

REGULATORY ECONOMIC ANALYSIS

FOR

REFUGE ALTERNATIVES  
FOR UNDERGROUND COAL MINES  
FINAL RULE

RIN: 1219-AB58

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# **I. EXECUTIVE SUMMARY**

## **INTRODUCTION**

In accordance with Section 13 of the Mine Improvement and New Emergency Response (MINER) Act of 2006, MSHA is issuing a final rule that requires refuge alternatives in underground coal mines. The final rule is consistent with, and responsive to, the report issued by the National Institute for Occupational Safety and Health (NIOSH) on refuge alternatives.

This Regulatory Economic Analysis (REA) examines the costs and benefits of MSHA's final rule on refuge alternatives. The final rule includes requirements for approval of refuge alternatives and components and for installation, maintenance and repair of refuge alternatives and components. The final rule includes requirements for location of refuge alternatives to assure that they are readily accessible to all persons underground when an emergency occurs, and provisions for installing necessary roof and rib supports in areas where refuge alternatives are placed. In addition, the final rule requires that the location of refuge alternatives be noted on underground mine maps. The final rule provides for inspections of refuge alternatives before each shift to assure that they function correctly when they are used, and for miners to be trained in their use and care.

## **MINE SECTOR AFFECTED**

The final rule applies to all underground coal mines in the United States. As of February 2008, MSHA data reveal that there were 624 underground coal mines employing approximately 42,200 persons in the United States in 2007, of which 613 mines employed persons working underground. These 613 mines employed approximately 37,800 miners and 5,100 contractors, for a total of approximately 42,900 persons underground.

## **BENEFITS**

In accordance with Executive Order (E.O.) 12866, MSHA has evaluated the potential benefits of the final rule. MSHA has evaluated its accident and fatality data from 1900 through 2006. For this final rule, MSHA estimates that 221 lives could have been saved over the 107 year period. If refuge alternatives had been available, MSHA estimates that the range of lives saved would have been between a low of 25 percent and a high of 75 percent. Using these estimates, the final rule will result in a range of approximately one to three lives saved over a two year period.

The final rule improves mine operators' preparedness for mine emergencies and requires that refuge alternatives provide a life-sustaining environment for persons trapped underground when escape is impossible.

## **COMPLIANCE COSTS**

MSHA estimates that the final rule will result in a total yearly cost of \$2.6 million for manufacturers of refuge alternatives and \$50.3 million for underground coal mine operators. The total yearly cost of the final rule includes the amortized value of first-year costs to operators of approximately \$126.6 million. Disaggregated by mine size, the

estimated yearly cost is \$4.3 million for operators with 1-19 employees, \$40.8 million for operators with 20-500 employees, and \$5.3 million for operators with 501+ employees.

### **REGULATORY FLEXIBILITY CERTIFICATION AND ANALYSIS**

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

## II. INDUSTRY PROFILE

### INTRODUCTION

This chapter provides information concerning the structure and economic characteristics of the underground coal mining industry, including the number of mines and the number of miners and contractors by type and size of mine. The data for 2007 are from the U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Evaluation and Information Resources (PEIR), as of February 5, 2008. The value of the coal output of the U.S. underground coal mining sector was estimated to be \$14.0 billion in 2007.

### STRUCTURE OF THE MINING INDUSTRY

MSHA divides the mining industry into two major sectors based on commodity: (1) coal mines and (2) metal and nonmetal mines. Each sector is further divided by type of operation (i.e., underground mines and surface mines). The Agency collects 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 their employees. Each independent contractor is issued one MSHA contractor identification number but may work at any mine.

### STRUCTURE OF THE COAL MINING INDUSTRY

Table II-1 presents data on underground coal mines, by employment size, excluding contractors. Underground coal mine employment in 2007 was approximately 43,500, of which 42,200 were miners and 1,300 were office employees. Of the 624 mines that reported employment during some portion of 2007, 613 mines had persons working underground. There were approximately 37,800 miners working underground.

**Table II-1: Underground Coal Mines (Excluding Contractors), by Employment Size, 2007**

Size of Mine	No. of Mines	No. of Miners	Office Employment	No. of Mines with Miners Underground	No. of Miners Working Underground
1-19 Employees	223	2,300	100	212	1,900
20-500 Employees	391	33,500	1,000	391	30,300
501+ Employees	10	6,400	200	10	5,600
All Underground Coal Mines	624	42,200	1,300	613	37,800

Table II-2 presents data on independent contractors that worked in underground coal mines in 2007. There were approximately 5,100 contractors that worked in underground coal mines in 2007.

**Table II-2: Underground Coal Contractors, 2007**

All Underground Coal Contractors			
No. of Firms	Non-Office Employment	Office Employment	Non-Office Employment Working Underground
307	9,200	250	5,100

**ECONOMIC CHARACTERISTICS OF THE COAL MINING INDUSTRY**

MSHA classifies the U.S. coal mining sector into three major commodity groups: bituminous, lignite, and anthracite. Bituminous operations represent approximately 91 percent of coal mining operations, employ 94 percent of all coal miners, and account for 93 percent of total coal production. Lignite operations represent approximately 1 percent of coal mining operations, employ 5 percent of all coal miners, and account for 7 percent of total coal production. Anthracite operations represent approximately 8 percent of coal mining operations, employ 1 percent of all coal miners, and account for 0.1 percent of total coal production.

The underground coal sector produced an estimated 349 million tons in 2007. The average price of coal in underground mines in 2007 was \$40.29 per ton. The value of coal produced by the underground sector was approximately \$14.0 billion.

### **III. BENEFITS**

#### **INTRODUCTION**

On June 15, 2006, the President signed the MINER Act to improve the safety of mines and mining. One of the goals of the MINER Act was to improve emergency response capability in underground coal mines. Toward that end, MSHA has issued a number of standards in the last several years and, in all of them, the Agency has reiterated that, as a first option, in the event of a mine emergency in an underground coal mine, the miner should be trained to evacuate the mine. In addition to these recent standards, over the years, MSHA has published a number of standards that address the safety of miners in the event of explosions, fires, or inundations in underground coal mines. These standards have included provisions concerning escape from a mine, such as: the availability of two separate and distinct escapeways for each working section; maps in an underground mine that delineate escape routes out of the mine; miner participation in practice drills to escape the mine in an emergency situation; and life-saving devices such as lifelines and self-contained self-rescue (SCSR) devices to facilitate escape.

MSHA considers refuge alternatives as a last resort to protect persons who are unable to escape from an underground coal mine in the event of an emergency. This final rule requires the availability of refuge alternatives in the event that escape is not possible or is delayed. This final rule will increase miners' safety and improve mine operators' preparedness for mine emergencies by requiring refuge alternatives underground to protect and sustain miners trapped when a life-threatening event occurs that prevents escape.

#### **EVALUATION OF ACCIDENT AND INJURY DATA**

MSHA has evaluated its accident and injury data from 1900 through 2006. During that period, 264 miners who were alive after a mine accident died later during rescue or escape. MSHA has estimated that recent Agency standards could have saved the lives of 43 of these miners. Thus, for purposes of estimating benefits, this final rule could potentially have saved the lives of 221 miners (264 - 43) over the 107 year period. If refuge alternatives had been available, MSHA estimates that the range of lives saved would have been between a low of 25 percent and a high of 75 percent. MSHA assumes that not all lives would be saved because there may be some cases in which persons would not survive even when refuge alternatives are available under the final rule, such as when miners are severely injured by an initial explosion. MSHA estimates that 55 lives could have been saved under the lower estimate, and that 166 lives could have been saved under the higher estimate. Using these estimates, the final rule will result in a range of approximately one to three lives saved over a two year period.

A commenter requested an explanation of how MSHA determined that 221 lives might have been saved if refuge alternatives had been available in underground coal mines. In determining its estimate, the Agency used the fatality data in an MSHA report entitled "Prevent, Escape, and Design" by the MSHA Technical Support, Approval & Certification Center, Applied Engineering Division. In this report, Agency Staff compiled data from descriptions of numerous underground coal mining disasters recorded in Volumes I and II of "Historical Summary of Mine Disasters in the United States." This report showed a total of 221 fatalities in underground coal mines that occurred when miners barricaded

themselves after an underground coal mining disaster. The Agency referenced the report in Chapter VIII of the Preliminary Regulatory Economic Analysis (PREA) and it is referenced in Chapter VIII of the REA.

## **NET BENEFITS AND COST-EFFECTIVENESS**

MSHA is not allowed to monetize benefits. However, for informational purposes only, MSHA has estimated the monetary value of the benefits associated with the final rule, the net benefits, and the cost-effectiveness of the final rule. These estimates are informational because MSHA does not use benefit-cost analysis as a basis for decision-making. In order to estimate monetary values for the benefits associated with the final rule, MSHA reviewed the approaches taken by other regulatory agencies for similar health and safety regulations. For our primary estimate, MSHA is applying a value recently used by the Department's Occupational Safety and Health Administration (OSHA) of \$6.8 million for each premature fatality avoided. The \$6.8 million value represents the sum of many individuals' willingness-to-pay (WTP) to reduce a small risk of premature death. Multiplying \$6.8 million by an approximately 1.55 lives saved per year yields \$6.8 million per year in benefits due to lives saved (compared to \$52.9 million in yearly costs at the 7 percent discount rate). Because of the uncertainty regarding valuing the many types of injuries possible in mine accidents MSHA did not attempt to monetize the value of injuries avoided due to this rulemaking.

As a result of these calculations, the rulemaking leads to net costs of approximately \$46.1 million per year, using the 7 percent discount rate. In terms of cost-effectiveness, the final rule requires mines to spend approximately \$52.9 million for each life saved. We acknowledge considerable uncertainty in these numbers, as the true number of lives saved, injuries avoided, and costs could be considerably larger or smaller than those estimated here.

OMB Circular A-4 requires, for economically significant rules, that agencies analyze the uncertainty inherent in their impact estimates, stating that "The important uncertainties connected with your regulatory decisions need to be analyzed and presented as part of the overall regulatory analysis." MSHA has conducted a sensitivity analysis of what we believe are the most relevant sources of uncertainty: the effectiveness of these interventions in leading to lives saved during a mining emergency, the costs associated with the interventions required by this rulemaking, and the value individuals place on small changes in risk. For ease of presentation, we report the impact of changing assumptions on the net benefits and cost-effectiveness of this rulemaking using only the 7% discount rate.

For the primary estimate, MSHA assumes that future accidents will occur at roughly the same rate as past accidents, and projects that this rulemaking will be 80% effective in saving the lives of 45 miners, based on those killed in four past accidents where it is reasonable to expect that miners' lives might have been saved by the final rule. If, instead of 80% effective, the rule is only 50% effective (or if there are approximately 40% fewer accidents in the future than in the past), then the number of lives saved per year drops to approximately 1, the estimated net cost of this rulemaking increases to approximately \$46.1 million per year, and the cost per life saved increases to approximately \$54 million. On the other hand, if the rule is 100% effective (or if there are

approximately 25% more accidents in the future than in the past), then the number of lives saved per year increases to approximately 2, the net cost of the rule drops to \$39.3 million per year, and the cost per life saved drops to \$26.4 million.

MSHA estimates that the cost of compliance with this rulemaking is approximately \$52.9 million per year. If the actual cost of compliance is 50% higher than this, then the net cost of the rulemaking increases to approximately \$73 million per year, and the cost per life saved increases to \$79.4 million. If the actual cost of compliance is 50% lower than this, then the net cost of the rulemaking decreases to approximately \$19.7 million per year, and cost per life saved decreases to \$26.5 million.

As noted above, MSHA reports the net benefits of this rulemaking purely for informational purposes. OMB circular A-4 acknowledges the considerable uncertainty inherent in monetizing the value individuals place on small changes in risk, but also states that “A substantial majority of the resulting estimates of VSL vary from roughly \$1 million to \$10 million per statistical life.” Using a VSL of \$1 million would increase the net cost of this rulemaking to approximately \$51.9 million. Using a VSL of \$10 million would decrease the net cost of this rulemaking to \$42.9 million.

## **CONCLUSION**

The final rule implements the MINER Act, and sets forth requirements for refuge alternatives in underground coal mines and the training of miners in their use. It includes testing, transport, maintenance, inspection, and approval requirements. These requirements are essential for effective operation of the refuge alternatives during an emergency. To facilitate mine emergency preparedness, under the final rule, mine operators must integrate refuge alternative training into existing escapeway drill training – quarterly mine evacuation training and annual expectations training.

In addition, the final rule includes requirements for installing necessary roof and rib support in areas where refuge alternatives are placed. It also requires that the locations of refuge alternatives be noted on the mine maps so that miners can easily locate the refuge alternatives in an emergency. The final rule also requires that miners be trained to maintain and repair refuge alternatives. In addition, the final rule requires that refuge alternatives and components be inspected before each shift to assure that they are functioning properly and will operate effectively in the event of an emergency. The final rule also includes requirements for the location of refuge alternatives to assure that they are readily accessible to miners underground when an emergency occurs.

## IV. COMPLIANCE COSTS

### INTRODUCTION

In this chapter, MSHA estimates the total yearly cost of the refuge alternatives final rule. Due to rounding, totals presented in this analysis may deviate from the sum of components.

Table IV-1 summarizes the estimated yearly costs of the final rule, consisting of annual costs and first-year costs annualized by using a 7 percent discount rate. MSHA estimates that the final rule will result in a total yearly cost of \$52.9 million, of which \$2.6 million will be incurred by manufacturers of refuge alternatives and \$50.3 million will be incurred by underground coal mine operators. Table IV-1(a) shows an alternative estimate of the yearly costs of the final rule, consisting of annual costs and first-year costs annualized by using a 3 percent discount rate. Table IV-1(a) shows that, under the assumption of a 3 percent discount rate, the final rule will result in a total yearly cost of \$50.9 million, of which \$2.6 million will be incurred by manufacturers of refuge alternatives and \$48.3 million will be incurred by underground coal mine operators. MSHA recognizes that manufacturers' approval costs would likely be passed on to mine operators.

A commenter stated that the Summary of Yearly Costs in the Preliminary Regulatory Economic Analysis (PREA) did not include any element for plan development or revision, or the providing of systems for audit. MSHA did include in its cost estimates in the PREA, as well as in the REA, the cost to mine operators of revising Emergency Response Plans (ERP). Table IV-1 of the PREA presented a summary, rather than an itemization, of yearly costs to comply with the rule. In the PREA, the summary item "Cost for Pre-Shift Exams and Revisions to Plans, Maps, and Program" included the cost of revising ERPs. Table IV-1 of the REA includes the summary item "Refuge Alternatives and Emergency Response Plan," which includes the cost of revisions to ERPs. Detailed explanation of MSHA's estimates of the cost of revising ERPs is contained in the REA in the discussion of the costs of final § 75.1507.

Refuge alternatives in underground coal mines are subject to existing § 7.8, which allows for post-approval product audit under the existing regulation. A manufacturer with an MSHA approval for a refuge alternative or component could be audited. MSHA does not expect these audits to be frequent and thus costs are assumed to be negligible. Furthermore, MSHA does not expect that any costs to manufacturers which may result from the audits will materialize into increased costs to mine operators. Therefore, in the PREA and in the REA, MSHA does not estimate any cost for post-approval product audit under existing § 7.8.

**Table IV-1: Summary of Yearly Costs of Final Rule  
With First Year Costs Annualized at 7 Percent**

<b>Cost to Manufacturers</b>				
Application and Approval				\$2.6 million
<b>Cost to Mine Operators</b>				
	Mine Size			
	1-19 employees	20-500 employees	501+ employees	Total
Roof Control Plan Information	\$438,000	\$3.2 million	\$297,000	\$4.0 million
Preshift Examination	\$235,000	\$5.0 million	\$923,000	\$6.1 million
Mine Emergency Evacuation and Firefighting Program of Instruction, Mine Emergency Evacuation Training and Drills	\$515,000	\$10.3 million	\$1.9 million	\$12.8 million
Refuge Alternatives and Emergency Response Plan	\$3.0 million	\$21.9 million	\$2.0 million	\$26.9 million
Other Provisions*	\$60,000	\$400,000	\$30,000	\$ 0.5 million
<b>Total</b>	<b>\$4.3 million</b>	<b>\$40.8 million</b>	<b>\$5.2 million</b>	<b>\$50.3 million</b>
<b>Cost to Manufacturers and Mine Operators</b>				
<b>Total Yearly Cost</b>				<b>\$52.9 million</b>

\* Includes Mine Ventilation Map; Mine Map; and Escapeway Maps; Training and Records for Examination, Maintenance, and Repair of Refuge Alternatives and Components; and Communications Facilities.

