Preliminary Regulatory Economic Analysis

For

Proximity Detection Systems for Mobile Machines in Underground Mines

Proposed Rule

(RIN 1219-AB78)

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

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1. EXECUTIVE SUMMARY

Introduction

The Mine Safety and Health Administration (MSHA) is issuing a proposed rule under section 101(a) of the Federal Mine Safety and Health Act of 1977 (Mine Act) to protect miners working near certain mobile machines in the confined space of an underground coal mine. These miners are exposed to significant hazards from pinning, crushing, and striking accidents that can result in life threatening injuries and death. To prevent these hazards, the proposed rule would require underground coal mine operators to install proximity detection systems on mobile machines. This rulemaking would establish performance, maintenance, and training requirements related to the installation of proximity detection systems on certain mobile machines.

Background

Proximity detection is a technology that uses electronic sensors to detect motion or the location of one object relative to another. A proximity detection system can provide a warning and stop a mining machine before a pinning, crushing, or striking accident occurs that could result in injury or death of a miner. MSHA's review of the Agency's investigation reports for mobile machine accidents that occurred from 1984 through 2014 (31 years) indicated that proximity detection systems may have prevented 179 injuries and 42 fatalities.

The proximity detection technology needed to reduce the frequency of these accidents exists and is currently in use in some underground coal mines. MSHA has approved four proximity detection systems. These approvals were issued under 30 CFR part 18. Each approved proximity detection system consists of machine-mounted components and miner-wearable components. As of January 2015, 129 mobile machines in underground coal mines have been equipped with proximity detection systems.

Requirements of the Proposed Rule

The proposed rule would require underground coal mine operators to equip mobile machines with proximity detection systems within three years after the effective date of the rule. For proximity detection systems with miner-wearable components, the mine operator would be required to provide a miner-wearable component to each miner on the working section. Together, the machine-mounted components and any miner-wearable components make up the overall proximity detection system.

The proposed rule would require that the proximity detection system cause a machine to stop before contacting a miner. Additionally, the machine-mounted components would be required to provide a visual warning signal, and the miner-wearable components would be required to provide audible and visual warning signals. The warning signals would be required to be distinguishable from other signals and alert miners before the system causes the machine to stop. The proposed rule would also establish requirements for performance and maintenance of a proximity detection system, operational checks, training, and recordkeeping.

Mine Sector Affected

The proposed rule would apply to underground coal mines in the United States. On average in 2014, 300 active underground coal mines were using mobile machines. They employed 39,870 miners and contractors (excluding office workers). The U.S. underground coal sector produced an estimated 348 million tons of coal in 2014. The average price of coal for underground mines in 2014 was $60.98 per ton. MSHA estimates that total revenue for underground coal mines was $21.2 billion (348 million tons x $60.98).

Net Benefits

MSHA estimates the total net benefits of the proposed rule over 10 years at a 7 percent discount rate would be -$14.7 million or -$2.0 million annualized. At a 3 percent discount rate, the corresponding values would be $2.9 million and $0.3 million annualized.

In addition to the reduction in fatal and non-fatal injuries from pinning, crushing, and striking accidents, there would be several benefits from the proposed rule that are not quantified due to insufficient information. For example, MSHA anticipates that the proposed rule would result in additional savings to mine operators by avoiding the production delays typically associated with mine accidents. Pinning, crushing, or striking accidents can disrupt production at a mine during the time it takes to remove the injured miner, investigate the cause of the accident, and clean up the accident site. Such delays due to an accident can last for a shift or more and result in delayed production, and other miscellaneous expenses.

Potentially there could be some offsets to these benefits if the proximity detection system stops the equipment without a miner actually being in danger. MSHA anticipates that technology has been sufficiently developed to minimize these occurrences. While MSHA is unaware of any instances of a proximity detection system causing a false positive stoppage, MSHA estimates that miners would be able to restart their mobile machines quickly and the cost of these occurrences would be de minimis. MSHA's estimates of the monetized costs and benefits of the proposed rule are presented in Chapters 3 and 4.

Executive Orders 12866 and 13563; Regulatory Flexibility Act

Executive Orders 12866 and 13563 require that agencies assess all costs and benefits of available regulatory alternatives and, if regulation is necessary, select regulatory approaches tailored to impose the least burden, consistent with regulatory objectives, and that “benefits justify the costs” (including potential economic, environmental, public health and safety effects, distributive impacts, and equity). Executive Order 13563 emphasizes the importance of quantifying both costs and benefits, of reducing costs, of harmonizing rules, and of promoting flexibility. OMB has determined that the proposed rule would be a significant regulatory action because it raises novel legal and policy issues. MSHA has conducted a preliminary regulatory economic analysis for the proposed rule. This analysis covers 10 years and begins with the effective date of the rule.

The Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), requires regulatory agencies to consider a rule’s economic impact on small entities. For the mining industry, the Small Business Administration (SBA) defines a small business as one with 1-500 employees and a large business as one with 501+ employees. MSHA has traditionally defined a small mine to be one employing 1-19 employees. MSHA provides analyses for both small mine definitions.

Using SBA’s definition of a small business, 285 of the 300 underground coal mines affected by this proposed rule are small. Using the Agency’s traditional small mine definition results in 55 mines with 1-19 employees. The estimated annualized cost of the proposed rule for underground coal mines with 1-500 employees would be approximately $13.1 million. This represents less than a tenth of one percent of annual revenue for those mines. The estimated annualized cost of the proposed rule for underground coal mines with 1-19 employees would be approximately $1.7 million. This represents approximately 0.9 percent of annual revenues for those mines. MSHA estimates that some mines might experience somewhat higher costs than the average mine in their size category while others might experience lower costs.

MSHA concludes that it would be able to certify that the proposed rule does not have a significant economic impact on a substantial number of small entities. Under the SBREFA amendments to the RFA, MSHA must include in the proposed rule a factual basis for this conclusion. See Chapter 6 of this document for the analysis.

2. 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 employees by mine size. This data comes from the U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Evaluation and Information Resources.

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 (e.g., underground mines or surface mines). The Agency maintains data on the number of mines and on mining employment by mine type and size.

This proposed rule affects 300 active underground coal mines that use mobile mining machines as described in the preamble. The 12-month average for 2014 indicates that there are 722 active working sections using mobile machines. In each working section of an active underground coal mine there can be, on average, one continuous mining machine, a scoop, and either one shuttle car and two coal hauling machines; or, one continuous mining machine, one shuttle car and a continuous haulage system.

The proposed rule would require that the following type of mobile machines: shuttle cars, coal hauling machines, continuous haulage systems, and scoops at non-longwall working sections of underground coal mines to be equipped with a proximity detection system. MSHA estimates that there are 2,116 mobile machines currently in use in underground coal mines that would be affected by the requirements of the proposed rule. Of the 2,116 mobile machines, 1,987 would need a proximity detection system. The remaining 129 mobile machines have a proximity detection system. The mobile machines with proximity detection systems would still be subject to certain requirements of the proposed rule (e.g., checks of the proximity detection system required by the proposed rule). Table 2-1 presents the industry profile data by mine employment size.

Table 2–1: Industry Data
Underground Coal Mines, Working Sections,
Mobile Machines, and Mine Employees (Excluding Office Employees)
12-Month Average for 2014 by Mine Employment Size Group*

Mine Size	No. of Mines with Mobile Machines	No. of Working Sections with Mobile Machines	No. of Mobile Machines Affected by the Proposed Rule	Mine Employment (Excluding Office Employees)
1-19 Employees	55	61	180	587
20-500 Employees	230	546	1,594	27,849
501+ Employees	15	115	342	11,434
Total	300	722	2,116	39,870

* Source: MSHA Data

Hourly wage rates (including benefits) for 2014 for underground coal miners are based upon data from the 2012 InfoMines Survey Results adjusted by the Bureau of Labor Statistics' Employment Cost Index (ECI).[1] Table 2-2 shows the hourly wage rates (including benefits) in underground coal mines by occupation.

Table 2–2: 2014 Hourly Wage Rates for Underground Coal Mines
Hourly Wage Rate by Occupation

Clerical Employee	$29.16
Miner	$42.16
Supervisor	$101.46

[1] InfoMine data from InfoMines USA, Inc., U.S. Coal Mine Salaries, Wages, and Benefits 2012 Survey Results. The ECI used from the BLS data is the "Goods-producing: natural resources, construction, and maintenance' index (Series ID number CIU201G000400000I).

Economic Characteristics of the Underground Coal Mining Industry

The U.S. underground coal mining industry produced approximately 348 million tons of coal in 2014 (in this document, all references to tons refer to short tons). The adjusted average open market U.S. sales price of underground coal for 2014 was $60.98 per ton.[2] MSHA estimates that revenue for underground coal production in 2014 was approximately $21.2 billion. Table 2-3 presents 2014 coal production and revenues by mine size.

Table 2–3: Underground Coal Production and Revenues in 2014

Mine Size	Coal Production (Millions of Tons)	Coal Revenue (Millions of Dollars)*
1-19 Employees	3	$189
20-500 Employees	237	$14,454
501+ Employees	108	$6,602
Total	348	$21,245

* Rounding may affect totals. Coal Revenue = $60.98 per ton x Coal Production

2 Energy Information Administration (EIA)'s recent forecast shows little overall change in prices for underground coal for several years. MSHA has used the latest EIA available annual price (2013) from its coal annual report to calculate revenues. U.S. Department of Energy. Energy Information Administration (EIA, 2015). Annual Coal Report 2013, January 2015, p. 47.

3. COMPLIANCE COSTS

Introduction

This chapter presents MSHA's estimate of the costs for underground coal mine operators to comply with the requirements of the proposed rule to install proximity detection systems on certain mobile machines in underground coal mines. The proposed rule would require mobile machines on the working sections of coal mines, except longwall working sections, to be equipped with proximity detection systems. A proximity detection system consists of machine-mounted components and any miner-wearable components.

The proposed rule would establish performance and maintenance requirements for proximity detection systems and would require training for persons performing the installation and maintenance of the system. The proposed rule would also require mine operators to provide a miner-wearable component to each miner on the working section, except longwall working sections, and new task training for miners as required under Part 48.

Timing

This Preliminary Regulatory Economic Analysis estimates the ten-year costs that underground coal mine operators would incur to comply with the proposed rule. MSHA estimates that 20 percent of the initial startup cost would be realized in the first year, another 40 percent would be realized in the second year, and the remaining 40 percent would be realized in the third year. Recurring costs are those costs that would occur annually such as maintenance, or at a different rate such as the 5-year service life of miner-wearable components.

Discounting

Discounting is a technique used to apply the economic concept that the preference for the value of money decreases over time. In this analysis, MSHA provides cost totals at zero, three, and seven percent discount rates. The zero percent discount rate is referred to as the undiscounted rate. MSHA used the Excel NPV function to determine the present value of costs and computed an annualized cost from the present value using the Excel PMT function.[3] The PMT function provides the annualized cost over 10 years at a three and seven percent discount rate. This formula returns a negative number, so the result was multiplied by -1 to obtain the annualized cost.

[3] Office of Information and Regulatory Affairs, Regulatory Impact Analysis: Frequently Asked Questions, February 7, 2011 [http://www.whitehouse.gov/sites/default/files/omb/assets/OMB/circulars/a004/a-4_FAQ.pdf]

Summary of Costs

MSHA estimates that the total undiscounted cost of the proposed rule over a 10-year period would be approximately $160.8 million, $148.6 million at a 3 percent rate, and $134.7 million at a 7 percent rate. The total cost annualized over 10 years would be approximately $16.1 million per year, $16.9 million per year at a 3 percent rate, and $17.9 million per year at a 7 percent rate. Table 3-1 provides the undiscounted, discounted, and annualized total costs for four key summary cost categories of the proposed rule. The remainder of this chapter provides the detailed cost analyses for these four categories.

Table 3–1: Summary of 10-Year Costs of the Proposed Rule

	Total Cost ($ millions)		
Cost Category	(0% discount rate)	(3% discount rate)	(7% discount rate)
Equipment, Including Installation	$141.7	$132.7	$122.0
Training	$0.2	$0.2	$0.2
Maintenance	$11.7	$9.7	$7.7
Operations	$7.2	$6.0	$4.8
Total Cost of the Proposed Rule	$160.8	$148.6	$134.7
Total Annualized Cost	$16.1	$16.9	$17.9

Data on Number of Machines Affected, by Mine Size

As of 2014, MSHA estimates that there are 2,116 mobile machines (which consist of shuttle cars, coal hauling machines, continuous haulage systems, and scoops) in underground coal mines. Most of these machines use electricity as a power source and the remaining mobile machines use diesel fuel. Of the 2,116 mobile machines in service, 129 machines are equipped with proximity detection systems. The remaining 1,987 mobile machines would be required to be equipped with proximity detection systems. Table 3-2 shows the number of mobile machines by power source and type that would be required to be equipped with a proximity detection system under the proposed rule. Table 3-3 shows the distribution of these mobile machines by mine size.

Table 3–2: Mobile Machines Inventory Summary
(Underground Coal Mines)

	(a) Total Machines	(b) Machines with Proximity Detection Systems	(c)* Machines that need Proximity Detection Systems
Electric			
Shuttle Cars	714	55	659
Electric Coal Hauling Machines	490	24	466
Electric Scoops	650	50	600
Subtotal	1,854	129	1,725
Diesel			
Diesel Coal Hauling Machines	92	0	92
Diesel Scoops	104	0	104
Subtotal	196	0	196
Continuous Haulage Systems**	66	0	66
Total	2,116	129	1,987

* Column (c) = column (a) – column (b)
** Although continuous haulage systems are electrically powered, they are shown separately because they are bigger and longer than other electrically powered mobile machines and require more machine-mounted components.

Table 3–3: Mobile Machines Requiring Proximity Detection Systems by Mine Size
(Underground Coal Mines)

Mine Size	(a) Electric Machines	(b) Diesel Machines	(c) Continuous Haulage Systems	(d)* Total
1-19 Employees	161	5	14	180
20-500 Employees	1,290	123	52	1,465
501+ Employees	274	68	0	342
Total	1,725	196	66	1,987

* Column (d) = column (a) + column (b) + column (c)

Equipment, Including Installation

MSHA estimates that the ten-year undiscounted total equipment cost, including installation cost, would be approximately $141.7 million. There are three equipment cost categories associated with the purchase and installation of proximity detection systems on mobile machines. These equipment cost categories are 1) machine-mounted components, 2) approval process for machine modification, and 3) miner-wearable component costs. These costs estimates are found in Table 3-4.

Table 3–4: Total Equipment and Installation Costs
(10-Year Undiscounted Costs)

Equipment Cost Category	Undiscounted Cost
Machine-Mounted Components	$139,499,000
Approval Process for Machine Modification	$202,874
Miner-Wearable Component Costs	$1,998,400
Total Cost	$141,700,274

Machine-Mounted Components

Proposed § 75.1733(a) would require mine operators to equip mobile machines with proximity detection systems. A proximity detection system consists of machine-mounted components that includes multiple generators (approximately four) and any miner-wearable components. The generator creates an electromagnetic field that enables the proximity detection system to detect miners with the wearable component. The cost of equipping a mobile machine with the machine-mounted components depends on the type of mobile machine and its power source (electric or diesel). MSHA expects the service life for machine-mounted components to be 10 years.

The primary cost estimate to purchase and install the total machine-mounted components of the proximity detection system on a mobile machine would be $65,000 for an electrically powered mobile machine and $74,000 for a diesel powered mobile machine. Machine-mounted components for the diesel powered mobile machine cost more than the components for an electrically powered mobile machine because when installing the components more time would be needed to address possible fire hazards and modifying mechanical systems of the diesel powered mobile machine with the machine-mounted components.

