NIOSH RECOMMENDATIONS
for
REVISION OF HAZARDOUS ORDERS

Non-Agriculture Hazardous Order No. 9
Occupations in Connection with Mining, Other Than Coal

Cost Benefit Analysis
by
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1.   INTRODUCTION

The NIOSH report [NIOSH, 2002] recommendation is to expand the current Hazardous Order (HO) regarding mining in occupations other than coal (OTC)

No.	Recommendation	Rationale
1	Expand the HO to include all work performed in connection with petroleum and natural gas extraction.	"Workers throughout the mining industry continue to suffer high numbers and rates of occupational fatalities and injuries, including the oil and gas extraction industry, which is currently excluded from HO 9."
2	Remove the exemption permitting youths to perform work involving repair and maintenance of roads and working on track crews.	"Removal of these exemptions is consistent with recommendations for new Hazardous Orders addressing construction work and railroad work appearing later" in the NIOSH report.

Currently, HO 9—Mining Other Than Coal prohibits all occupations involving underground work in mines or quarries as well as surface occupations at underground mines. The repair and maintenance of roads is permitted; however, if such work is performed underground or in an open pit or quarry, it is prohibited under the current HO. In addition, work on track crews is permitted under the current HO only in an area of an opencut metal mine and if mining activities are not being conducted when the track crew is working. Track crews are also excluded from the HO if they work at least three miles from an open quarry.

The objective of the cost benefit analysis, therefore, is to more thoroughly analyze the NIOSH recommendation to update the current HO regarding youths employed in mining occupations, including the rationale behind the recommendation, to estimate likely costs and benefits associated with implementation, and to evaluate the impact of implementation among the various stakeholders. Finally, this analysis is intended to be a non-budgetary tool and is based on certain assumptions and predictions of costs over time. As a result, dollar estimates are subject to change given changes in both the underlying assumptions and costs and benefit estimates.

2.   ASSUMPTIONS AND LIMITATIONS

The following are the general assumptions and constraints that were made for the overall analysis.

1. Data regarding the number of youths employed is derived based on assumed occupational categories, the nature of part-time work within the industry, and the total number of youths age 16-19 employed in 2003 within the mining industry.

2. The scope of this CBA encompasses only the portion of the mining industry operating domestically, both onshore and offshore. International petroleum and natural gas mining efforts fall outside of the jurisdiction of both state and federal governmental authority.

3. Because of limitations of data concerning the number of youths employed within the mining industry, estimates are derived using current data from the Current Population Survey (CPS) as well as occupational classifications and number of workers data collected by the Bureau of Labor Statistics (BLS).

4. Industry will fully implement and comply with the HO, if adopted.

5. The count for injuries and illnesses are separate and mutually exclusive, with each based on a separate incident.

6. Adoption of the HO will have a direct impact on the number of deaths, injuries, and illnesses and will reduce the rate to zero for the age group under consideration.

7. Costs associated with implementation by the industry will be passed along in the form of higher prices to consumers. There will not be an adverse effect on the size of the industry due to adoption of the HO.

8. State adoption of the HO will occur via an expedited rule adoption process and will not include a lengthy analysis and comment period.

9. Multiplier effects to the economy are not included in the analyses. For example, any increase in prices as a result of industry implementation of the HO will be offset by a decrease in workers' compensation premiums via taxes collected by a state to fund the workers' compensation program.

10. The analysis is limited to the impact to the industry as a whole and does not measure the economic impact to any particular region.

11. Any implementation costs associated with translation of the HO into multilingual formats are considered to be sunk costs and not considered. This assumption is based on Executive Order 13166, which established mandatory accessibility to government services for individuals with limited English proficient.

3.   METHODOLOGY

The following overall approach was used in conducting the cost benefit analysis for this HO:

A.   The literature was reviewed and facts and information collected to study the overall mining industry, employment trends, safety and health issues, and economic factors.

B.   Facts and information were collected and analyzed with regard to fatalities, injuries, and illnesses in the mining industry, including petroleum and natural gas extraction.

C.   Other factors regarding implementation of the HO were examined, including those associated with the feasibility of implementing the HO, the impact to small and family-owned businesses, and the possible cause-and-effect relationships.

D.   Quantitative costs and benefits were developed based on the Office of Management and Budget (OMB) guidelines, and in particular, Circular A-4 guidelines. Methodology specific to the quantitative assessment is described further in Section 9.1.1.

E.   Qualitative costs and benefits (those costs and benefits that are non-quantifiable and/or immeasurable within the scope of this analysis) were determined based on the literature review and information gathering process.

F.   The relevant stakeholders for the analysis were considered to be the individuals (youth workforce), industry, and government (federal and state). The analysis focused on costs and benefits to each of these stakeholders independently.

G.   Sensitivity analyses were conducted on those assumptions and variables considered to be the most uncertain to determine the impact of the changes on the overall quantitative results.

4.   LITERATURE REVIEW

4.1   Review of Injuries, Illnesses, and Fatalities

Following are statistics regarding occupational injuries, illnesses, and fatalities regarding ionizing radiation exposure and form the basis for estimating the costs and benefits of HO implementation:

- In general, mining has the highest fatality rate of any industry, with 23.5 deaths per 100,000 workers in 2002 and 121 total fatalities across all sectors of the industry. Illness rates in the mining industry for the same year were 17.7 (per 10,000 workers) for mining in general; 10.5 in the oil and gas extraction sector; 32.8 in the metal mining sector; and 11.9 in the nonmetallic minerals, except fuels, sector.   [BLS, 2002]

- According to the International Association of Drilling Contractors (IADC), in 2003, the U.S. had both the highest accident incidence and frequency rate of all other geographical regions. The incident rate for the one-year period was 1.15 per 200,000 manhours, and the frequency rate was 5.74 per 1,000,000 manhours. [IADC, 2004]

- The Census of Fatal Occupational Injuries (CFOI) database revealed no youth fatalities in the oil and gas extraction industry for the 10-year period 1992-2001. [CFOI, 1992-2001] In addition, a review of the BLS Fatal Occupational Injuries database yielded no results for fatalities related to the source of mining, oil and gas.   [BLS, 1992-2001]

- Over the eight-year period 1994-2001, there were an average of 15,800 injuries within the oil and gas extraction industry, 2,700 injuries within the crude petroleum and natural gas industry, and 13,000 injuries within the oil and gas field services industry for all age groups.

- For the period 1992-2001, there were 15 recorded injuries involving days away from work (DAFW) in youths age 17 and under within the industry "Oil and Gas Extraction." All 15 of the injuries occurred over a one-year period (1994) with a median DAFW of 4 days. [BLS, 1992-2001]

- Of the 15 injuries occurring in 1994, 9 resulted in 3-5 DAFW while the remaining 7 resulted in 31 or more DAFW.

- In 2002, there were 91 injuries and illnesses with DAFW within the oil and gas field services industry for the age group 16-19 years. Within the same age group, there were 44 injuries and illnesses with DAFW in the non-metallic minerals, except fuels, industry.

- The 2002 injury and illness rate in the oil and gas extraction industry was 3.4 per 100 full-time workers. The rate in the oil and gas field services segment was 4.5 per 100 full-time workers. [BLS, 2004]

- Injuries within mining occupations varied from strains, sprains, puncture, lacerations, and bruises to fractures, amputations, and multiple traumatic injuries. [BLS, 2004]

- During the first four months of 2004, eight fatalities were recorded by the Mine Safety and Health Administration (MSHA) within the metal/non-metals mining sector. Ages ranged from 24 to 74, with a mean age of 47.25. None of the fatalities occurred on track crews or road maintenance crews.