**Table IV-1(a): Summary of Yearly Costs of Final Rule  
with First Year Costs Annualized at 3 Percent**

<b>Requirement</b>				<b>Yearly Cost</b>
<b>Cost to Manufacturers</b>				
Application and Approval				\$2.6 million
<b>Cost to Mine Operators</b>				
	Mine Size			
	1-19 employees	20-500 employees	501+ employees	Total
Roof Control Plan Information	\$438,000	\$3.2 million	\$297,000	\$4.0 million
Preshift Examination	\$235,000	\$5.0 million	\$923,000	\$6.1 million
Mine Emergency Evacuation and Firefighting Program of Instruction, Mine Emergency Evacuation Training and Drills	\$515,000	\$10.3 million	\$1.9 million	\$12.8 million
Refuge Alternatives and Emergency Response Plan	\$2.8 million	\$20.3 million	\$1.8 million	\$25.0 million
Other Provisions*	\$60,000	\$400,000	\$30,000	\$ 0.5 million
<b>Total</b>	<b>\$4.0 million</b>	<b>\$39.3 million</b>	<b>\$5.0 million</b>	<b>\$48.3 million</b>
<b>Cost to Manufacturers and Mine Operators</b>				
<b>Total Yearly Cost</b>				<b>\$50.9 million</b>

\* Includes Mine Ventilation Map; Mine Map; and Escapeway Maps; Training and Records for Examination, Maintenance, and Repair of Refuge Alternatives and Components; and Communications Facilities.

Table IV-2 shows the estimated average yearly cost of the final rule per underground coal mine, by mine size, with first year costs annualized by using a 7 percent discount rate. By mine size, the estimated yearly cost per mine is: \$40,000 for operators with 1-19 employees; \$104,000 for operators with 20-500 employees; and \$515,000 for operators with 501+ employees. Table IV-2(a) shows an alternative estimate of average yearly cost of the final rule per underground coal mine, by mine size, with first year costs annualized by using a 3 percent discount rate. By mine size, the estimated yearly cost per mine is: \$38,000 for operators with 1-19 employees; \$101,000 for operators with 20-500 employees; and \$500,000 for operators with 501+ employees.

**Table IV-2: Average Yearly Cost\* per Mine, by Mine Size with First Year Costs Annualized at 7 Percent**

Mine Size	Yearly Cost of Final Rule	No. of Underground Mines with Refuge Alternatives	Yearly Cost per Mine
1-19 employees **	\$4.3 million	106	\$40,000
20-500 employees	\$40.8 million	391	\$104,000
501+ employees	\$5.2 million	10	\$515,000
All Mines	\$50.3 million	507	\$99,000

\* Excludes refuge alternative and component approval costs.

\*\* MSHA estimates that 117 mines with 1-19 employees would not require a refuge alternative under the final rule.

**Table IV-2(a): Average Yearly Cost\* per Mine, by Mine Size with First Year Costs Annualized at 3 Percent**

Mine Size	Yearly Cost of Final Rule	No. of Underground Mines with Refuge Alternatives	Yearly Cost per Mine
1-19 employees **	\$4.0 million	106	\$38,000
20-500 employees	\$39.3 million	391	\$101,000
501+ employees	\$5.0 million	10	\$500,000
All Mines	\$48.3 million	507	\$95,000

\* Excludes refuge alternative and component approval costs.

\*\* MSHA estimates that 117 mines with 1-19 employees would not require a refuge alternative under the final rule.

Table IV-3 summarizes the estimated first year costs of the final rule. Total estimated first year costs will be \$129.2 million, of which \$2.6 million will be incurred by manufacturers and \$126.6 million will be incurred by mine operators. The distribution of the \$126.6 million cost by mine size is approximately: \$11.3 million for operators with 1-19 employees; \$103.4 million for operators with 20-500 employees; and \$12.0 million for operators with 501+ employees.

**Table IV-3: Summary of First-Year Costs of Final Rule**

<b>Requirement</b>				<b>First-Year Cost</b>
<b>Cost to Manufacturers</b>				
Application and Approval				\$2.6 million
<b>Cost to Mine Operators</b>				
	Mine Size			
	1-19 employees	20-500 employees	501+ employees	Total
Roof Control Plan Information	\$442,000	\$3.3 million	\$298,000	\$4.0 million
Preshift Examination	\$235,000	\$5.0 million	\$923,000	\$6.1 million
Mine Emergency Evacuation and Firefighting Program of Instruction, Mine Emergency Evacuation Training and Drills	\$519,000	\$10.4 million	\$1.9 million	\$12.8 million
Refuge Alternatives and Emergency Response Plan	\$10.0 million	\$83.7 million	\$8.7 million	\$102.4 million
Other Provisions*	\$130,000	\$1.1 million	\$110,000	\$1.3 million
Subtotal of Operators' First-Year Costs	\$11.3 million	\$103.4 million	\$12.0 million	\$126.6 million
<b>Cost to Manufacturers and Mine Operators</b>				
Total First-Year Costs				\$129.2 million

\* Includes Mine Ventilation Map; Mine Map; and Escapeway Maps; Training and Records for Examination, Maintenance, and Repair of Refuge Alternatives and Components; and Communications Facilities.

## **METHODOLOGY**

For the final rule, MSHA estimates the following costs: (1) one-time or intermittent costs; (2) annual costs; and (3) annualized costs. One-time costs are those that are incurred only once, usually in the first year of compliance. Intermittent costs are those costs that may recur from time to time, but not annually. Capital expenditures can be a one-time cost, for example, when equipment is purchased once and only once to comply with a rule. Capital expenditures can be intermittent costs when equipment is purchased periodically, for example every 5 years. Annual costs are costs that normally occur every year. Two examples of annual costs are maintenance costs and recordkeeping costs. Annualized costs are one-time or intermittent costs that are amortized over the economic

life of the investment using a specified interest (or discount) rate to produce an equivalent constant stream of costs. For the REA, the Agency used a (real) discount rate of 7 percent, as recommended by the Office of Management and Budget (OMB), using the annualization 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 non-annual recurring investment (in years).

MSHA estimates that the average life of refuge alternative is 10 years. MSHA estimates that all the components for refuge alternatives have a 5-year service life, except for block and mortar and mandors, which have a 10-year service life. Other cost items, including installation of refuge alternatives, installation of supplemental roof and rib supports, and installation of signs, are annualized over a 10-year period. MSHA annualized the first-year costs using an annualization factor of 0.244 to reflect a 5-year service life and a 7 percent discount rate, and an annualization factor of 0.142 to reflect a 10-year service life and a 7 percent discount rate. Yearly costs are the sum of annual costs and annualized costs.

In addition, MSHA discounted costs incurred in later years using a 7 percent discount rate to reflect the fact that money can be invested until the cost is incurred and that the real cost would not change over time.

MSHA used hourly wage rates of \$33.70 for an underground coal miner, \$85.14 for an underground coal mine supervisor or a certified person, \$26.37 for an underground coal clerical employee, and \$74.32 for an underground coal mining engineer.<sup>1</sup> MSHA assumes that contractors receive the same wage as underground coal miners. The wage rates include benefits such as social security, unemployment insurance, and workers’ compensation, but they do not reflect shift differentials or overtime pay. MSHA refers to miner “compensation” as “wages,” where that term is understood to include benefits.

## SCOPE

The final rule applies to underground coal mines. Table IV-4 presents the total number of underground coal miners and contractors, by mine size. The totals include only miners and contractors working underground. The contractors have been apportioned into mine size categories in proportion to the number of miners working underground in each mine size category.

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<sup>1</sup> Hourly wage rates are derived from InfoMine USA, Inc., *U.S. Coal Mine Salaries, Wages, & Benefits: 2007 Survey Results*.

**Table IV-4: Number of Miners and Contractors Working Underground in 2007 <sup>a</sup>**

Mine Size	1-19 Employees	20-500 Employees	501+ Employees	All Underground Miners
Miners	1,900	30,300	5,600	37,800
Contractors	300	4,100	800	5,100
Miners & Contractors	2,200	34,400	6,400	42,900

<sup>a</sup> Source: Table II-1 and Table II-2.

## **DERIVATION OF FINAL RULE COMPLIANCE COSTS**

The following sections in the chapter address the costs of the final rule. Section IV-A presents cost estimates for applicants to obtain MSHA approval of a refuge alternative or component under 30 CFR part 7, subpart L. Section IV-B presents cost estimates for mine operators to comply with the final rule requirements in 30 CFR part 75. Where possible, MSHA presents costs for each provision of the final rule. In some cases, costs for more than one provision are combined, and these cases are noted.

### **SECTION IV-A: 30 CFR PART 7—TESTING BY APPLICANT OR THIRD PARTY**

The final rule includes new requirements for the approval of prefabricated self-contained refuge alternatives and components of refuge alternatives. Under the final rule, the applicant (usually the manufacturer) will provide the required information and demonstrate that the refuge alternative or component functions as intended and is safe for use in an underground coal mine. Based upon an evaluation of this information, MSHA will issue an approval.

Section IV-A of the REA addresses MSHA's estimates of the costs of obtaining approval for refuge alternatives and components for refuge alternatives. The costs involved in completing and submitting applications for approval and in obtaining approval services are included in the estimate of costs associated with application requirements in final § 7.503. Several provisions in Part 7 (final §§ 7.504, 7.505, 7.506, 7.507, and 7.508) specify tests required for approval of refuge alternatives or components, and results of these tests must be included in the application for approval. MSHA has included the costs of tests and approval services associated with the final rule in the estimate of costs related to application requirements in final § 7.503.

#### **Final § 7.501 Purpose and Scope.**

Under the final rule, the purpose of approved refuge alternatives is to provide a life-sustaining environment for miners trapped underground when escape is impossible. The final rule applies to underground coal mines. MSHA has determined that there are no costs associated with this provision.

#### **Final § 7.502 Definitions.**

The final rule includes several definitions to assist applicants in preparing applications for approval and to facilitate the mining community's understanding of the rule. MSHA has determined that there are no costs associated with this provision.

### **Final § 7.503 Application Requirements.**

Final § 7.503 requires that an application for approval of a prefabricated self-contained refuge alternative or component include information that will allow MSHA to evaluate whether a refuge alternative or component meets the technical requirements information required for a refuge alternative or component. Final § 7.503 (b) requires that the application for approval of a refuge alternative contain specific information, including the results of inspections, evaluations, calculations, and tests conducted under subpart L of 30 CFR part 7. Final § 7.503 (c) lists specific information required for an application for approval of an air-monitoring component. Final § 7.503 (d) lists specific information required for an application for approval of a harmful gas removal component.

This section of the REA addresses the costs of obtaining approval for prefabricated self-contained refuge alternatives and components, including application submission costs, costs for testing required by several provisions of the final rule, and costs for approval services.

#### **Application Submission Costs**

Under the final rule, an application for a prefabricated self-contained refuge alternative must include information and drawings sufficient to satisfy the design and technical requirements for the structural, breathable air, air-monitoring, and harmful gas removal provisions in the final rule. An application for a component of a refuge alternative must include appropriate information required for the components in a prefabricated self-contained unit. In addition, an application for a refuge alternative or component must include information on the refuge alternative's or component's parts; each component's or part's in-mine shelf life and recommended replacement schedule; materials that have a potential to ignite, used in each component or part, with their MSHA approval numbers; the capacity and duration of the refuge alternative or component on a per-person per-hour basis; the length, width, and height of the space required for storage of each component; and a manual that contains sufficient detail for each refuge alternative or component addressing in-mine transportation, operation, and maintenance of the unit. More detailed technical information must be provided for a breathable air component, air-monitoring component, or harmful gas removal component. In addition, the application must include the results of testing that demonstrate the ability of the refuge alternative or component to perform as required.

MSHA estimates that, on average, manufacturers will file 3 applications annually for a prefabricated self-contained refuge alternative, and 10 applications annually for a component of a refuge alternative. MSHA projects that there will be more applications in the first few years after the final rule takes effect, but that in subsequent years the number of applications will decline.

Based upon prior practice with approval requirements, MSHA assumes that, upon request from the Agency for additional information, each applicant will make changes to the overall application. The Agency estimates that an applicant takes an average of 400 hours to prepare an application for a prefabricated self-contained refuge alternative (300 hours for the original application and 100 hours to make changes). MSHA estimates that an applicant would take an average of 150 hours to prepare an application for a component (100 hours for the original application and 50 hours to make changes). MSHA

uses wages in the mining industry to approximate wages for manufacturers of refuge alternatives. Of the total time to prepare the application and to make changes, MSHA assumes that: 50 percent will be spent by a supervisor at an hourly wage rate of (\$85.14); 40 percent will be spent by a chief engineer at an hourly wage rate of (\$74.32); and 10 percent will be spent by a clerical employee at an hourly wage rate of (\$26.37). MSHA estimates a weighted average hourly wage rate of \$74.94 to calculate the cost of preparing and submitting the application.

MSHA estimates that costs to submit the application and any necessary changes, copy costs, and postage, will be \$53 for an application for a prefabricated self-contained refuge alternative, and \$27 for an application for a refuge alternative component. To estimate these costs, MSHA assumes that an application for a prefabricated self-contained refuge alternative, including any changes, will be 300 pages and that an application for a component, including any changes, will be 150 pages. MSHA assumes copy costs of \$0.15 per page and postage costs of approximately \$1.50 per 50 pages.

Multiplying 400 hours by the weighted average wage rate of \$74.94 and adding the \$53 for costs of submitting the application will provide an estimated cost of \$30,000 to prepare and submit an application for a prefabricated self-contained refuge alternative. The annual cost for 3 applicants to prepare and submit an application for approval of a prefabricated self-contained refuge alternative is estimated to be \$90,000.

Similarly, multiplying 150 hours by the composite wage rate of \$74.94 and then adding the \$27 for costs of submitting an application will give an estimated cost of \$11,300 to prepare and submit an application for a refuge alternative component. The annual cost for 10 applicants to prepare and submit an application for approval of a component of a refuge alternative is estimated to be \$113,000.

MSHA estimates the total annual cost to prepare and submit applications for refuge alternatives and components is \$203,000.

#### *Costs for Testing by Applicant or Third Party*

MSHA assumes that the applicant or third party will conduct several tests to meet the requirements of the final rule and will provide the results in the application for approval of the refuge alternative or component. The following tests verify the breathable air performance of the refuge alternative for 96 consecutive hours: apparent temperature under final § 7.504 (b) (2); carbon dioxide scrubbing under final § 7.508 (a) (2); oxygen delivery system under final § 7.506 (b), (c), and (d); positive pressure under final §§ 7.503 (b) (3) and 7.506 (c) (1) (iii); atmospheric monitoring under final § 7.507 (c); noise measurements under final § 7.504 (a) (2); and light measurements under final § 7.504 (c) (2).

In addition, MSHA assumes the following tests would be conducted: airlock purging under final § 7.508 (a) (1); to demonstrate that trained persons without tools can fully deploy the structure within 10 minutes under final § 7.505 (b) (1); NFPA 2112 flash fire under final § 7.505 (b) (3) and (5); gas analytical accuracy, both preconditioning and long term stability, under final § 7.507 (d); pounds per square inch (psi) overpressure under final § 7.505 (b) (2) and (4); carbon monoxide scrubbing under final § 7.508 (c) (1), (2) and (4); and carbon dioxide scrubbing under final § 7.508 (a) (2) and (c)(1), (3), and

(4). Under final § 7.504 (a) (1), tests must demonstrate that electrical components exposed to the mine atmosphere are intrinsically safe for use, and that electrical components located inside the refuge alternative are intrinsically safe for use or permissible. Intrinsic safety testing falls under existing § 18.68, and permissibility testing falls under existing §§ 7.306 and 18.62. Under § 7.505 (a) (5), tests must be conducted for flame resistance. Testing for flame-resistance falls under existing § 7.27.

Agency staff provided cost estimates for the tests. These testing costs are shown in Table IV-A1. Based on this information, MSHA estimates that the total cost (including setup and tear-down costs) of tests for a prefabricated self-contained refuge alternative application is \$255,800. The estimated cost of tests for 3 prefabricated self-contained refuge alternative applications per year is \$767,400.

Tests for a component application could involve any one or a combination of the tests for the prefabricated self-contained refuge alternative. MSHA estimates that the average cost for tests for a component is approximately 8 percent (\$21,300) of the cost for tests for a prefabricated self-contained refuge alternative. The estimated annual cost of tests for 10 component applications per year is \$213,000.

MSHA estimates that the annual cost of tests for 3 prefabricated self-contained refuge alternative applications and 10 component applications a year is \$980,000.