While continuous haulage systems are electrically powered mobile machines, they are considered separately in this analysis because they are longer than other electrically powered mobile machines and therefore require more machine-mounted components. The cost to purchase and install machine-mounted components on a continuous haulage system would be $195,000 (3 sets of machine-mounted components/machine X $65,000).

A proximity detection system that creates a stop zone with a single-generator machine-mounted component would be a less expensive alternative to a proximity detection system that uses multiple generators. MSHA estimates the cost to purchase and install a single-generator proximity detection system would be $25,000 for an electrically powered mobile machine, $28,000 for a diesel powered mobile machine, and $75,000 for a continuous haulage system. MSHA has found that proximity detection systems using a single-generator is not, at this time, a viable option for mobile machines in use in underground mines. However, MSHA anticipates that as the technology develops a single-generator proximity detection system may be practical; therefore, MSHA has included the costs for a single-generator proximity detection system as an alternate for machine mounted components.

MSHA's alternate cost estimate for proximity detection systems averages the estimated price by machine type with the less expensive single-generator proximity detection system mentioned in the above paragraph. MSHA's alternate cost estimates for an operator to purchase and install a proximity detection system would be $45,000 (($65,000 + $25,000) ÷ 2) for an electrically powered mobile machine, $51,000 (($74,000 + $28,000) ÷ 2) for a diesel powered mobile machine, and $135,000 (($195,000 + $75,000) ÷ 2) for a continuous haulage system.

The cost estimates for both a single generator machine-mounted component system and a multiple generator machine-mounted component system include the installation of the machine-mounted components and initial miner training on the installation and maintenance of the system provided by the manufacturer. The Agency requests comments on MSHA's cost assumptions on the purchase installation, and maintenance as well as initial training costs associated with the machine-mounted component of proximity detection systems on mobile machines.

As noted in Table 3-3, MSHA estimates that mine operators would need to equip 1,987 mobile machines with the machine-mounted components. Using the primary cost estimates ($65,000, $74,000, and $195,000); MSHA estimates that the one-time cost to equip 1,987 mobile machines with machine-mounted components would be $139.5 million. When using the alternate cost estimates ($45,000, $51,000, and $135,000), MSHA estimates that the one-time cost to equip 1,987 mobiles machines with machine-mounted components would be $96.5 million. Table 3-5 summarizes, by mine size, the one-time cost to purchase and install machine-mounted components on mobile machines using the primary cost estimates.

Table 3–5: Primary Cost to Equip Mobile Machines with Machine-Mounted Components By Mine Size (10-Year Undiscounted)*

	(a)	(b)	(c)	(d)
Mine Size	Electric Machines	Diesel Machines	Continuous Haulage Systems	Total
1-19 Employees	$10,465,000	$370,000	$2,730,000	$13,565,000
20-500 Employees	$83,850,000	$9,102,000	$10,140,000	$103,092,000
501+ Employees	$17,810,000	$5,032,000	$0	$22,842,000
Total Cost				$139,499,000

* Dollars in column (a) = machine totals from column (a) of Table 3-3 x $65,000, in column (b) = machine totals from column (b) of Table 3-3 x $74,000, and in column (c) = machine totals from column (c) of Table 3-3 x $195,000

Table 3-6 summarizes, by mine size, the one-time cost to purchase and install machine-mounted components on mobile machines using the alternate cost estimates.

Table 3–6: Alternate Cost to Equip Mobile Machines with Machine-Mounted Components By Mine Size (10-Year Undiscounted)*

	(a)	(b)	(c)	(d)
Mine Size	Electric Machines	Diesel Machines	Continuous Haulage Systems	Total
1-19 Employees	$7,245,000	$255,000	$1,890,000	$9,390,000
20-500 Employees	$58,050,000	$6,273,000	$7,020,000	$71,343,000
501+ Employees	$12,330,000	$3,468,000	$0	$15,798,000
Total Cost				$96,531,000

* Dollars in column (a) = machine totals from column (a) of Table 3-3 x $45,000, in column (b) = machine totals from column (b) of Table 3-3 x $51,000, and in column (c) = machine totals from column (c) of Table 3-3 x $135,000

Approval Process for Machine Modification

Two proximity detection systems approved for use in underground coal mines have been installed on coal hauling machines and scoops. MSHA approves a proximity detection system as permissible equipment under existing regulations in 30 CFR part 18 or 36 for use in underground coal mines. This ensures that the systems will not introduce an ignition hazard when operated in a potentially explosive atmosphere. MSHA approval does not address the operational capabilities of the systems.

There are three methods to obtain MSHA approval to add the machine-mounted components of a proximity detection system to a mobile machine:

a mobile machine manufacturer can apply for a Revised Approval Modification Program (RAMP) approval,

a mine operator may apply to MSHA's Approval and Certification Center (A&CC) for a Field Modification, or

a mine operator can submit to the MSHA district manager a District Field Change application.

In addition to the above, MSHA offers an optional Proximity Detection Acceptance (PDA) program, which allows a proximity detection system manufacturer to obtain MSHA acceptance for the machine-mounted components of a proximity detection system (PDA Acceptance Number). This acceptance states that the machine-mounted components of the proximity detection system have been evaluated under 30 CFR part 18 and are suitable for installation on an MSHA-approved machine. It permits the manufacturer or owner of a mobile machine to add the machine-mounted components of a proximity detection system to a machine by requesting MSHA approval to add the acceptance number to the machine approval. If used, the PDA must be paired with one of the three approval methods listed above.

As shown in Table 3-2, MSHA estimates 1,987 (2,116 – 129) mobile machines must be equipped with a proximity detection system to meet the requirements of the proposed rule. Of the 1,987 mobile machines, MSHA estimates that 1,563 mobile machines would be equipped with a proximity detection system using a RAMP application completed by the mobile machine manufacturer. The RAMP permits the mobile machine manufacturer to add machine-mounted components of a proximity detection system to a mobile machine by requesting MSHA approval to add the PDA acceptance number to the machine approval. MSHA assumes that the costs of the RAMPs would be included in the purchase and installation price of the proximity detection system noted earlier, and would not be counted as a separate cost.

For the remaining 424 (1,987 – 1,563) mobile machines, mine operators would either choose to apply for a field modification or a district field change to add the machine-mounted components of proximity detection system to their mobile machines. Since most modifications involving electrically powered mobile machines are not as complex as diesel powered mobile machines, MSHA anticipates that mine operators would seek to modify most of the remaining electrical machines through an application for a district field change. Given the complexity of modifying a diesel powered mobile machine, all modifications performed on these machines would be approved using a field modification.

District Field Change Application

The process of submitting an application for a district field change involves several steps. First, the mine operator must draft, file, and submit to their MSHA district office a letter explaining how and when the machine would be modified. Then the operator must have a miner modify and prepare the machine for inspection by an MSHA inspector. After which, an MSHA inspector would then inspect the mobile machine; and, if needed, the mine operator would make corrections to the mobile machine. MSHA estimates that a mining engineer earning $101.46 per hour would take 21 minutes to draft and submit the letter while a miner earning $42.16 per hour would take 30 minutes to prepare the machine for inspection. MSHA estimates that it would cost a mine operator $1.30 in postage to mail the application to their MSHA district office. In addition, if a corrective action is needed after an inspection, MSHA estimates that the average cost of a corrective action would be $1.02 per application (which equals a weighted average of zero costs for applications not associated with the need for corrective actions and a cost of $21.08 per corrective action). MSHA estimates that, on average, the cost of a district field change, including preparation and administrative cost, would be $58.91 per application ($101.46 hourly wage rate x 0.35 hrs. + $42.16 hourly wage rate x 30 minutes. + $1.02 per corrective action + $1.30 postage).

MSHA estimates that 290 district field change applications would be submitted at a cost of $58.91 per application for an estimated total cost of $17,084. A mine operator is allowed to modify only one mobile machine for each district field change application submitted. Table 3-7 shows, by mine size, the cost of submitting 290 district field change applications to equip 290 electric mobile machines with the machine-mounted components of proximity detection systems.

Table 3–7: Total Cost for District Field Change Requests
(10-Year Undiscounted Costs)

	(a)	(b)
Mine Size	No. of District Field Changes	Undiscounted Cost*
1-19 Employees	27	$1,591
20-500 Employees	221	$13,019
501+ Employees	42	$2,474
Total	290	$17,084

*Column (b) = column (a) x $58.91

District Field Modification Request

The process of submitting an application for a field modification requires mine operators to design and document the changes that would be made to the mobile machine, and then apply to MSHA's Approval and Certification Center (A&CC), for approval of the proposed changes. MSHA estimates that it would take a mine engineer, earning $101.46 per hour, on average, 8 hours to design and document the changes that would be made to the mobile machine. It would then take A&CC 10 hours at a cost of $180 per hour to review the modification for compliance; mine operators are charged for MSHA's approval services. To verify that a modification has been performed according to the approved documentation, an MSHA inspector is accompanied by a mine engineer to inspect the mobile machine. MSHA estimates that the mine engineer, earning $101.46 per hour, spends on average 2 hours with the MSHA inspector. MSHA estimates the average cost of a field modification would be $2,815 per request (($101.46 hourly wage rate x 10 hrs.) + ($180 x 10 hrs.)).

MSHA expects that 66 field modification requests would be submitted to modify diesel powered mobile machines and some older electrically powered mobile machines. A mine operator is allowed to modify multiple mobile machines for each request submitted. MSHA's experience with previous approvals (e.g. methane monitors) suggests that many of these requests would include multiple machines. MSHA estimates that the 66 field modification requests would allow 134 (424 – 290) mobile machines to be equipped with the machine-mounted components of proximity detection systems.

The estimated total cost to submit 66 field modification would be $185,790 (66 field modifications x $2,815 per field modification). Table 3-8 shows, by mine size, the cost of submitting 66 field modification requests so that 134 mobile machines can be equipped with the machine-mounted components of proximity detection systems.

Table 3–8: Total Cost for Field Modification Requests(10-Year Undiscounted Cost)

	(a)	(b)
Mine Size	No. of Field Modifications	Undiscounted Cost*
1-19 Employees	6	$16,890
20-500 Employees	45	$126,675
501+ Employees	15	$42,225
Total	66	$185,790

* Column (b) = column (a) x $2,815

MSHA estimates that the total undiscounted cost of purchasing and installing the machine-mounted components of a proximity detection system on 1,987 mobile machines, seeking approvals, and modifying existing proximity detection systems would be approximately $139.7 million ($139,499,000 + $17,084 +$185,790).

Miner-Wearable Component Cost

Proposed § 75.1733(a) would require, for proximity detection systems with mine-wearable components, that the mine operator must provide a miner-wearable component to each miner on the working section. MSHA has approved four proximity detection systems and all operate using electro-magnetic technology. Two of the four systems that have been installed on coal hauling machines and scoops use miner wearable components to trigger an alarm and stop the machine when there is a potential for a collision.

In the Regulatory Economic Analysis (REA) that accompanied the Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines final rule (80 FR 2188), MSHA estimated that, over a 10-year period, mine operators would purchase 9,289 miner-wearable components. However, this estimate did not include the miner-wearable components needed for miners on working sections utilizing mobile machines that service full-face continuous mining machines or conventional mining methods, because those were excluded from that proposed rulemaking. MSHA estimates that there are 1,037 miners on working sections utilizing mobile machines that service full-face continuous mining machines or conventional mining methods (Please see Table 3-15). In addition, MSHA estimates that the service life of a miner-wearable component is 5 years. Over 10 years, MSHA estimates that, 2,498 additional miner-wearable components (2 miner-wearable components (1 miner- wearable component every 5 years) x 1,037 miners + spares) would be needed for the additional miners not accounted for in the proximity system final rule. The 2,498 figure also accounts for the replacement of broken or lost units.

A miner-wearable component would not require regular maintenance other than daily charging, which MSHA assumes would be a *de minimis* cost. MSHA estimates that the purchase cost of a miner-wearable component would be $800. MSHA estimates that the cost over 10 years to purchase 2,498 miner-wearable components would be approximately $2.0 million. Table 3-9 shows, by mine size, the cost to mine operators to purchase the 2,498 miner-wearable components that would be needed as a result of the proposed rule.

Table 3–9: Miner-Wearable Components Purchase Costs
(10-Year Undiscounted Costs)*

	(a)	(b)*
Mine Size	Total No. of Components	Undiscounted Cost
1-19 Employees	104	$83,200
20-500 Employees	368	$294,400
501+ Employees	2,026	$1,620,800
Total	2,498	$1,998,400

* Column (b) = column (a) x $800

Training

MSHA estimates that the ten-year total undiscounted training cost would be $215,286. There are three training cost categories. The costs associated with training miners to install, maintain, and use proximity detection systems are shown below in Table 3-10.

Table 3–10: Total Training Costs
(10-Year Undiscounted Costs)

Training Cost Category	Undiscounted Cost
Installation and Maintenance Training	$71,324
Miner-Wearable Component New Task Training	$61,356
Machine Operator New Task Training	$74,696
Training Plan Updates	$7,910
Total Cost	$215,286

Installation and Maintenance Training

Proposed §75.1733(b)(6) would require that a proximity detection system be installed and maintained in proper operating condition by a person trained in the installation and maintenance of the system. It is MSHA's experience that mine operators would arrange for the manufacturers to train miners on the installation and maintenance of a proximity detection system.

The cost for this training would be included in the mine operator's cost of purchasing and installing the proximity detection system. However, the mine operator would incur additional costs related to the wages of miners attending the training. In addition, proposed §75.1733(d)(3) would require that a record be kept of personnel trained in the installation and maintenance of the proximity detection system.

In the REA for the Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines final rule, MSHA estimated that 1,292 miners would receive installation and maintenance training for machine-mounted components of proximity detection systems, which are installed on continuous mining machines (please see

Table 3-11). These miners, who would be mainly responsible for the maintenance of the machine-mounted components of proximity detection systems on continuous mining machines, would also be responsible for the maintenance of the machine-mounted components of proximity detection systems on mobile machines. MSHA estimates that it would take one additional hour for the manufacturer to train these miners to install and maintain the machine-mounted components on mobile machines. MSHA estimates that the hourly wage rate of a miner who installs and maintains the machine-mounted components of a proximity detection system would be $42.16.

MSHA estimates that it would take a clerical employee, earning $29.16 per hour, 3 minutes to record the training. The cost to provide the additional one hour of training and to record the training would be approximately $43.62 per miner [(1 hr. x $42.16 hourly wage rate) + 3 minutes. x $29.16 hourly wage rate)]. MSHA estimates that the total cost to provide additional training to miners previously trained and to record the training would be $56,355. Table 3-11 shows, by the mine size, the cost to provide and record the additional training.

Table 3–11: Installation and Maintenance Training Cost for Miners
(10-Year undiscounted Costs)

Mine Size	No. of Miners	Undiscounted Cost *
1-19 Employees	104	$4,536
20-500 Employees	1,140	$49,725
501+ Employees	48	$2,094
Total	1,292	$56,355

* Cost = No. of Miners x $43.62. Rounding may affect totals.

The REA for the Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines final rule did not include the installation and maintenance training costs for miners on working sections utilizing mobile machines that service full-face continuous mining machines or conventional mining methods. MSHA estimates that there are 10 mines that utilize full-face continuous mining machines, and 4 mines that utilize conventional mining methods. For the 10 mines that utilize full-face continuous mining machines, 1 mine has 20-500 employees and 9 mines have 501+ employees. For the 4 mines that utilize conventional mining methods, 3 mines have 1-19 employees and 1 mine has 20-500 employees. Since this rulemaking covers the installation of proximity detection systems on mobile machines in these mines, MSHA estimates that 88 additional miners would need training on the installation and maintenance of machine-mounted components installed on mobile machines. Table 3-12 shows, by mine size, the estimated number of additional miners requiring installation and maintenance training.

