Regulatory Impact Analysis of Financial Responsibility Requirements under CERCLA § 108(b) for Classes of Facilities in the Hardrock Mining Industry Proposed Rule

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U.S. Environmental Protection Agency
Office of Land and Emergency Management

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Appendices

List of Exhibits

Acronyms

ACS	-	American Community Survey
AMD	-	Acid Mine Drainage
ANVSAs	-	Alaska Native Village Statistical Areas
ATSDR	-	Agency for Toxic Substances and Disease Registry
CERCLA	-	Comprehensive Environmental Response, Compensation, and Liability Act
CWA	-	Clean Water Act
EABs	-	Environmental Assurance Bonds
EIA	-	U.S. Energy Information Administration
FA	-	Financial Assurance
FR	-	Financial Responsibility
FRRs	-	Financial Responsibility Requirements
FRS	-	Facility Registry System
GAAP	-	Generally Accepted Accounting Principles
GAO	-	Government Accountability Office
HA	-	Public Health Assessment or Health Consultation
HHLs	-	Hawaiian Home Lands
IRFA	-	Initial Regulatory Flexibility Analysis
LOC	-	Letter of Credit
MCSs	-	Mineral Commodity Summaries
MDRS	-	Mine Data Retrieval System
MSHA	-	U.S. Mine Safety and Health Administration
NPV	-	Net Present Value
NRD	-	Natural Resource Damages
NRSRO	-	Nationally Recognized Statistical Rating Organization
O&M	-	Operations and Maintenance
OIG	-	EPA Office of Inspector General
OIRA	-	Office of Information and Regulatory Affairs
OMB	-	Office of Management and Budget
OSWER	-	Office of Solid Waste and Emergency Response
OTSAs	-	Oklahoma Tribal Statistical Areas

PRPs	-	Potentially Responsible Parties
RFA	-	Regulatory Flexibility Act
RIA	-	Regulatory Impact Assessment
S&P	-	Standard & Poor's
SARA	-	Superfund Amendments and Reauthorization Act of 1986
SBA	-	Small Business Administration
SBREFA	-	Small Business Regulatory Enforcement Fairness Act of 1996
SDTSAs	-	State-Designated Tribal Statistical Areas
SERs	-	Small Entity Representatives
SISNOSE	-	Significant Impact on a Substantial Number of Small Entities
TDSAs	-	Tribal-Designated Statistical Areas
TMDL	-	Total Maximum Daily Load
UMRA	-	Unfunded Mandates Reform Act
USEPA	-	U.S. Environmental Protection Agency
USGS	-	U.S. Geological Survey
UST	-	Underground Storage Tank
WACC	-	Weighted Average Cost of Capital

Executive Summary

ES.1 Background and Overview

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authorizes EPA to conduct cleanup at abandoned and non-operating sites contaminated with hazardous substances. CERCLA was enacted to provide for cleanup of hazardous substances and to hold responsible parties liable for cleanup. The Act therefore addresses threats posed by existing contamination through remediation and discourages future contamination through enforcement. Under the current baseline responsible parties are liable for financial responsibility FR) pertaining to cleanup; however, if a party defaults on all or a portion of that obligation, the firm's liability shifts to the government and the public.

Section 108(b) of CERCLA establishes the government's authority to promulgate financial responsibility requirements for facilities involved in the production, transport, storage, or disposal of hazardous material. The 1986 Superfund Amendments and Reauthorization Act (SARA) amendments to CERCLA clarified that section 108(b) can require regulated facilities to demonstrate financial responsibility through one of the following financial assurance mechanisms: insurance, guarantee, surety bond, letter of credit, or qualification as self-insurer. CERCLA 108(b) allows EPA to require facility owners and operators to acquire financial assurance for their environmental liabilities and stipulates the instruments through which an owner or operator may do so.