- For the period July 1, 1995 to May, 2004, there were 75 accidents listed under SIC 1389—Support Activities for Oil and Gas Operations, 51 of which involved fatalities. During the same period, there were 4 reported accidents, all of which involved fatalities, under SIC 1321—Natural Gas Liquid Extraction, and 19 reported accidents, 10 involving fatalities, under SIC 1311—Crude Petroleum and Natural Gas Extraction. [OSHA, 2004]

- A review of the NIOSH Fatality Assessment and Control Evaluation (FACE) database reviewed only one fatality involving a youth in which the youth was working as part of a railroad dismantling crew (Minnesota FACE 98MN044). There was no indication, however, that the youth was performing the work in connection with any type of mining operation. [NIOSH, 2004]

4.2   Petroleum and Natural Gas Extraction Industry

Within the general mining industry, petroleum and natural gas extraction accounts for the most significant contribution to real Gross Domestic Product (GDP), with an annual 2001 contribution of $72.9 billion (chained 1996 dollars), or 68 percent of total GDP within the mining industry. [DOC, BEA, 2004] Oil and gas extraction is heavily contingent upon prices and is often categorized as a "boom or bust" industry. Although once categorized by a few key industry players, technological advances over the past decades have increased the playing field for smaller companies domestically as well as made ventures into international areas easier and more profitable for the larger companies such as Exxon Mobil Corporation, BP p.l.c., Royal

Dutch Shell and Chevron Texaco. [Gale Group, 2004] As shown in Table 1, the majority of the industry's domestic operations, and domestic workforce, is located primarily in the states of California, Texas, Louisiana, Oklahoma, Colorado, and New Mexico. In addition, environmental and regulatory constraints remain important concerns across the industry, both domestically as well as abroad.

TABLE 1

U.S. PETROLEUM AND GAS EXTRACTION RIGS (2001-2003)

State	Year		
	2001	2002	2003
Alabama			
Land	2	1	2
Offshore	4	2	1
Alaska			
Land	12	10	9
Offshore	2	2	1
Arkansas	2	1	2
California			
Land	33	20	18
Offshore	4	3	3
Colorado	32	28	39
Florida	0	0	1
Iowa	0	1	1
Kansas	23	8	9
Kentucky	6	5	4
Louisiana			
Land	74	55	59
Offshore	119	92	85
International Water	21	16	14
Michigan	1	1	3
Mississippi	14	8	8
Montana	10	8	14
Nevada	0	0	1
New Mexico	68	42	65
New York	5	4	3
North Dakota	14	10	14
Ohio	10	9	8
Oklahoma	130	91	129
Pennsylvania	11	11	10
South Dakota	1	0	0
Tennessee	1	0	0
Texas			
Land	436	321	428
Offshore	25	15	18
International Water	1	2	3
Utah	21	13	14
Virginia	2	2	1
Washington	1	0	0
W. Virginia	18	13	16
Wyoming	55	40	54
TOTAL U.S.:	1,156	830	1,032

According to the International Association of Drilling Contractors (IADC), for the week ending 14 May 2004, there were 1,162 active rotary rigs in the United States, compared to 1,153 the prior week, 1,150 the prior month, and 1,040 the prior year.
Source: Baker Hughes Rig Count, Annual Averages – By State, found at: http://www.bakerhughes.com/investor/rig/rig_na.htm

In general, the workforce within the oil and gas extraction industry is typically older; approximately 55 percent of workers were between 35 and 54 years of age in 2001. [ILO, 2002] In addition, because exploration is vital to ensure profitability, the industry can be categorized as much more mobile than traditional strip mining operations. As a result, workers often are required to work away from home for long periods; while operations and maintenance workers may work at one field location for an extended period, exploration and drilling personnel often move from field to field. Particularly in offshore operations, average workdays are typically long (12-hour shifts), although workers usually work fewer days. Consequently, only about 1 in 12 employees work fewer than 35 hours per week; the average non-supervisory weekly work hours in 2002 were 39.5 hours. [BLS, 2004] Although most professional workers are not unionized, some of the other occupations associated with petroleum and natural gas extraction are more often represented by unions. Total overall unionization, however, totaled about 2 percent across the industry in 2002. [BLS, 2004]

Because of the highly technical and intrinsically dangerous nature of the type of work within the industry, workforce stability is especially important. Although "boom" periods often increase hiring of lesser skilled workers, median tenure in 1991 was 6.3 years. [BLS Report on the American Workforce, 1995] Of note is a growing trend within the industry to use contract personnel to supplement the workforce. Field services (NAICS Code 213112/SIC Code 1389) is a sub-industries that relies on a more diverse workforce than what typically has been the norm within the industry. In terms of employment growth, the industry is one of the fastest declining occupational groups across the U.S., with an expected industry-wide decline of 27.8 percent expected through 2012. Decreases in employment are primarily due to technological gains that boost productivity, international competition, and regulatory restrictions. [BLS, 2004] Table 2 below depicts employment projections for certain occupations requiring lesser levels of skill and experience that younger workers are more likely to fill.

TABLE 2

ANNUAL AVERAGE GROWTH IN EMPLOYMENT –PETROLEUM AND NATURAL GAS EXTRACTION AND RELATED OCCUPATIONS

Specialty	Employment		% Change
	2000	*2010*	
Rail track laying and maintenance equipment operators	11,800	8,700	-27%
Derrick operators, oil and gas	16,100	16,100	0%
Rotary drill operators, oil and gas	18,100	16,600	-8%
Service unit operators, oil, gas, and mining	11,000	10,800	-1%

Specialty	Employment		% Change
	2000	*2010*	
Roustabouts, oil and gas	41,300	39,600	-4%
Helpers, extraction workers	37,000	37,900	2%

Source: America's Career InfoNet

5. DATA ANALYSIS AND INTERPRETATION

The NIOSH recommendation seeks to expand coverage to the petroleum and natural gas extraction industry, which is the fastest growing of all of the mining specialties. In reviewing the data regarding fatalities, injuries, and illnesses, however, it is not clear that a substantial number of injuries and illnesses occur, and in addition, there are no reports of youth fatalities over the past decade within this particular industry. In addition, due to the nature of the work, it appears that very few minors are employed in the industry.

The NIOSH recommendation further seeks to expand coverage to prohibit all work in connection with both track crews and road maintenance to maintain consistency across other areas of their report. In terms of supportability of this recommendation, no specific data regarding youth fatalities and injuries/illnesses involved in these activities were found to support removal of these exemptions. Nonetheless, based on the presentation of the data, it may be feasible to presume that fatalities and injuries for this age group exist but are included within the construction industry statistics.

In terms of the number of establishments that would be impacted by this HO, Appendix 2 lists the NAICS codes, establishment size, and number of employees as compiled in the Bureau of the Census (BOC) 2001 County Business Patterns. The majority of establishments employ between 1 and 19 employees.

5.1 Youth Occupations in the Mining Industry

According to the Current Population Survey, in 2003 there were approximately 4,000 workers aged 16-19 within the oil and gas extraction sector, 3,000 employed within the nonmetallic mineral mining and quarrying sector, and an additional 4,000 employed in "support activities for mining." [CPS, 2003] The median age for workers within these three divisions were 43.4, 41.3, and 40.5, respectively. Further, in reviewing the 2003 Industry-Specific Occupational Employment and Wage Estimates Standard Occupational Classification (SOC) codes for the petroleum and natural gas extraction industry, it is assumed that young workers would be employed in one of the specialties listed in Table 3 above. In comparing the proportion of overall workers to those occupations assumed to be filled by younger workers, and based on a range of 25 to 40 percent of the total 11,000 workers aged 16-19 within the industry, Table 3 shows the employment estimates by occupational categories for the target population of this analysis.

TABLE 3

ESTIMATE OF YOUTHS EMPLOYED BY OCCUPATION

Specialty	%	Number of Youths	
		Low Estimate	*High Estimate*
Rail track laying and maintenance equipment operators	9.44%	260	519
Derrick operators, oil and gas	12.76%	351	702
Rotary drill operators, oil and gas	11.85%	326	652
Service unit operators, oil, gas, and mining	11.13%	306	612
Roustabouts, oil and gas	28.88%	794	1,589
Helpers, extraction workers	25.93%	713	1,426
Total Estimate < 18 years of age	100%	2,750	5,500

6.   STATE LABOR LAWS

An analysis of state child labor laws reveals that the majority of states either generally adopt federal regulations or have more specific laws, defined by age groups (under age 18, under age 16) with regard to occupations involving mining. Fourteen states defer to federal child labor regulations with regard to hazardous occupations. Six states have no mining-specific laws enacted. In addition, three states, namely Massachusetts, Nevada, and Pennsylvania, specifically prohibit minors from working in activities involving track repair. Appendix 6 provides a more detailed accounting of the individual state and their laws with regard to mining. Based on the analysis, it can be generally assumed that current state laws are less stringent that the proposed HO and therefore would require some implementation effort and costs. Since federal and state government child labor laws are independent of one another, changes at the federal level will have some impact on the state laws regardless of current stringency.