Table 3–12: Additional Installation and Maintenance Training Numbers
Mines that utilize Full-Face Continuous Mining Machines or Conventional Mining Methods

Mine Size	No. of Full-Face and Conventional Mines	No. of Miners Trained per Mine	Total No. of Miners Trained*
1-19 Employees	3	2	6
20-500 Employees	2	5	10
501+ Employees	9	8	72
Total	14		88

* Total No. of Miners Trained = No. of Full-Face and Conventional Mines x No. of Miners Trained per Mine

MSHA estimates that it would take 4 hours for the manufacturer to train a miner to install and maintain the machine-mounted components on mobile machines. MSHA estimates that the cost to provide training and to create a record would be $170.10 [(4 hrs. x $42.16 hourly wage rate) + 3 minutes x $29.16 hourly wage rate)]. MSHA estimates that the total cost to provide training and to record the training for miners not previously trained would be $14,969. Table 3-13 shows, by mine size, the cost of providing and recording the training, by mine size.

Table 3–13: Additional Installation and Maintenance Training Cost
(10-Year Undiscounted Costs)

Mine Size	No. of Miners	Undiscounted Cost*
1-19 Employees	6	$1,021
20-500 Employees	10	$1,701
501+ Employees	72	$12,247
Total	88	$14,969

* Cost = No. of Miners x $170.10, Rounding may affect totals

Miner-Wearable Component, New Task Training

Existing §48.7(c) requires that miners assigned a new task to be instructed in the safety or health aspects and safe work procedures of the task. Miners working for the first time near mobile machines equipped with a proximity detection system would receive new task training on the proper functioning of the proximity detection system's miner-wearable components. The manufacturers would provide miners this new task training at the mine when they install the proximity detection system on a mobile machine. The training cost, except the wages of the miners attending the training, would be included in the cost of purchasing and installing the proximity detection system.

In the REA of the Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines final rule, MSHA estimated that 9,289 miners would receive new task training on the use of miner-wearable components around continuous mining machines. MSHA estimates that these same miners would need 6 minutes of additional new task training on the use of miner-wearable components around mobile machines. MSHA projects that 15 percent of these miners earn a supervisor's hourly wage rate of $101.46 and the remaining 85 percent earn a miner's hourly wage rate of $42.16. In addition, existing §48.9 requires that a record be kept of task-trained personnel using existing MSHA Form 5000-23. MSHA estimates that a clerical employee, earning

$29.16 per hour, would spend 1 minute per miner trained, recording this new task training on MSHA Form 5000-23. MSHA estimates that the cost to train and record the training would be $10.64 per supervisor [(6 minutes x $101.46 hourly wage rate) + (1 minute x $29.16 hourly wage rate)] and $4.70 per miner [(6 minutes x $42.16 hourly wage rate) + (1 minute x $29.16 hourly wage rate)]. MSHA estimates that the total cost to provide the additional new task training to those previously trained and to record the training would be $52,016. Table 3-14 shows, by the mine size, the cost to provide and record the additional new task training, by mine size.

Table 3–14: Updating Miner-Wearable Component New Task Training
(10-Year Undiscounted Cost)

Mine Size	No. of Supervisors	No. of Miners	Total Undiscounted Training and Recording Cost*
1-19 Employees	60	339	$2,233
20-500 Employees	1,126	6,378	$42,021
501+ Employees	208	1,178	$7,762
Total Cost			$52,016

*Total Training and Recording Costs = (No. of Supervisors x $10.64 per supervisor) + (No. of Miners x $4.70 per miner).

MSHA also estimates that, under the proposed rule, an additional 1,037 miners would need new task training on the use of miner-wearable components around mobile machines in mines utilizing full-face continuous mining machines or conventional mining methods. MSHA estimated the number of additional miners that would need miner-wearable component new task training by multiplying the number of working sections in mines that utilize full-face continuous mining machines or conventional mining methods by the average number miners per shift per mine size. MSHA estimates that there are 55 working sections that utilize full-face continuous mining machines, and 8 working sections that utilize conventional mining methods. In addition, MSHA estimates that, on average, there are 11 miners per working section for mines utilizing full-face continuous mining machines and 10 miners per working section for mines utilizing conventional mining methods; some mines employ more than 10 miners per working section while others employ less than 10 miners per working section. Table 3-15 shows, by mine size, the number of additional miners that would need miner-wearable component new task training for mines utilizing either full-face continuous mining machines or conventional mining methods.

Table 3–15: No. of Additional Miners Needing New Task Training

Mine Size	No. of Miners in mines utilizing full-face continuous mining machines	No. of Miners in mines utilizing conventional mining methods	Total No. of Miners
1-19 Employees	0	40	40
20-500 Employees	84	80	164
501+ Employees	833	0	833
Total	917	120	1,037

Total No. of Miners = No. of Miners in mines utilizing full-face continuous mining machines + No. of Miners in mines utilizing conventional mining methods

MSHA projects 15 percent of these miners earn a supervisor's hourly wage rate of $101.46 and the remaining 85 percent earn a miner's hourly wage rate of $42.16. MSHA estimates that it takes 10 minutes to train a miner who has not had previous training to use a miner-wearable component. In addition, existing §48.9 requires that a record be kept of task-trained personnel using existing MSHA Form 5000-23. MSHA estimates that a clerical employee earning $29.16 per hour would spend 1 minute per miner trained, recording this new task training on MSHA Form 5000-23.

MSHA estimates that the cost to train and record the training would be $17.40 per supervisor [(10 minutes x $101.46 hourly wage rate) + (1 minute x $29.16 hourly wage rate)] and $7.52 per miner [(10 minutes x $42.16 hourly wage rate) + (1 minute x $29.16 hourly wage rate)]. MSHA estimates that the total cost to provide new task training to those who have not been previously trained and to record the training would be $9,340. Table 3-16 shows the cost to provide and record the new task training, by mine size.

Table 3–16: Additional Miner-Wearable Component New Task Training
(10-Year Undiscounted Cost)

Details	No. of Supervisors	No. of Miners	Total Undiscounted Training and Recording Cost*
1-19 Employees	6	34	$360
20-500 Employees	25	139	$1,480
501+ Employees	125	708	$7,499
Total Cost			$9,340

* Total Training and Recording Costs = (No. of Supervisors x $17.40 per Supervisor) + (No. of Miners x $7.52 per Miner).

MSHA recognizes that visitors to the mine and miners who are not routinely on the working section would need training; however, the cost to train these individuals would be, on average, *de minimis* and highly variable from mine to mine.

<u>Machine Operator, New Task Training</u>

Under existing §48.7(a)(3) mine operators are required to provide mobile machine operators with new task training each time a machine is changed in a manner that could affect a miner's health and safety. Machine operators working for the first time with mobile machines equipped with a proximity detection system would receive new task training on the proper functioning of a mobile machine that has been equipped with a proximity detection system. MSHA expects that the manufacturer would provide this training at the mine when the proximity detection system is installed on a mobile machine. Therefore, the training cost, except the wages of the machine operators attending the training, would be included in the cost of purchasing and installing the proximity detection system.

MSHA estimates that the number of machine operators per mobile machine by mine size would be:

1 machine operator per proximity detection system-equipped mobile machine (1 production shift/day) in mines with 1-19 employees;

2 machine operators per proximity detection system-equipped mobile machine (2 production shift/day) in mines with 20-500 employees; and,

3 machine operators per proximity detection system-equipped mobile machine (3 production shift/day) in mines with 501+ employees.

MSHA calculated the total number of machine operators that need new task training by multiplying the number of mobile machines, per mine size, that would need to be equipped with a proximity detection system times the number of machine operators per mobile machine for that mine size. The total number of machine operators that would need training would be 4,136 (Please see Table 3-17).

Based on MSHA's previous experience with proximity detection systems, the Agency estimates that it would take 25 minutes to train each machine operator on a mobile machine equipped with a proximity detection system. MSHA believes 25 minutes would be sufficient to explain the operation of a proximity detection system-equipped mobile machine, how the miner-wearable component interacts with the system, and to emphasize that the machine operators must continue to adhere to normal safe practices when working on or near mobile machines. MSHA estimates the cost of training a machine operator would be $17.57 per operator (25 minutes x $42.16 hourly wage rate).

Part 48 also requires that a record be kept of task-trained personnel. MSHA anticipates that a clerical employee, earning $29.16 per hour, would spend 1 minute per machine operator recording this new task training for each machine operator using MSHA Form 5000-23. MSHA estimates that the cost of creating this record would be $0.49 (1 minute x $29.16 hourly wage rate). MSHA estimates that the cost to train a machine operator and make a record of this training would be $18.06 per machine operator ($17.57 per machine operator + $0.49 to make a record of this training). MSHA anticipates that the total one-time cost of machine operator new task training for proximity detection system-equipped mobile machines would be $74,696. This would be a one-time cost phased in over three years. Costs by mine size are shown below in Table 3-17.

Table 3–17: Machine Operators New Task Training Costs

	(a)	(b)	(c)	(d)	(e)
Mine size	Mobile Machines	Machine operators per mobile machine	Total No. of machine operators	Training and Recordkeeping Cost	Total Cost
1-19 Employees	180	1	180	$18.06	$3,250
20-500 Employees	1,465	2	2,930	$18.06	$52,916
501+ Employees	342	3	1,026	$18.06	$18,530
Total	1,987		4,136		$74,696

* Dollars in table are rounded
* Column (c) = column (a) x column (b)
* Column (e) = $18.06 x column (c)

Training Plan Updates

Existing §48.3 requires underground coal mine operators to have an MSHA approved training plan. When new task training is required, mine operators must revise their training plans to include each new task. This revision must include a complete list of task assignments, the titles of personnel conducting the training, the outline of training procedures used, and the evaluation procedures used to determine the effectiveness of the training. Equipping mobile machines with a proximity detection system would require two additional types of new task training: (1) training miners on the miner-wearable component and (2) training mobile machine operators on the operational changes due to the machine-mounted components.

MSHA anticipates that mine operators would make one revision and submission of their training plan to cover the new task training requirements. MSHA anticipates that revising a training plan would not require a mine operator to allocate significant time or resources because the Agency usually provides many publications, training modules, and video tapes, as well as accident reports and compilations of accident statistics routinely used in training courses at little or no cost to the mine operator.

MSHA anticipates that a mine supervisor, earning $101.46 per hour, would spend 15 minutes to revise and submit an amended training plan to MSHA. MSHA estimates the cost of revising and submitting an amended mine training plan to MSHA would be $26.37 per mine [(15 mins. x $101.46 hourly wage rate) + $1 to copy and submit an amended training plan]. Table 3-18 shows, by mine size, that MSHA estimates that the total cost of revising and submitting amended training plans would be $7,910.

Table 3–18: Training Plan Updates

Mine Size	No. of Mines	Revision Cost	Undiscounted Cost *
1-19 Employees	55	$26.37	$1,450
20-500 Employees	230	$26.37	$6,065
501+ Employees	15	$26.37	$395
Total	300		$7,910

Maintenance

MSHA estimates that the ten-year total undiscounted maintenance cost for the machine-mounted components of the proximity detection systems would be approximately $11.7 million. This cost, which would be phased in as proximity detection systems are installed, is discussed below.

Total Annual Cost of Maintenance

MSHA estimates that annual maintenance cost would be one percent of the purchase cost of the machine-mounted components. Therefore, annual maintenance cost would be: $650 for an electric powered mobile machine; $740 for a diesel powered mobile machine; and $1,950 for a continuous haulage system. MSHA estimates that after all machine-mounted components of proximity detection systems have been installed on mobile machines covered by the proposed rule, the total annual cost of maintenance for all machine-mounted components would be approximately $1.5 million. Table 3-19 shows, by mine size, the total annual cost of maintenance for machine-mounted components of proximity detection systems on mobile machines in underground coal mines.

Table 3–19: Total Annual Cost of Maintenance
By Mine Size and Machine Type

	(a)*	(b)**	(c)***	
Mine Size	Electric	Diesel	Continuous Haulage Systems	Undiscounted Cost
1-19 Employees	$104,650	$3,700	$27,300	$135,650
20-500 Employees	$922,325	$91,020	$101,400	$1,114,770
501+ Employees	$178,100	$50,320		$228,420
Total Cost				$1,478,840

* Column (a) = ($650 x no. of machines in column (a) of Table 3-3) + ($650 x 129 proximity detection system equipped mobile machines in mine size 20-500 employees)
** Column (b) = $740 x no. of machines in column (b) of Table 3-3.
*** Column (c) = $1,950 x no. of machines in column (c) of Table 3-3.

MSHA anticipates that manufacturers would cover the cost of maintenance for one year after mine operators install a proximity detection system. The first year that the rule is in effect, it would address mobile machines that installed proximity detection systems before the rule became effective, as well as those mobile machines that would need to install proximity detection systems in the first year.

Since manufacturers cover the maintenance cost in the first year that the device is installed, this means that mobile machines that have a proximity detection system before the rule became effective (129 machines) would incur maintenance costs of $83,850 (or 1% of purchase costs) in all years. However, mine operators that install proximity detection systems in the first year on mobile machines, would not incur maintenance costs until the second through the tenth year that the rule is in effect.

Mine operators that install proximity detection systems on mobile machines in the second year that the rule is in effect would not incur maintenance costs (until years three through ten. Finally, mine operators that install proximity detection systems on mobile machines in year three would not incur maintenance costs until years four through ten.

Using the description of the annual rates of installation above, MSHA estimates that the rounded, undiscounted values in years four through ten would each have $1.5 million in annual costs. The value for year one is $83,500, year two is $320,000, and year three is $960,000 to maintain machine-mounted components of proximity detection systems.

The total undiscounted value for ten years would be $11.7 million. (See Table 3-1 in the Summary of Costs section.)

Operations

MSHA estimates that the ten-year total undiscounted proximity detection system checks costs would be approximately $7.2 million. The two cost categories are miner-wearable component and machine-mounted components checks. The costs are shown in Table 3-20 below.

Table 3–20: Total Proximity Detection System Check Costs
10-Year Undiscounted Costs

Proximity Detection System Checks Cost Category	Undiscounted Cost
Miner-Wearable Components Pre-Use Checks	$895,860
Machine-Mounted Components Checks	$6,296,265
Total Cost	$7,192,125

Miner-Wearable Components Pre-Use Checks

Proposed §75.1733(c)(2) would require that each miner-wearable component be checked for proper operation at the beginning of each shift that the component is to be used. Defects would have to be corrected before the miner-wearable component is used. This provision would assure that the miner is protected before getting near a machine. It is important that the miner-wearable component is not damaged and has sufficient power.

Earlier in this analysis, when deriving costs for miners to receive new task training on miner-wearable components, MSHA estimated that 1,037 additional miners would need miner-wearable components. The cost of the miner-wearable component pre-use checks for the miner-wearable components used by these miners was not included in the Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines final rule because that rule did not cover miners on working sections where mobile machines service either full-face continuous mining machines or conventional mining methods. The proposed rule estimates the cost of the miner-wearable component pre-use checks for miner-wearable components not covered by The Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines final rule.

MSHA estimates that, on average, an underground coal miner works 200 days per year. MSHA anticipates that each miner or supervisor equipped with a miner-wearable component would perform the pre-use check to verify that the unit is not damaged and has sufficient power. Based on MSHA’s experience with similar mining equipment (e.g. cap lamps), the Agency estimates that a miner or a supervisor would spend approximately 30 seconds checking the miner-wearable component before it is used. A miner earning $42.16 per hour or a supervisor earning $101.46 per hour would conduct the miner-wearable component pre-use check. MSHA projects that 15 percent of the miners conducting the checks earn a supervisor’s hourly wage rate and the remaining

85 percent earn a miner's hourly wage rate. As a result, MSHA used a composite wage rate when determining the cost of miner-wearable component pre-use check. This wage rate is based on the 15 percent who earn a supervisor's hourly wage rate and the 85 percent who earn a miner's hourly wage rate.