**Table IV-A1: Summary of Costs for Tests Required by Final Part 7**

Test Required by Final Rule	Cost
Performance: <ul style="list-style-type: none"> <li>• Apparent Temperature - § 7.504(b)(2)</li> <li>• Oxygen Delivery System - § 7.506 (b),(c),(d)</li> <li>• Positive Pressure - § 7.503 (b)(3); § 7.506(c)(1)(iii)</li> <li>• Atmospheric Monitoring - § 7.507(c)</li> <li>• Noise Measurements - § 7.504(a)(2)</li> <li>• Light Measurements - § 7.504(c)(2)</li> <li>• Deploy Unit without Tools within 10 minutes - § 7.505(b)(1)</li> </ul>	\$71,255
Airlock Purging - § 7.508(a)(1)	\$4,000
NFPA 2112 Flash Fire - § 7.505(b)(3) and (5)	\$2,500
Flame Resistance - § 7.505(a)(5)	\$2,500
Intrinsic Safety - § 7.504(a)(1)	\$4,750
Permissibility - § 7.504(a)(1)	\$4,750
Gas Analytic Accuracy (Preconditioning and Long-Term Stability) - § 7.507(d)	\$105,600
15-psi Overpressure - § 7.505(b)(2)and(4)	\$50,000
Carbon Monoxide Scrubbing - § 7.508(c)(1),(2)and(4)	\$4,000
Carbon Dioxide Scrubbing - § 7.508(a)(2)	\$6,400
<b>Total</b>	<b>\$255,755</b>

*MSHA Approval Services*

MSHA charges applicants a fee that covers direct and indirect costs for evaluation and approval services performed by the Agency. As of January 1, 2008, the MSHA fee is \$84 per hour for services rendered.<sup>2</sup> In addition MSHA applies a support factor to this fee to cover the administrative, clerical and technical support services involved in evaluating an application. In the PREA, the support factor was inadvertently omitted in estimating the cost of evaluation services. In the REA, MSHA applies a support factor of 1.617 to the Agency fee of \$84 per hour, resulting in a total hourly charge of \$136 for MSHA evaluation services. Based on MSHA experience, MSHA estimates that the average time necessary for the Agency to evaluate an application and any changes total 3,000 hours for a prefabricated self-contained refuge alternative and 150 hours for a component. MSHA fee information for 2007 shows that the Agency took approximately 3,000 hours to perform a diesel engine power package approval. MSHA estimates approval services for prefabricated self-contained refuge alternatives would be similar.

<sup>2</sup> “Fee Adjustments for Testing, Evaluation, and Approval of Mining Products,” Federal Register, December 27, 2007, vol. 72, no. 247, pp. 73380-81.

MSHA's charge for evaluating a prefabricated self-contained refuge alternative application is equal to the \$136 hourly charge multiplied by 3,000 hours, or \$408,000. The estimated annual cost for MSHA to evaluate 3 prefabricated self-contained refuge alternative applications a year is \$1,224,000. MSHA's charge for evaluating a component application is equal to the \$136 hourly charge multiplied by 150 hours, or \$20,400. The estimated annual cost for MSHA to evaluate 10 component applications a year would be \$204,000.

The Agency estimates that the annual cost for MSHA evaluation of 3 prefabricated self-contained refuge alternative applications and 10 component applications per year is \$1,428,000.

Adding the annual costs for submission of applications, applicant or third-party testing, and MSHA evaluation of the application, the Agency estimates the total annual cost associated with application requirements in final § 7.503 to be \$2,611,000 (\$203,000 + \$980,000 + \$1,428,000). All costs related to approval of refuge alternatives and components are addressed in final § 7.503 and included in this amount.

#### **Final § 7.504 Refuge Alternatives and Components; General Requirements.**

Final § 7.504 includes general requirements for prefabricated self-contained refuge alternatives and components, including design and safety requirements. Under the final rule, refuge alternatives and components exposed to the mine atmosphere must be approved as intrinsically safe for use. Electrical components located inside the refuge alternative shall be either approved as intrinsically safe or approved as permissible. Refuge alternatives must not produce continuous noise levels in excess of 85 dBA in the structure interior, nor liberate harmful gases; and must be designed to be safely moved and to withstand collision forces during transport.

The apparent temperature in a fully occupied refuge alternative must not exceed 95 degrees. Tests must be conducted to determine the apparent temperature under maximum occupancy, and the results reported in the application. The manufacturer shall specify the maximum external ambient temperature in which the refuge alternative can operate when fully occupied.

Also under this provision, the refuge alternative must have a two-way communication facility that is part of the mine communication system which can be used from inside the refuge alternative. The refuge alternative must also have accommodations for an additional communication system and other requirements as defined in the communications portion of the operator's approved ERP. Refuge alternatives must also include other supplies: lighting sufficient for persons to perform tasks; a means to contain human waste and minimize odor; first aid supplies; materials, parts, and tools for repairs of components; and a portable fire extinguisher that meets the requirements of part 75, is appropriate for extinguishing fires of chemicals used for harmful gas removal, and uses a low-toxicity extinguishing agent that does not produce a hazardous by-product when activated. Containers for storage of components or provisions must be airtight, waterproof, rodent-proof, easy to open and close without tools, and conspicuously marked with instructions and expiration date.

### **Final § 7.505 Structural Components.**

Final § 7.505 includes requirements for structural components of refuge alternatives, including requirements related to the floor space and volume, airlock, and resistance to overpressure, flash fires, and other damage. Under the final rule, the refuge alternative structure must provide at least 15 square feet of floor space per person. The refuge alternative structure must provide cubic feet of volume per person as follows: 30 cubic feet for mining heights of 36 inches or less; 37.5 cubic feet for mining heights greater than 36 inches but less than or equal to 42 inches; 45 cubic feet for mining heights greater than 42 inches but less than or equal to 48 inches; 52.5 cubic feet for mining heights greater than 48 inches but less than or equal to 54 inches; 60 cubic feet for mining heights greater than 54 inches. The structure must include additional space to secure components during transportation and to provide ready access to them for maintenance examinations.

The structure must include an airlock to create a barrier and isolate the interior space from the mine atmosphere unless the refuge alternative is capable of maintaining positive pressure. The airlock must be designed for multiple uses to accommodate the structure's maximum occupancy, and must be configured to accommodate a stretcher without compromising its function.

The structure must be designed to withstand overpressure and flash fires and must be constructed of materials that are noncombustible or MSHA-approved flame-resistant, and reinforced to withstand routine handling and to resist puncture and tearing during deployment and use. The structure must be reinforced to prevent damage that would hinder deployment, entry, or use, and the structure must permit measurement of outside gas concentrations without exiting the structure or allowing entry of the outside atmosphere.

Inspections or tests must be conducted to determine that: the structure can be deployed without tools within 10 minutes by a trained person; gases will not pass into the interior atmosphere despite overpressure and flash fire forces; the structure resists puncture and tearing (in accord with ASTM D2582-07 Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting); repairs can be completed within 10 minutes; and no harmful gases or noticeable odors are released before or after a flash fire and any released gases are identified through testing.

For refuge alternatives with pressurized air for deployment or use, the structure must include a pressure regulator or other means to prevent overpressure and a means to repair and re-pressurize the structure. Also, the structure must provide a means to conduct a pre-shift examination, without entering the structure, of components critical for deployment, and a means of indicating tampering or unauthorized entry.

### **Final § 7.506 Breathable Air Components.**

Final § 7.506 includes requirements for breathable air components in the refuge alternative. Breathable air must be supplied by compressed air cylinders, compressed breathable-oxygen cylinders, or fans or compressors installed on the surface. Only uncontaminated breathable air may be supplied. Within the refuge alternative, breathable air must sustain each occupant for 96 hours. Oxygen and carbon dioxide concentrations

must be maintained at prescribed levels, and breathable air supplied by compressed air must be supplied at a prescribed minimum flow rate.

Fans or compressors must: be equipped with a carbon monoxide detector located at the surface and a visual and audible alarm; assure breathing air quality and prevent condensation; include maintenance instructions with specifications for periodic replacement or refurbishment; provide positive pressure and an automatic means to maintain positive pressure at prescribed levels; include warnings to assure that only uncontaminated breathable air is supplied; include air lines that are capable of removing water accumulation and withstanding damage from normal mining operations, flash fire, overpressure, and ground failure; and prevent contamination of the breathable air by harmful gases, water, and other materials.

Compressed breathable oxygen must: include instructions for deployment and operation; provide oxygen at a prescribed flow rate; include a means to regulate the pressure and volume of oxygen; include independent backup regulators; and be used with equipment that will not ignite or combust.

The applicant must submit evidence to assure that the breathable air component will not cause an ignition. The analysis must address oxygen fire hazards and fire hazards from chemicals used for removal of carbon dioxide and identify the means used to prevent any ignition source.

#### **Final § 7.507 Air-monitoring Components.**

Under final § 7.507 a refuge alternative must have an air monitoring component that allows occupants to determine concentrations of carbon dioxide, carbon monoxide, oxygen, and methane inside and outside the structure and in the airlock. Refuge alternatives designed for mines with a history of other harmful gases must be equipped to measure their concentrations.

The air-monitoring component must be inspected or tested and the results included in the application, and the components must be approved as intrinsically safe by MSHA. Paragraph (e) includes the measurement error and analytical accuracy requirements for the air-monitoring component, and the requirement that it be kept fully charged and ready for immediate use.

#### **Final § 7.508 Harmful Gas Removal Components.**

Final § 7.508 includes requirements for harmful gas removal components in the refuge alternative. Each refuge alternative must include means for removing harmful gases. Within 20 minutes of deployment of the refuge alternative, the concentrations of carbon monoxide and methane in the airlock must be diluted to prescribed levels.

Carbon dioxide removal components must be used with breathable air cylinders or oxygen cylinders and must remove carbon dioxide at a prescribed rate. The carbon dioxide concentration in the occupied structure must be maintained at prescribed levels, and the carbon dioxide removal component must be tested and evaluated to demonstrate that it can maintain carbon dioxide concentrations at the prescribed levels.

Chemicals used for harmful gas removal must be: contained so as not to come into contact with persons and to not release airborne particles; provided with all materials,

parts, and instructions necessary for their deployment and use; and stored in approved containers marked with instructions for disposal of the used chemicals.

To determine its ability to remove harmful gases effectively throughout its designated shelf-life, each harmful gas removal component must be tested in accordance with requirements in the final rule, specifically addressing the effects of storage and transportation. Under the final rule, alternate performance tests may be conducted if they provide the same level of assurance of the harmful gas removal component's capability as the requirements in the final rule.

**Final § 7.509 Approval Markings.**

Final § 7.509 includes requirements for markings to demonstrate MSHA approval of refuge alternatives and components. Each approved refuge alternative or component must have a legible, permanent approval marking securely and conspicuously attached. The refuge alternative must include a means to conspicuously indicate out-of-service status and reason it is out of service. The airlock must be conspicuously marked with the recommended maximum occupancy at one time. MSHA estimates that the costs for this provision are negligible.

**Final § 7.510 New Technology.**

Final § 7.510 allows for the approval of refuge alternatives or components that incorporate new technology when the refuge alternative provides no less protection than those meeting the requirements of this subpart. MSHA has determined that there are no costs associated with this final provision.

**SECTION IV-A SUMMARY: 30 CFR PART 7 REQUIREMENTS**

Table IV-A summarizes the estimated yearly cost of \$2.6 million for manufacturers of refuge alternatives and components.

**Table IV-A: Summary of Yearly Costs for Part 7 Requirements**

Final Requirement	Yearly Cost
§ 7.501 Purpose and Scope.	\$0
§ 7.502 Definitions	\$0
§ 7.503 Application Requirements	
Prepare Applications for Approval	\$203,000
Applicant or Third Party Testing	\$980,000
MSHA Evaluation of Application	\$1,428,000
§ 7.504 Refuge Alternatives and Components; General Requirements.	*
§ 7.505 Structural Components	*
§ 7.506 Breathable Air Components	*
§ 7.507 Air-monitoring Components	*
§ 7.508 Harmful Gas Removal Components	*
§ 7.509 Approval Markings	\$0
§ 7.510 New Technology	\$0
<b>Total</b>	<b>\$2.6 million</b>

\* Application preparation, testing, and MSHA evaluation costs related to this provision are included in discussion of final § 7.503 costs.

## **SECTION IV-B: 30 CFR PART 75—MANDATORY SAFETY STANDARDS— UNDERGROUND COAL MINES**

### **Final § 75.221 Roof Control Plan Information.**

Final § 75.221 (a) (12) requires that the roof control plan contain a description of the roof and rib support necessary for the refuge alternative. Under this provision, mine operators who install refuge alternatives must revise the existing roof control plan to include information about the additional steps to protect refuge alternatives from roof and rib falls. Under the existing standard, mine operators must follow the roof control plan and are therefore required to install roof and rib support described in the plan. Below is a discussion of the costs associated with revising the roof control plan and with installing necessary roof and rib support as required by this provision.

#### *Revision of Roof Control Plan*

MSHA estimates that the revision of the roof control plan will be a one-page addendum that will be filed with MSHA once with no additional revisions needed. MSHA assumes that the roof control plan will be revised by a supervisor, at an hourly wage rate of \$85.14, and that the revision will take 30 minutes (0.5 hours), on average, for all mines. In addition, MSHA estimates that a clerical employee will take a total of 3 minutes (0.05 hours), at an hourly wage of \$26.37, to copy and submit the one-page addendum to MSHA, plus approximately \$1.00 for copies and postage.

Based on these assumptions, the estimated cost for a mine to revise the roof control plan is approximately \$45 ( $\$85.14/\text{hr.} \times 0.5 \text{ hour} + \$26.37/\text{hr.} \times 0.05 \text{ hour} + \$1.00$ ). The estimated first-year cost is \$4,800 for 106 mines with 1-19 employees, \$17,600 for 391 mines with 20-500 employees, and \$450 for 10 mines with 501+ employees, for a total of \$23,000.

Using an annualization factor of 0.142, the estimated annualized cost is \$700 for 106 mines with 1-19 employees; \$2,500 for 391 mines with 20-500 employees; and \$100 for 10 mines with 501+ employees; for a total of \$3,200.

#### *Installation of Necessary Roof and Rib Support*

Under existing § 75.220, mine operators must install necessary roof and rib support specified in the roof control plan. MSHA estimates that 50% of all refuge alternatives will be located in areas needing roof support for the refuge alternative. MSHA estimates that materials for the roof and rib support, such as roof bolts, mesh, and straps will cost \$200. MSHA estimates that roof and rib support can be installed in 15 minutes (0.25 hours) by 2 miners at a wage rate of \$33.70. MSHA estimates a cost of \$217 to install roof and rib support for each refuge alternative located in an area needing support.

Based on the estimates of the total number of refuge alternatives (discussed in the REA under final § 75.1506), MSHA estimates that the total number of refuge alternatives in outby areas requiring roof and rib support will be 0 in mines with 1-19 employees, 77 in mines with 20-500 employees, and 14 in mines with 501+ employees. The estimated first-year cost to install roof and rib support for refuge alternatives in outby areas is \$20,000: \$0 for mines with 1-19 employees ( $\$217 \times 0$ ), \$17,000 for mines with 20-500 employees ( $\$217 \times 77$ ), and \$3,000 for mines with 501+ employees ( $\$217 \times 14$ ).

MSHA estimates that the roof and rib support for refuge alternatives located in outby areas will be used for 10 years. Using an annualization factor of 0.142, the estimated annualized cost is \$0 for 106 mines with 1-19 employees; \$2,400 for mines with 20-500 employees; and \$400 for mines with 501+ employees; for a total of \$2,800.

MSHA estimates that the total number of refuge alternatives in working sections (inby) requiring roof and rib support will be 53 in mines with 1-19 employees, 392 in mines with 20-500 employees, and 36 in mines with 501+ employees. MSHA estimates that refuge alternatives in working sections will be moved an average of 38 times per year. The estimated number of moves per year is higher than the estimate in the PREA and is explained under final § 75.1506. MSHA estimates that roof and rib support will be required with each move, for a total annual cost per refuge alternative of \$8,246 (\$217 x 38 relocations). The estimated annual cost to install roof and rib support for refuge alternatives in working sections (inby) is \$4.0 million: \$437,000 for mines with 1-19 employees (\$8,246 x 53), \$3.2 million for mines with 20-500 employees (\$8,246 x 392), and \$297,000 for mines with 501+ employees (\$8,246 x 36).

Including the cost of revising the roof control plan, installing necessary roof and rib supports for refuge alternatives in outby areas, and installing necessary roof and rib supports for refuge alternatives in working sections (inby), the total annual cost associated with final § 75.221 is estimated to be \$4.0 million: \$438,000 for mines with 1-19 employees; \$3.2 million for mines with 20-500 employees; and \$297,000 for mines with 501+ employees.

#### **Final § 75.313 Main Mine Fan Stoppage with Persons Underground.**

Final § 75.313 (f) requires that any electrical component exposed to the mine atmosphere shall be approved as intrinsically safe for use during fan stoppages and that any electrical components located inside the refuge alternative shall be either approved as intrinsically safe or approved as permissible for use during fan stoppages. Final § 75.313(f) differs from the provision in the proposed rule, which specified that any electric-powered refuge alternative component that may be operated during fan stoppages be intrinsically safe. These requirements are consistent with and re-state the existing requirement applicable to the operation of electrical equipment during fan stoppages. Therefore, MSHA has not estimated any cost for this provision.

#### **Final § 75.360 Preshift Examination at Fixed Intervals.**

Final § 75.360 (d) requires that persons conducting the pre-shift examination check the refuge alternative for damage, the integrity of the tamper-evident seal and the mechanisms required to deploy the refuge alternative, and the ready availability of compressed oxygen and air.