7.   IMPACT ON SMALL AND FAMILY-OWNED BUSINESSES

By scope, HOs are not applicable to businesses with annual sales of less than $500,000, unless they are engaging in interstate commerce. Although almost 90 percent of all establishments fall under the small business category in terms of employee size, average revenue in the industry is higher than in most other industries. In addition, the nature of the mining industry inherently meets the federal definition of interstate trade; therefore, any changes in federal regulations would almost certainly affect the majority establishments through the industry.

As reflected in Appendix 2, Oil & Gas Mining Industry by Establishment Size, the majority of petroleum and natural gas extraction establishments are small in terms of employee size, with an average of 88 percent of all establishments employing between 1 and 19 employees. In terms of sales, however, while no establishments are reflected to gross annual revenue of less than $500,000 under SIC 1311—Crude petroleum and natural gas extraction, there is only a small percentage of establishments (8.9 percent) under SIC code 1321—Natural gas liquid extraction, that fall below that threshold. On the other hand, roughly 57.8 percent of establishments under

SIC 1389—Support activities for oil and gas operations, report annual revenues of approximately $300,000.   (See Appendix 1--Definitions)

8.   FEASIBILITY OF IMPLEMENTATION

In reviewing the size, scope, and limited geographical dispersion of the mining industry, particularly with regard to the petroleum and natural gas extraction sector, the relatively few youth workers estimated to be employed, and the overall decline in the general domestic workforce, it is predicted that implementation of the NIOSH recommendations to this hazardous order should not be particularly cumbersome. In addition, because a majority of U.S. states currently prohibit minors from working in any occupation connected with mining, implementation of the recommendations should result in minimal impact across both industry as well as governmental regulatory agencies.

9.   EVALUATION OF COSTS AND BENEFITS

9.1   Quantitative

The objective of the quantitative analysis is to distinguish between two alternatives, maintaining the "status quo" (not implementing the HO as defined by the NIOSH recommendation) or full implementation of the HO, by systematically identifying the various costs and benefits associated with each alternative and assigning a derived monetized value to compare the net effect. As an end result, both the Net Present Value (NPV) and Benefit to Cost Ratio (BCR) are used as comparison ratios to economically value the alternatives in terms of highest benefit and lowest cost. The NPV ratio shows the discounted effect of the monetized costs and benefits, which include injury, illness, and fatality reduction, promulgation and implementation costs to industry and government, and post-implementation enforcement costs. The BCR ratio reflects the total discounted benefits of implementing the HO divided by the total discounted costs, which are primarily the costs associated with promulgation, implementation, and post-implementation. More specific methodology is discussed below.

9.1.1   Methodology

In conducting the quantitative analysis, the following methodology was used to formulate the various costs and benefits associated with each alternative.

1. Costs and benefits are examined over a 10-year planning horizon.

2. In order to reflect benefits and costs equally, both are presented in constant Fiscal Year (FY) 04 dollars. All prior year, current, and any future costs reflect the level of prices of base year 2004, which has the equivalent effect of inflation removed.

3. Both a 3 percent and a 7 percent discount rate are used. The 3 percent rate is the "social rate of discount," which attempts to compensate for the social implication of the analysis, while the 7 percent rate is the discount rate as prescribed under OMB guidance.

4. Any adjustments for inflation are made using the GDP Deflator index and are converted to FY04 dollars.

5. The incremental approach examines the net effect of implementing the HO versus not implementing the HO. The full value approach provides the full Net Present Value (NPV) for both alternatives equally.

6. Non-fatal injuries and illnesses are valued using a cost-of-illness approach. Estimates for industry costs are derived from the OSHA "Safety Pays!" database using an average cost of injuries/illnesses for the categories *Sprains, Strains, Fractures, Contusions, Lacerations, Burns, Punctures, Poisons – Chemicals, Amputations, Concussions*, and *Injuries, Not Specified* for FY04 and are based on an injury and illness rate of 2.14 per year. Estimates for individual costs are calculated based on average annual number of injuries and illnesses multiplied by a cost of injury Willingness to Pay (WTP) figure of $50,000.

7. Fatalities are estimated using a value of $5 million per life and assuming an average of 0 fatalities annually for youths under age 18 for the baseline analysis.

8. Costs to industry are costs associated with implementing the order based on internal efficiency workplace regulatory costs in "other" firms (category includes mining and include workforce education, worker replacement costs, and any wage differential costs. The costs do not include transfer costs, which have an overall effect on the economy and measure price increases but are outside the scope of this analysis [Crain, WM, Hopkins, TD.]

9. Costs to government include cost to implement the order as well as surveillance costs attributed to enforcing the order. Federal enforcement costs are derived using historical data on past child labor investigations, including number of investigations conducted, average time spent on investigations, total man-hours expended, and average investigator wages. Average penalties are not calculated as they are assumed to be wash costs for this analysis (cost to industry/benefit to government).

9.1.2   Assumptions and Constraints (Specific to the Quantitative Analysis)

In addition to the general assumptions and constraints described in Section 2 above, the following are more specific assumptions that relate specifically to the quantitative analysis.

1. Implementation of the HO, if adopted, will not occur until FY05. Year 0 (FY04) includes some costs attributed to government implementation; however, the full effects, including benefits, of implementation do not occur until FY05.

2. It is assumed that the injury, illness, and fatality rate will continue indefinitely without implementation of the HO.

3. With regard to government enforcement costs, it is assumed some proportion of youths

who are injured on the job sustain a disabling injury such that they then become qualified for federal government benefits. Further, even at a fixed injury/illness rate of 2.14 per year under the "without implementation" approach, the cost burden increases by some annual level to account for the continued, long-term nature of the disability.

9.1.3 Results

The overall NPV of the "With Implementation" approach is $2,543 million (3 percent discount rate) and $2,361 million (7 percent discount rate), while the overall NPV of the "Without Implementation" approach is $1,369 million (3 percent discount rate) and $1,151 million (7 percent discount rate. Table 3 presents the incremental approach, in which the overall net benefit is -$1,174 million (3 percent discount rate) and -$1,210 million (7 percent discount rate). More in-depth views of the underlying estimates are provided in Appendices 3 and 4. Further, at an annual profit margin of 9 percent, on average a company would need to generate additional revenue of $197,762 per injury/illness to compensate for both the direct and indirect cost of the injury or illness.

Table 4 presents the results of the analysis. More in-depth views of the underlying estimates are provided in Appendices 3 and 4.

TABLE 4

WITH IMPLEMENTATION EFFECT - NPV @ 3 PERCENT AND 7 PERCENT
(000s)

Year	NPV @ 3 Percent			NPV @ 7 Percent		
	Benefits/Cost Avoidances (Costs) to Individuals	*Benefits/Cost Avoidances (Costs) to Industry*	*Benefits/Cost Avoidances (Costs) to Government*	*Benefits/Cost Avoidances (Costs) to Individuals*	*Benefits/Cost Avoidances (Costs) to Industry*	*Benefits/Cost Avoidances (Costs) to Government*
2004 (Year 0)	$0	$0	($223)	$0	$0	($223)
2005 (Year 1)	$103	($1,211)	($295)	$100	($1,166)	($284)
2006 (Year 2)	$101	$29	($76)	$93	$27	($70)
2007 (Year 3)	$98	$29	($73)	$87	$25	($65)
2008 (Year 4)	$95	$28	($71)	$82	$24	($61)
2009 (Year 5)	$92	$27	($68)	$76	$22	($56)
2010 (Year 6)	$90	$26	($66)	$71	$21	($52)
2011 (Year 7)	$87	$25	($64)	$67	$19	($49)
2012 (Year 8)	$84	$25	($61)	$62	$18	($45)
2013 (Year 9)	$82	$24	($59)	$58	$17	($42)
2014 (Year 10)	$80	$23	($57)	$54	$16	($39)
Total NPV:	$913	($975)	($1,112)	$752	($976)	($1,112)
Overall Net Benefit (Cost):	($1,174)			($1,210)		
BCR:	(0.46)			(0.51)		

9.2　Qualitative

Several factors are not captured in the quantitative analysis as a result of other limitations, including overall data issues. These factors, however, are relevant and should also be considered in the overall analysis. Table 5 depicts qualitative factors as well as the potential impact on the individual, industry, and/or government as estimated based on the overall analysis of literature, facts, and information.