MSHA estimates the composite wage rate would be $51.06 per hour (15 percent x $101.46 hourly wage rate + 85 percent x $42.16 hourly wage rate). MSHA anticipates that the cost of each miner-wearable component pre-use check would be $0.41 (30 seconds x $51.06 composite hourly wage rate). The total annual cost of the pre-use checks would be $85,034 (1,037 miners x 200 days x $0.41).

Proposed §75.1733(d)(2) would require a record to be made of defects found as a result of the miner-wearable component pre-use checks, including corrective actions and the dates of these corrective actions. MSHA estimates that 10 percent of the estimated 1,037 miner-wearable components would develop defects each year.

Based on MSHA's experience with miner-wearable components, the Agency estimates that the average cost per corrective action would be 20 percent of the miner-wearable component's purchase price or $160 ($800 per miner-wearable component x 20 percent).

MSHA anticipates that mine operators would contract with the manufacturers to perform most corrective actions, but mine operators may perform some corrective actions. MSHA does not separately estimate the maintenance cost by who performs the corrective action. MSHA estimates that the time to make a record (which includes recording the defect, the corrective action taken, and the date when the corrective action was taken) would require 2 minutes of a certified person's time.

MSHA anticipates that the cost to make a record would be $1.70 (2 minutes x $51.06 composite hourly wage rate). MSHA estimates the cost of performing and recording each corrective action to be $161.70 ($160 to perform corrective action + $1.70 to make a record). MSHA estimates that the total cost to perform corrective actions and to make a record of such actions would be $16,768.

MSHA estimates that the total annual cost for miner-wearable components pre-use checks, and performing corrective actions and recording these actions would be $101,802 ($85,034 + $16,768). Table 3-21 shows, by mine size, the derivation of the estimated annual cost of $101,802.

Table 3–21: Annual Miner-Wearable Components Pre-Use Checks And Corrective Actions Cost

Mine Size	(a) No. of Miner-Wearable Components	(b)* Pre-Use Checks Cost	(c)** No. of Corrective Actions Taken	(d)*** Corrective Actions and Record Cost	(e) Undiscounted Cost
1-19 Employees	40	$3,280	4	$647	$3,927
20-500 Employees	164	$13,448	16	$2,652	$16,100
501+ Employees	833	$68,306	83	$13,470	$81,776
Total	1,037	$85,034	103	$16,768	$101,802

* Column (b) = Column (a) x 200 days x $0.41./check
** Column (c) = Column (a) x 10%
*** Column (d) = Column (c) x $161.70

Using the assumption of a three-year initial phase-in schedule, 20 percent of the $101,802 total annual cost for miner-wearable components pre-use checks, corrective actions, and recordkeeping would be realized in year one, 60 percent in year two, and 100 percent in year three and every year thereafter through year ten. Based upon the 10-year period MSHA uses to estimate costs for the proposed rule, the total ten-year undiscounted cost of the miner-wearable components pre-use checks, corrective actions, and recordkeeping would be approximately $0.9 million.

Machine-Mounted Component Check

Proposed §75.1733(c)(1) would require that operators designate a person to perform a check of machine-mounted components of the proximity detection system to verify that components are intact, the system is functioning properly, and to take action to correct defects. This check would have to be done: (i) at the beginning of each shift when the machine is to be used; (ii) immediately prior to the time the machine is to be operated if not in use at the beginning of a shift; or (iii) within one hour of a shift change if the shift change occurs without an interruption in production.

Proposed §75.1733(d)(1) would require that at the completion of the check a certified person specified in existing §75.100 certify by initials, date, and time that the check was conducted. This certification would be necessary to assure compliance with proposed §75.1733(c)(1). Proposed §75.1733(d)(1) would also requires a certified person to record defects found as a result of this check, including corrective actions and dates of corrective actions taken.

MSHA estimates that the machine-mounted components check requirement would increase the amount of time for a designated person to conduct the check of the mobile machines by approximately 20 seconds for each affected machine. MSHA also estimates that it would take approximately 10 seconds for a certified person to record the results of the check, and certify by initials the date and time that the check was conducted. A designated miner, earning a non-supervisory wage of $42.16 per hour, would conduct the checks. A certified person, earning a supervisor's wage of $101.46 per hour, would record the results of the check. The average cost of a pre-use check and certification would be $0.52 [(20 seconds. x $42.16 hourly wage rate) + (10 seconds x $101.46 hourly wage rate)].

MSHA estimates that the annual number of checks would be 200 checks per machine in mines with 1-19 employees (1 shift/day x 200 days), 600 checks per machine in mines with 20 to 500 employees (2 shifts/day x 300 days), and 1,050 checks per machine in mines with 501+ employees (3 shifts/day x 350 days). MSHA estimates that the total annual cost of conducting machine-mounted component checks under proposed §75.1733(c)(1) would be $702,780.

MSHA also estimates that as a result of the checks, a corrective action would be taken on each proximity detection system-equipped mobile machine approximately once a year. The cost of the action to correct a defect would be included in the maintenance of the mobile machine. This maintenance cost was mentioned in the previous section entitled Maintenance.

Recording and certifying this corrective action would take an additional two minutes. A supervisor, earning $101.46 per hour, would record and certify the corrective action. MSHA estimates that the cost to record and certify the corrective action would be $3.38 (2 minutes x $101.46 hourly wage rate). MSHA estimates the total annual cost for recording and certifying the corrective actions would be $7,156.

MSHA estimates that the total annual cost for machine-mounted components checks, certification of the checks, recording corrective actions, and certifying corrective actions would be $709,936 ($702,780 for component checks and certification of the checks + $7,156 for recording and certifying corrective actions). Table 3-22 shows this cost by mine size.

Table 3–22: Annual Cost for Machine-Mounted Components Checks, Certifications of Checks, Recording of Corrective Actions, and Certifications of Corrective Actions*

	(a)	(b)	(c)*	(d)	(e)**
Mine Size	No. of Machines	Exams per year	No. of Checks	No. of Corrective Actions	Total Cost
1-19 Employees	180	200	36,000	180	$19,329
20-500 Employees	1,594	600	956,400	1,594	$502,719
501+ Employees	342	1,050	359,100	342	$187,889
Total Cost					$709,936

* Dollar totals are rounded.
** Column (c) =column (a) x column (b),
** Column (e) = [column (c) x $0.52] + [column (d) x $3.38].

Due to the assumed three-year initial phase-in schedule, 20 percent of the $709,936 total annual cost for machine-mounted components checks, certification of the checks, recording corrective actions, and certifying corrective actions would be realized in year one, 60 percent in year two, and 100 percent in year three and every year thereafter through year ten. Based upon the 10-year period MSHA uses to estimate costs for the proposed rule, the total ten-year undiscounted cost for machine-mounted components checks, certification of the checks, recording corrective actions, and certifying corrective actions would be approximately $6.3 million.

The total ten-year undiscounted cost for pre-use checks and corrective actions for both miner-wearable components and machine-mounted components of proximity detections systems would be approximately $7.2 million. (See Table 3-19 at the beginning of the Operations section.)

Detailed Cost Summary

Table 3-23 provides additional detail to the summary data provided in Table 3-1. Each cost category corresponds to a cost section discussed in the preceding cost analysis. MSHA solicits comments on any cost items in Chapter 4.

Table 3–23: Detailed Summary of 10-Year Undiscounted Cost

Cost Category	Undiscounted Costs
Equipment, Including Installation	
Machine-Mounted Components	$139,499,000
Approval Process for Machine Modification	$202,874
Miner-Wearable Component Costs	$1,998,400
Subtotal	$141,700,274
Training	
Installation and Maintenance Training	$71,324
Miner-Wearable Component New Task Training	$61,356
Machine Operator New Task Training	$74,696
Training Plan Updates	$7,910
Subtotal	$215,286
Maintenance	
Maintenance Costs	$11,719,422
Operation	
Miner-Wearable Component Pre-Use Checks	$895,860
Machine-Mounted Components Checks	$6,296,265
Subtotal	$7,192,125
Total	$160,827,107

4. BENEFITS

Introduction

Working near mobile machines exposes miners to dangers from pinning, crushing, and striking hazards. Conditions in underground coal mines that contribute to these hazards include: (1) limited visibility; (2) limited space around mining equipment; and (3) uneven and slippery ground conditions that may contain debris. The proposed rule would reduce the likelihood of pinning, crushing, or striking accidents and would reduce the risk of fatalities and injuries to miners. MSHA reviewed the accident reports for mobile machine accidents that occurred from 1984 through 2014 (31 years). MSHA's review included analyzing mobile machine fatal accident reports and researching the narrative of non-fatal accident reports. MSHA excluded fatalities and injuries that a proximity detection system could not have prevented, such as a roof or rib fall pinning a miner against a machine or a machine striking and pushing a stationary machine into a miner.

Fatal Accidents

MSHA found that the proximity detection systems could have prevented up to 42 fatalities in underground coal mines over a 31 year period from 1984 through 2014. When the requirements of the proposed rule are totally phased in three years after the effective date, MSHA anticipates that, approximately two fatalities would be prevented each year. Table 4-1 shows the fatalities by type of mobile machine that the proposed rule would have prevented.

Table 4–1: Preventable Underground Coal Mines Fatalities
By Mobile Machine Type (1984-2014)

Mobile Machine Type	Fatalities
Shuttle Cars, Coal Hauling Machines, and Continuous Haulage Systems	32
Scoops	10
Total	42

Non-Fatal Accidents

MSHA found that proximity detection systems could have prevented up to 179 non-fatal injuries related to mobile machine accidents that occurred in underground coal mines from 1984 through 2014. A non-fatal injury can range in severity from an injury where no days are lost or activities restricted to an injury that leads to a permanent physical disability. MSHA classifies non-fatal injuries according to the following criteria:

No days away from work and no days restricted activity;

Days restricted activity only;

Days away from work only;

Days away from work and days of restricted activity; and

Permanent partial or total disability.

Table 4-2 summarizes the classification by injury criteria for the 179 non-fatal injuries that the proposed rule would have prevented. The data on the severity of injuries are from mine operators' reports submitted to MSHA by mine operators.

Table 4–2: Preventable Underground Coal Mine Non-Fatal Injuries
By Injury Classification (1984-2014)

Non-Fatal Injury Classification	Injuries
Non-Permanent Injury Criteria	
No days away from work and no days restricted activities	9
Days restricted activity only	5
Days away from work only	142
Days away from work and restricted activity	4
Subtotal	160
Permanent Injury Criteria	
Permanent partial or total disability	19
Subtotal	19
Total	179

When the proposed rule requirements are totally phased in three years after the effective date, MSHA anticipates that approximately eight non-fatal injuries would be prevented each year.

Non-Quantified Benefits

In addition to preventing injuries and fatalities, MSHA anticipates that the proposed rule would result in additional savings to mine operators by avoiding some of the production delays typically associated with mine accidents. Pinning, crushing, or striking accidents can disrupt production at a mine during the time it takes to remove the injured miner, investigate the cause of the accident, and clean up the accident site. Such delays can last for a shift or more. Factors such as lost wages, delayed production and other miscellaneous expenses could result in significant costs; however, MSHA has not quantified these savings due to lack of specific information. MSHA solicits data and information that would help the Agency quantify these savings.

Monetized Value of Injuries and Fatalities Prevented

To estimate the monetary values of the reductions in fatalities and non-fatal injuries, MSHA uses an analysis of the imputed values to avoid fatalities and non-fatal injuries based on a willingness-to-pay approach. This approach relies on the theory of compensating wage differentials (i.e., the wage premiums paid to workers to accept the risk associated with various jobs) in the labor market. A number of studies have shown a correlation between higher job risk and higher wages, suggesting that employees demand monetary compensation in return for incurring greater risk. The measure of risk reduction as applied to fatalities is known as the Value of a Statistical Life (VSL).

VSL is not the valuation of life, but the valuation of reductions in risks.[4, 5] For low-probability risks, the usual assumption made is that the willingness to pay to avoid the risk of a fatal injury increases proportionately with growing risk. Economists use wage studies and survey research to estimate the average value for very small changes in risk and then scale the estimate to one. For example, when an individual is willing to accept additional pay of $10 for additional risk of death of one in a million, the estimated VSL is approximately $10 million (i.e., $10 per individual x 1 million individuals).[6]

VSL is a term that refers to the measurement of willingness to pay for reductions in risk of injury or premature death. The VSL literature frequently mentions the need for an alternate terminology to reduce the widespread misunderstanding by the public and decision makers alike.[7] MSHA maintains the common VSL terminology of the longer-term literature and OMB Circular A-4 but emphasizes that although VSL is a statistical concept for monetizing benefits, it is not the value of an individual's life.

In 2003, the Office of Management and Budget (OMB) set the range for VSL between $1 million to $10 million per statistical life in OMB Circular A-4. Using the GDP Deflator (U.S. Bureau of Economic Analysis, 2014), this range would be roughly equivalent to $1.3 to $12.5 million in 2014 dollars. The sections that follow describe alternate values for VSL that all fall within OMB's recommended range updated to a 2014 base year.

Estimating the Value of Fatalities and Injuries Prevented

In previous rules, MSHA estimated the value of deaths and injuries prevented based on a 2003 meta-analysis by Viscusi & Aldy adjusted for inflation. Viscusi and Aldy (2003) analyzed several studies that used a willingness-to-pay methodology to estimate the imputed value of life-saving programs. This meta-analysis found that each fatality prevented was valued at approximately $7 million[8] and each lost time/non-fatal injury was valued at approximately $50,000 in 2000 dollars. The $50,000 value equals 0.7 percent of the VSL. Their VSL estimate, while within the range of the substantial majority of such estimates in the literature, is lower than estimates in more recent

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[4] Regulatory Impact Analysis: A Primer, available at http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf, pg. 10.

[5] Cameron, T.A., "Euthanizing the Value of a Statistical Life", Review of Environmental Economics and Policy 4(2) (2010), 161-178.

[6] See Hammitt, James K., Valuing Changes in Mortality Risk: Lives Saved Versus Life Years Saved (Summer 2007). Review of Environmental Economics and Policy, Vol. 1, Issue 2, pp. 228-229, 2007.for both the simplified and more technical explanation.

[7] See Cropper, et.al, p. 14, and supra note 5 above.

[8] Although many analysts refer to the text in the body of the paper that says "approximately $7 million", the appendix to their article shows the details and the base value for adjustment is $6.7 million.

research papers and recent estimates used by other federal agencies such as the Department of Transportation (DOT)[9] and United States Coast Guard (USCG).

Non-fatal injuries are far more common than fatalities and vary widely in severity, as well as probability. The resulting loss in quality of life includes pain and suffering, and reduced income. Non-fatal injuries should be estimated by potential victims' willingness-to-pay for personal safety. While estimates of willingness-to pay to avoid injury are available, these estimates are generally only available for an average injury resulting in a lost workday, and not for a range of injuries varying in severity. Because detailed willingness-to-pay estimates covering the entire range of potential disabilities are unobtainable, MSHA traditionally develops estimates for two classes of non-fatal injuries: lost-time injuries and permanent disabling injuries.

Given the significant life-changing consequences of a permanent partial or total disability, MSHA believes it is not appropriate to use the value estimated for a typical non-fatal injury. Instead, MSHA bases the value of a permanent partial or total disability prevented on the work of Magat, Viscusi & Huber (1996), which estimated the values for both a non-fatal lymph cancer prevented and a non-fatal nerve disease prevented. The Occupational Safety and Health Administration (OSHA, 2006) used this approach in the Final Economic Analysis supporting its hexavalent chromium final rule, and the Environmental Protection Agency used this approach in its Stage 2 Disinfectants and Disinfection Byproducts water rule (EPA, 2003).