MSHA calculates the total annual cost by mine size by multiplying the value of the additional time it will take a supervisor to examine a refuge alternative during a pre-shift examination by the number of shifts per day, by the number of work days per year, and by the number of refuge alternatives. MSHA estimates that a supervisor will perform the pre-shift examination and will take 6 minutes (0.1 hours) to examine each refuge alternative, at an hourly wage of \$85.14. In addition, MSHA estimates the following:

- There will be 106 refuge alternatives in mines with 1-19 employees, 937 refuge alternatives in mines with 20-500 employees, and 99 refuge alternatives in mines with 501+ employees. These estimates of the number of refuge alternatives differ slightly from the estimates in the PREA and are discussed under final § 75.1506.
- On average, the number of shifts per work day per mine will be one shift for mines with 1-19 employees, two shifts for mines with 20-500 employees, and three shifts for mines with 501+ employees.
- On average, the number of work days per year will be 260 days (5 days per week) for mines with 1-19 employees; 312 days (6 days per week) for mines with 20-500 employees; and 365 days (7 days per week) for mines with 501+ employees.

Based on these assumptions, the annual cost is approximately \$235,000 for mines with 1-19 employees ( $\$85.14/\text{hr.} \times 0.10 \text{ hour} \times 1 \text{ shift/day} \times 260 \text{ work days} \times 106 \text{ refuge alternatives}$ ); \$5.0 million for mines with 20-500 employees ( $\$85.14/\text{hr.} \times 0.10 \text{ hour} \times 2 \text{ shifts/day} \times 312 \text{ work days} \times 937 \text{ refuge alternatives}$ ); and \$923,000 for mines with 501+ employees ( $\$85.14/\text{hr.} \times 0.10 \text{ hour} \times 3 \text{ shifts/day} \times 365 \text{ work days} \times 99 \text{ refuge alternatives}$ ). The total annual cost for all mines to examine refuge alternatives during pre-shift examination is approximately \$6.1 million.

#### **Final § 75.372 Mine Ventilation Map.**

Final § 75.372 (b) (11) requires that the mine ventilation map include the location of all refuge alternatives. In addition, final § 75.1200 (g) requires that the mine map include the location of all refuge alternatives, and final § 75.1505 (a) requires that the escapeway map include the location of all refuge alternatives. MSHA estimates that all maps will need to be revised when refuge alternatives are initially installed in the mine, as well as each time a refuge alternative is relocated.

MSHA assumes that this requirement will apply to the approximately 507 mines that will install refuge alternatives. For cost estimation purposes, MSHA assumes that all maps at a mine, that is, the mine ventilation map, the mine map, and the escapeway map, will be revised at the same time. Therefore, this section of the REA addresses the combined cost associated with final §§ 75.372 (b) (11), 75.1200 (g), and 75.1505 (a).

Because mines have to file maps under the existing standard, MSHA includes no filing costs in this estimate. MSHA assumes that the initial revisions to the maps will be performed by a supervisor, at an hourly wage rate of \$85.14, and will take, on average, 30 minutes (0.5 hours) for mines with 1-19 employees, 45 minutes (0.75 hours) for mines with 20-500 employees, and one hour for mines with 501+ employees.

Using these assumptions, MSHA calculates the cost for the initial revision of the maps as the supervisor's wage multiplied by the time to revise the maps multiplied by the number of mines. The first-year cost for all mines with refuge alternatives is estimated to be \$4,500 for mines with 1-19 employees ( $\$85.14/\text{hr.} \times 0.5 \text{ hour} \times 106 \text{ mines}$ ); \$25,000 for mines with 20-500 employees ( $\$85.14/\text{hr.} \times 0.75 \text{ hour} \times 391 \text{ mines}$ ); and \$850 for mines with 501+ employees ( $\$85.14/\text{hr.} \times 1.0 \text{ hour} \times 10 \text{ mines}$ ), for a total first-year cost of \$30,000.

Using an annualization factor of 0.142, the estimated yearly cost is \$600 for 106 mines with 1-19 employees, \$3,600 for 391 mines with 20-500 employees, and \$100 for 10 mines with 501+ employees, for a total yearly cost of \$4,300.

To estimate the costs of revising maps when refuge alternatives are relocated, MSHA assumes that a supervisor, at an hourly wage rate of \$85.14, will take 90 seconds (0.025 hours) to revise all maps to reflect the new location because the revisions will be computerized and will occur quickly. MSHA assumes that refuge alternatives in outby areas will not be relocated and that each refuge alternative in working sections (inby) will be relocated an average of 38 times per year. MSHA calculates the total annual cost of revising the maps when refuge alternatives are relocated as the supervisor's wage multiplied by the time to make each revision, multiplied by the average number of relocations per refuge alternative each year and by the number of refuge alternatives. The estimated annual cost is \$8,600 for mines with 1-19 employees ( $\$85.14/\text{hr.} \times 0.025 \text{ hour} \times 106 \text{ refuge alternatives} \times 38 \text{ relocations}$ ), \$63,300 for mines with 20-500 employees ( $\$85.14/\text{hr.} \times 0.025 \text{ hour} \times 783 \text{ refuge alternatives} \times 38 \text{ relocations}$ ), and \$5,700 for mines with 501+ employees ( $\$85.14/\text{hr.} \times 0.025 \text{ hour} \times 71 \text{ refuge alternatives} \times 38 \text{ relocations}$ ), for a total of \$77,600.

MSHA estimates a total yearly cost of \$82,000 (\$4,300 for initial revisions + \$77,600 relocation revisions) for the requirements in final §§ 75.372 (b) (11), 75.1200 (g), and 75.1505 (a) that the mine ventilation map, mine map, and escapeway map, respectively, reflect the locations of refuge alternatives.

#### **Final § 75.1200 Mine Map.**

Final § 75.1200 (g) requires the mine map to include the location of all refuge alternatives. As noted above, these costs have been addressed in § 75.372.

#### **Final § 75.1202-1 Temporary Notations, Revisions, and Supplements.**

Final § 75.1202-1(b)(4) requires that the temporary notations used to keep mine maps up-to-date include symbols designating refuge alternatives. In discussing the costs associated with final §§ 75.372 (b)(11), 75.1200 (1)(n), and 75.1505 (a), MSHA has estimated that all map revisions will be computerized, will occur quickly, and will be performed when refuge alternatives are initially installed and when they are relocated in the mine. Therefore, MSHA estimates no additional costs associated with this final requirement.

#### **Final § 75.1501 Emergency Evacuations.**

Final § 75.1501 requires that the responsible person in an emergency have current knowledge of the locations of refuge alternatives. MSHA assumes that the responsible person in an emergency will be a supervisor trained in the location of refuge alternatives under final § 75.1504 and responsible for revisions to mine maps under final §§ 75.372 (b) (11), 75.1200 (g), and 75.1505 (a). Because this person will have current knowledge of the locations of refuge alternatives under these other provisions, MSHA estimates no additional cost associated with final § 75.1501.

**Final § 75.1502 Mine Emergency Evacuation and Firefighting Program of Instruction.**

Final § 75.1502 (c) requires that the mine emergency evacuation and firefighting program of instruction be revised to include instruction for miners in the deployment, use and maintenance of refuge alternatives, a review of the location of refuge alternatives, a summary of procedures for deploying refuge alternatives, a summary of the construction methods for 15 psi stoppings constructed prior to an event, and a summary of procedures related to refuge alternative use. This requirement will apply only to those mines that have refuge alternatives.

MSHA estimates that the revision of this program of instruction will be a two-page addendum that will be submitted to MSHA once, with no additional revisions needed. MSHA assumes that this program of instruction will be revised by a supervisor, at \$85.14 per hour, and will take 30 minutes (0.5 hours), on average, for all mines. In addition, MSHA estimates that a clerical employee, at \$26.37 per hour, will take a total of 3 minutes (0.05 hours) to copy and submit the two-page addendum. MSHA assumes approximately \$1.00 copy and postage costs.

MSHA calculates the total cost per mine to revise and submit the program of instruction to be \$45 ( $\$85.14/\text{hr.} \times 0.5 \text{ hour} + \$26.37/\text{hr.} \times 0.05 \text{ hour} + \$1.00 \text{ copy and postage cost}$ ). MSHA calculates the first-year cost as the cost per mine multiplied by the number of mines with refuge alternatives: \$4,800 for mines with 1-19 employees ( $\$45 \times 106$ ), \$17,700 for mines with 20-500 employees ( $\$45 \times 391$ ), and \$450 for mines with 501+ employees ( $\$45 \times 10$ ), for a total of approximately \$23,000. Using an annualization factor of 0.142, MSHA estimates a yearly cost of \$700 for mines with 1-19 employees, \$2,500 for mines with 20-500 employees, and \$100 for mines with 501+ employees, for a total of \$3,300 to revise the mine emergency evacuation and firefighting program of instruction.

**Final § 75.1504 Mine Emergency Evacuation Training and Drills.**

Final § 75.1504 (b) requires that the quarterly mine emergency evacuation training and drills include physically locating refuge alternatives; reviewing the mine and escapeway maps, including locating refuge alternatives, reviewing the procedures for deploying refuge alternatives and components; for miners who will be constructing the 15 psi stoppings prior to an event, reviewing the procedures for constructing them; reviewing the procedures for use of refuge alternatives and components; and task training in proper transportation of the refuge alternative or component. Final § 75.1504 (c) (3) requires that each miner receive annual expectations training in the deployment and use of refuge alternatives. This training will include how to deploy and use refuge alternatives similar to those in use at the mine, how to deploy and operate the components and equipment, and when to use the refuge alternative during a mine emergency. Under the final rule, expectations training will be required for miners within the first quarter of employment.

MSHA assumes that all coal miners working underground and 20 percent of the contractors working underground in the 507 mines with refuge alternatives will receive training on refuge alternatives. Based on these assumptions, MSHA estimates that 38,400 persons will receive training, as follows.

- For mines with 1-19 employees: 1,500 miners and 50 contractors, totaling 1,550 persons trained.
- For mines with 20-500 employees: 30,300 miners and 800 contractors, totaling 31,100 persons trained.
- For mines with 501+ employees: 5,600 miners and 150 contractors, totaling 5,800 persons trained.

MSHA assumes that supervisors constitute 15 percent of the 38,400 persons who will receive training, or approximately 5,800 supervisors. MSHA uses these assumptions to estimate costs of quarterly training and drills and annual expectations training under final § 75.1504.

#### Quarterly Training and Drills

MSHA estimates that the requirements in final § 75.1504 (b) for quarterly training and drills on refuge alternatives will be integrated into existing quarterly drills and training and will result in an additional 15 minutes (0.25 hour) of quarterly training per person at an hourly wage of \$33.70 per miner, and \$85.14 per supervisor. Because quarterly training and drills are required under the existing rule, MSHA estimates no additional cost for quarterly training certification related to refuge alternatives. MSHA assumes that trainers for the quarterly drills and training will be supervisors. Supervisors providing the training will be considered participants in the training for compliance purposes. MSHA assumes that new miners will receive quarterly training in the next scheduled quarter.

Based on these assumptions, MSHA calculates a weighted average annual cost of approximately \$41 per person for the additional quarterly training related to refuge alternatives [ $(\$33.70/\text{hr.} \times 0.25 \text{ hour} \times 0.85, \text{ the proportion of trained persons who are miners} + \$85.14/\text{hr.} \times 0.25 \text{ hour} \times 0.15, \text{ the proportion of trained persons who are supervisors}) \times 4 \text{ times per year}$ ]. The total annual cost for quarterly drills and training is calculated as the cost per person of \$41 multiplied by the estimated number of persons to be trained. MSHA estimates an annual cost of \$64,000 for mines with 1-19 employees (\$41 per year  $\times$  1,550 persons); \$1.3 million for mines with 20-500 employees (\$41 per year  $\times$  31,100 persons); and \$240,000 for mines with 501+ employees (\$41 per year  $\times$  5,800 persons), for a total annual cost of \$1.6 million related to the requirements for quarterly training and drills.

#### Annual Expectations Training

Final § 75.1504 (c) (3) requires that each miner receive annual expectations training in the deployment and use of refuge alternatives. MSHA estimates that 38,400 miners working underground will receive regularly scheduled annual expectations training, and that 15 percent of these, or approximately 5,800 persons, will be supervisors. MSHA estimates that this training will be integrated into existing annual expectations training for self-contained self-rescue devices. MSHA estimates that it will take 3 hours to train persons in the use of refuge alternatives and components. Since MSHA assumes that expectations training on refuge alternatives will occur in conjunction with other annual expectations training, MSHA estimates that no additional travel time and associated costs will be incurred. Because annual expectations training is required under the existing

standard, MSHA estimates no additional cost for annual expectations training certification related to refuge alternatives.

MSHA estimates 38,400 persons (5,800 supervisors and 32,600 miners) will receive regularly scheduled annual expectation training. MSHA estimates that additional persons will need to be trained due to turnover. MSHA estimates that 7 percent of persons will leave their job and be replaced by others that will need training. Of the additional 2,700 persons ( $.07 \times 38,400$ ) that need to be trained due to turnover, MSHA assumes that 25 percent will be able to take training in the mine's regularly scheduled annual expectations training. MSHA assumes that the remaining 75 percent, or about 2,000 persons, will need to receive expectations training from a training contractor in a separate session. Of these 2,000 persons, about 300 will be supervisors and about 1,700 will be miners.

Based on these assumptions, MSHA estimates a total of 34,300 miners (32,600 + 1,700) and 6,100 supervisors (5,800 + 300) will receive expectations training, for a total of about 40,400 persons annually.

For cost estimation purposes, MSHA assumes that mines will hire a contractor to provide the annual expectations training on the use of refuge alternatives. MSHA estimates that a training contractor will charge \$150 per person for regularly scheduled training, which will cover the cost of the trainer's time, the facility, and the equipment (i.e., a model refuge alternative and components). MSHA estimates that separate training sessions for newly hired persons will involve fewer economies of scale than regularly scheduled annual expectations training and will therefore be offered at a 33-percent higher cost, or approximately \$200 per person.

Based on these assumptions, MSHA estimates the annual cost related to the requirements for annual expectations training as follows:

- Miner wage of \$33.70 x 3 hours x 34,000 miners to be trained (1,400 in mines with 1-19 employees, 27,800 in mines with 20-500 employees, 5,200 in mines with 501+ employees)
- Supervisor wage of \$85.14 x 3 hours x 6,100, the estimated number of supervisors to be trained (240 in mines with 1-19 employees, 4,900 in mines with 20-500 employees, 1,000 in mines with 501+ employees)
- \$150 scheduled training fee x 38,400, the estimated number of miners and supervisors to receive scheduled training (1,550 in mines with 1-19 employees, 31,100 in mines with 20-500 employees, 5,800 in mines with 501+ employees)
- \$200 separate training fee x 2,000, the estimated number of miners and supervisors to receive separate training. (80 in mines with 1-19 employees, 1,600 in mines with 20-500 employees, 300 in mines with 501+ employees)

MSHA estimates an annual cost of \$450,000 for mines with 1-19 employees; \$9.1 million for mines with 20-500 employees; and \$1.7 million for mines with 501+ employees, for a total annual cost of \$11.2 million related to the requirements for annual expectations training.

For all training-related requirements in final § 75.1504, including quarterly drills and training and annual expectations training, MSHA estimates an annual cost of \$514,000 for mines with 1-19 employees; \$10.3 million for mines with 20-500 employees; and \$1.9 million for mines with 501+ employees, for a total estimated annual cost of \$12.8 million.

One commenter stated that training costs in the PREA were grossly underestimated. In the PREA, MSHA provided a detailed explanation of the basis for its estimates of the costs of training. The commenter provided no specific rationale for the objection to MSHA's estimates and no specific information to serve as a basis for revising the Agency's estimates. Therefore, MSHA has not changed the methodology or assumptions that the Agency included in the PREA.

**Final § 75.1505 Escapeway Maps.**

Final § 75.1505 (a) requires the escapeway map to include the location of all refuge alternatives. Under final § 75.1505 (b), escapeway maps must be kept up-to-date with any changes in location of refuge alternatives. As noted above, these costs have been addressed in final § 75.372.

**Final § 75.1506 Refuge Alternatives.**

Final § 75.1506 requires that refuge alternatives be provided and includes requirements for the use and maintenance and repair of refuge alternatives. Final § 75.1506 (a), (b), and (c) require that refuge alternatives and components provided by mine operators must: be approved by MSHA, provide sufficient capacity as specified to accommodate all persons working underground; and be located as specified throughout the mine. Final § 75.1506 (d) requires roof and rib support be specified in the mine's roof control plan; costs related to this requirement are included under final § 75.221. Final § 75.1506 (f) requires that refuge alternatives be removed from service and repaired or replaced when damaged, and final § 75.1506 (h) requires that refuge alternatives be conspicuously identified with signs or markers as specified. Cost estimates related to these final requirements are addressed below on a section-by-section basis: cost of refuge alternatives under final § 75.1506 (a) and (b); relocation of refuge alternatives in working sections under final § 75.1506 (c); repair of refuge alternatives under final § 75.1506 (f); and markings and signs for refuge alternatives under final § 75.1506 (h).