- *Economic feasibility and impact.* To determine both the economic feasibility and impact of implementing this HO, some factors to consider are 1) average profit margin within the industry (in this case around 9.3 percent); 2) average annual number of injuries, illnesses, and fatalities; 3) number of businesses affected; 4) current regulatory environment; and 5) nature of the industry, including trends, rate of growth, etc. As the petroleum industry in particular expands exploration into international territories, reliance on the U.S. labor market has decreased significantly.

- *Alternative to a Complete Ban.* Although safety training activities may lessen the risk of injuries, illnesses, and fatalities, mining remains one of the most dangerous industries in terms of occupational hazards. As a result, there would not appear to be any other alternative other than an overall prohibition of youth workers within the industry.

- *Illegal Working.* Although there are a substantial number of "small businesses" within the mining industry, current employment practices reveal that very few minors are employed within the industry as a result of an overall lack of part-time opportunities, general nature of the work, etc. As a result, the issue of illegal working should not be of major concern with implementing this HO.

- *Technological Impact.* Technological trends in mining primarily center around the ability to detect undiscovered natural resources as well as to develop additional capabilities to more effectively mine those resources. As a result of these trends, "oil production by non-majors from the lower 48 onshore part of the United States has exceeded that of majors since the early 1990s. These smaller companies tend to drill smaller fields and have faster depletion rates than the majors. However, with access to advanced technologies, the smaller companies have been able to reduce their finding costs to levels comparable to those of the majors." [DOE EIA, 2004] As this trend continues, and with the increased use of contractors in supplemental roles, safety and health efforts across the industry will likely be significantly impacted.

- *Days Away From School.* The current DAFW estimate reflects a median number of four days in mining occupations; however, the estimate varies to a high of more than 31. This statistic, in comparison with other industries, is higher than average, however, with limited part-time employment opportunities, the impact on days away from school is estimated to be low.

TABLE 5

IMPACT OF QUALITATIVE FACTORS

FACTOR	POTENTIAL IMPACT
Economic feasibility and impact	Low Impact
Illegal working	Low Impact
Technological impact	Moderate to High Impact
Days away from school	Low Impact

Definitions*:*
No Impact: Factor has no effect, either positively or negatively, on individuals, industry, and/or government.
Low Impact: Factor may have some effect, either positively or negatively, on individuals, industry, and/or government.
Moderate Impact: Factor will most likely have an effect, either positively or negatively, on individuals, industry, and/or government.
High Impact: Factor will have an effect, either positively or negatively, on individuals, industry, and/or government.

10.   SENSITIVITY ANALYSIS

In order to more clearly estimate the effects of certain assumptions and other variables given the degree of overall uncertainty of the data, a sensitivity analysis is conducted on several of these key assumptions. Changing each assumption individually while holding all other variables constant, the sensitivity analysis reflects the overall change to NPV at both the 3 percent and 7 percent discount rates and reflects the level of sensitivity the overall results are to the change. Further, because the quantitative results shown in Section 9 above support the "Without Implementation" approach, a fortiori approach, whereby the assumptions are weighted against the more favorable approach, is used.

Following is a list of assumptions challenged as well as the supporting rationale. In addition, Table 6 presents the numerical results of the analysis, including the percentage change from the baseline analysis.

- *Fatalities to youth within the mining industry do occur.* Revised assumption that there is at least one fatality annually.

- *Injury rate is increasing by 20 percent annually.* This assumption is based on the dynamics of the mining industry as well as the growth in the use of contractors for field services support.

- *Industry implementation costs are 50 percent lower.* Since the estimated number of youths employed within the industry is relatively low compared to all other

industries in which youths are employed, the revised assumption accounts for lower costs to industry of implementing the revised HO.

- *Impact of implementation will occur within 5 years*. The revised assumption predicts that full impact of implementation of the HO will occur earlier based on the overall decline of the industry.

TABLE 6

RESULTS OF SENSITIVITY ANALYSIS
(000's)

Change in Assumption	**NPV @ 3%**		**NPV @ 7%**	
	Incremental Benefits (Costs)	*% Change from Baseline*	*Incremental Benefits (Costs)*	*% Change from Baseline*
Fatality rate is one per year.	$41,695	3650.50%	$34,087	2916.31%
Injury rate is increasing by 20 percent annually.	$1,165	199.21%	$558	146.11%
Industry implementation costs are 50 percent lower.	($554)	52.84%	($613)	49.35%
Impact of implementation will occur within 5 years.	($1,399)	(19.14%)	($1,374)	(13.53%)

11.   SUMMARY AND CONCLUSIONS

The proposed NIOSH recommendation to amend the current HO to prohibit youths from working specifically in petroleum and natural gas extraction occupations was made based on the inherent dangers of the mining industry in general. The NIOSH recommendation further proposes to expand coverage to youths working on road maintenance and track crews. However, in evaluating the costs versus benefits of implementing the proposed amendment, it appears from a quantitative perspective that cost exceeds benefits with a NPV of ($1,174) at a 3 percent discount rate and ($1,210) at a 7 percent discount rate. Because the analysis was based on historical counts of injuries/illnesses, and fatalities among the youth worker population, and no fatalities were recorded within the mining industry during the study period, the assumption of no fatalities was challenged in a sensitivity analysis based on a revised assumption that youth fatalities do occur but are recorded elsewhere. The result strongly favored an implementation approach, based on one fatality per year. In addition, increasing the injury rate by 20 percent annually also proved to make the "With Implementation" approach the more favorable approach over the 10-year planning horizon.

APPENDIX 1: DEFINITIONS

Following are breakdowns by SIC codes of petroleum and natural gas mining establishments including field services, and include average sales by establishment size.

(Source: Dun & Bradstreet data found at http://www.zapdata.com)

SIC 1311 – Crude Petroleum and Natural Gas

Num. of Employees	Number of Businesses	% Total	Total Sales	Avg. Sales
unknown	434	5.4	1,007.6	10.5
1	1,118	14	448.7	0.5
2 to 4	3,524	44.2	4,975.2	1.6
5 to 9	1,350	16.9	4,118.8	4
10 to 24	884	11.1	5,610.2	9.8
25 to 49	318	4	2,959.9	18.4
50 to 99	164	2.1	18,672	192.5
100 to 249	105	1.3	22,043.301	408.2
250 to 499	37	0.5	304,962.406	11,729.3
500 to 999	33	0.4	20,884.9	949.3
1,000 to 2,499	5	0.1	95,388.797	19,077.801
2,500 to 4,999	2	0	2,025.8	1,012.9
Total/Avg	7,974	100	483,097.594	78.8

Note: Sales figures are in millions.

SIC 1321 – Natural Gas Liquids

Num. of Employees	Number of Businesses	% Total	Total Sales	Avg. Sales
unknown	14	3.6	21.5	10.7
1	34	8.9	5.5	0.2
2 to 4	85	22.1	61.9	1.1
5 to 9	106	27.6	112.2	1.4
10 to 24	86	22.4	167	6
25 to 49	31	8.1	1,566.9	120.5
50 to 99	17	4.4	265.3	53.1
100 to 249	7	1.8	36	18
250 to 499	2	0.5	75	75
500 to 999	2	0.5	3,849.6	1,924.8
Total/Avg	384	100	6,160.8	27.8

Note: Sales figures are in millions.