Although permanent partial and total disabilities are not cancers or nerve diseases, MSHA believes they have a similar impact on the quality of life with similar valuations. The Magat, Viscusi & Huber (1996) study estimates the value of preventing a non-fatal lymph cancer at 58.3 percent of the value of preventing a fatality. Similarly, they estimate the value of preventing a non-fatal nerve disease at 40 percent of the value of preventing a fatality. Of the two diseases valued in this study, MSHA believes that a permanent disability resulting from a pinning, crushing, or striking injury more closely resembles the consequences of a nerve disease than the consequences of a non-fatal cancer. For example, loss of strength, inability to move easily, and constant pain are three main consequences of nerve disease that are similar to major consequences caused by a permanent disability from a pinning, crushing, or striking injury.

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[9] Before issuing their 2013 updated guidance, the Department of Transportation convened a panel of experts to review current VSL research. The panel unanimously concluded that hedonic wage studies completed within the previous 10 years using the Census of Fatal Occupational Injuries (CFOI) database are the most appropriate. At that time, DOT updated their VSL guidance to $9.1 million (2012 dollars). The most recent DOT update, dated June 13, 2014 updated the VSL value for a 2013 base year to $9.2 million. See http://www.dot.gov/office-policy/transportation-policy/guidance-treatment-economic-value-statistical-life .

Accordingly, MSHA estimates the value of preventing a permanent, partial, or total disability at 40 percent of VSL.[10]

Selection of a VSL

For this proposed rule, MSHA considered DOT's approach for assigning a dollar value to prevented fatal injuries. DOT relied on recent studies that considered risk and pay in various occupations. In DOT's 2012 guidance, entitled Treatment of the Economic Value of a Statistical Life, the agency reviewed nine studies that considered risk and pay in various occupations, arriving at $9.1 million as the value of statistical life.

There are many examples of studies involving consumer product purchases. The most cited body of research applicable to this rulemaking is comprised of hedonic wage studies, which estimate the wage differential that employers must pay workers to accept riskier jobs, after considering other factors. Besides the problem of identifying and quantifying these factors, researchers must have a reliable source of data on fatality and injury risks and assume that workers' psychological risk assessment conforms to the objective data. The accuracy of hedonic wage studies has improved over the last decade with the availability of more complete data from the Census of Fatal Occupational Injuries (CFOI), supported by advances in econometric modeling, including the use of panel data from the Panel Study of Income Dynamics. As DOT noted, recent studies have used panel data to analyze the behavior of workers who switch from one job to another, where the analysis can safely assume that any trade-off between wage levels and risk reflects the preferences of a single individual, and not differences in preferences among individuals, which provide more reliable results than older studies.[11] In addition, advances in data and econometric techniques have allowed specialized estimates of VSL for particular subgroups, such as workers in particular industries.[12]

Alternate VSL Estimates

OMB Circular A-4 requires agencies to consider the impact of alternative assumptions. MSHA estimated three alternatives for VSL.

<u>Primary Benefit Estimate:</u> The primary estimate of $9.4 million is based on DOT's methodology, with the exception for DOT's preferred income elasticity adjustment. MSHA reviewed DOT's findings[13] and used the Congressional Budget Office (CBO,

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[10] Other federal agencies such as DOT, OSHA, and USCG also estimate some injury and illness values as a percentage of VSL.

[11] For this reason, as was noted above, the expert panel convened by DOT in 2012 recommended that only studies conducted during the last decade be used.

[12] For example, prior to 2012, DOT used the Viscusi and Aldy 2003 elasticity estimate (averaged to 0.55)

[13] DOT (2014)

2014) forecast of 1.3 percent real income growth each year and an income elasticity of 0.55 based upon Viscusi and Aldy (2003) to project a VSL of approximately $10 million in the 10th year from the effective date when the proposed rule becomes final.[14]

Alternative Benefit Estimate - I: The benefit estimate of $12.1 million is based upon Viscusi's 2013 article that emphasizes, that when possible, labor characteristics should be used to develop VSLs. Viscusi presents a table of four VSLs estimated using two functional forms and two fatality rates based on hours and employment. The article states that the narrow confidence intervals, which overlap, are indicative of the relative stability of the VSL estimates whether the hours-based fatality rate or employment-based measure is used. Table 1 in the article shows the highest fatality rate is for mining. Given that there is statistical overlap of the VSL calculations and to reflect the mining industry risk, MSHA selected Viscusi's $11.1 million in 2007 dollars and adjusted to $12.1 million in 2014 dollars for the alternative estimate.[15] As in the primary estimate, MSHA applied the 1.3 percent real income growth each year and an income elasticity of 0.55. This provides a final value after 10 years of approximately $12.9 million.

Alternative Benefit Estimate - II: The high estimate of $12.1 million is the same alternate estimate I, except MSHA applied an income elasticity of 1.0[16] instead of the income elasticity of 0.55 applied in the first alternate VSL scenario. This provides a final value after 10 years of approximately $13.6 million.

Tables 4-3 to 4-5 show the values by year for VSL and injury monetization values, rounded for display purposes, which result from the methodology above. These tables

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[14] Researchers have estimated a wide range for the average income elasticity for VSL use. Older studies were primarily meta studies while newer studies increasingly focus on wage studies. Newer research, which is confirming the theory that VSL increases with higher incomes, is producing a more narrow range and finding income elasticity values that may exceed 1.0 consistent with the theory of VSL. For a broad description of the recent literature regarding income elasticity for VSL, see articles such as Hammit and Robinson (2011), Doucouliagos et al (2013), and Viscusi (2013). For information on examples of federal agencies using income elasticity to adjust VSL, see the EPA BenMap, EPA Particulate Matter rule evaluation (EPA-452/R-12-005, December 2012) and DOT citations in the reference list at the end of this evaluation.

It is worth noting, however, that a number of theoretical questions surrounding the income elasticity adjustment remain, such as: would discounting for both costs and benefits negate the need for an adjustment; and since income elasticity is rarely constant, should the analyst adjust all rule-induced benefits and costs?

[15] Viscusi's 2013 article is the first research MSHA is aware of that touches upon the high risk of mining (Table 1) and VSL. Mining is identified as the highest risk and the discussion of the new VSL values emphasize risk, whether by industry or occupation. The article includes calculation with the hours based fatality rates and the employment based fatality rate.

[16] In 2012 DOT updated its guidance to use an elasticity of 1.0. Viscusi (2013) also includes a discussion of values including 1.0.

include a non-disabling injury value that reflects a constant 40 percent of VSL. The non-disabling injuries represent a constant 0.7 percent of the VSL. The constant percentage implicitly maintains the same relationship between the original injury values and the VSL. The additional analysis and tables in the Net Benefits Chapter (Chapter 5) apply alternative discount rates of 3 percent and 7 percent to the calculations.

Table 4–3: Annual Values for VSL and Injuries, Primary Benefit Estimate

Year	VSL ($ millions)	Injury Disabling ($ millions)	Injury, Non-disabling ($)	*Injury Weighted Average ($)
1	$9.4	$3.8	$70,000	$512,000
2	$9.5	$3.8	$71,000	$513,000
3	$9.5	$3.8	$71,000	$513,000
4	$9.6	$3.8	$72,000	$514,000
5	$9.7	$3.9	$72,000	$526,000
6	$9.7	$3.9	$73,000	$527,000
7	$9.8	$3.9	$73,000	$527,000
8	$9.9	$4.0	$74,000	$540,000
9	$9.9	$4.0	$74,000	$540,000
10	$10.0	$4.0	$75,000	$541,000

* Weighted average is based upon an average of 11.9% disabling and 88.1% non-disabling (e.g. 0.119* $3.8 million + 0 .881 * $70,000)

Table 4–4: Annual Values for VSL and Injuries, Alternative Benefit Estimate - I

Year	VSL ($ millions)	Injury Disabling ($ millions)	Injury, Non-disabling ($)	*Injury Weighted Average ($)
1	$12.1	$4.8	$90,000	$649,000
2	$12.2	$4.9	$91,000	$662,000
3	$12.3	$4.9	$91,000	$662,000
4	$12.4	$4.9	$93,000	$663,000
5	$12.4	$5.0	$93,000	$675,000
6	$12.5	$5.0	$94,000	$676,000
7	$12.6	$5.1	$94,000	$688,000
8	$12.7	$5.1	$95,000	$689,000
9	$12.8	$5.1	$95,000	$689,000
10	$12.9	$5.2	$97,000	$702,000

* Weighted average is based upon an average of 11.9% disabling and 88.1% non-disabling (e.g. 0.119* $3.8 million + 0 .881 * $70,000)

Table 4–5: Annual Values for VSL and Injuries, Alternative Benefit Estimate - II

Year	VSL ($ millions)	Injury Disabling ($ millions)	Injury, Non-disabling ($)	*Injury Weighted Average ($)
1	$12.1	$4.8	$90,000	$649,000
2	$12.3	$4.9	$92,000	$662,000
3	$12.4	$5.0	$92,000	$674,000
4	$12.6	$5.0	$94,000	$676,000
5	$12.7	$5.1	$95,000	$689,000
6	$12.9	$5.2	$97,000	$702,000
7	$13.1	$5.2	$97,000	$702,000
8	$13.2	$5.3	$99,000	$716,000
9	$13.4	$5.4	$100,000	$729,000
10	$13.6	$5.4	$102,000	$731,000

* Weighted average is based upon an average of 11.9% disabling and 88.1% non-disabling (e.g. 0.119* $3.8 million + 0 .881 * $70,000)

Timing of the Benefits

Due to the time mine operators would need to equip existing mobile machines with proximity detection systems, MSHA would allow mine operators 36 months after the effective date to install proximity detection systems on their mobile machines. This period would allow mine operators time to schedule installations during planned rebuilds or scheduled maintenance and to train their workforce on proximity detection systems.

In the cost chapter, MSHA estimates that mine operators would equip mobiles machines without proximity detection systems at the following rate: 20 percent in the first year and 40 percent in each of the next 2 years. MSHA assumes no benefits in the first year; however, benefits could occur at any time throughout the year once the operators install the proximity detection system.

In the second year, half of the 40 percent installed that year and the 20 percent from the first year would provide 40 percent of the full annual benefits. In the third year, the same logic provides an additional 40 percent, or 80 percent of the full annual benefits. In the fourth and following years after full implementation, MSHA did not apply any lag to the benefits.

Technical Discussion of Injuries, Fatalities, and Dollar Estimates

As stated earlier in this chapter, MSHA reviewed 31 years of fatality and injury data. The data do not reflect a steady state or an overall trend, but they include periods where the fatalities and injuries are significantly different from the average value. MSHA used a number of statistical tests to determine whether the data revealed a relationship to coal production, employment, or accident data from previous years. The models using relationships to project outcomes were not good fits to the data. MSHA determined that simple time series models[17] provided results very similar to simple averages and provided the advantage of including more recent historical trends MSHA used exponential smoothing which works like a moving average to capture changes in trends and smooth out extreme values. Additionally, there have been no pinning, crushing, or striking accidents reported when an installed proximity detection system failed to prevent this hazard. Although at some point in the future the technology may not prevent an injury or a fatality, MSHA has assumed that requiring the use of proximity detection on mobile machines would lead to avoidance of all of the injuries and fatalities that could be prevented by these systems. If proximity detection system use demonstrates to be substantially less effective than complete avoidance of injuries and fatalities, MSHA's assumption would have overestimated rule-induced benefits.[18] MSHA requests comments on the Agency's assumption that proximity detection is 100 percent effective in eliminating the hazards from pinning, crushing, and striking accidents. For those interested in the background data and projection of benefits, a technical appendix provides the historical data and information on the exponential smoothing.

The benefit estimates have decimal values that reflect the projections over 10 years. The fractional values provide best estimates of the expected dollar impact but do not suggest a fractional injury or fatality would occur. Table 4-6 shows the projected injuries and fatalities by year that would be prevented by the proposed rule requirements. Table 4-6 also estimates the undiscounted benefits of multiplying the projected deaths and injuries prevented by the corresponding VSL and weighted average injury dollar values in Tables 4-3 through 4-5. Additional total benefit dollars for the alternative values shown in Table 4-4 and Table 4-5 are included below the total for the primary estimate in Table 4-6. The Net Benefit chapter (Chapter 5) provides the discounted values for the undiscounted values in the total lines.

[17] MSHA used a commercial software package that provided the ability to examine a large number of possible models and periods. The best models used exponential smoothing. Results of the models were very close to estimates using only data averages.

18 Moreover, throughout this analysis, the implicit assumption is that the use of proximity detection systems would, in the absence of this rule, remain at the current level. If use of such systems were to increase even in the absence of this rule, the assumption of constant-level use would yield overestimates of rule-induced costs and benefits.

Table 4–6: Projected Primary Benefits Estimate (Undiscounted)

Year	Injuries Prevented	Deaths Prevented	Injuries Prevented ($ millions)	Deaths Prevented ($ millions)	Total Benefits ($ millions)
1	0.0	0.0	$0.0	$0.0	$0.0
2	3.4	0.7	$1.7	$6.9	$8.6
3	6.8	1.5	$3.5	$13.9	$17.4
4	8.5	1.8	$4.3	$17.5	$21.8
5	8.5	1.8	$4.5	$17.6	$22.1
6	8.5	1.8	$4.5	$17.8	$22.3
7	8.5	1.8	$4.5	$17.9	$22.4
8	8.5	1.8	$4.6	$18.0	$22.6
9	8.5	1.8			
10	8.5	1.8	$4.6	$18.3	$22.9
Primary Total	69.5	15.0	$36.7	$146.0	$182.6
Alternative I - Total	69.5	15.0	$47.2	$188.1	$235.3
Alternative II - Total	69.5	15.0	$48.7	$194.1	$242.8
Average Injuries and Fatalities	47.3	11.1	$25.0	$108.4	$133.4

Benefit Summary

MSHA projects that thirty-six months after the effective date when the proposed rule would become effective, approximately two fatalities, and eight non-fatal injuries per year would be prevented because of the requirements of the proposed rule. MSHA estimates that the undiscounted monetized value of the prevented fatalities and injuries would total $182.6 million for the primary benefits estimate, $235.3 million for the first alternative benefits estimate, and $242.8 million for the higher alternative benefits estimate.

5. Net Benefits

Introduction

This chapter presents a summary of MSHA's estimates of the net-benefits of the proposed rule. Under the Mine Act, MSHA is not required to use the estimated net benefits as the basis for its regulatory decisions.

The net benefit estimates are based on cost estimates presented in Chapter 3 and the benefit estimates presented in Chapter 4. To compare the cost and benefit estimates, it is necessary to project the timing of the injuries and fatalities that the rule would prevent. Based on the analysis presented in this chapter and summarized in Table 5-3, MSHA estimates that the total value of the first net benefits scenario over a 10-year period based on the primary benefits estimate would be $21.8 million undiscounted (0 percent discount rate), $2.9 million at a 3 percent discount rate, and -$14.7 million at a 7 percent discount rate. The corresponding annualized values are $2.1 million, $0.3 million, and -$2.0 million.

Estimated Cost of the Proposed Rule

The cost estimates from Table 3-1 are displayed below in Table 5-1. These estimates are used to derive the net benefit estimates shown in Table 5-3.

Table 5–1: Cost Summary (10 Years)

	Total Cost ($ millions)		
Cost Category	(0% discount rate)	(3% discount rate)	(7% discount rate)
Equipment, Including Installation	$141.7	$132.7	$122.0
Training	$0.2	$0.2	$0.2
Maintenance	$11.7	$9.7	$7.7
Operations	$7.2	$6.0	$4.8
Total Cost of the Proposed Rule	$160.8	$148.6	$134.7
Total Annualized Cost	$16.1	$16.9	$17.9

Summary of Monetized Benefits

In Chapter 4, MSHA projected, based upon historical data, the injuries, and fatalities that would be prevented by the proposed rule, and then used these projections to monetize the benefits to miners. Table 5-2 shows a summary of the primary total undiscounted benefits estimate of $182.6 million, in terms of present value and annualized values, which are shown in Chapter 4 (Table 4-6). These primary benefit values are used to derive the net benefit values for the first net benefit scenario shown in Table 5-3.

