

MSHA used a similar approach in Table V-2 to analyze the impact of the final rule on small mines as defined by SBA. Table V-2 shows compliance cost as a percentage of yearly revenues for small M/NM mines is about 0.0002 percent.

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

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
Small (≤ 500)	$ 52,243	$ 34,595,081,503	0.0002%
Large (> 500)	$ 39,264	$ 3,405,198,845	0.0012%

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

[b] Data for revenues derived from: U.S. Department of Labor, Mine Safety and Health Administration 2002 Program Evaluation and Information Resources; U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2002*; and U.S.G.S. *Mineral Commodity Summaries 2003*.

Table V-3 shows that compliance cost as a percentage of yearly revenues for small coal mines, using MSHA's traditional definition of a small mine (fewer than 20 employees), is about 0.0004 percent.

TABLE V-3: The Impact of Proposed Rule on the Surface Coal Mining Sector by MSHA

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
Small (< 20)	$ 875	$ 246,974,282	0.0004%
Large (≥ 20)	$ 43,750	$ 9,837,238,934	0.0004%

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

[b] Data for revenues derived from: U.S. Department of Labor, Mine Safety and Health Administration 2002 Program Evaluation and Information Resources; U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2002*; and U.S.G.S. *Mineral Commodity Summaries 2003*.

When applying the SBA definition, Table V-4 shows compliance cost as a percentage of yearly revenues for small coal mines is about 0.0002 percent.

TABLE V-4: The Impact of Proposed Rule on the Surface Coal Mining Sector by SBA Size

Mine Size	Estimated Net Cost[a]	Estimated Revenue[b]	Costs as % of Revenue
Small (≤ 500)	$ 13,125	$ 8,094,788,943	0.0002%
Large (> 500)	$ 31,500	$ 1,989,424,273	0.0016%

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

[b] Data for revenues derived from: U.S. Department of Labor, Mine Safety and Health Administration 2002 Program Evaluation and Information Resources; U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2002*; and U.S.G.S. *Mineral Commodity Summaries 2003*.

When applying both MSHA and SBA definitions of small mines, the estimated compliance costs of the proposed rule are substantially less than 1 percent of estimated revenues, well below the level suggesting that the proposed rule might have a significant economic impact on a substantial number of small entities. Accordingly, MSHA has certified that the rule would not have a significant economic impact on a substantial number of small entities that are covered by the rule.

VI. OTHER REGULATORY CONSIDERATIONS

THE UNFUNDED MANDATES REFORM ACT OF 1995

This proposed rule does not include any Federal mandate that may result in increased expenditures by State, local, or tribal governments; nor would it increase private sector expenditures by more than $100 million annually; nor would it significantly or uniquely affect small governments. Accordingly, the Unfunded Mandates Reform Act of 1995 requires no further agency action or analysis.

NATIONAL ENVIRONMENTAL POLICY ACT

MSHA has reviewed this proposed rule in accordance with the requirements of the National Environmental Policy Act (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). Since this proposed rule would impact safety, not health, the rule is categorically excluded from NEPA requirements because it would have no significant impact on the quality of the human environment (29 CFR § 11.10(a)(1)). Accordingly, MSHA has not conducted an environmental assessment nor provided an environmental impact statement.

MSHA has assessed the environmental impacts as follows: This proposed rule would 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. MSHA solicits public comment concerning the accuracy and completeness of this environmental assessment.

As a result of this environmental assessment, MSHA finds that the proposed rule would have no significant impact on the human environment. Accordingly, MSHA has not provided an environmental impact statement.

ASSESSMENT OF FEDERAL REGULATIONS AND POLICIES ON FAMILIES

This proposed rule would have no affect on family well-being or stability, marital commitment, parental rights or authority, or income or poverty of families and children. Accordingly, Section 654 of the Treasury and General Government Appropriations Act of 1999 requires no further agency action, analysis, or assessment.

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

This proposed rule would not implement a policy with takings implications. Accordingly, Executive Order 12630, Governmental Actions and Interference with Constitutionally Protected Property Rights, requires no further agency action or analysis.