SIC 1389– Oil and Gas Field Services, NEC

Num. of Employees	Number of Businesses	% Total	Total Sales	Avg. Sales
unknown	363	3.3	141	2.8
1	2,069	18.7	479.9	0.3
2 to 4	4,336	39.1	1,023.2	0.3
5 to 9	1,621	14.6	1,689.5	1.4
10 to 24	1,506	13.6	2,545.5	2.5
25 to 49	629	5.7	15,749	42.8
50 to 99	341	3.1	2,723.8	16
100 to 249	166	1.5	3,400.3	54.8
250 to 499	32	0.3	3,049.3	190.6
500 to 999	15	0.1	383.7	42.6
1,000 to 2,499	2	0	N/A	N/A
2,500 to 4,999	1	0	N/A	N/A
5,000 to 9,999	1	0	1,841.1	1,841.1
Total/Avg	11,082	100	33,026.301	3.8

Note: Sales figures are in millions.

APPENDIX 2: PETROLEUM AND NATURAL GAS EXTRACTION INDUSTRY BY ESTABLISHMENT SIZE

1997 Economic Census—Mining

NAICS	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments	Employment Size Class		
					1-19	*20-99*	*100 or more*
211111	Crude petroleum and natural gas extraction	100,308	$4,968,722	7,781	7,071	544	166
211112	Natural gas liquid extraction	10,549	$541,593	529	366	156	7
213112	Support activities for oil and gas operations	106,339	$3,628,416	7,068	6,100	840	128

2001 County Business Patterns

NAICS	Industry	Number of Employees	Annual Payroll ($1,000)	Total Establishments	Employment Size Class			
					1-19	*20-99*	*100-499*	*> 499*
211111	Crude petroleum and natural gas extraction	78,394	$5,493,358	7,254	6,551	570	122	11
211112	Natural gas liquid extraction	9,586	$724,419	437	311	117	8	1
213112	Support activities for oil and gas operations	127,801	$6,065,115	6,980	5,853	925	181	21

APPENDIX 3: DETAILS OF THE CALCULATION OF COSTS AND BENEFITS

Without Implementation				**TOTAL**
	Fatalities and Non-fatalities	Promulgation	Implementation/ Surveillance	
Individuals[1]	$107,000	$0	$0	$107,000
Industry[2]	$31,163	$0	$0	$31,163
Government[3]	$3,320	$0	$0	$3,320

[1] Individual costs are calculated as follows: {$5,000,000 (VSL) x 0 (avg. number of fatalities)} + {2.14 (avg. number of injuries/illnesses) x $50,000 (WTP injury) }

[2] Industry costs are calcuated as follows: {$14,562 (OSHA "Safety Pays!" database, direct and indirect costs) x 2.14 (avg. number of injuries/illnesses)} + {$25,687 (avg. cost to industry per fatality, adjusted for inflation) x 0 (avg. number of fatalities)}

[3] Government cost includes Medicaid and disability income paid to individuals and their beneficiarie and is calculated as follows: $10,344 (annual cost of Social Security benefit) x {2.14 x .15 (percentage of injuries/illnesses estimated to result in long-term disability)}. As an ongoing government cost, and as new workers are assumed to be added to this burden annually, the base cost is escalated by 10 percent annually.

With Implementation				**TOTAL**
	Fatalities and Non-fatalities	Promulgation	Implementation/ Surveillance	
Individuals[1]	$0	$0	$0	$0
Industry[2]	$0	$0	$1,278,320	$1,278,320
Government[3,4]	$0	$445,423	$81,250	$526,673

[1] The assumption is made here that implementing the HO will reduce the injury, illness, and fatality rate to zero.

[2] Industry costs are calcuated using SBA findings for average efficiency cost to industries on implementing federal workplace regulations. an average per-employee cost of FY04$319.58 x 4,000 (estimated number of youths employed), industry implementation costs are estimated to be $1,278,320.

[3] Government promulgation costs (federal government cost) is based on the equivalent of 3 GS-13s ($120,000/annual burdened salary) x 1 year} + $50,000 (cost to publish the order). State government costs for implementation are based on two legal workers per state (51 states) at an avg. hourly rate of $43.41 x 16 hours.

[4] Government enforcement costs (federal government cost) are based on an additional burden of 50 annual investigations @ cost of $1,625/investigation.

Annual Costs - Without Implementation												
	Fiscal Year											Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Individuals												
Death/Ilnesses/Injuries	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$ 1,177,000
Promulgation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Implementation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Industry												
Death/Ilnesses/Injuries	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	342,789
Promulgation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Implementation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Government												
Death/Ilnesses/Injuries	$3,320	$3,652	$4,018	$4,419	$4,861	$5,348	$5,882	$6,471	$7,118	$7,829	$8,612	61,531
Promulgation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Implementation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$141,483	$141,815	$142,180	$142,582	$143,024	$143,510	$144,045	$144,633	$145,280	$145,992	$146,775	$ 1,581,321

Annual Costs - With Implementation												
	Fiscal Year											Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Individuals												
Death/Ilnesses/Injuries	$107,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ 107,000
Promulgation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Implementation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Industry												
Death/Ilnesses/Injuries	$31,163	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ 31,163
Promulgation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ -
Implementation	$0	$1,278,320	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ 1,278,320
Government												
Death/Ilnesses/Injuries	$3,320	$3,320	$3,320	$3,320	$3,320	$3,320	$3,320	$3,320	$3,320	$3,320	$3,320	$ 36,525
Promulgation	$222,711	$222,711	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ 445,423
Implementation	$ -	$ 81,250	$ 81,250	$ 81,250	$ 81,250	$ 81,250	$ 81,250	$ 81,250	$ 81,250	$ 81,250	$ 81,250	$ 812,500
Total	$364,194	$1,585,602	$84,570	$84,570	$84,570	$84,570	$84,570	$84,570	$84,570	$84,570	$84,570	$ 2,710,930

APPENDIX 4: NET PRESENT VALUE (NPV) CALCULATIONS

COST/BENEFIT ANALYSIS NET EFFECT (INCREMENTAL APPROACH) (@ 3 PERCENT)												
Fiscal Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	**TOTAL**
Year of Implementation	0	1	2	3	4	5	6	7	8	9	10	
Without Implementation Alternative - Cost to Individuals	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$107,000	$ 1,177,000
With Implementation Alternative - Cost to Individuals	$107,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ 107,000
Without Implementation Alternative - Cost to Industry	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$ 342,789
With Implementation Alternative - Cost to Industry	$ 31,163	$ 1,278,320	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,309,483
Without Implementation Alternative - Cost to Government	$3,320	$3,652	$4,018	$4,419	$4,861	$5,348	$5,882	$6,471	$7,118	$7,829	$8,612	$ 61,531
With Implementation Alternative - Cost to Government	$ 226,032	$ 307,282	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 1,294,447
Net Cost (Cost Savings/Avoidances) - Individual	$ -	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (1,070,000)
Net Cost (Cost Savings/Avoidances) - Industry	$ -	$ 1,247,157	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ 966,693
Net Cost (Cost Savings/Avoidances) - Government	$ 222,711	$ 303,629	$ 80,553	$ 80,151	$ 79,709	$ 79,223	$ 78,688	$ 78,100	$ 77,453	$ 76,741	$ 75,958	$ 1,232,916
Discount Factor (@ 3%)	1.00	0.971	0.943	0.915	0.888	0.863	0.837	0.813	0.789	0.766	0.744	
Discounted Cost (Cost Savings/Avoidances) - Individual	$ -	$ (103,883)	$ (100,858)	$ (97,920)	$ (95,068)	$ (92,299)	$ (89,611)	$ (87,001)	$ (84,467)	$ (82,007)	$ (79,618)	$ (912,732)
Discounted Cost (Cost Savings/Avoidances) - Industry	$ -	$ 1,210,832	$ (29,374)	$ (28,518)	$ (27,688)	$ (26,881)	$ (26,098)	$ (25,338)	$ (24,600)	$ (23,884)	$ (23,188)	$ 975,263
Discounted Cost (Cost Savings/Avoidances) - Government	$ 222,711	$ 294,786	$ 75,929	$ 73,349	$ 70,820	$ 68,338	$ 65,900	$ 63,502	$ 61,142	$ 58,816	$ 56,520	$ 1,111,814
Net Discounted Cost (Cost Savings/Avoidances)	$ 222,711	$ 1,401,735	$ (54,303)	$ (53,089)	$ (51,935)	$ (50,842)	$ (49,809)	$ (48,837)	$ (47,925)	$ (47,075)	$ (46,286)	$ 1,174,345
Cumulative Discounted Costs for Without Implementation Alternative	$ 141,483	$ 279,168	$ 413,186	$ 543,669	$ 670,744	$ 794,538	$ 915,173	$ 1,032,773	$ 1,147,459	$ 1,259,349	$ 1,368,564	
Cumulative Discounted Costs for With Implementation Alternative	$ 364,194	$ 1,903,614	$ 1,983,329	$ 2,060,723	$ 2,135,863	$ 2,208,814	$ 2,279,640	$ 2,348,404	$ 2,415,165	$ 2,479,981	$ 2,542,909	
Net Present Value (NPV)	$ 222,711	$ 1,624,446	$ 1,570,143	$ 1,517,054	$ 1,465,119	$ 1,414,277	$ 1,364,468	$ 1,315,631	$ 1,267,706	$ 1,220,631	$ 1,174,345	
Benefits to Cost Ratio (BCR)												(0.46)