Table 5–2: Summary of 10-Year Primary Benefit Values

Discount Rate	Benefits, Present Value ($ millions)	Annualized Benefits ($ millions)
7 Percent	$120.0	$16.0
3 Percent	$151.5	$17.2
Undiscounted	$182.6	$18.3

Alternate Scenarios

To reflect the timing of net benefits over the 10-year period, which begins at the rule's effective date, and to allow conversion to an equivalent steady stream of annualized benefits, MSHA first estimated the undiscounted values and then applied discount rates of 3 percent and 7 percent.

As discussed in Chapters 3 and 4, the proposed rule's cost and benefit estimates are not constant from year to year. Costs and benefits vary from year to year due to the rate at which proximity detection systems are installed on mobile machines and the need to replace equipment that reaches the end of its useful life. For each year of the 10-year period, MSHA compared the benefit estimate values to the cost estimate values to calculate the net benefit estimate.

In addition to the primary net-benefit scenario, MSHA estimated two alternate net-benefit scenarios. The scenarios differ by the Value of Statistical Life (VSL), the income elasticity utilized for the benefits estimates, and two alternate cost estimates. The estimates for the primary scenario utilize a VSL of $9.4 million with an income elasticity of 0.55 for the primary benefits estimate and a total cost that includes a proximity detection system purchase price of $65,000 for electrically powered mobile machines, $74,000 for diesel powered mobile machines, and $195,000 for continuous haulage systems. The second scenario utilizes a VSL of $12.1 million with an income elasticity of 0.55 for the middle benefits estimate and the same total cost mentioned in the first scenario. Finally, the third scenario utilizes a VSL of $12.1 million with an income elasticity of 1.0 instead of 0.55 for the highest benefit estimate and the low cost estimate.

Table 5-3 shows, by year, estimates for benefits, costs, and net benefits, and the corresponding annualized values at an undiscounted, a 3 percent, and a 7 percent discount rate for the first scenario. In addition, Table 5-3 shows the present value totals for benefits, costs, and net benefits, and the corresponding annualized values for the second and third scenarios at an undiscounted, a 3 percent, and a 7 percent discount rate.

Table 5–3: Estimates of Net Benefits, Costs, and Benefits

Primary Scenario (VSL of $9.4 million with an income elasticity of 0.55, Primary Costs)

No Discount				3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits ($ Millions)	Costs ($ Millions)	Net Benefits ($ Millions)	Discount Factor	Discounted Benefits ($ Millions)	Discounted Costs ($ Millions)	Discounted Net Benefits ($ Millions)	Discount Factor	Discounted Benefits ($ Millions)	Discounted Costs ($ Millions)	Discounted Net Benefits ($ Millions)
1	$0	$28,467,655	-$28,467,655	0.9709	$0	$27,638,500	-$27,638,500	0.9346	$0	$26,605,285	-$26,605,285
2	$8,670,974	$57,229,890	-$48,558,916	0.9426	$8,173,224	$53,944,660	-$45,771,436	0.8734	$7,573,564	$49,986,802	-$42,413,238
3	$17,341,947	$58,096,308	-$40,754,361	0.9151	$15,870,338	$53,166,351	-$37,296,013	0.8163	$14,156,195	$47,423,893	-$33,267,698
4	$21,868,350	$2,290,579	$19,577,771	0.8885	$19,429,746	$2,035,150	$17,394,596	0.7629	$16,683,260	$1,747,472	$14,935,788
5	$22,152,434	$2,290,579	$19,861,855	0.8626	$19,108,885	$1,975,874	$17,133,011	0.7130	$15,794,380	$1,633,151	$14,161,228
6	$22,160,904	$2,490,419	$19,670,485	0.8375	$18,559,408	$2,085,687	$16,473,721	0.6663	$14,766,746	$1,659,472	$13,107,275
7	$22,343,351	$2,690,259	$19,653,092	0.8131	$18,167,189	$2,187,427	$15,979,762	0.6227	$13,914,316	$1,675,358	$12,238,958
8	$22,635,905	$2,690,259	$19,945,646	0.7894	$17,868,992	$2,123,716	$15,745,277	0.5820	$13,174,303	$1,565,755	$11,608,547
9	$22,635,905	$2,290,579	$20,345,326	0.7664	$17,348,536	$1,755,538	$15,592,998	0.5439	$12,312,432	$1,245,923	$11,066,509
10	$22,826,821	$2,290,579	$20,536,242	0.7441	$16,985,299	$1,704,406	$15,280,893	0.5083	$11,603,998	$1,164,414	$10,439,584
Total	$182,636,591	$160,827,107	$21,809,484		$151,511,618	$148,617,309	$2,894,309		$119,979,194	$134,707,526	-$14,728,332
Annlzd	$18,263,659	$16,082,711	$2,180,948		$17,244,450	$16,915,031	$329,419		$15,964,802	$17,924,599	-$1,959,797

Second Net-Benefit Scenario (VSL of $12.1 million with an income elasticity of 0.55, Primary costs)

Total	$235,315,551	$160,827,107	$74,488,444		$195,205,441	$148,617,309	$46,588,132		$154,572,234	$134,707,526	$19,864,708
Annlzd	$23,531,555	$16,082,711	$7,448,844		$22,217,508	$16,915,031	$5,302,476		$20,567,859	$17,924,599	$2,643,259

Third Net-Benefit Estimates (VSL of $12.1 million with an income elasticity of 1.0, Low costs)

Total	$242,801,187	$114,503,571	$128,297,615		$201,220,589	$105,567,488	$95,653,101		$159,136,508	$95,442,165	$63,694,343
Annlzd	$24,280,119	$11,450,357	$12,829,762		$22,902,128	$12,015,272	$10,886,856		$21,175,195	$12,699,829	$8,475,366

6. REGULATORY FLEXIBILITY ANALYSIS

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 proposed rule on small entities. Based on that analysis, MSHA certifies that the proposed rule would 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. Because the Agency has not established an alternative definition, MSHA 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.

The Agency, as is MSHA's practice, has also examined the impact of the proposed 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 would 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 the proposed 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 proposed rule would not have a significant economic impact on a substantial number of small entities without further analysis. If the estimated cost is equal to or exceeds one percent of revenue, MSHA investigates whether further analysis is required.

Derivation of Costs and Revenues for Mines

Chapter 3 presented the cost details by mine size. Revenue for underground coal mines is derived from data on coal prices and tonnage. The average open market U.S. sales price of underground coal for 2014 was $60.98 per ton.[19] For mines with 1-19 employees, 2014 underground coal revenue was $189 million (3.1 million tons x $60.98 per ton). For mines with 1-500 employees, 2014 underground coal revenue was $14.6 billion (240.1 million tons x $60.98 per ton). Total 2014 underground coal revenue was $21.2 billion.

Screening Analysis for Underground Coal Mines

The estimated annualized cost of the proposed rule for underground coal mines with 1-19 employees is approximately $1.7 million, which represents approximately 0.9 percent of annual revenues.

When applying SBA's definition of a small mine, the estimated annualized cost of the proposed rule for underground coal mines with 1-500 employees is approximately $13.1 million, which represents approximately one tenth of one percent of annual revenues.

Table 6-1 below shows MSHA's annualized estimate of the cost of the proposed rule compared to mine revenue, by mine size. The Agency has provided a discussion of the costs of the proposed rule for each size category of mines in Chapter 3 of the Preliminary Regulatory Economic Analysis. MSHA estimates that some mines might experience costs somewhat higher than the average cost per mine in their size category while others might experience lower costs.

[19] Recent information from the Energy Information Agency (EIA) information such as their monthly updates and forecast updates, shows little forecasted overall change in prices for underground coal for several years, MSHA has used the latest EIA available annual price (2013) from their coal annual report to calculate revenues. U.S. Department of Energy. Energy Information Administration (EIA, 2015). Annual Coal Report 2013, January 2015, p. 47.

Table 6–1: Cost of Proposed Rule Compared to Mine Revenues
By Mine Size, for Underground Coal Mines

Mine Size (Employees)	No. of Mines	Annualized Cost of Proposed Rule (in Millions)	Annual Revenues (in Millions)	Annual Cost per Mine	Cost of Proposed Rule as Percent of Revenues
1-19	55	$1.7	$189	$30,523	0.89%
1-500	285	$13.1	$14,643	$45,914	0.09%
All Mines	300	$17.9	$21,246	$59,744	0.08%

Based on this analysis, MSHA has determined that the proposed rule would not have a significant economic impact on a substantial number of small underground coal mine operators with 500 or fewer employees.

7. PAPERWORK REDUCTION ACT OF 1995

Introduction

This section shows the estimated paperwork burden hours and related burden costs to underground coal mine operators, proximity detection system manufacturers, and mobile machine manufacturers under the proposed rule. The burden hour and cost estimates presented in this chapter use the detailed analysis of all costs over ten years presented in Chapter 3. This chapter provides only information collection costs for three years presented as average annual values. The cost items in this chapter are a subset of the total costs in Chapter 3, and only relate to information collection requirements.

Summary of Paperwork Burden Hours and Related Costs

Table 7-1 shows that, in the first three years the proposed rule is in effect, the mining community would incur 3,094 annual burden hours, burden-hour costs of approximately $313,354, and information collection costs of approximately $114,565. The section-by-section description of the information collection follows the table.

Table 7–1: Summary Crosswalk of Rule Provisions
PREA Cost Analysis and OMB Control Number Burdens

Collection Burden Requirements	OMB No.	Burden Hours	Burden Costs	Other Costs to Respondents
§ 75.1733(a)	1219-0066	792	$80,356	$114,565
§ 75.1733(d)(1)	1219-0148	2,293	$232,648	0
§ 75.1733(d)(2)	1219-0148	4	$204	0
§ 75.1733(d)(3)	1219-0148	5	$146	0
Total	-------------	3,094	$313,354	$114,565

Description of Paperwork Provisions

Proposed § 75.1733(a)

Proposed § 75.1733(a) would require underground coal mine operators to equip mobile machines with a proximity detection system. MSHA must approve the components of a proximity detection system as permissible equipment under existing regulations in 30 CFR part 18 or 36 for use in underground coal mines. Three manufacturers have developed four proximity detection systems that are approved for use with mobile machines. MSHA approval does not address the operational capabilities of the systems.

There are three methods to obtain MSHA approval to add the machine-mounted components of a proximity detection system to a mobile machine: (1) a mobile machine manufacturer can apply to the Approval and Certification Center (A&CC) for a Revised Approval Modification Program (RAMP) approval; (2) a mine operator can apply to the Approval and Certification Center (A&CC) for a Field Modification; or (3) a mine operator can submit to the MSHA district manager a District Field Change application.

MSHA offers an optional Proximity Detection Acceptance (PDA) program, which allows a proximity detection system manufacturer to obtain MSHA acceptance for the machine-mounted components of a proximity detection system (PDA Acceptance Number). This acceptance states that the machine-mounted components of the proximity detection system have been evaluated under 30 CFR part 18 and are suitable for installation on an MSHA-approved machine. It permits the mobile machine manufacturer or owner of a machine to add the machine-mounted components of a proximity detection system to a mobile machine by requesting MSHA approval to add the acceptance number to the machine approval.

PDA Program

For proximity detection system manufacturers applying for MSHA acceptance, MSHA estimates that it would take a supervisor, earning $101.46 an hour, 43 hours to draft an acceptance application to the A&CC. Burden hours and related burden costs are shown below.

Responses: Average total responses = 2 acceptance applications (2 applications in year one, 2 applications in year two, and 2 applications in year three)

Burden Hours: 2 applications x 43 hrs. to draft the application = 86 hrs.

Burden Costs: 86 hrs. x $101.46 wage rate = $8,726

RAMP

For mobile machine manufacturers submitting a revised approval modification request to add the proximity detection system to an electric mobile machine approval, MSHA estimates that it would take a supervisor, earning $101.46 per hour, an average of 20 hours to complete a RAMP request and submit it to the A&CC. MSHA's estimates of the burden hours and related burden costs to machine manufacturers are shown below.

Responses: Average total responses = 7 requests (7 requests in year one, 7 requests in year two, and 7 requests in year three)

Burden Hours: 7 requests x 20 hrs. to complete the request = 140 hrs.

Burden Costs: 140 hrs. x $101.46 wage rate = $14,204

For mobile machine manufacturers submitting a revised approval modification request to add the proximity detection system to a diesel mobile machine approval, MSHA estimates that it would take a supervisor, earning $101.46 per hour, an average of 120 hours to complete a RAMP request and submit it to the A&CC. MSHA's estimates of the burden hours and related burden costs to machine manufacturers are shown below.

Responses: Average total responses = 4 requests (4 requests in year one, 4 requests in year two, and 4 requests in year three)

Burden Hours: 4 requests x 120 hrs. to complete the request = 480 hrs.

Burden Costs: 480 hrs. x $101.46 wage rate = $48,701

District Field Change

Where mobile machines would not be equipped with a proximity detection system through a RAMP, MSHA anticipates that mine operators would apply for a District Field Change in order to equip electric mobile machines with proximity detection systems. MSHA anticipates that mine operators would choose to apply for a District Field Change because this is the more convenient and most cost effective of the two options. Mine operators would be required to notify MSHA's district office in writing when changes have been or would be made in accordance with 30 CFR part 18. A copy of all notifications must be maintained in the appropriate mine file.

MSHA estimates that it would take a supervisor, earning $101.46 per hour, 21 minutes to draft a letter informing MSHA's district office when a mine would be equipping a mobile machine with a proximity detection system, mail the letter to MSHA's district office, and file one copy.

Responses: Average total responses = 97 District Field Change requests (96 requests in year one, 97 requests in year two, and 97 requests in year three)

Burden Hours: 97 requests x 21 min. to draft the request = 34 hrs.

Burden Costs: 34 hrs. x $101.46 wage rate = $3,450

Field Modifications

Where mobile machines would not be equipped with a proximity detection system through a RAMP, MSHA anticipates that mine operators would apply for a Field Modification in order to equip diesel mobile machines with proximity detection systems. Mine operators would be required, in accordance with 30 CFR part 18, to seek written approval from the A&CC to equip diesel mobile machines with proximity detection systems. A copy of all notifications must be maintained in the appropriate mine file.

MSHA estimates that it would take a supervisor, earning $101.46 per hour, 141 minutes (2 hours and 21 minutes) to draft a letter seeking approval from the A&CC to equip a diesel mobile machine with a proximity detection system, mail the letter to the A&CC, file one copy, and accompany the inspector while the inspector verifies that the proximity detection system meets compliance.

Responses: Average total responses = 22 Field Modification requests (22 requests in year one, 22 requests in year two, and 22 requests in year three)

Burden Hours: 22 requests x 141 min. to draft the request = 52 hrs.

Burden Costs: 52 hrs. x $101.46 wage rate = $5,276

Other Costs to Respondents, Manufacturers

To determine costs under this section, MSHA estimated the number of hours it would take MSHA's A&CC to review the relevant documents. The calculation accounts for the number of documents, the number of hours to review each document, and the hourly rate charged by MSHA.