**Final § 75.1506 (a) and (b).**

Under final § 75.1506 (a), refuge alternatives must be provided. Prefabricated self-contained units, including the structural, breathable air, air monitoring, and harmful gas removal components of the unit must be approved under 30 CFR part 7. The structural components of refuge alternatives consisting of 15-psi stoppings in a secure space with an isolated atmosphere must be approved by the District Manager, and the breathable air, air monitoring, and harmful gas removal components must be approved under 30 CFR part 7.

Final § 75.1506 (a) (3) states that prefabricated self-contained refuge alternative structures approved by states or accepted by MSHA in approved ERPs that are in service prior to the publication date of the final rule are permitted until January 1, 2019, or until replaced, whichever comes first. Also, breathable air, air-monitoring, and harmful gas removal components of prefabricated self-contained units or units consisting of 15-psi stoppings in a secure space and an isolated atmosphere that states have approved and those

that MSHA has accepted in approved ERPs that are in service prior to the date of publication of the final rule are permitted until January 1, 2014, or until replaced, whichever comes first. Also, refuge alternatives consisting of materials pre-positioned for persons to use to construct a secure space with an isolated atmosphere that MSHA has accepted in approved ERPs that are in service prior to the date of the final rule are permitted until January 1, 2011, or until replaced, whichever comes first.

One commenter stated that their mine had spent roughly \$750,000 on portable, self-contained shelters that met West Virginia requirements and said that to replace those systems with MSHA-approved versions “can be expected to be more than 5 times that cost.” Under the final rule, prefabricated refuge alternatives that states have approved would be permitted until January 2019 or until replaced, whichever comes first.

Under final § 75.1506 (b) (1), the refuge alternative structure must provide at least 15 square feet of floor space per person and cubic feet of volume per person as follows: 30 cubic feet for mining heights of 36 inches or less; 37.5 cubic feet for mining heights greater than 36 inches but less than or equal to 42 inches; 45 cubic feet for mining heights greater than 42 inches but less than or equal to 48 inches; 52.5 cubic feet for mining heights greater than 48 inches but less than or equal to 54 inches; 60 cubic feet for mining heights greater than 54 inches.

Final §§ 75.1506 (b) (2) and (3) require that the capacity of refuge alternatives must be sufficient to accommodate all persons working underground, including the maximum number of persons that can be expected to be on or near working sections at any time and persons reasonably expected to use it in outby areas.

This section of the REA addresses the estimated costs of refuge alternatives.

#### Unit Costs of Refuge Alternatives

Final § 75.1506 (a) (1) requires that prefabricated self-contained refuge alternatives meet the approval requirements in 30 CFR part 7. Final § 75.1506 (a) (2) requires that the structural components of refuge alternatives consisting of 15-psi stoppings in a secure space and an isolated atmosphere be approved by the District Manager and that the breathable air, air monitoring, and harmful gas removal components of these units meet the approval requirements in 30 CFR part 7. Based upon the requirements for approval of refuge alternatives and components, MSHA estimated unit costs for refuge alternatives and components and supplies. MSHA recognizes that mine operators may use various types of refuge alternatives to comply with the requirements in the final rule. However, for cost estimation purposes, MSHA estimated unit costs for three types of prefabricated self-contained refuge alternatives and one type of refuge alternative consisting of 15-psi stoppings in a secure space and an isolated atmosphere.

The types of refuge alternatives addressed in the REA differ from those included in the PREA due to changes in the final rule. For example, materials pre-positioned for miners to use to construct a secure space after an event are not included in the final rule. It is important to note, however, that MSHA will accept these refuge alternatives, as well as certain other types of refuge alternatives, for a specified time after the final rule is effective.

The REA addresses costs related to prefabricated self-contained refuge alternatives and refuge alternatives consisting of 15-psi stoppings in a secure space and an isolated atmosphere.

In addition to the cost estimates for refuge alternatives consisting of 15-psi stoppings in a secure space and an isolated atmosphere (called “refuge alternatives constructed in place” in the PREA) and prefabricated self-contained units included in the PREA, the REA provides estimates for two types of refuge alternatives not included in the PREA: a prefabricated self-contained unit with an inflatable barrier designed to support up to 16 persons and a prefabricated self-contained unit with an inflatable barrier designed to support up to 26 persons. MSHA used manufacturers’ data and information to estimate costs for these two types of refuge alternatives.

MSHA estimated annualized costs for refuge alternatives and components. Annualized costs are one-time or intermittent costs that are amortized over the life of the investment to produce an equivalent annual cost. To calculate annualized costs for refuge alternatives, MSHA projected that some items have a 5-year service life, while others have a 10-year service life. MSHA multiplies the cost of each item with a 5-year service life by a factor of 0.244 and multiplies the cost of each item with a 10-year service life by a factor of 0.142. Both annualization factors use a 7 percent discount rate.

Table IV-B1 summarizes the estimated costs of each type of refuge alternative, including costs of the components and supplies. More detailed discussion of the costs for each type of refuge alternative follows.

Refuge Alternative Built Prior to an Emergency, Consisting of Stoppings in a Secure Space and Isolated Atmosphere for Outby Areas

MSHA estimates that, for outby areas, operators will choose refuge alternatives built prior to an emergency, consisting of 15-psi stoppings in a secure space and an isolated atmosphere. MSHA estimates that these units will accommodate 20 persons. MSHA estimates that it will take 20 miners 7 hours, at an hourly wage of \$33.70, to construct and install this type of refuge alternative, for a total cost of \$472. MSHA estimates a cost of \$1,000 for blocks and mortar to install the unit.

In addition, MSHA estimates the following costs for the components to be used in these refuge alternatives:

*Lighting:* The refuge alternatives must include lighting sufficient for persons to perform tasks. MSHA estimates that 8 chemical light sticks, at a total cost of \$16, will meet the requirement. MSHA assumes that the light sticks will have a service life of 5 years and calculates the annualized cost of \$4 by multiplying \$16 by a factor of 0.244.

*Sanitation:* The refuge alternative must include a means to contain human waste and minimize odor. MSHA estimates that a chemical toilet, at a total cost of \$100, will meet these requirements. MSHA assumes that the chemical toilet has a service life of 5 years and calculates the annualized cost of \$24 by multiplying \$100 by a factor of 0.244.

*First aid:* The refuge alternative must include first aid supplies. MSHA estimates a cost of \$200 for first aid supplies. MSHA assumes that the first aid supplies have a service life of 5 years and calculates the annualized cost of \$49 by multiplying \$200 by a

factor of 0.244.

*Tools for repairs:* The refuge alternative must include tools for repairs of components. MSHA estimates a cost of \$200 for hoses and wrenches used for repairs. MSHA assumes that the hoses and wrenches have a service life of 5 years and calculates the annualized cost of \$49 by multiplying \$200 by a factor of 0.244.

*Airlock:* Refuge alternatives not capable of maintaining adequate positive pressure must include an airlock to create a barrier and isolate the interior space from the mine atmosphere. MSHA estimates a cost of \$300 for two manddoors to be used for an airlock. MSHA assumes that the manddoors have a service life of 10 years and calculates the annualized cost of \$43 by multiplying \$300 by a factor of 0.142.

*Breathable air:* The final rule allows several methods of providing breathable air. In the REA, MSHA estimates the cost of the breathable air component using compressed oxygen cylinders and compressed air cylinders. MSHA estimates that high-capacity (HC) 4,500-psi cylinders of compressed air will be used in all refuge alternatives, at a cost of \$405 each. MSHA assumes that compressed air cylinders have a service life of 5 years and calculates the annualized cost of \$99 per cylinder by multiplying \$405 by a factor of 0.244. MSHA estimates that two compressed air regulators will be needed in all refuge alternatives, at a total cost of \$580 (\$290 each). MSHA assumes that the compressed air regulators have a service life of 5 years and calculates the annualized cost of \$142 by multiplying \$580 by a factor of 0.244.

The Agency estimates that at one K-sized 2,200-psi cylinder of oxygen, costing \$330, will be needed in all refuge alternatives for every two persons. MSHA assumes that oxygen cylinders have a service life of 5 years and calculates the annualized cost of \$81 per cylinder by multiplying \$330 by a factor of 0.244. In addition, MSHA estimates that two oxygen regulators will be needed in all refuge alternatives, at a total cost of \$574 (\$287 each). MSHA assumes that the oxygen regulators have a service life of 5 years and calculates the annualized cost of \$140 by multiplying \$574 by a factor of 0.244.

MSHA estimates a total cost of \$6,884 for breathable air for a 20-person refuge alternative consisting of 15-psi stoppings in a secure space and an isolated atmosphere: six high-capacity (HC) 4,500-psi cylinders of compressed air for airlock purges and to maintain air pressure in the unit; ten K-sized 2,200-psi cylinders of oxygen; two compressed air regulators; and two oxygen regulators.

During the rulemaking process, MSHA considered certain other breathable air options that could be used to meet the requirements of the refuge alternatives final rule: existing boreholes; provisions for 48 hours of breathable air plus borehole pre-arrangements; and compressed air stations. Although mine operators may use these options, MSHA has not included them in the Agency's cost estimates because the Agency did not have verifiable data that they are currently being used solely to satisfy the requirements in the final rule and believes that their costs are more speculative. MSHA has developed a range of costs for these breathable air options.

(a) Boreholes: Some mines already have boreholes that were drilled for purposes of exploration, and boreholes may be used for power lines or communications, for pumping water into or out of the mine, and for other purposes. However, the

Agency estimates that, for most mines, it would cost between \$100,000 and \$500,000 to drill new boreholes to meet the final rule requirements. One commenter stated that his company uses a series of “constructed shelters” that cost approximately \$75,000 each, including the cost of a borehole to supply air and communications. The commenter stated that the proposed rule “could easily increase that cost by a factor of 10.” This commenter suggests, and MSHA agrees, that using refuge alternatives consisting of boreholes near working sections would represent higher cost options. In developing cost estimates for the proposed rule and the final rule, MSHA included less costly options for refuge alternatives.

(b) Breathable air for 48 hours, plus borehole pre-arrangements: the final rule allows the option of sustaining persons for 48 hours, rather than 96, if a mine operator has made arrangements to have a borehole drilled to the refuge alternative within 48 hours of an emergency. MSHA has estimated that the difference in cost between 48 hours worth of supplies and 96 hours worth of supplies is \$5,000 for 10-person refuge alternatives and \$10,000 for 20-person refuge alternatives. In this situation, if boreholes are needed after the 48 hours, MSHA believes that the costs are similar to those in option 1 above.

(c) Compressed air stations: The final rule allows a mine operator to provide breathable air from compressors installed on the surface. Normally, compressors will be connected to a series of pipes, filters, and valves running through the mine to the working sections. This option will eliminate the need for cylinders of compressed air and oxygen and harmful gas removal. However, only one piped compressed air system has been installed in an underground coal mine, and its estimated cost is in excess of \$120,000. MSHA has not included this option in its cost estimates.

*Air monitoring:* Under the final rule, refuge alternatives must have an air-monitoring component that allows occupants to determine concentrations of carbon dioxide, carbon monoxide, oxygen, and methane inside and outside the structure and in the airlock. Refuge alternatives designed for mines with a history of other harmful gases must be equipped to measure their concentrations. MSHA estimates a cost of \$3,000 for a multi-gas detector. MSHA assumes that the multi-gas detector has a service life of 5 years and calculates the annualized cost of \$732 by multiplying \$3,000 by a factor of 0.244.

*Harmful gas removal:* Under the final rule, refuge alternatives must have a means for removing harmful gases. Both lithium hydroxide curtains and soda lime pellets are commonly used to remove harmful gases. MSHA assumes that one half of the harmful gas removal components will use lithium hydroxide curtains and one half will use soda lime pellets. For one person a 96-hour supply is estimated to cost \$960 for lithium hydroxide and \$700 for the soda lime. These two costs yield an average estimated cost of \$830 per person for harmful gas removal. MSHA assumes that the harmful gas removal component has a service life of 5 years and calculates the annualized cost of \$203 by multiplying \$830 by a factor of 0.244.

*Food and water:* The final rule requires food and water for 96 hours for each occupant of the refuge alternative. MSHA estimates that food and water cost \$10 per person per 24-hour period, or \$40 per person for 96 hours. MSHA assumes that the food

and water have a service life of 5 years and calculates the annualized cost to be \$10 per person for 96 hours by multiplying \$40 by a factor of 0.244.

As shown in Table IV-B1, MSHA estimates a cost of \$29,572 for a 20-person refuge alternative unit consisting of 15-psi stoppings in a secure space and an isolated atmosphere. To calculate an annualized cost for this type of refuge alternative, MSHA takes the sum of the annualized cost of each component or item as shown in Table IV-B1. As Table IV-B1 shows, the estimated annualized cost for a unit consisting of 15-psi stoppings in a secure space and an isolated atmosphere is \$7,035.

#### Prefabricated Self-Contained Refuge Alternative with a Rigid Steel Barrier for Working Sections

A prefabricated self-contained refuge alternative with a rigid barrier will be one type of refuge alternative appropriate for locations near working sections (inby). Based on manufacturers' information, MSHA estimated that a prefabricated self-contained unit with a steel barrier designed to support 20 persons will cost \$100,000. This amount includes the cost of the components and equipment and materials in the self-contained unit. However, a unit of that size, as presently designed, will not meet the volume and floor space requirements in the rule; MSHA estimated that a unit of that size could accommodate only 10 persons. Accordingly, the Agency reduced the cost of a prefabricated self-contained unit from \$100,000 to \$87,000, to reflect the reduced costs for oxygen, compressed air, harmful gas removal, and food and water for 10 persons rather than 20 persons. The estimated \$87,000 includes the costs for components and supplies as required under CFR 30 Part 7.

In addition, MSHA estimates that it will take 4 miners 7 hours to install a prefabricated self-contained unit in a mine, for a cost of \$404 (4 miners x 7 hours x \$33.70/hr.). As shown in Table IV-B1, the estimated cost for the installation of a prefabricated self-contained unit to accommodate 10 persons is \$87,404.

MSHA estimates that a prefabricated self-contained unit with a rigid barrier will have a 10-year service life. The Agency also annualizes over a 10-year period the estimated \$404 cost for installation of the unit. The estimated annualized costs total \$12,411 ( $\$87,404 \times 0.142$ ).

After the first 5 years, the following components, equipment, and materials in the prefabricated self-contained unit will need to be replaced, at an estimated total cost of \$19,070: cylinders of compressed air and of oxygen, regulators for the cylinders, hoses and wrenches, air monitoring component, harmful gas removal component, sanitation, lighting, food and water, and first aid supplies. The \$19,070 cost for these items is annualized over a 5-year period using a factor of 0.244 and is multiplied by a discount factor of 0.713 to reflect the fact that these costs will not be incurred until the 6th year after the final rule takes effect. Estimated annualized cost for these replacement items is \$3,318 ( $\$19,070 \times 0.244 \times 0.713$ ). As shown in Table IV-B1, the total annualized cost for a prefabricated self-contained unit with a rigid barrier is \$15,730 (\$12,411 for installation and \$3,319 for replacement of components, equipment and materials after 5 years).

#### Prefabricated Self-Contained Refuge Alternative with an Inflatable Barrier for Working Sections (Inby)

Based on manufacturers' information, MSHA estimates that a prefabricated self-contained refuge alternative with an inflatable barrier designed to accommodate up to 16 persons would cost between \$80,000 and \$100,000. MSHA uses an estimate of \$90,000 for this refuge alternative. Based on manufacturers' information, MSHA estimates that a larger unit with an inflatable barrier designed to accommodate up to 26 persons would cost \$110,000. This estimated cost takes into account the need for additional steel and fabric for the larger structure, as well as additional oxygen, compressed air, harmful gas removal, and food and water for the additional capacity. The estimated \$90,000 and \$110,000 amounts include the costs of components and supplies as required under CFR 30 Part 7.

In addition, MSHA estimates that it will take 4 miners 7 hours to install a prefabricated self-contained unit in a mine, for a cost of \$404 (4 miners x 7 hours x \$33.70/hr.). As shown in Table IV-B1, the estimated installation cost for a prefabricated self-contained unit with an inflatable barrier is \$90,404 for a unit to accommodate up to 16 persons and \$110,404 for a unit to accommodate up to 26 persons.

MSHA estimates that a prefabricated self-contained refuge alternative with inflatable barrier will have a 10-year service life. The Agency also annualizes over a 10-year period the estimated \$404 cost for installation of the unit. The estimated annualized cost is \$12,837 ( $\$90,404 \times 0.142$ ) for a unit to accommodate up to 16 persons and \$15,677 ( $\$110,404 \times 0.142$ ) for a unit to accommodate up to 26 persons.