[1] The discount factor is calculated as follows:

$1/(1 + \text{discount rate})^t$ where t = year of life cycle and the discount rate.

[2] Assumes no time lag between year of implementation and year cost savings/avoidance begins.

COST/BENEFIT ANALYSIS NET EFFECT (INCREMENTAL APPROACH) (@ 7 PERCENT)												
Fiscal Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	**TOTAL**
Year of Implementation	0	1	2	3	4	5	6	7	8	9	10	
Without Implementation Alternative - Cost to Individuals	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 1,177,000
With Implementation Alternative - Cost to Individuals	$107,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ 107,000
Without Implementation Alternative - Cost to Industry	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 342,789
With Implementation Alternative - Cost to Industry	$ 31,163	$ 1,278,320	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,309,483
Without Implementation Alternative - Cost to Government	$3,320	$3,652	$4,018	$4,419	$4,861	$5,348	$5,882	$6,471	$7,118	$7,829	$8,612	$ 61,531
With Implementation Alternative - Cost to Government	$ 226,032	$ 307,282	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 1,294,447
Net Cost (Cost Savings/Avoidances) - Individual	$ -	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (107,000)	$ (1,070,000)
Net Cost (Cost Savings/Avoidances) - Industry	$ -	$ 1,247,157	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ (31,163)	$ 966,693
Net Cost (Cost Savings/Avoidances) - Government	$ 222,711	$ 303,629	$ 80,553	$ 80,151	$ 79,709	$ 79,223	$ 78,688	$ 78,100	$ 77,453	$ 76,741	$ 75,958	$ 1,232,916
Discount Factor (@ 7%)	1.00	0.935	0.873	0.816	0.763	0.713	0.666	0.623	0.582	0.544	0.508	
Discounted Cost (Cost Savings/Avoidances) - Individual	$ -	$ (100,000)	$ (93,458)	$ (87,344)	$ (81,630)	$ (76,290)	$ (71,299)	$ (66,634)	$ (62,275)	$ (58,201)	$ (54,393)	$ (751,523)
Discounted Cost (Cost Savings/Avoidances) - Industry	$ -	$ 1,165,568	$ (27,219)	$ (25,438)	$ (23,774)	$ (22,219)	$ (20,765)	$ (19,407)	$ (18,137)	$ (16,950)	$ (15,842)	$ 975,818
Discounted Cost (Cost Savings/Avoidances) - Government	$ 222,711	$ 283,766	$ 70,358	$ 65,427	$ 60,810	$ 56,485	$ 52,433	$ 48,637	$ 45,078	$ 41,742	$ 38,613	$ 986,060
Net Discounted Cost (Cost Savings/Avoidances)	$ 222,711	$ 1,349,333	$ (50,319)	$ (47,355)	$ (44,594)	$ (42,023)	$ (39,630)	$ (37,404)	$ (35,334)	$ (33,409)	$ (31,622)	$ 1,210,354
Cumulative Discounted Costs for Without Implementation Alternative	$ 141,483	$ 274,021	$ 398,206	$ 514,596	$ 623,708	$ 726,029	$ 822,013	$ 912,083	$ 996,637	$ 1,076,047	$ 1,150,660	
Cumulative Discounted Costs for With Implementation Alternative	$ 364,194	$ 1,846,065	$ 1,919,932	$ 1,988,967	$ 2,053,485	$ 2,113,783	$ 2,170,136	$ 2,222,802	$ 2,272,023	$ 2,318,023	$ 2,361,015	
Net Present Value (NPV)	$ 222,711	$ 1,572,045	$ 1,521,726	$ 1,474,371	$ 1,429,777	$ 1,387,754	$ 1,348,123	$ 1,310,719	$ 1,275,385	$ 1,241,976	$ 1,210,354	
Benefits to Cost Ratio (BCR)												(0.51)

[1] The discount factor is calculated as follows:

$1/(1 + \text{discount rate})^t$ where t = year of life cycle and the discount rate.

[2] Assumes no time lag between year of implementation and year cost savings/avoidance begins.

COST/BENEFIT ANALYSIS (FULL VALUE APPROACH) (@ 3 PERCENT)												
Fiscal Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
Year of Implementation	0	1	2	3	4	5	6	7	8	9	10	
Without Implementation Alternative - Cost to Individuals	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 1,177,000
With Implementation Alternative - Cost to Individuals	$ 107,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 107,000
Without Implementation Alternative - Cost to Industry	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 31,163	$ 342,789
With Implementation Alternative - Cost to Industry	$ 31,163	$ 1,278,320	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,309,483
Without Implementation Alternative - Cost to Government	$ 3,320	$ 3,652	$ 4,018	$ 4,419	$ 4,861	$ 5,348	$ 5,882	$ 6,471	$ 7,118	$ 7,829	$ 8,612	$ 61,531
With Implementation Alternative - Cost to Government	$ 226,032	$ 307,282	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 1,294,447
Discount Factor (@ 3%)	1.00	0.971	0.943	0.915	0.888	0.863	0.837	0.813	0.789	0.766	0.744	
Discounted Without Implementation Alternative - Cost to Individuals	$ 107,000	$ 103,883	$ 100,858	$ 97,920	$ 95,068	$ 92,299	$ 89,611	$ 87,001	$ 84,467	$ 82,007	$ 79,618	$ 1,019,732
Discounted With Implementation Alternative - Cost to Individuals	$ 107,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 107,000
Discounted Without Implementation Alternative - Cost to Industry	$ 31,163	$ 30,255	$ 29,374	$ 28,518	$ 27,688	$ 26,881	$ 26,098	$ 25,338	$ 24,600	$ 23,884	$ 23,188	$ 296,987
Discounted With Implementation Alternative - Cost to Industry	$ 31,163	$ 1,241,087	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,272,250
Discounted Without Implementation Alternative - Cost to Government	$ 3,320	$ 3,546	$ 3,787	$ 4,044	$ 4,319	$ 4,613	$ 4,926	$ 5,261	$ 5,619	$ 6,001	$ 6,408	$ 51,845
Discounted With Implementation Alternative - Cost to Government	$ 226,032	$ 298,332	$ 79,716	$ 77,394	$ 75,140	$ 72,951	$ 70,826	$ 68,763	$ 66,761	$ 64,816	$ 62,928	$ 1,163,659
Net Present Value (NPV) - Without Implementation Alternative	$ 141,483	$ 137,685	$ 134,019	$ 130,483	$ 127,075	$ 123,793	$ 120,635	$ 117,600	$ 114,686	$ 111,891	$ 109,214	$ 1,368,564
Net Present Value (NPV) - With Implementation Alternative	$ 364,194	$ 1,539,419	$ 79,716	$ 77,394	$ 75,140	$ 72,951	$ 70,826	$ 68,763	$ 66,761	$ 64,816	$ 62,928	$ 2,542,909
Benefit to Cost Ratio (BCR) - Without Implementation Alternative												0.86
Benefit to Cost Ratio (BCR) - With Implementation Alternative												(0.46)

[1] The discount factor is calculated as follows:

$1/(1 + \text{discount rate})^t$ where t = year of life cycle and the discount rate.