PDAs: (2 PDA application x 53 hrs. x $101.46) + (2 PDA application x $5 postage cost) = $10,765

RAMPs (Electric): (7 RAMP applications x 27 hrs. x $101.46) + (7 RAMP applications x $5 postage cost) = $19,211

RAMPs (Diesel): (4 RAMP applications x 32 hrs. x $101.46) + (4 RAMP applications x $5 postage cost) = $13,007

Field Modification requests: (22 Field Modification requests x 32 hrs. x $101.46) + (22 RAMP applications x $1.30 postage cost) = $71,457

Other Costs to Respondents, Mine Operators

Where mobile machines would not be equipped with a proximity detection system through a RAMP, MSHA anticipates that mine operators would submit District Field Change requests in order to equip electric mobile machines with a proximity detection system according to §75.1733. MSHA estimates it would cost $0.30 to print two copies of the request (one copy would be kept on file by the mine operator and the other copy would be submitted to MSHA) and $1.00 in postage costs to mail the request letter to MSHA's district or field office. MSHA's estimates of underground coal mine operators' costs are presented below.

Costs: 97 District Field Change requests x $1.30 = $126

Total Other Cost Burden: $114,565 ($10,765 + $19,211+ $13,007 + $71,457+ $126)

Proposed § 75.1733(d)(1)

Records, Machine-mounted Components

Proposed § 75.1733(d)(1) would require that at the completion of the system check required under proposed § 75.1733(c)(1), the certified person specified in existing § 75.100 must confirm that the check was done and then certify by initials, date, and time that the check has been conducted. MSHA estimates that it takes a certified person earning $101.46 per hour 10 seconds to certify by initials, date, and time that the check has been conducted. Proposed § 75.1733(d)(1) also requires that any defects found as a result of this check, including corrective actions and date of corrective action, must be recorded. MSHA estimates that once a year, a corrective action would be needed. Recording this corrective action would require an additional 2 minutes.

MSHA estimates the number of checks per machine per year is 200 checks at mines with 1-19 employees (200 workdays x 1 shift per workday), 600 checks at mines with 20-500 employees (300 workdays x 2 shifts per workday), and 1,050 checks at mines with 501+ employees (350 workdays x 3 shifts per workday).

MSHA's estimates of the annual burden hours and related burden costs to underground coal operators are based upon the average number of proximity detection system-equipped machines for the first three years. The estimates for the 1,269 total proximity detection system-equipped machines and corresponding burdens are:

108 proximity detection system-equipped machines (average first three years) at mines with 1-19 employees (36 machines in year one, 108 machines in year two, and 180 machines in year three)

956 proximity detection system-equipped machines (average first three years) at mines with 20-500 employees (319 machines in year one, 956 machines in year two, and 1,594 machines in year three)

205 proximity detection system-equipped machines (average first three years) at mines with 501+ employees (68 machines in year one, 205 machines in year two, and 342 machines in year three)

Responses: Total responses = 811,719
21,600 checks (108 proximity detection system-equipped machines x 200 checks)
573,600 checks (956 proximity detection system-equipped machines x 600 checks)
215,250 checks (205 proximity detection system-equipped machines x 1,050 checks)
1,269 corrective actions recorded (1,269 proximity detection system-equipped machines x 1 corrective action recorded/year)

Burden Hours: Total burden hours = 2,293 hrs.
810,450 checks x 10 secs. per check = 2,251 hrs.
1,269 corrective actions recorded x 2 min. per corrective action = 42 hrs.

Burden Costs: 2,293 hrs. x $101.46 hourly wage rate = $232,648

Proposed § 75.1733(d)(2)

Records, Miner-Wearable Components

Proposed § 75.1733(d)(2) would require a record of defects found as a result of the check of the miner-wearable component under proposed § 75.1733(c)(3). These defects, including corrective actions and date of corrective action, must be recorded. Recording this corrective action would require 2 minutes of a miner's or supervisor's time at a composite average wage rate of $51.06 an hour (see cost chapter). MSHA estimates that 1,249 miner-wearable components would routinely be in use and that 10 percent (125) of these components would require a corrective action each year.

MSHA's estimates of the annual burden hours and costs to underground coal mine operators are presented below.

Responses: 125 records of corrective actions (1,249 components x 10 percent)

Burden Hours: 125 corrective actions x 2 min. per corrective action = 4 hrs.

Burden Costs: 4 hrs. x $51.06 hourly wage rate = $204

Proposed § 75.1733(d)(3)

Record, Installation and Maintenance Training

Proposed § 75.1733(d)(3) would require that a record be kept of personnel trained in the installation and maintenance of proximity detection system machine-mounted components. MSHA anticipates that a clerical employee, earning $29.16 per hour, would spend 3 minutes creating a record of all personnel trained at each mine. MSHA's estimates of the burden hours and related burden costs to underground coal mine operators are presented below.

Responses: Average total responses = 100 records (100 mine records (100 mine records in year one, 100 mine records in year two, and 100 mine records in year three)

Burden Hours: Average total burden hours = 5 hrs. (100 mine records x 3 min. to make the record = 5 hrs.)

Burden Costs: 5 hrs. x $29.16 hourly wage rate = $146

Proposed § 75.1733(d)(4) and (5)

Proposed § 75.1733(d)(4), like proposed § 75.1733(d)(5), would require the mine operator to maintain records in a secure book or electronically in a secure computer system not susceptible to alteration. Proposed § 75.1733(d)(5), like proposed § 75.1733(d)(6), would require that the operator retain records for at least one year and make them available for inspection by authorized representatives of the Secretary and representatives of miners. These same requirements exist for other similar recordkeeping; therefore, MSHA estimates no additional burden or cost associated with these provisions.

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9. TECHNICAL APPENDIX

This technical appendix provides basic statistics, data, and charts showing the history of injuries and fatalities used for the benefit section as well as the future basic projection logic. This history reflects accident reports reviewed going back to 1984 as discussed in the preamble. MSHA used this data to project values for ten years using the econometric software package EViews and two exponential smoothing approaches. Both traditional smoothing (labeled “Simple” in Table A-1) and a newer method known as Error-Trend-Seasonal or Exponential Smoothing (ETS) were applied to the data. The EViews help system defines ETS as follows (definition edited for brevity):

> EViews 8 uses the dynamic nonlinear model framework of Hyndman, Koehler, et al. (2002). The ETS (Error-Trend-Seasonal or Exponential Smoothing) framework defines an extended class of exponential smoothing methods that encompasses standard ES models (e.g., Holt and Holt–Winters additive and multiplicative methods), but offer a variety of new methods.

MSHA used the default settings for traditional smoothing. ETS uses an iterative process to optimize an estimate. The EViews ETS smoothing settings were set to automatic except for a couple of the estimates that could not be solved with the auto settings. For these few instances, solutions were estimated with the trend set to additive and the Error set to Auto. In either case, the Akaike information criterion (AIC) was used for model selection. The AIC represents a comparable quality statistic and is used only for model selection. MSHA used the detailed equipment level information rather than aggregated data to estimate a bottom-up forecasting approach. When the aggregate data is used, the result is a top down method that dampens recent spikes in the data. The 2015 estimate for the two methods were averaged to produce the estimates used in Chapter 4, benefits. The 2015 value is used for year one and held constant for years 2-10. The estimates and averages are shown below in Table A-1. Screen shots of the two smoothing menus are shown in Figure A-1.

Table A- 1 Estimated and Average Avoided Fatalities and Injuries*

Fatalities

Equipment	Simple	ETS	Average
Coal Hauling Machines (RAM)	0.4	0.3	0.4
Scoops	0.3	0.3	0.3
Shuttle Cars	0.7	1.4	1.0
CHS	0.1	0.1	0.1
Total	1.5	2.2	1.8

Permanent Injuries

Equipment	Simple	ETS	Average
Coal Hauling Machines (RAM)	0.2	0.2	0.2
Scoops	0.4	0.2	0.3
Shuttle Cars	0.6	0.3	0.5
CHS	0.0	0.0	0.0
Total	1.2	0.8	1.0

Nonpermanent Injuries

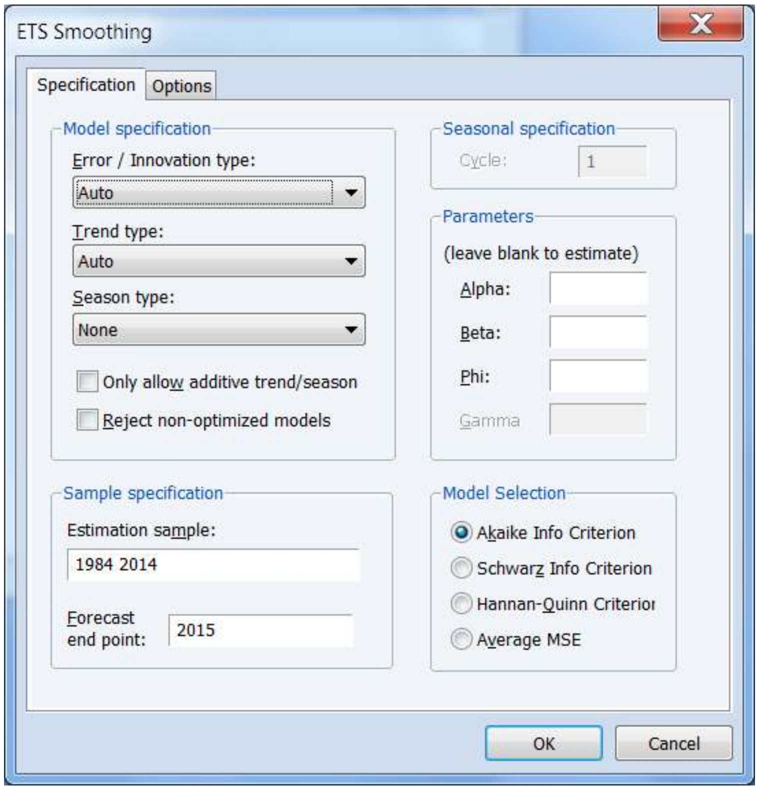
Equipment	Simple	ETS	Average
Coal Hauling Machines (RAM)	0.4	0.5	0.4
Scoops	3.2	3.1	3.1
Shuttle Cars	2.9	2.7	2.8
CHS	1.1	1.1	1.1
Total	7.6	7.3	7.5

Total Injuries

Equipment	Simple	ETS	Average
Coal Hauling Machines (RAM)	0.7	0.7	0.7
Scoops	3.6	3.3	3.4
Shuttle Cars	3.5	3.0	3.3
CHS	1.1	1.1	1.1
Total	8.8	8.1	8.5

*Rounding affects displayed average value.

Figure A 1 EViews Smoothing Criteria (EViews Screen Shots)



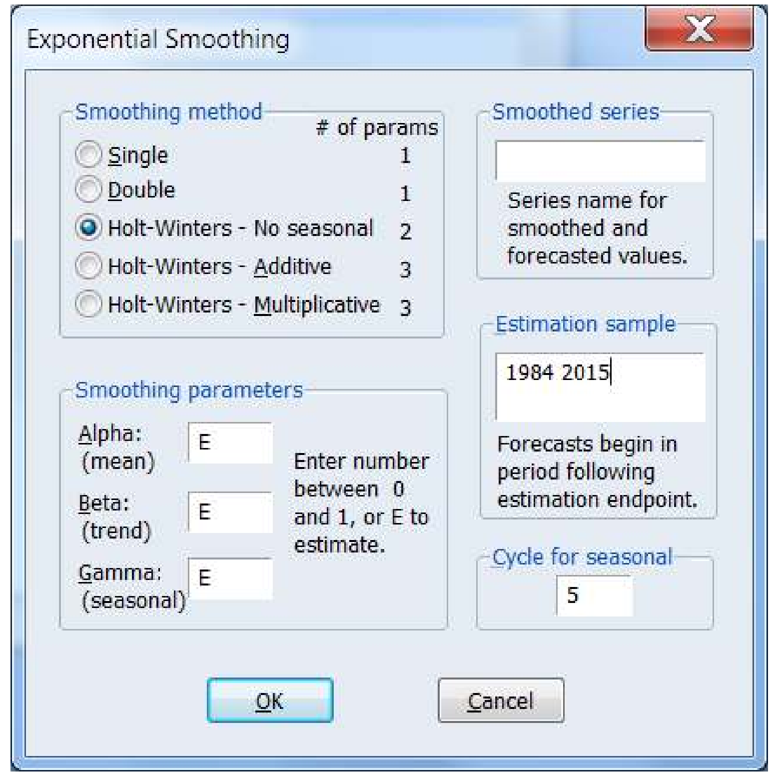


Table A- 2 Statistics Tables Label Key for Following Tables and Figures

Label	
INJ_NONPERM	Total Non-Permanent Injuries
INJ_PERM	Total Permanent Injuries
FATAL	Total Fatalities
NONPERMRAM	Non-Permanent Injuries, Equipment = Ram Cars
NONPERMCHS	Non-Permanent Injuries, Equipment = Coal Haulage System
NONPERMSHTL	Non-Permanent Injuries, Equipment =Shuttle
NONPERMSCOOP	Non-Permanent Injuries, Equipment =Scoops
PERMRAM	Permanent Injuries, Equipment = Ram Cars
PERMCHS	Permanent Injuries, Equipment = Coal Haulage System
PERMSHTL	Permanent Injuries, Equipment = Shuttle
PERMSCOOP	Permanent Injuries, Equipment = Scoops
FATALRAM	Fatalities, Equipment = Ram Cars
FATALCHS	Fatalities, Equipment = Coal Haulage System
FATALSHTL	Fatalities, Equipment = Shuttle
FATALSCOOP	Fatalities, Equipment = Scoops

Table A- 3 Summary Statistics (31 Years) for Fatalities and Injuries by Totals, Permanent or Non-Permanent Injury, and Equipment Type

All Years Examined (1984 – 2014)	N of Cases	Minimum	Maximum	Range	Sum	Median	Arithmetic Mean	Standard Deviation	Variance	Skewness (G1)
INJ_NONPERM	31	1	15	14	160	5	5.161	2.968	8.806	1.346
INJ_PERM	31	0	3	3	19	0	0.613	0.761	0.578	1.292
FATAL	31	0	4	4	42	1	1.355	1.253	1.57	0.788
NONPERMRAM	31	0	3	3	14	0	0.452	0.768	0.589	1.827
NONPERMCHS	31	0	2	2	14	0	0.452	0.624	0.389	1.075
NONPERMSHTL	31	0	8	8	83	2	2.677	2.023	4.092	0.886
NONPERMSCOOP	31	0	5	5	49	1	1.581	1.501	2.252	1.163
PERMRAM	31	0	1	1	2	0	0.065	0.25	0.062	3.728
PERMCHS	31	0	1	1	1	0	0.032	0.18	0.032	5.568
PERMSHTL	31	0	2	2	9	0	0.29	0.529	0.28	1.672
PERMSCOOP	31	0	1	1	7	0	0.226	0.425	0.181	1.379
FATALRAM	31	0	1	1	4	0	0.129	0.341	0.116	2.327
FATALCHS	31	0	1	1	4	0	0.129	0.341	0.116	2.327
FATALSHTL	31	0	3	3	24	1	0.774	0.956	0.914	1.221
FATALSCOOP	31	0	1	1	10	0	0.323	0.475	0.226	0.798

Table A- 4 Summary Statistics (10 Years) for Fatalities and Injuries by Totals, Permanent or Non-Permanent Injury, and Equipment Type

Latest 10 Years (2005 – 2014)	N of Cases	Minimum	Maximum	Range	Sum	Median	Arithmetic Mean	Standard Deviation	Variance	Skewness (G1)
INJ_NONPERM	10	1	15	14	51	4	5.1	3.814	14.544	2.218
INJ_PERM	10	0	3	3	9	1	0.9	0.876	0.767	1.465
FATAL	10	0	4	4	15	1	1.5	1.269	1.611	0.815
NONPERMRAM	10	0	2	2	3	0	0.3	0.675	0.456	2.277
NONPERMCHS	10	0	2	2	6	0.5	0.6	0.699	0.489	0.78
NONPERMSHTL	10	0	7	7	21	1.5	2.1	2.079	4.322	1.504
NONPERMSCOOP	10	0	5	5	21	1.5	2.1	1.663	2.767	0.71
PERMRAM	10	0	1	1	2	0	0.2	0.422	0.178	1.779
PERMCHS	10	0	0	0	0	0	0	0	0	.
PERMSHTL	10	0	2	2	4	0	0.4	0.699	0.489	1.658
PERMSCOOP	10	0	1	1	3	0	0.3	0.483	0.233	1.035
FATALRAM	10	0	1	1	3	0	0.3	0.483	0.233	1.035
FATALCHS	10	0	1	1	2	0	0.2	0.422	0.178	1.779
FATALSHTL	10	0	3	3	8	1	0.8	0.919	0.844	1.546
FATALSCOOP	10	0	1	1	2	0	0.2	0.422	0.178	1.779