After the first 5 years, the following components, equipment, and materials in the prefabricated self-contained unit will need to be replaced, at an estimated total cost of \$27,710 for a 16-person unit and \$42,149 for a 26-person unit: cylinders of compressed air and of oxygen, regulators for the cylinders, hoses and wrenches, air monitoring component, harmful gas removal component, sanitation, lighting, food and water, and first aid supplies. The cost for these items is annualized over a 5-year period using a factor of 0.244 and is multiplied by a discount factor of 0.713 to reflect the fact that these costs will not be incurred until the 6th year after the final rule takes effect. Estimated annualized costs for these replacement items are \$4,820 ( $\$27,710 \times 0.244 \times 0.713$ ) for a 16-person unit and \$7,333 ( $\$42,149 \times 0.244 \times 0.713$ ) for a 26-person unit. As shown in Table IV-B1, the total annualized cost for a prefabricated self-contained inflatable unit for up to 16 persons is \$17,657 (\$12,837 for installation and \$4,820 for replacement of components, equipment and materials after 5 years). The total annualized cost for a prefabricated self-contained inflatable unit for up to 26 persons is \$23,010 (\$15,677 for installation and \$7,333 for replacement of components, equipment and materials after 5 years).

**Table IV-B1: Unit Costs and Annualized Costs of Refuge Alternatives and Components**

COST ITEM	RELATED PROVISION	TYPE OF REFUGE ALTERNATIVE							
		Unit with 15-psi Stoppings and Secure Space with Isolated Atmosphere (20 person capacity)		Prefabricated Self-Contained Unit with Rigid Barrier (10 person capacity)		Prefabricated Self-Contained Unit with Inflatable Barrier (16 person capacity)		Prefabricated Self-Contained Unit with Inflatable Barrier (26 person capacity)	
		Unit Cost	Annualized Unit Cost	Unit Cost	Annualized Unit Cost	Unit Cost	Annualized Unit Cost	Unit Cost	Annualized Unit Cost
Unit cost				\$87,000	\$12,354	\$90,000	\$12,780	\$110,000	\$15,620
Installation		\$472	\$67	\$404	\$57	\$404	\$57	\$404	\$57
Concrete blocks & mortar		\$1,000	\$142						
Mandoors (2)	§ 75.1507(a)(6) § 7.505(a)(3)	\$300	\$43						
				<b>Components and Supplies Included in Unit Cost*</b>					
Compressed air cylinders	§§ 75.1507(a)(4)&(5) § 7.506	\$2,430	\$593	\$4,050	\$705	\$6,480	\$1,127	\$10,530	\$1,832
Oxygen cylinders	§§ 75.1507(a)(4)&(5) § 7.506	\$3,300	\$805	\$1,650	\$287	\$2,640	\$459	\$4,329	\$753
Compressed air regulators (2)	§§ 75.1507(a)(4)&(5) § 7.506	\$580	\$142	\$580	\$101	\$580	\$101	\$580	\$101
Oxygen regulators (2)	§§ 75.1507(a)(4)&(5) § 7.506	\$574	\$140	\$574	\$100	\$574	\$100	\$574	\$100
Sanitation (chemical toilet)	§ 75.1507(a)(7) § 7.504(c)(3)	\$100	\$24	\$100	\$17	\$100	\$17	\$100	\$17
Harmful gas removal	§ 75.1507(a)(8) § 7.508	\$16,600	\$4,050	\$8,300	\$1,444	\$13,280	\$2,310	\$21,580	\$3,754
Air-monitoring (multi-gas detector)	§ 75.1507(a)(9) § 7.507	\$3,000	\$732	\$3,000	\$522	\$3,000	\$522	\$3,000	\$522
Chemical light sticks (8)	§ 75.1507(a)(10) § 7.504(c)(2)	\$16	\$4	\$16	\$3	\$16	\$3	\$16	\$3
Food & water	§ 75.1507(e)(1)	\$800	\$195	\$400	\$70	640	\$111	1040	\$181
Hoses & wrenches	§ 75.1507(e)(3) § 7.504(c)(5)	\$200	\$49	\$200	\$35	\$200	\$35	\$200	\$35
First-aid supply	§ 75.1507(e)(4) § 7.504(c)(4)	\$200	\$49	\$200	\$35	\$200	\$35	\$200	\$35
<b>Total, cost including Installation</b>		<b>\$29,572</b>	<b>\$7,035</b>	<b>\$87,404</b>	<b>\$15,730</b>	<b>\$90,404</b>	<b>\$17,657</b>	<b>\$110,404</b>	<b>\$23,010</b>

\* Included in unit cost of prefabricated self-contained units. MSHA assumes that these components, materials, or equipment for prefabricated self-contained units will be replaced after 5 years, so the annualized costs for the replacement components for these units are discounted by 5 years.

### Number of Refuge Alternatives

MSHA estimates the number of refuge alternatives required under the final rule based on the estimated number of miners and contractors working underground, the capacity requirements in final § 75.1506 (b), and the location requirements in § 75.1506 (c). Under final § 75.1506 (c) (1), refuge alternatives must be provided within 1,000 feet from the nearest working face and from locations where mining equipment is being installed or removed, except that for underground anthracite coal mines, refuge alternatives must be provided between 1,000 feet and 2,000 feet from the nearest working face.

Under final § 75.1506 (c) (2), refuge alternatives must be spaced within one-hour travel distances in outby areas such that persons are never more than a 30 minute travel distance from a refuge alternative or surface escape facility. However, a mine operator may request and the District Manager may approve a different location in the ERP.

To estimate the maximum number of persons working underground at one time, MSHA added 3 percent to the average number of persons on a shift to account for seasonal variation and added 15 percent to account for shift variation for those mines with more than one production shift a day. MSHA also took into account the fact that some mines conduct “hot-seat” practices. Hot-seat practices occur when the replacement crew enters the mine while the previous crew is still working. When the replacement crew arrives at the working section, this crew switches with the previous crew, which then exits the mine. A mine that engages in this practice has two crews in the mine at the same time.

MSHA estimates that the maximum number of persons working underground at any time in all underground coal mines is 22,000 persons. Of these, MSHA estimates that 13,700 work inby or near working sections (1,400 at mines with 1-19 employees; 11,000 at mines with 20-500 employees; and 1,300 at mines with 501+ employees) and 8,000 work in outby areas (200 at mines with 1-19 employees; 6,900 at mines with 20-500 employees; and 1,100 at mines with 501+ employees). MSHA uses these estimates to derive the number of refuge alternatives required by the final rule. MSHA’s estimate of the number of refuge alternatives near working sections (inby) is based on the number of persons working underground near working sections for mines with 20-500 employees and for mines with 501+ employees. For mines with 1-19 employees, MSHA’s estimate of the number of refuge alternatives for inby areas takes into consideration the proximity of the working section to a surface escape facility, and MSHA’s estimate of the number of refuge alternatives for outby areas for all mine sizes is based on travel distances, as well as an operator’s request for a different location based on an assessment of the risk to persons in outby areas. Table IV-B2 shows the estimated number of refuge alternatives for inby and outby areas by type and mine size. Details of the estimated number of refuge alternatives follow.

*Total Refuge Alternatives in Working Sections (Inby):* MSHA estimates that half of the 212 mines with 1-19 employees (106 mines) will be located so close to a surface escape facility that they will not need any refuge alternatives for working sections (inby). The remaining half (106 mines) will need one refuge alternative in each mine near working sections. MSHA estimates that the 391 mines with 20-500 employees will need a total of 783 refuge alternatives near working sections and the 10 mines with 501+ employees will need 71 refuge alternatives near working sections. MSHA estimates that a total of 960

refuge alternatives will be installed near working sections (inby) for all mines. This estimate is slightly lower than the estimated 986 refuge alternatives near working sections that was in the PREA because, in the REA, MSHA assumes that slightly more mines will use refuge alternatives with higher capacity and thus fewer refuge alternatives will be required.

MSHA estimates that all refuge alternatives near working sections (inby) will be prefabricated self-contained units. Although MSHA recognizes that there are several types of refuge alternatives with various capacity limits, for cost purposes, MSHA estimates that, for all mine sizes, 5 percent of the refuge alternatives will be prefabricated self-contained units with a rigid steel barrier accommodating 10 persons. For mines with 1-19 employees, MSHA estimates that 95 percent of the refuge alternatives will be prefabricated self-contained units with an inflatable barrier and a capacity of up to 16 persons. For mines with 20-500 employees, MSHA estimates that 60 percent of refuge alternatives will be prefabricated self-contained units with an inflatable barrier and a capacity of up to 16 persons and 35 percent of refuge alternatives will be prefabricated self-contained units with an inflatable barrier and a capacity of up to 26 persons. For mines with 501+ employees, MSHA estimates that 5 percent of refuge alternatives will be prefabricated self-contained units with an inflatable barrier and a capacity of up to 16 persons and 90 percent of refuge alternatives will be prefabricated self-contained units with an inflatable barrier and a capacity of up to 26 persons.

For cost estimation purposes, MSHA estimates that the types of refuge alternatives near working sections (inby) will be distributed as follows:

- Of the 106 refuge alternatives for the 106 mines with 1-19 employees that need a refuge alternative, 5 will be prefabricated self-contained units with a rigid barrier and 101 will be prefabricated self-contained units with an inflatable barrier.
- Of the 783 refuge alternatives for mines with 20-500 employees, 39 will be prefabricated self-contained units with a rigid barrier; 470 will be prefabricated self-contained units with an inflatable barrier to accommodate up to 16 persons, and 274 will be prefabricated self-contained units with an inflatable barrier to accommodate up to 26 persons.
- Of the 71 refuge alternatives for mines with 501+ employees, 4 will be prefabricated self-contained units with a rigid barrier; 4 will be prefabricated self-contained units with an inflatable barrier to accommodate up to 16 persons, and 63 will be prefabricated self-contained units with an inflatable barrier to accommodate up to 26 persons.

*Total Refuge Alternatives in Outby Areas:* MSHA estimates that none of the 106 mines with 1-19 employees that need refuge alternatives will need them in outby areas because persons working in outby areas will never be more than a 30-minute travel distance from the refuge alternative near the inby area or a surface escape facility. Of the 391 mines with 20-500 employees, 101 will not need refuge alternatives because persons working in outby areas will never be more than a 30-minute travel distance from a refuge alternative near the inby area or a surface escape facility. MSHA estimates that operators of the remaining 290 mines will request approval of a different location for outby refuge alternatives based on an assessment of risk to persons in the outby area. MSHA estimates

that, based on this assessment of risk, 127 mines will need a total of 154 refuge alternatives in outby areas, and 163 mines will not need refuge alternatives in outby areas. MSHA estimates that all 10 mines with 501+ employees will request approval of a different location for refuge alternatives based on an assessment of risk to persons in outby areas and will need a total of 28 refuge alternatives, based on this assessment.

For cost purposes, MSHA assumes that all of the estimated 182 refuge alternatives in outby areas will be units consisting of 15-psi stoppings in a secure space and an isolated atmosphere with a 20-person capacity. Although, the Agency is aware of other types of refuge alternatives for outby areas, it believes that the approach in the REA reflects a more realistic assessment of the types of refuge alternatives that mine operators will choose for outby areas. Table IV-B2 summarizes, by mine size, MSHA’s estimates of the number and types of refuge alternatives in underground coal mines.

**Table IV-B2: Number of Refuge Alternatives by Type and Mine Size**

Type of Refuge Alternative	Mine Size			All Underground Coal Mines
	1-19 Employees	20-500 Employees	501+ Employees	
<b>Refuge Alternatives for Inby Areas</b>				
Prefabricated, rigid barrier (10-person capacity)	5	39	4	48
Prefabricated, inflatable barrier (16 person capacity)	101	470	4	575
Prefabricated, inflatable barrier (26 person capacity)	0	274	63	337
Subtotal for Inby Refuge Alternatives	<b>106</b>	<b>783</b>	<b>71</b>	<b>960</b>
<b>Refuge Alternatives for Outby Areas</b>				
Secure space with isolated atmosphere (20-person capacity)	0	154	28	182
<b>Total Refuge Alternatives Inby and Outby</b>	<b>106</b>	<b>937</b>	<b>99</b>	<b>1,142</b>

Total First-Year Costs for Installing Refuge Alternatives

To estimate the total cost for all mines for refuge alternatives as required by final § 75.1506, MSHA multiplies the per-unit cost of each type of refuge alternative by the estimated number of each type of refuge alternative.

Multiplying the estimated number of each type and size of refuge alternative (shown in Table IV-B2) by the estimated unit cost (shown in Table IV-B1) yields a total first-year cost of \$98.8 million for refuge alternatives under final § 75.1506. The estimated cost of \$98.8 million for refuge alternatives, which is a first-year cost, includes \$93.4 million for refuge alternatives near working sections (inby) and \$5.4 million for refuge alternative in outby areas.

Total Annual Costs for Installing Refuge Alternatives

MSHA estimates an annualized cost of \$19.9 million for refuge alternatives under final § 75.1506 by multiplying the estimated number of each type and size of refuge

alternative (shown in Table IV-B2) by the annualized unit cost (shown in Table IV-B1). The estimated annualized cost by mine size is: \$1.9 million for mines with 1-19 employees, \$16.3 million for mines with 20-500 employees, and \$1.8 million for mines with 501+ employees.

Each year, new underground coal mines open, and these mines will incur costs for refuge alternatives that are not included in the \$98.8 million estimated first-year cost for refuge alternatives under final § 75.1506. Based on an analysis of 2003-2007 MSHA data, the Agency estimates that, each year, 18 percent of mines with 1-19 employees and 8 percent of mines with 20-500 employees would be new underground coal mines. MSHA estimates that there would be no new underground coal mines with 501+ employees. MSHA assumes that the number of refuge alternatives per new mine will be the same as for existing mines of the same size.

MSHA estimates that the annual number of refuge alternatives near working sections (inby) in new mines will total 82, consisting of 19 in mines with 1-19 employees ( $106 \times 0.18$ ) and 63 in mines with 20-500 employees ( $785 \times 0.08$ ). MSHA assumes that 50 percent of these 82 refuge alternatives (41) will be refuge alternatives removed from mines that will have reached the end of their working life; the remaining 41 refuge alternatives will be new.

The Agency estimates that the cost to transfer a previously owned refuge alternative into a new mine is \$1,800. This cost consists of:

- \$404 for removing the refuge alternative (2 miners  $\times$  \$33.70  $\times$  6 hours to remove a prefabricated unit),
- \$1,000 (flat rate estimate) to transport the unit from the old mine to the new mine, and
- \$404 to set up the unit in the new mine (2 miners  $\times$  \$33.70  $\times$  6 hours to set up a prefabricated unit),

The total estimated cost per year for all 41 previously owned refuge alternatives in working sections (inby) of new mines is \$72,000: \$16,000 in mines with 1-19 employees and \$56,000 in mines with 20-500 employees.

MSHA estimates that approximately 10 new refuge alternatives will be installed in working sections (inby) of new mines with 1-19 employees and approximately 31 new refuge alternatives will be installed in working sections (inby) of new mines with 20-500 employees. MSHA assumes that, for mines with 1-19 employees, one refuge alternative will be a prefabricated self-contained unit with a rigid barrier and the rest will be prefabricated self-contained units with inflatable barriers with a 16-person capacity. For mines with 20-500 employees, 2 refuge alternatives will be prefabricated self-contained units with rigid barriers, 19 will be prefabricated self-contained units with inflatable barriers with a 16-person capacity, and 11 will be prefabricated self-contained units with inflatable barriers with a 26-person capacity. The totals do not add precisely to the sum due to rounding.

The total cost for new refuge alternatives in working sections (inby) of new mines is based on the unit costs for each type of refuge alternative, presented in Table IV-B1.

The total cost per year for new refuge alternatives in working sections (inby) of new mines is estimated to be \$4.0 million. For mines with 1-19 employees, the estimated cost per year is \$901,000 (1 x \$87,404 + 9 x \$90,404). For mines with 20-500 employees, the estimated cost is \$3.1 million (2 x \$87,404 + 19 x \$90,404 + 11 x \$110,404).

MSHA estimates that the annual number of refuge alternatives in outby areas of new underground coal mines would be 12 (154 units x 0.08), all of which would be new refuge alternatives in mines with 20-500 employees. As shown in Table IV-B2, the estimated cost of a 20-person unit consisting of 15-psi stoppings in a secure space and an isolated atmosphere is \$29,572. Thus, the estimated cost per year for 12 units in outby areas would be \$354,864 (12 x \$29,572).

The total estimated cost per year for refuge alternatives in new underground coal mines would be \$4.4 million (\$72,000 for previously owned refuge alternatives in working sections (inby) + \$4.0 million for new refuge alternatives in working sections (inby) + \$350,000 million for new refuge alternatives in outby areas). However, these costs would not begin until the second year after the final rule takes effect. Therefore, MSHA applied a 7 percent discount factor to these costs. The Agency estimates that the total annual cost of refuge alternatives for new mines would be \$4.1 million (\$4.4 million/1.07): \$860,000 for mines with 1-19 employees and \$3.3 million for mines with 20-500 employees.

Including the \$4.1 million cost for new mines and the \$19.9 million annualized cost for existing mines, the Agency estimates that the total yearly cost for refuge alternatives under final § 75.1506 is \$24.1 million: \$2.7 million for mines with 1-19 employees, \$19.6 million for mines with 20-500 employees, and \$1.8 million for mines with 501+ employees.