COST/BENEFIT ANALYSIS (FULL VALUE APPROACH) (@ 7 PERCENT)												
Fiscal Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	**TOTAL**
Year of Implementation	0	1	2	3	4	5	6	7	8	9	10	
Without Implementation Alternative - Cost to Individuals	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 107,000	$ 1,177,000
With Implementation Alternative - Cost to Individuals	$ 107,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 107,000
Without Implementation Alternative - Cost to Industry	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$31,163	$ 342,789
With Implementation Alternative - Cost to Industry	$ 31,163	$ 1,278,320	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,309,483
Without Implementation Alternative - Cost to Government	$ 3,320	$ 3,652	$ 4,018	$ 4,419	$ 4,861	$ 5,348	$ 5,882	$ 6,471	$ 7,118	$ 7,829	$ 8,612	$ 61,531
With Implementation Alternative - Cost to Government	$ 226,032	$ 307,282	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 84,570	$ 1,294,447
Discount Factor (@ 7%)	1.00	0.935	0.873	0.816	0.763	0.713	0.666	0.623	0.582	0.544	0.508	
Discounted Without Implementation Alternative - Cost to Individuals	$ 107,000	$ 100,000	$ 93,458	$ 87,344	$ 81,630	$ 76,290	$ 71,299	$ 66,634	$ 62,275	$ 58,201	$ 54,393	$ 858,523
Discounted With Implementation Alternative - Cost to Individuals	$ 107,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 107,000
Discounted Without Implementation Alternative - Cost to Industry	$ 31,163	$ 29,124	$ 27,219	$ 25,438	$ 23,774	$ 22,219	$ 20,765	$ 19,407	$ 18,137	$ 16,950	$ 15,842	$ 250,036
Discounted With Implementation Alternative - Cost to Industry	$ 31,163	$ 1,194,692	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,225,854
Discounted Without Implementation Alternative - Cost to Government	$ 3,320	$ 3,414	$ 3,509	$ 3,608	$ 3,709	$ 3,813	$ 3,920	$ 4,030	$ 4,143	$ 4,259	$ 4,378	$ 42,101
Discounted With Implementation Alternative - Cost to Government	$ 226,032	$ 287,179	$ 73,867	$ 69,035	$ 64,518	$ 60,298	$ 56,353	$ 52,666	$ 49,221	$ 46,001	$ 42,991	$ 1,028,160
Net Present Value (NPV) - Without Implementation Alternative	$ 141,483	$ 132,538	$ 124,186	$ 116,390	$ 109,112	$ 102,321	$ 95,983	$ 90,070	$ 84,554	$ 79,410	$ 74,613	$ 1,150,660
Net Present Value (NPV) - With Implementation Alternative	$ 364,194	$ 1,481,871	$ 73,867	$ 69,035	$ 64,518	$ 60,298	$ 56,353	$ 52,666	$ 49,221	$ 46,001	$ 42,991	$ 2,361,015
Benefit to Cost Ratio (BCR) - Without Implementation Alternative												1.05
Benefit to Cost Ratio (BCR) - With Implementation Alternative												(0.51)

[1] The discount factor is calculated as follows:

$1/(1 + \text{discount rate})^t$ where t = year of life cycle and the discount rate.

APPENDIX 5: QUALITATIVE COSTS AND BENEFITS

ISSUE	Qualitative Cost	Qualitative Benefit
1. Promulgating the Rule	• Public awareness of the need to have a new HO	
2. Implementing the Rule	• Time necessary for analysis the new rule and adjust to new standards	
3. Post-Implementation Impact		
a. Impact on youth/families	• Lost employment opportunity for youth	• Decrease in pain and suffering
b. Impact on businesses in the health care industry (effectiveness, efficiency, and other impacts)	• It appears that many businesses may not be covered under this proposed HO due to the size and annual revenue.	
c. Other impacts	• Fairness and equity	

APPENDIX 6: ANALYSIS OF STATE CHILD LABOR LAWS

Purpose

Many of the state child labor laws contain specific prohibition of youths working in occupations in connection with mining, which are undoubtedly prompted by the existing federal HOs. Although this analysis records all references to the subject of mining, particularly petroleum and natural gas extraction, the aim was to identify state HOs that are stricter than the new HO as proposed by NIOSH.

Overall Findings

There are very few states that do not have child labor HOs. Generally, states' child labor laws with regard to occupations involving mining are fairly consistent across three main approaches: 1) adoption of federal rules (hazardous occupations) (14 states); 2) general prohibition of minors working in mining occupations (30 states); and 3) no mining-specific law (7 states).

Alabama – Prohibits minors < 18 from any work in connection with mining.

Prohibited occupations and places for persons under 18 years of age (Sec. 25-8-43)

> No person under 18 years of age shall be employed or permitted or suffered to work at any of the following occupations, positions, or places: …In or about or in connection with any mine, coke breaker, coke oven, or quarry in any capacity

Alaska – Prohibits minors < 18 from any work in connection with mining.

Occupations prohibited to minors under 18:
> **1.**   All occupations in connection with mining. (8AAC 05.070)

Arizona – Prohibits minors < 18 from any work in connection with mining.

A person shall not employ or allow a person under the age of 18 years to work in, about or in connection with:
> (1)   Mine or quarry occupations.

Arkansas - – Prohibits minors < 16 from any work in connection with mining.

No child under the age of sixteen (16) years shall be employed, permitted, or suffered to work in any capacity:
> (7)   In any mine, coal breaker, coke oven, or quarry.

California – Adopts federal regulations

Mentions the compliance with federal child labor HOs.

Colorado – Prohibits minors < 18 from any work in connection with mining.

The following occupations are declared to be hazardous for minors under age 18.
(Sec. 8-12-110 (2))
    a.   Mining, logging, oil drilling, or quarrying.

Connecticut – Prohibits minors < 18 from any work involving mining.

Employment of minors under age 18 is prohibited in the following industries:
      Mining (Underground and Surface)

Delaware – Adopts federal regulations

Mentions the compliance with federal child labor HOs.

District of Columbia - Adopts federal regulations

The District of Columbia adopts the Federal Hazardous Occupations orders for minors under 18 years of age.

Florida – Prohibits minors < 18 from any work involving mining.

No minor under 18 years of age, whether such person's disabilities or nonage have been removed, shall be employed or permitted or suffered to work in any of the following places of employment or in any of the following occupations:
      (a) Any mining occupation

Georgia – Prohibits minors < 16 from any work involving mining.

The following occupations, positions and/or locations shall be deemed hazardous and no minor under age of 16 years shall be employed to work at or in the vicinity of or assist in the operation of such hazardous machinery, nor shall a minor under the age of 16 be similarly employed in any other occupation that a reasonable person in good conscience would consider dangerous to the life, limb or injurious to the health and/or morals of such minor.
                (i)   Mine, coke breaker, coke oven or quarry.

Hawaii – Prohibits minors < 18 from any work involving mining.

Occupations declared hazardous for minors under 18 years of age:

12-25-43   Occupations in connection with mining.

Idaho - No mining-specific laws

No mention of occupations involving mining or adherence to the Federal Child Labor HOs

Illinois – Prohibits minors < 16 from any work involving mining (other than office and messenger work).

No minor under 16 years of age shall be employed, permitted or allowed to work:
1. In or about any mine or quarry; provided that office and messenger and other non-hazardous employment shall not be prohibited;

Indiana – Adopts federal regulations

Adopts the federal child labor HOs for children under age 18.