Figure A- 2 Total Non-Permanent Injuries by Equipment Type

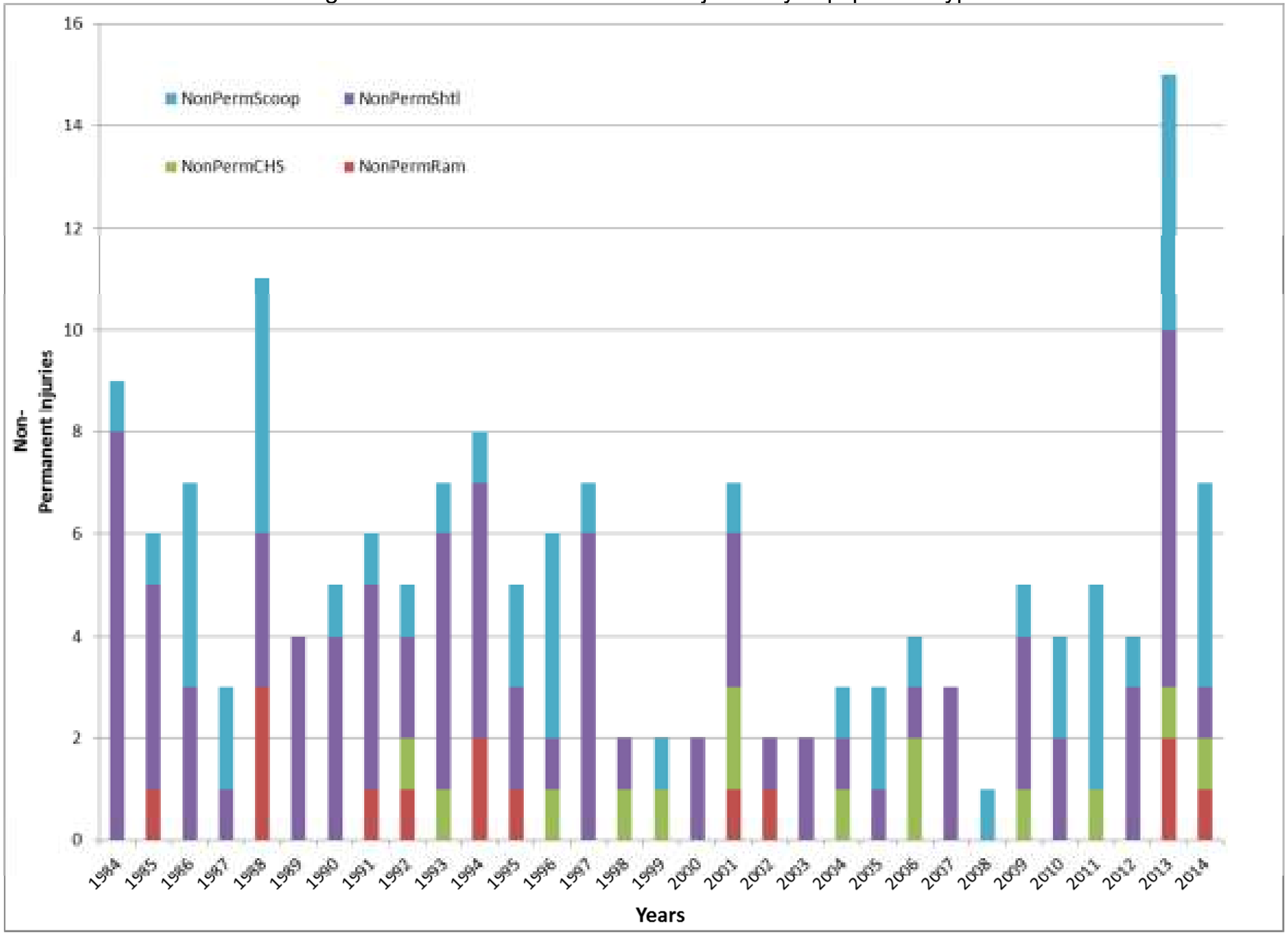


Table A- 5 Non-Permanent Injury by Equipment Type, Year Detail

Year	Inj_NonPerm		NonPermRam	NonPermCHS	NonPermShtl	NonPermScoop
1984	9		0	0	8	1
1985	6		1	0	4	1
1986	7		0	0	3	4
1987	3		0	0	1	2
1988	11		3	0	3	5
1989	4		0	0	4	0
1990	5		0	0	4	1
1991	6		1	0	4	1
1992	5		1	1	2	1
1993	7		0	1	5	1
1994	8		2	0	5	1
1995	5		1	0	2	2
1996	6		0	1	1	4
1997	7		0	0	6	1
1998	2		0	1	1	0
1999	2		0	1	0	1
2000	2		0	0	2	0
2001	7		1	2	3	1
2002	2		1	0	1	0
2003	2		0	0	2	0
2004	3		0	1	1	1
2005	3		0	0	1	2
2006	4		0	2	1	1
2007	3		0	0	3	0
2008	1		0	0	0	1
2009	5		0	1	3	1
2010	4		0	0	2	2
2011	5		0	1	0	4
2012	4		0	0	3	1
2013	15		2	1	7	5
2014	7		1	1	1	4

Figure A- 3 Total Permanent Injuries by Equipment Type

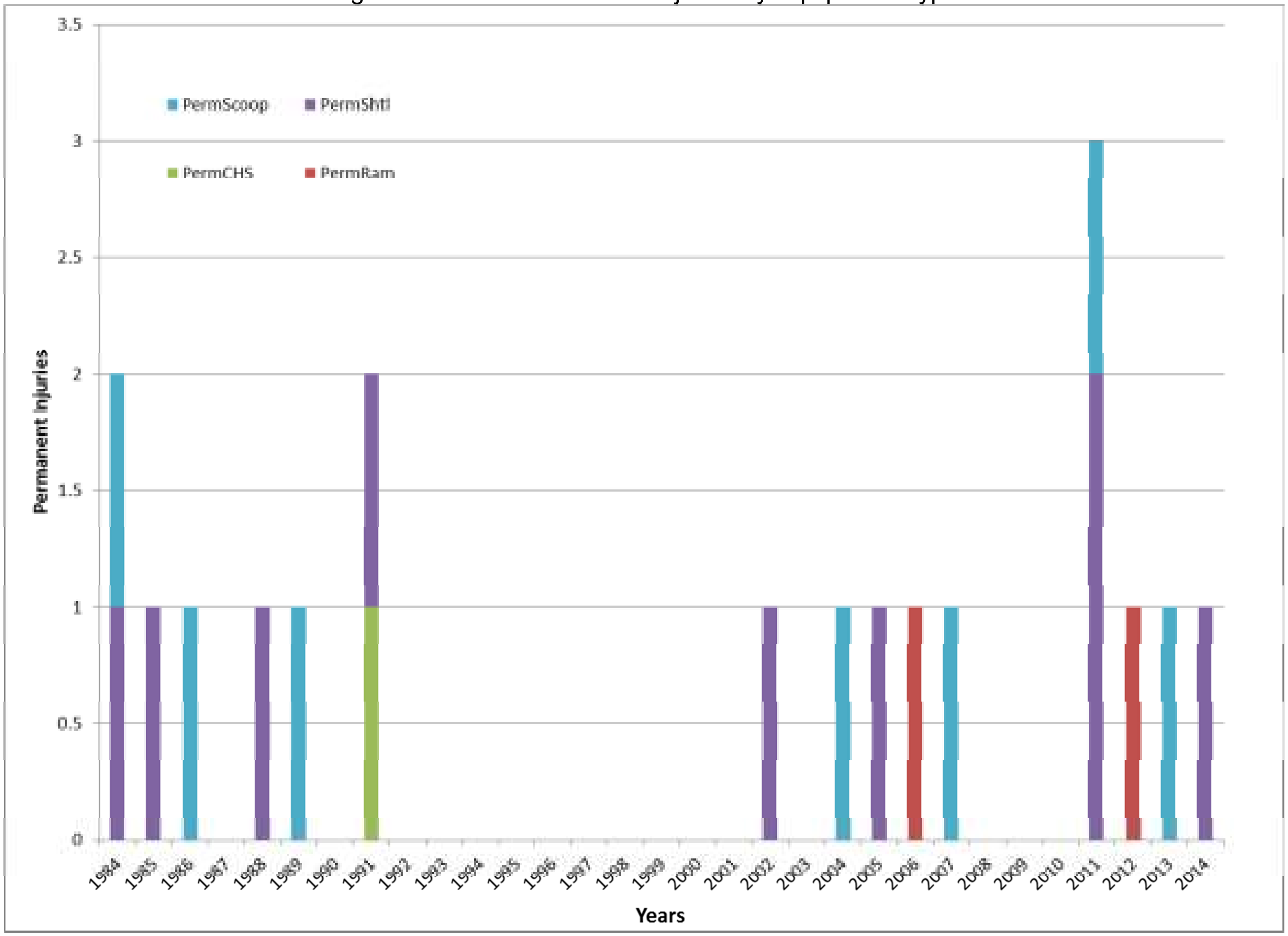


Table A- 6 Permanent Injury by Equipment Type, Year Detail

Year	Inj_Perm		PermRam	PermCHS	PermShtl	PermScoop
1984	2		0	0	1	1
1985	1		0	0	1	0
1986	1		0	0	0	1
1987	0		0	0	0	0
1988	1		0	0	1	0
1989	1		0	0	0	1
1990	0		0	0	0	0
1991	2		0	1	1	0
1992	0		0	0	0	0
1993	0		0	0	0	0
1994	0		0	0	0	0
1995	0		0	0	0	0
1996	0		0	0	0	0
1997	0		0	0	0	0
1998	0		0	0	0	0
1999	0		0	0	0	0
2000	0		0	0	0	0
2001	0		0	0	0	0
2002	1		0	0	1	0
2003	0		0	0	0	0
2004	1		0	0	0	1
2005	1		0	0	1	0
2006	1		1	0	0	0
2007	1		0	0	0	1
2008	0		0	0	0	0
2009	0		0	0	0	0
2010	0		0	0	0	0
2011	3		0	0	2	1
2012	1		1	0	0	0
2013	1		0	0	0	1
2014	1		0	0	1	0

Figure A-4 Total Fatalities by Equipment Type

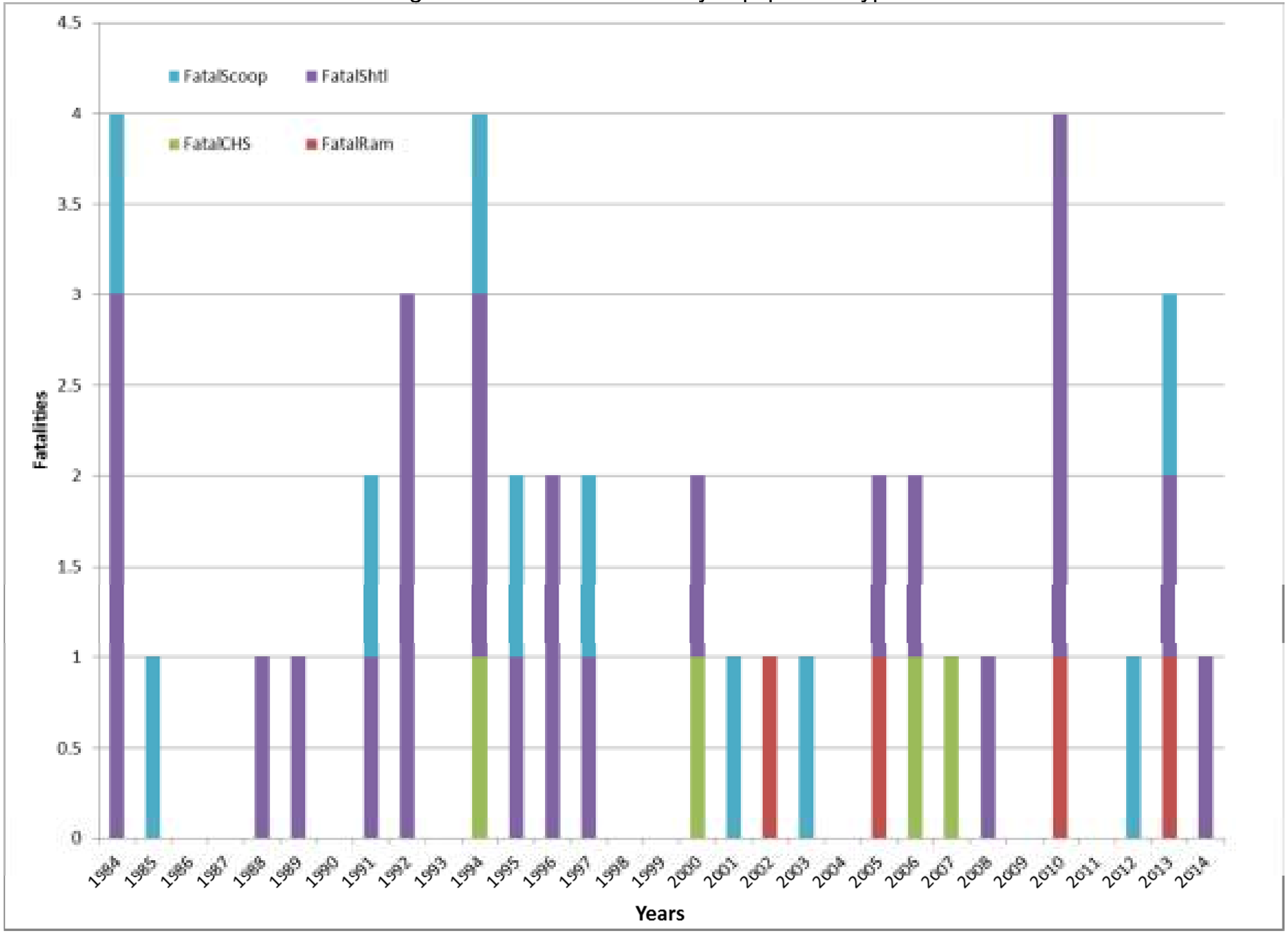


Table A- 7 Fatalities by Equipment Type, Year Detail

Year	Fatal		FatalRam	FatalCHS	FatalShtl	FatalScoop
1984	4		0	0	3	1
1985	1		0	0	0	1
1986	0		0	0	0	0
1987	0		0	0	0	0
1988	1		0	0	1	0
1989	1		0	0	1	0
1990	0		0	0	0	0
1991	2		0	0	1	1
1992	3		0	0	3	0
1993	0		0	0	0	0
1994	4		0	1	2	1
1995	2		0	0	1	1
1996	2		0	0	2	0
1997	2		0	0	1	1
1998	0		0	0	0	0
1999	0		0	0	0	0
2000	2		0	1	1	0
2001	1		0	0	0	1
2002	1		1	0	0	0
2003	1		0	0	0	1
2004	0		0	0	0	0
2005	2		1	0	1	0
2006	2		0	1	1	0
2007	1		0	1	0	0
2008	1		0	0	1	0
2009	0		0	0	0	0
2010	4		1	0	3	0
2011	0		0	0	0	0
2012	1		0	0	0	1
2013	3		1	0	1	1
2014	1		0	0	1	0