**Final § 75.1506 (c).**

Final § 75.1506 (c) (1) requires that refuge alternatives be provided within 1,000 feet from the nearest working face and from locations where mechanized mining equipment is being installed or removed, except that for underground anthracite coal mines, refuge alternatives shall be provided between 1,000 feet and 2,000 feet from the nearest working face.

This final rule requirement differs from the requirement in the proposed rule that refuge alternatives be provided between 1,000 and 2,000 feet from the working face. Under final § 75.1506 (c) (2), refuge alternatives must be spaced within 1-hour travel distances in outby areas where persons work so that persons in outby areas are never more than a 30-minute travel distance from a refuge alternative or surface escape facility. Under the final rule, like the proposal, an operator may request, and a District Manager may approve, a different location for a refuge alternative based on an assessment of the risk to persons in outby areas. The provision includes the factors an operator must consider in making an assessment of risks to persons in outby areas.

In the PREA, MSHA estimated that each refuge alternative near working sections (inby) would be relocated an average of 25 times a year to meet the location requirements in the proposed rule. MSHA estimates that refuge alternatives will need to be moved 50 percent more often, or 38 times per year, to meet the location requirements in the final rule. MSHA estimates that it will take two miners 1 hour to relocate a refuge alternative. The

estimated annual cost to relocate one refuge alternative is \$2,560 (2 miners x \$33.70/hr. x 1 hour x 38 relocations per year).

The total annual cost to relocate refuge alternatives in working sections (inby) is estimated to be \$2.5 million: \$271,000 for mines with 1-19 employees (\$2,560 x 106 inby refuge alternatives); \$2.0 million for mines with 20-500 employees (\$2,560 x 783 inby refuge alternatives); and \$182,000 for mines with 501+ employees (\$2,560 x 71 inby refuge alternatives).

**Final § 75.1506 (d).**

Final § 75.1506 (d) requires that roof and rib support necessary for refuge alternative locations be included in the roof control plan. Documentation of the estimated costs for this requirement is in the REA in the discussion of final § 75.221.

**Final § 75.1506 (e).**

Final § 75.1506 (e) requires that refuge alternatives be protected from damage during transportation, installation, and storage. Costs for transporting and installing refuge alternatives are addressed elsewhere in the REA. MSHA estimates that any additional costs related to protecting refuge alternatives from damage would be minimal and estimates no additional cost for this provision.

**Final § 75.1506 (f).**

Final § 75.1506 (f) requires that damaged refuge alternatives be removed from service and repaired or replaced. While a refuge alternative is not in service, all persons except those doing the repairs must be withdrawn from the area serviced by the refuge alternative. MSHA assumes that refuge alternatives will have a 10-year service life and that 15 percent of refuge alternatives near working sections (inby) and 5 percent of refuge alternatives in outby areas (which are less likely to be damaged since they are not moved after installation) will need to be repaired some time during their service life. Based on these assumptions, MSHA estimates that each year there will be 17 repairs of refuge alternatives: 2 repairs in mines with 1-19 employees; 13 repairs in mines with 20-500 employees; and 2 repairs in mines with 501+ employees. The estimated 17 repairs per year in the REA is higher than the estimate of 13 repairs in the PREA. In the REA, MSHA increased the estimated proportion of inby refuge alternatives requiring repair from 10 percent in the PREA to 15 percent based on the estimated increased number of moves MSHA projects under the final rule.

MSHA estimates that the cost to repair a refuge alternative includes the cost of replacement parts (assumed to be 10 percent of the unit's price) and 2 hours of labor for each repair. The estimated annual cost to make 17 repairs to refuge alternatives is \$152,000, which consists of:

- \$18,100 in mines with 1-19 employees [2 repairs x (10% x \$89,850 average price of units in inby areas) + (2 repairs x 2 hours x \$33.70/hr.)];
- \$120,000 in mines with 20-500 employees [(12 repairs x 10% x \$96,850 average price of units in inby areas) + (1 repair x 10% x \$29,100 average price of units in outby areas) + (13 repairs x 2 hours x \$33.70/hr.)];

- \$13,800 in mines with 501+ employees [(1 repair x 10% x \$107,850 average price of units in inby areas) + (1 repair x 10% x \$29,100 average price of units in outby areas) + (2 repairs x 2 hours x \$33.70/hr.)].

In some cases, mines are large enough so that miners could be shifted to another working area while repairs are being made to the refuge alternative. MSHA assumes that a work crew consists of nine miners and one supervisor. In other cases, where miners cannot be shifted to another area to work, they will have to be withdrawn from the mine until the refuge alternative is repaired, with the exception of those persons doing the repairs.

Of the 17 annual repairs, MSHA assumes that 9 repairs will require miners to shift to another work area to continue to mine coal. Moving to the other work area will take 1 hour of time at an estimated cost of \$388 each [(9 miners x \$33.70/hr. x 1 hour) + (1 supervisor x \$85.14/hr. x 1 hour)]. Thus, the total cost related to these 9 repairs for a work crew to shift to another work area, will be approximately \$3,500, which consists of:

- \$2,700 (\$388 x 7 repairs in mines with 20-500 employees) and;
- \$800 (\$388 x 2 repairs in mines with 501+ employees).

MSHA assumes that the remaining 8 repairs will require withdrawing miners from the mine until the refuge alternative is repaired. MSHA estimates that this situation will occur 2 times per year in mines with 1-19 employees and 6 times per year in mines with 20-500 employees for 8 hours each time. MSHA assumes that withdrawing miners will not occur in mines with 501+ employees.

The withdrawal of a work crew of nine miners and one supervisor will result in costs associated with delay in production and additional labor costs required for that delayed production. Based on Agency data on tons produced per miner-hour and the price per ton of coal, MSHA estimates that if miners were not withdrawn, a work crew in mines with 1-19 employees would produce \$7,550 worth of coal in 8 hours, and a work crew in mines with 20-500 employees would produce \$11,291 worth of coal in 8 hours. MSHA assumes that the coal not produced during the withdrawal of the miners would instead be extracted 5 years later. MSHA calculates the cost of the delay as the value of the coal if produced in 8 hours currently, less the present value of the coal if produced 5 years from now.

MSHA uses a discount rate of 7 percent and standard discounting formula over 5 years  $(1/1.07)^5$  to calculate the present value of the delayed coal production. The present value of \$1.00 worth of production in 5 years is \$0.713. ( $\$1.00$  discounted by 7 percent per year over 5 years =  $(1/1.07)^5 = \$0.713$ ), so that the cost of delaying \$1.00 worth of production by 5 years is \$0.287 ( $\$1.00 - \$0.713$ ). Similarly, the cost of the delayed production is equal to 0.287 multiplied by the value of 8 hours of current production, for a cost of \$2,167 ( $0.287 \times \$7,500$ ) for mines with 1-19 employees and \$3,241 ( $0.287 \times \$11,291$ ) for mines with 20-500 employees.

A second cost for the period when miners are withdrawn is the cost of the labor needed for the delayed 8 hours of coal production (delayed by 5 years). Based upon Agency data on wage rates, MSHA estimates the cost is equal to the labor cost for a shift multiplied by 0.713, or an estimated \$2,215 (8 hours x \$388 x 0.713).

Based upon Agency data on tons produced per miner-hour, the price per ton of coal, and wage rates, MSHA estimates that the cost of 8 hours of delayed production for a crew of ten persons will be: \$4,382 for mines with 1-19 employees (\$2,167 + \$2,215) and \$5,456 for mines with 20-500 employees (\$3,241 + \$2,215). Thus, the Agency estimates that cost related to withdrawing miners from the mine due to repairs to refuge alternatives will be \$41,500, consisting of:

- \$8,800 (\$4,382 x 2 withdrawals in mines with 1-19 employees) and;
- \$32,700 (\$5,456 x 6 withdrawals in mines with 20-500 employees)].

The Agency estimates that total annual cost related to repairs to refuge alternatives will be \$197,000 (\$152,000 for replacement parts and repair time + \$3,500 for situations when miners will have to be shifted to another area to work + \$41,500 for situations when miners will have to be withdrawn from the mine).

**Final § 75.1506 (g).**

Final § 75.1506 (g) requires that refuge alternatives be located in areas clear of machinery and obstructions. MSHA estimates that the cost of this provision is negligible.

**Final § 75.1506 (h).**

Final § 75.1506 (h) requires that refuge alternatives be conspicuously marked at their location and that directional signs be posted so that they can be easily located in an emergency. MSHA estimates that five signs will be posted for each refuge alternative. MSHA estimates a cost of \$50 for the five signs.

Based on MSHA's estimates of the total number of refuge alternatives, MSHA estimates that the total number of refuge alternatives requiring 5 signs will be 106 in mines with 1-19 employees, 937 in mines with 20-500 employees, and 99 in mines with 501+ employees. The estimated first-year cost to provide signs for refuge alternatives is \$57,000: \$5,300 for mines with 1-19 employees (\$50 x 106), \$47,000 for mines with 20-500 employees (\$50 x 937), and \$5,000 for mines with 501+ employees (\$50 x 99). This estimate is slightly lower than that in the PREA because the number of refuge alternatives estimated in the REA is slightly lower than that in the PREA.

MSHA assumes that signs have a service life of 10 years and calculates the annualized cost of approximately \$7 by multiplying \$50 by a factor of 0.142. The estimated annualized cost is \$8,100: \$750 for mines with 1-19 employees (\$7 x 106), \$6,700 for mines with 20-500 employees (\$7 x 937), and \$700 for mines with 501+ employees (\$7 x 99).

Each year, new underground coal mines open, and these mines will incur costs beyond those incurred by existing mines. Based on an analysis of 2003-2007 MSHA data, the Agency estimates that, each year, 18 percent of mines with 1-19 employees and 8 percent of mines with 20-500 employees would be new underground coal mines. MSHA estimates that there would be no new underground coal mines with 501+ employees. MSHA assumes that the number of refuge alternatives per new mine will be the same as for existing mines of the same size.

Based on these assumptions, MSHA estimates that the annual cost to new mines for signs is \$4,700: \$950 for mines with 1-19 employees ( $\$5,300 \times 0.18$ ) and \$3,750 for mines with 20-500 employees ( $\$47,000 \times .08$ ). However, these costs will not begin until the second year after the final rule takes effect. Therefore, MSHA applied a 7 percent discount factor to these costs. The Agency estimates that the total annual cost of for new mines under this final provision is \$4,400 ( $\$4,700/1.07$ ): \$900 for mines with 1-19 employees and \$3,500 for mines with 20-500 employees.

Including the cost to existing and new mines, the Agency estimates that the total annual cost for signs under the final rule is \$13,000: \$1,600 for mines with 1-19 employees, \$10,200 for mines with 20-500 employees, and \$700 for mines with 501+ employees.

### **Final § 75.1507 Emergency Response Plan; Refuge Alternatives and Components.**

Final § 75.1507 requires that the mine Emergency Response Plan (ERP) include information about the refuge alternatives used in the mine. Under final § 75.1507 (a), the ERP must include a description of the types of refuge alternatives used in the mine, i.e., a prefabricated self-contained unit or a unit consisting of 15-psi stoppings constructed prior to an event in a secure space and an isolated atmosphere.

The ERP must also include procedures for maintaining the refuge alternatives, the rated capacity and expected number of occupants, the duration of breathable air per person, and information about backup oxygen, the airlock, sanitation facilities, harmful gas removal and gas monitoring, methods for providing lighting sufficient for persons to perform tasks, and suitable locations for refuge alternatives.

Final § 75.1507 (a) (2) requires that the ERP include procedures or methods for maintaining approved refuge alternatives and components. MSHA has included the cost for maintaining refuge alternatives in the annualization factors applied to refuge alternative components. These annualization factors reflect the scheduled replacement of the components in refuge alternatives. MSHA assumes that any other maintenance costs will be negligible.

Under final § 75.1507 (b) and (c) the ERP will include, where applicable, information for refuge alternative units consisting of 15-psi stoppings constructed prior to an event in a secure space and an isolated atmosphere and advance arrangements for refuge alternatives which sustain persons for only 48 hours. Under final § 75.1507 (d), the ERP must specify that the refuge alternative provides sufficient food and water to sustain the maximum number of expected occupants for at least 96 hours (or 48 hours if advance arrangements are made). Also under this final provision, the ERP must specify that the refuge alternative provides manuals on the transportation, operation and maintenance of the refuge alternative or components, sufficient materials and tools for repairs, and first aid supplies. MSHA has included the cost of food and water with the cost of refuge alternatives and components and other supplies under final § 75.1506.

Under the final rule, operators would have to revise existing ERPs to include the specified information. MSHA estimates that, for the 507 mines with refuge alternatives,

this process will include an initial revision of the plan and any necessary changes, which must be submitted to MSHA for approval.

MSHA assumes that the initial and necessary changes will be made by a supervisor at an hourly wage of \$85.14 and on average will take: 12 hours for mines with 1-19 employees; 24 hours for mines with 20-500 employees, and 36 hours for mines with 501+ employees. For cost purposes, MSHA estimates that the information on refuge alternatives will include 12 pages of the emergency response plan for mines with 1-19 employees, 24 pages for mines with 20-500 employees, and 36 pages for mines with 501+ employees. In addition, MSHA estimates that a clerical employee will take a total of 6 minutes (0.10 hours) to copy and submit the emergency response plan information for mines with 1-19 employees, 12 minutes (0.20 hours) for mines with 20-500 employees, and 15 minutes (0.25 hours) for mines with 501+ employees. MSHA assumes copy and postage costs of \$3 for mines with 1-19 employees, \$6 for mines with 20-500 employees, and \$8 for mines with 501+ employees.

Based on the previous assumptions, MSHA calculates a cost per mine to revise an ERP to be \$1,030 per mine for mines with 1-19 employees ( $\$85.14/\text{hr.} \times 12 \text{ hours} + \$26.37/\text{hr.} \times 0.10 \text{ hour} + \$3 \text{ copy and postage cost}$ ), \$2,050 per mine for mines with 20-500 employees ( $\$85.14/\text{hr.} \times 24 \text{ hours} + \$26.37/\text{hr.} \times 0.20 \text{ hours} + \$6 \text{ copy and postage cost}$ ), and \$3,100 per mine for mines with 501+ employees ( $\$85.14/\text{hr.} \times 36 \text{ hours} + \$26.37/\text{hr.} \times 0.25 \text{ hour} + \$8 \text{ copy and postage cost}$ ).

The total for all mines will be the sum of the cost for each mine size category, or approximately \$943,000 ( $\$1,030 \times 106 \text{ mines with 1-19 employees} + \$2,050 \times 391 \text{ mines with 20-500 employees} + \$3,100 \times 10 \text{ mines with 501+ employees}$ ). Using an annualization factor of 0.142, MSHA estimates a total yearly cost of \$15,500 for mines with 1-19 employees, \$114,000 for mines with 20-500 employees, and \$4,400 for mines with 501+ employees, for a total of \$134,000 for revising emergency response plans to meet the requirements in this final provision.

#### **Final § 75.1508 Training and Records for Examination, Maintenance, and Repair of Refuge Alternatives and Components.**

Final § 75.1508 (a) (1) requires that persons who examine, maintain, or repair refuge alternatives and components be instructed in how to perform this work and that persons trained in such activities be certified. Final § 75.1508 (b) requires that a record of all maintenance or repair be made by the person conducting the repair. Final § 75.1508 (c) requires training certifications and repair records to be kept at the mine for one year.

Under this provision, persons who conduct a pre-shift examination must be trained. The existing rule requires that a certified person conduct a pre-shift examination, and this final rule requires that refuge alternatives be included in the pre-shift examination. The person conducting a pre-shift examination of the refuge alternative will check the refuge alternative for damage, the integrity of the tamper-evident seal, mechanisms required to deploy the refuge alternative, and the ready availability of compressed oxygen and air. MSHA estimates that training to perform these activities will be integrated at a negligible cost into the existing training for certified persons.

Final § 75.1508 (a) (1) also requires that persons who maintain and repair refuge alternatives be trained. MSHA estimates that persons who maintain and repair refuge alternatives will receive instructions from manufacturers. MSHA also estimates that two miners per mine will receive this training, each at an hourly wage of \$33.70, and that the training will take about 1 hour. Final § 75.1508 (a) (2) requires a record of the training, and MSHA estimates that recording by a supervisor will take 3 minutes (0.05 hours).

Final § 75.1508 (b) requires a record of each repair, including corrective action taken. MSHA estimates that the total number of repair and maintenance cases per year on all refuge alternatives will be fewer than 20 and that the recording of each maintenance and repair will take about 1 minute. Therefore MSHA estimates that the cost of this provision is negligible. Likewise, MSHA estimates a negligible cost of keeping records of training certifications and repair records at the mine for one year under this final provision.

Based on these assumptions, MSHA calculates a cost of about \$72 per mine for training to maintain and repair a refuge alternative (2 miners x \$33.70/hr. x 1 hour + 1 supervisor x \$85.14/hr. x 0.05 hour). MSHA estimates a total annual cost for repair-related training and records requirements of \$36,000 for all mines with refuge alternatives: \$7,600 for mines with 1-19 employees (106 x \$72); \$28,000 for mines with 20-500 employees (391 x \$72); and \$700 for mines with 501+ employees (10 x \$72).