Iowa – Prohibits minors < 18 from any work involving mining.

92.8 Under eighteen – prohibited occupations

No person under eighteen years of age shall be employed or permitted to work with or without compensation at any of the following occupations or business establishments:
1. Occupations in connection with mining.

Kansas – Adopts federal regulations

Adopts the federal child labor HOs for children under age 18.

Kentucky – Adopts federal regulations

Adopts the federal child labor HOs for children under age 18.

Louisiana – Prohibits minors < 18 from any work involving mining.

Prohibited occupations for minors under age 18:

Sec. 161. Minors; prohibited employments.

Minors, except those indentured as apprentices in accordance with Chapter 4 of this Title, shall not be employed, permitted, or suffered to work:
(1) In or about any mine or quarry;

Maine – Prohibits minors age 16 and 17 from any work in connection with mining.

Minors Sixteen and Seventeen Years of Age

Minors who are sixteen and seventeen years of age may not be employed in the following occupations:
1. All mining occupations;

Maryland – Adopts federal regulations;

Mentions the compliance with federal child labor HOs.

Massachusetts – No mining-specific laws; however, minors < 18 are prohibited from working as part of track repairing crews.

No mention of occupations involving mining or adherence to the Federal Child Labor HOs

No person shall employ a minor under eighteen or permit him to work:
      (1)   at track repairing;

Michigan – Prohibits minors < 18 from any work involving mining.

Rule 209.

        (1)   A minor shall not be employed in any operation in or around a mine or quarry.

Minnesota – Prohibits minors < 18 from any work involving mining.

No minor under the age of 18 shall be employed:
    A.   In or about mines, quarries, and sand or gravel pits.

Mississippi - No mining-specific laws

No mention of occupations involving mining or adherence to the Federal Child Labor HOs

Missouri – Prohibits minors under age 16 from any work involving mining, except office or other non-hazardous work.

294.40   Minors under sixteen not to work in certain occupations. – A child under sixteen shall not be employed or permitted to work by any person, firm, or corporation in connection with:
    (1)   Any mine or quarry except in offices or at other non-hazardous employment;

Montana – Prohibits minors < 18 any work involving mining (apprentice exemption).

41-2-107 *Prohibited employment of minors who are sixteen and seventeen years old.* Unless working as an apprentice or student-learner under the provisions of 41-2-110, a minor 16 or 17 years of age may not be employed in or in connection with any of the following occupations:
    (1)   a mining occupation;

Nebraska – No mining-specific laws

No mention of occupations mining or adherence to the Federal Child Labor HOs

Nevada – Prohibits minors < 16 from any work involving mining.

Employing or permitting child under 16 years of age to work certain occupations prohibited.
   a.   Any mine, coal breaker, quarry, smelter, ore reduction works, laundry, tobacco warehouse, cigar factory or other factory where tobacco is manufactured or prepared.

New Hampshire – Adopts federal regulations;

Mentions compliance with federal child labor HOs.

New Jersey – Prohibits minors < 18 from any work involving mining.

34:2-21.17   No minor under 18 years of age shall be employed, permitted or suffered to work in, about, or in connection with the following:
   • Mines or quarries;

New Mexico – Prohibits minors < 18 from any work involving mining where explosives are used.

50-6-5   Prohibited occupations for children under eighteen (18).

No child under the age of eighteen years shall be employed or permitted to labor in any mine or quarry underground or at or about any place where explosives are used. However, children under the age of eighteen years but not under the age of fourteen years may be employed to separate mica if blasting is done during periods when there is nobody working, and the mica is subsequently removed from the blasting area to another site for operation.

New York - Prohibits minors < 18 from any work involving mining.

UNDER 18 YEARS OF AGE:
Art. 4, Section 133 (2)   No minor of any age shall be employed in or assist in:
   a.   any occupation in or in connection with a mine or quarry;

North Carolina – Adopts federal regulations.

Mentions the compliance with federal child labor HOs.

North Dakota – Prohibits minors < 16 from any work involving mining.

34-07-16   Prohibited employments and occupations of minors under age 16.

No minor fourteen or fifteen years of age may be employed or permitted to work in:
   1.   Any mine or quarry.

Ohio – Prohibits minors < 18 from any work involving mining

Occupations prohibited for minors under 18 years of age:
4101:9-2-15   Occupations in connection with mining, other than coal

Oklahoma – Adopts federal regulations for minors < 16;

Section 72.1   Hazardous Employment

      A.   No child under the age of sixteen (16) years of age shall be employed or permitted to work at any of the following occupations:

             (1) Manufacturing, mining, or processing occupations, including occupations requiring performance of any duties in work rooms or work places where goods are manufactured, mined, or otherwise processed:

Oregon – Adopts federal regulations for minors 16 and 17 years of age.

Mentions the compliance with federal child labor HOs.

Pennsylvania – Prohibits minors < 18 from work involving track repairing and as section hands on railroads and railways; also prohibits minors between 16 and 18 from working in certain occupations within quarries

"Child Labor Law" Act of 1915, P.L. 286, No. 177

Title 43. Labor

Prohibited occupations for minors under age 18:

Sec. 5   No minor under eighteen years of age shall be employed or permitted to work in the operation or management of hoisting machines, in oiling or cleaning machinery, in motion; at switch-tending, at gate-tending, at track-repairing;

      §11.41.   **Section hands.**

            Employment of minors under 18 years of age as section hands on railroads and railways is prohibited.

      §11.42.   **Quarries.**

            Employment of minors between 16 and 18 years of age is permitted in quarries but such minors shall be prohibited from engaging in any of the following occupations in quarries:

             (1)   Drilling, shot firing or assisting in loading or tamping holes.

      (2)   Face cleaning.

      (3)   Attaching blocks to chains for cable hoisting.

      (4)   Operating or assisting in operating steam, air or electric shovels, or in any other occupation prohibited by section 5 of the act (43 P.S. §46).

Rhode Island - No mining-specific laws

No mention of occupations involving mining or adherence to the Federal Child Labor HOs

South Carolina – Prohibits minors < 18 from any work involving mining.

    C.(1)   Except as provided in subparagraph (2) of this paragraph the occupations of motor vehicle driver and outside helper on any public road, highway, in or about any mine (including open pit mine or quarry), place where logging or sawmill operations are in progress, or in any excavation of the type identified in 71-3107(O) are particularly hazardous for the employment of minors between sixteen and eighteen years of age.

South Dakota - No mining-specific laws

No mention of occupations involving mining or adherence to the Federal Child Labor HOs

Tennessee – Prohibits minors < 18 from any work involving mining.

A minor under age 18 may not be employed in connection with the following:
    (1)   Occupations in connection with mining elements other than coal;

Texas - Adopts federal regulations

Adopts the federal child labor HOs for children under age 18.

Utah - Adopts federal regulations

Adopts the federal child labor HOs for children under age 18.

Vermont - Adopts federal regulations

Adopts the federal child labor HOs for children under age 18.

Virginia – Prohibits minors < 18 from any work involving mining.

§40.100.   Certain employment prohibited or limited.

    A. No child under eighteen years of age shall be employed, permitted or suffered to work:
    1.   <u>In any mine</u>, quarry, tunnel, underground scaffolding work; in or about any plant or establishment manufacturing or storing explosives or articles

containing explosive components, in any occupations involving exposure to radioactive substances or to ionizing radiations including X-ray equipment;

Washington – Prohibits minors < 18 from any work involving mining.

WAC 296-125-030   Prohibited and hazardous employment – All minors.
    (1)   All mining occupations

West Virginia – Prohibits minors < 18 from any work involving mining.

    (a) No child under eighteen years of age may be employed, permitted or suffered to work in, about, or in connection with any of the following occupations:
        (1) Mining, including coal mining;

Wisconsin – Prohibits minors < 18 from any work involving mining.

Occupations prohibited for minors under age 18:
DWD 270.06 (12)
    (11)   Mining other than coal.

Wyoming – No mining-specific laws

No mention of occupations involving mining or adherence to the Federal Child Labor HOs

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