EXECUTIVE ORDER 12988: CIVIL JUSTICE REFORM

This proposed rule was drafted and reviewed in accordance with Executive Order 12988, Civil Justice Reform. This proposed 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. MSHA has determined that this proposed rule would meet the applicable standards provided in Section 3 of Executive Order 12988.

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

This proposed rule would have no adverse impact on children. Accordingly, Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, as amended by Executive Orders 13229 and 13296, requires no further agency action or analysis.

EXECUTIVE ORDER 13132: FEDERALISM

This proposed rule would not have "federalism implications," because it would 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, Executive Order 13132, Federalism, requires no further agency action or analysis.

EXECUTIVE ORDER 13175: CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENTS

This proposed rule would not have "tribal implications," because it would 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, Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, requires no further agency action or analysis.

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

In accordance with Executive Order 13211, MSHA has reviewed this proposed rule for its impact on the supply, distribution, and use of energy. This proposed rule would regulate both the coal and metal/nonmetal mining sectors. Because this proposed rule would result in yearly net costs of less than 0.001 percent of revenues to the coal mining industry, the proposed rule would neither significantly reduce the supply of coal nor significantly increase its price. Regulation of the metal/nonmetal sector of the mining industry has no significant impact on the supply, distribution, or use of energy.

This proposed rule is not a "significant energy action," because it would not be "likely to have a significant adverse effect on the supply, distribution, or use of energy" "(including a shortfall in supply, price increases, and increased use of foreign supplies)." Accordingly, Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use, requires no further agency action or analysis.

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

In accordance with Executive Order 13272, MSHA has thoroughly reviewed this proposed rule to assess and take appropriate account of its potential impact on small businesses, small governmental jurisdictions, and small organizations. As discussed in Chapter V of this PREA, MSHA has determined and certified that this proposed rule would not have a significant economic impact on a substantial number of small entities.

VII. PAPERWORK REDUCTION ACT OF 1995

The Agency has determined that there are no additional paperwork burden hours and related costs associated with the proposed 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. Finkelstein, M. M., "Asbestos in Long-Term Employees of an Ontario Asbestos-Cement Factory." *American Review of Respiratory Disease*. 125: 496-501, 1982.
5. Hornung, R.W., Reed, L.D., "Estimation of Average Concentration in the Presence of Nondetectable Values." *Applied Occupational Environmental Hygiene* 5(1):46-51, 1990.
6. Jacob, G., and Anspach, M. "Pulmonary Neoplasia Among Dresden Amosite Workers." *Ann NY Acad Sci* 132:536-548, 1965.
7. MSHA Metal/Nonmetal (April 2003) and Coal (February 1989) Program Area Handbooks.
8. Nicholson, W. 1972. *Microeconomic Theory*. Hinsdale, Illinois: Dryden Press.
9. 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.
10. 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.
11. Peto, J. "Dose-Response Relationships for Asbestos-Related Disease: Implications for Hygiene Standards, Part II, Mortality." *Ann NY Acad Sci* 330:195, 1979.
12. Peipins, L.A., Lewin, M., Campolucci, S., Lybarger, L.A., Miller, A., Middleton, D., Weis, C., Spence, M., Black, B., Kapil, V. "Radiographic Abnormalities and Exposure to Asbestos-Contaminated Vermiculite in the Community of Libby, Montana, USA." *Environmental Health Perspectives* 111:1753-1759.
13. U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2002*, DOE EIA-0584 (2002).
14. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2002,* DOE EIA-0384 (2002), October 2003.
15. U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2003*, January 2003.

16. U.S. Department of Health and Human Services, National Institute of Occupational Safety and Health, *Publication No. 2002-113*, May 2002.

17. U.S. Department of Health and Human Services, National Institute of Occupational Safety and Health, *WoRLD Surveillance Report 2002*, May 2003.

18. U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Evaluation and Information Resources, 2002 data.

19. U.S. Department of the Interior, U.S. Geological Survey, *Mineral Commodities Summaries 2003*, January 2003.

20. U.S. Department of Labor, Mine Safety and Health Administration, 2002 Final Data, CT441 Report, cycle 2002/381.

21. *U.S. Metal and Industrial Mineral Mine Salaries, Wages, and Benefits 2002 Survey Results*, Western Mine Engineering, 2002.