### **Final § 75.1600-3 Communications Facilities; Refuge Alternatives.**

Final § 75.1600-3 requires that a refuge alternative have a two-way communications system that is part of the mine communication system and that can be used from inside the refuge alternative. The refuge alternative must have accommodations for an additional communications system and other requirements as defined in the communications portion of the operator's approved ERP. MSHA is aware that these additional systems may not yet be available, but as they are developed, mine operators will be required to include them in their ERPs. The MINER Act requires, by June 15, 2009, that ERPs contain wireless communications systems. MSHA is working with NIOSH on this emerging technology and will provide further guidance to the mining community with respect to the Agency's expectations for "wireless communication" systems in ERPs.

MSHA estimates that a communications facility meeting these requirements can be provided at a cost of \$1,000 per refuge alternative. Based on MSHA's estimate of the total number of refuge alternatives, MSHA estimates that the total number of communications systems will be 106 in mines with 1-19 employees, 937 in mines with 20-500 employees, and 99 in mines with 501+ employees. The estimated first-year cost to provide communications facilities for refuge alternatives is \$1.1 million: \$106,000 for mines with 1-19 employees (\$1,000 x 106), \$937,000 for mines with 20-500 employees (\$1,000 x 937), and \$99,000 for mines with 501+ employees (\$1,000 x 99).

MSHA assumes that the communication system has a service life of 5 years. MSHA calculates the annualized cost of \$244 per communication system by multiplying \$1,000 by a factor of 0.244. The total annualized cost is estimated to be \$279,000: \$26,000 for mines with 1-19 employees (\$244 x 106), \$229,000 for mines with 20-500 employees (\$244 x 937), and \$24,000 for mines with 501+ employees (\$244 x 99).

Each year, new underground coal mines open, and these mines will incur costs for communications facilities that are not included in the estimated cost for communications incurred by existing mines. Based on an analysis of 2003-2007 MSHA data, the Agency estimates that, each year, 18 percent of mines with 1-19 employees and 8 percent of mines with 20-500 employees would be new underground coal mines. MSHA estimates that there would be no new underground coal mines with 501+ employees. MSHA assumes that the number of refuge alternatives per new mine will be the same as for existing mines of the same size.

Based on these assumptions, MSHA estimates that the annual cost to new mines for communications facilities is \$94,000: \$19,000 for mines with 1-19 employees ( $\$106,000 \times 0.18$ ), \$75,000 for mines with 20-500 employees ( $\$937,000 \times .08$ ). However, these costs will not begin until the second year after the final rule takes effect. Therefore, MSHA applied a 7 percent discount factor to these costs. The Agency estimates that the total annual cost of for new mines under final § 75.1600-3 is \$88,000 ( $\$94,000/1.07$ ): \$18,000 for mines with 1-19 employees and \$70,000 for mines with 20-500 employees.

For existing and new mines, the Agency estimates that the total annual cost for communications facilities under final § 75.1600-3 is \$366,500: \$44,000 ( $\$26,000 + \$18,000$ ) for mines with 1-19 employees, \$299,000 ( $\$229,000 + \$70,000$ ) for mines with 20-500 employees, and \$24,000 for mines with 501+ employees.

#### **SECTION IV-B SUMMARY: PART 75 REQUIREMENTS**

Table IV-B summarizes the estimated annual cost of \$50.3 million for mine operators to comply with the requirements for refuge alternatives in Part 75.

**Table IV-B: Summary of Yearly Costs for Part 75 Requirements**

Requirement	Total Yearly Cost			
	1-19 Employees	20-500 Employees	501+ Employees	All Mines
§ 75.221 Roof Control Plan Information	\$438,000	\$3.2 million	\$297,000	\$4.0 million
§ 75.313 Main Mine Fan Stoppage with Persons Underground	\$0	\$0	\$0	\$0
§ 75.360 Preshift Examination at Fixed Intervals	\$235,000	\$5.0 million	\$923,000	\$6.1 million
§ 75.372 Mine Ventilation Map, § 75.1200 Mine Map, § 75.1505 Escapeway Maps	\$9,000	\$67,000	\$6,000	\$82,000
§ 75.1202-1 Temporary Notations, Revisions, and Supplements	\$0	\$0	\$0	\$0
§ 75.1501 Emergency Evacuations	\$0	\$0	\$0	\$0
§ 75.1502 Mine Emergency Evacuation and Firefighting Program of Instruction	\$700	\$2,500	\$100	\$3,300
§ 75.1504 Mine Emergency Evacuation Training and Drills	\$514,000	\$10.3 million	\$1.9 million	\$12.8 million
§ 75.1506 Refuge Alternatives - (a) &(b) cost of refuge alternatives	\$2.7 million	\$19.6 million	\$1.8 million	\$24.1 million
§ 75.1506 Refuge Alternatives - (c) relocation of inby refuge alternatives	\$271,000	\$2.0 million	\$182,000	\$2.5 million
§ 75.1506 Refuge Alternatives - (f) repair of damaged refuge alternatives	\$27,000	\$155,000	\$15,000	\$197,000
§ 75.1506 Refuge Alternatives - (h) signs for refuge alternatives	\$2,000	\$10,000	\$1,000	\$13,000
§ 75.1507 Emergency Response Plan; Refuge Alternatives	\$15,000	\$114,000	\$4,000	\$134,000
§ 75.1508 Training and Records for Examination, Maintenance, and Repair of Refuge Alternatives and Components	\$7,600	\$28,000	\$700	\$36,000
§ 75.1600-3 Communications Facilities; Refuge Alternatives	\$44,000	\$299,000	\$24,000	\$366,000
Total	\$4.3 million	\$40.8 million	\$5.2 million	\$50.3 million

## **FEASIBILITY**

MSHA has concluded that the requirements of the final rule are both technologically and economically feasible. MSHA, however, recognizes that not all refuge alternatives will be appropriate for all mining conditions. In addition, the Agency recognizes that some aspects of refuge alternatives involve developing technology, for example, wireless communications facilities and means of controlling the temperature inside refuge alternatives.

### Technological Feasibility

Refuge alternatives are technologically feasible. They use commercially available technology that can reasonable be integrated into most coal mining operations. Refuge alternatives are currently being manufactured for, and some are currently in place in underground coal mines. In addition, refuge alternative components are currently available. MSHA may approve refuge alternatives or components that incorporate new technology, if the applicant demonstrates that the refuge alternative or components provide no less protection than those meeting the requirements of the final rule.

MSHA recognizes that using refuge alternatives in mines with low seam heights could be problematic. However, the final rule has changed the proposed volume requirements to take seam height into consideration.

MSHA also recognizes that research on some requirements of the final rule is ongoing. For example, the final rule requires additional communication systems in the operator's approved Emergency Response Plan (ERP). MSHA is aware that these additional systems may not yet be available, but as they are developed, mine operators will be required to include them in their ERPs. The MINER Act requires, by June 15, 2009, that ERPs contain wireless communication systems. MSHA is working with NIOSH on this emerging technology and will provide further guidance to the mining community with respect to the Agency's expectations for "wireless communication" systems in ERPs.

### Economic Feasibility

The yearly compliance cost of the final rule to underground coal mine operators is \$50.3 million, which is approximately 0.4 percent of total annual revenue of \$14.0 billion (\$50.3 million / \$14.0 billion) for all underground coal mines. MSHA concludes that the final rule would be economically feasible for these mines because the total yearly compliance cost is below one percent of the estimated annual revenue for all underground coal mines.

## **V. REGULATORY FLEXIBILITY CERTIFICATION**

### **INTRODUCTION**

Under the Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), MSHA has analyzed the impact of the final rule on small entities. Based on that analysis, MSHA certifies that the final rule will not have a significant economic impact on a substantial number of small entities. The factual basis for this certification is presented below.

### **DEFINITION OF A SMALL MINE**

Under the RFA, in analyzing the impact of a rule on small entities, MSHA must use the Small Business Administration's (SBA's) 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 established an alternative definition, and is required to use SBA's definition. The SBA defines a small entity in the mining industry as an establishment with 500 or fewer employees.

MSHA has also examined the impact of the final rule on mines with fewer than 20 employees, which MSHA and the mining community have traditionally referred to as "small mines." These small mines differ from larger mines not only in the number of employees, but also 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's rules and the impact of the agency's rules on them will also tend to be different. This analysis complies with the requirements of the RFA for an analysis of the impact on "small entities" while continuing MSHA's traditional definition of "small mines."

### **FACTUAL BASIS FOR CERTIFICATION**

#### **General Approach**

MSHA's analysis of the economic impact on small entities begins with a "screening" analysis. The screening analysis compares the estimated yearly cost of a rule for small entities to their estimated annual revenue. When the estimated cost is less than one percent of the estimated revenue for small entities, MSHA believes it is generally appropriate to conclude that the final rule will not have a significant economic impact on a substantial number of small entities. If the estimated cost is equal to or exceeds one percent of revenue, MSHA will investigate whether further analysis is required.

#### **Derivation of Costs and Revenues for Mines**

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 and the cost impact on mines, by size. Revenue for underground coal mines is derived from data on

underground coal prices and tonnage. The 2007 price of underground coal was \$40.29 per ton.<sup>3</sup>

Total underground coal production in 2007 was approximately 7.7 million tons for mines with 1-19 employees. Multiplying tons by the 2007 price per ton, 2007 underground coal revenue was \$310 million for mines with 1-19 employees. Total underground coal production in 2007 was approximately 278 million tons for mines with 1-500 employees. Multiplying tons by the 2007 price per ton, 2007 underground coal revenue was \$11.2 billion for mines with 1-500 employees. Total underground coal production in 2007 was approximately 349 million tons. Multiplying tons by the 2007 price per ton, total estimated revenue in 2007 for underground coal production was \$14.0 billion.

### Results of Screening Analysis

Table V-1 below shows MSHA’s estimate of the cost of the final rule compared to mine revenue, by mine size. For underground coal mines, Table V-1 shows that the final rule will result in an average yearly cost per mine of approximately \$19,000 for mines with 1-19 employees and \$73,000 for mines with 1-500 employees. The average yearly cost per mine for all underground coal mines is approximately \$80,500. The Agency has provided in Chapter IV of the REA a discussion of the costs of the final rule for each size category of mines.

**Table V-1: Cost of Final Rule Compared to Mine Revenues, by Mine Size for Underground Coal Mines**

Employment size	No. of Mines	Cost of Final Rule	Estimated Revenue (in millions)	Cost per Mine	Cost of Final Rule as Percent of Revenue
1-19	223	\$4,282,530	\$310	\$19,204	1.38%
1-500	614	\$45,107,526	\$11,194	\$73,465	0.40%
All mines	624	\$50,259,638	\$14,048	\$80,544	0.36%

As shown in Table V-1, the estimated yearly cost of the final rule for underground coal mines with 1-19 employees is approximately \$4.3 million, or approximately \$19,000 per mine. This is equal to approximately 1.38 percent of annual revenues. MSHA estimates that some mines might experience costs somewhat higher than the average per mine in its size category while others might experience lower costs.

When applying SBA’s definition of a small mine, the estimated yearly cost of the final rule for underground coal mines with 1-500 employees is approximately \$45 million, or approximately \$73,000 per mine. This is equal to approximately 0.40 percent of annual revenue. Even though the analysis reflects a range of impacts for different mine sizes, from 0.40 percent to 1.38 percent, the Agency concludes that this is not a significant economic impact on a substantial number of small mines. Because the yearly cost of the

<sup>3</sup> U.S. DOE, EIA, “Annual Coal Report 2007,” Table 28, October 2008.

final rule is less than one percent of annual revenues for small underground coal mines, as defined by SBA, MSHA has certified that the final rule will not have a significant impact on a substantial number of small mining entities, as defined by SBA.

## **VI. OTHER REGULATORY CONSIDERATIONS**

### **THE UNFUNDED MANDATES REFORM ACT OF 1995**

MSHA has reviewed the final rule under the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1501 et seq.). MSHA has determined that the final rule does not include any Federal mandate that may result in increased expenditures by State, local, or tribal governments or significantly or uniquely affect small governments. MSHA estimates that the final rule will increase private sector expenditures by more than \$100 million in the first year and has included an analysis of the costs of the requirements of the final rule in the REA.

The estimated compliance costs in the REA are \$129.2 million in the first year and \$52.9 million yearly thereafter. Therefore, the final rule is classified as a major rule and MSHA will comply with the Congressional Review Act (CRA). Under the CRA, major rules generally cannot take effect until 60 days after the rule is published.

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

The final rule has no effect on family well-being or stability, marital commitment, parental rights or authority, or income or poverty of families and children. Accordingly, § 654 of the Treasury and General Government Appropriations Act of 1999 (5 U.S.C. § 601 note) requires no further agency action, analysis, or assessment.

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

The final rule does not implement a policy with takings implications. Accordingly, Executive Order 12630 requires no further agency action or analysis.

### **EXECUTIVE ORDER 12988: CIVIL JUSTICE REFORM**

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

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

The final rule has no adverse impact on children. Accordingly, Executive Order 13045 requires no further agency action or analysis.

### **EXECUTIVE ORDER 13132: FEDERALISM**

The final rule does not have “Federalism implications” because it does not “have

substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.” MSHA acknowledges that West Virginia and Illinois have laws on refuge alternatives and has drafted the final rule to be consistent with and to minimize conflict with these laws.

#### **EXECUTIVE ORDER 13175: CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENTS**

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

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

The final rule has been reviewed for its impact on the supply, distribution, and use of energy because it applies to the coal mining industry. The final rule would result in yearly costs of approximately \$52.9 million to the underground coal mining industry, relative to annual revenues of \$14.0 billion in 2007, and it is not a “significant energy action” because it is not “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, E.O. 13211 requires no further Agency action or analysis.

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

MSHA has reviewed the final rule to assess and take appropriate account of its potential impact on small businesses, small governmental jurisdictions, and small organizations. MSHA has determined and certified that the final rule does not have a significant economic impact on a substantial number of small entities.

## VII. PAPERWORK REDUCTION ACT OF 1995

### INTRODUCTION

This section shows the estimated paperwork burden hours and related costs to mine operators and manufacturers under the final rule. It provides estimates of the burden hours and related costs in final §§ 7.503, 75.221, 75.360, 75.372, 75.1200, 75.1502, 75.1505, 75.1507, and 75.1508.

### SUMMARY OF PAPERWORK BURDEN HOURS AND RELATED COSTS

Table VII-1 shows that, in the first year the final rule is in effect, mine operators would incur 87,732 burden hours with related costs of approximately \$6.6 million. The costs reported in the first year are the annualized first-year costs and annual costs.

**Table VII-1: Burden Hours and Costs in the First Year**

Detail	Section	Hours	Costs
Refuge Alternative and Component Application for Approval	§ 7.503	2,700	\$202,325
Pre-Shift Examination	§ 75.360 (d)	72,066	\$6,135,700
Revise Roof Control Plan	§ 75.221 (a) (12)	280	\$3,168
Initially Revise Mine Map, Ventilation Map, and Escapeway Map	§ 75.1200 (g); § 75.372 (b) (11); § 75.1505 (a) & (b)	356	\$4,304
Revise Mine Map, Ventilation Map, and Escapeway Map to Reflect Refuge Alternative Relocations	§75.1200 (g); §75.372 (b) (11); §75.1505 (a) & (b)	912	\$77,647
Revise and File Emergency Response Plan	§75.1507	11,108	\$133,527
Revise and Submit Mine Emergency Evacuation and Firefighting Program of Instruction	§ 75.1502 (c)	280	\$3,168
Certify Training to Maintain and Repair Refuge Alternatives	§ 75.1508 (a) (2)	27	\$2,299
Record of Repairs of Refuge Alternatives	§ 75.1508 (b)	3	\$255
<b>Total</b>		<b>87,732</b>	<b>\$6,562,393</b>

Table VII-2 shows that, in the second year the final rule is in effect, and every year thereafter, mine operators would incur 75,681 burden hours with related costs of approximately \$6.4 million. The costs reported for the second year, and every year thereafter, are annual costs.

**Table VII-2: Burden Hours and Costs in the Second Year,  
And Every Year Thereafter**

Detail	Section	Hours	Costs
Refuge Alternative and Component Application for Approval	§ 7.503	2,700	\$202,325
Pre-Shift Examination	§ 75.360(d)	72,066	\$6,135,700
Revise Mine Map, Ventilation Map, and Escapeway Map to Reflect Refuge Alternative Relocations	§75.1200(g); §75.372(b)(11); §75.1505(a) & (b)	912	\$77,647
Record of Repairs of Refuge Alternatives	§ 75.1508(b)	3	\$255
Total		75,681	\$6,415,927

## VIII. REFERENCES

InfoMine USA, Inc., U.S. Coal Mine Salaries, Wages, and Benefits: 2007 Survey Results, 2008.

U.S. Department of Energy, Energy Information Administration, *Annual Coal Report 2006*, October 2007.

U.S. DOL, MSHA , Office of Program Evaluation and Information Resources (PEIR), February 5, 2008 data.