A series of studies and reviews conducted by the EPA Office of Inspector General (OIG) and the Government Accountability Office (GAO) from 2004 through 2008 demonstrated that the hardrock mining industry presented a risk to EPA and taxpayers with respect to the amount of cleanup costs for which they would be responsible. In accordance with CERCLA section 108(b) and in response to these concerns, EPA is publishing the proposed rule that would create a financial assurance regime for CERCLA liabilities in the hardrock mining industry. The proposed rule endeavors to increase the likelihood that owners and operators will provide funds necessary to address the CERCLA liabilities at their facilities, thus preventing the burden from shifting to the taxpayer. In addition, the rule would provide an incentive for implementation of sound practices at hardrock mining facilities that would decrease the need for future CERCLA actions. This Regulatory Impact Analysis (RIA) document assesses the costs, benefits, and other economic impacts of the proposed rule.

ES.2 Summary of the Proposed Rule

The proposed rule establishes financial responsibility requirements for certain facilities within the hardrock mining industry, thus ensuring that the industry more fully internalizes the costs associated with the risk of potential future cleanup. At present these potential costs impose a negative externality on the public. EPA's *Federal Register* notice (the Priority Notice) defined hardrock mining facilities as "those which extract, beneficiate or process metals (*e.g.*, copper, gold, iron, lead, magnesium, molybdenum, silver, uranium, and zinc) and non-metallic, non-fuel minerals (*e.g.*, asbestos, gypsum, phosphate rock, and sulfur)."[1] With respect to the proposed

[1] "Identification of Priority Classes of Facilities for Development of CERCLA Section 108(b) Financial Responsibility Requirements." *Federal Register* Vol. 74, No. 143. July 28, 2009.

rule, these facilities include: (1) mining facilities that fall within the classes described in the Priority Notice and (2) mineral processing facilities identified in the Priority Notice that receive ore from mining facilities subject to the rule and that are also proximate and under common operational control of the mining operation.

Owners and operators of facilities subject to this rule are required to demonstrate financial responsibility for future CERCLA liabilities identified in CERCLA section 107, *i.e.,* for response, health assessment, and natural resource damages.

The proposed rule requires that owners and operators subject to the rule:

- Notify EPA that they are subject to the rule and intend to comply and provide basic facility information, within 30 days of the rule's effective date;
- Identify a CERCLA section 108(b) financial responsibility level for their facility;
- Demonstrate evidence of financial responsibility to EPA; and
- Maintain the required amount of financial responsibility until the requirements for financial responsibility are released by EPA.

The rule proposes a financial responsibility formula that owners and operators will use to determine a financial responsibility amount sufficient to cover response, health assessment, and natural resource damages. Based on that formula, the proposed rule requires owners and operators to calculate and submit to EPA an estimate of a financial responsibility amount necessary to cover response and health assessment activities and to address natural resource damages. The formula is also structured to allow facilities, upon meeting certain criteria, to reduce their FR liability to account for enforceable reclamation plans that meet environmental performance standards.

The proposed rule would allow for the use of third-party financial responsibility instruments identified in CERCLA section 108(b)(2). Under Option 1 (preferred option), EPA is proposing an approach under which a financial test would not be available for use by hardrock mining facilities subject to this rule. Under this approach, owners or operators could demonstrate financial responsibility only by using a trust fund, insurance, a letter of credit, or a surety bond, or a combination of those instruments. Alternatively, EPA is co-proposing making a financial test available for use by hardrock mining facilities subject to this rule, which if passed would allow facilities to self-insure all or a portion of their financial responsibility without third-party instruments (Option 2).

The proposed rule allows owners and operators to demonstrate the financial responsibility level required at a facility using one or a combination of these instruments. In addition, the proposed rule allows the owner or operator to demonstrate financial responsibility for multiple facilities using a single instrument.

ES.3 Methodology

EPA developed a multi-dimensional analysis to estimate the costs of the proposed rule. This analysis involves identification of the potentially regulated universe, estimation of regulated facilities' financial responsibility obligations, and assessment of the costs associated with obtaining financial assurance for those facilities. Regarding the distribution of costs, EPA's analysis also examines the extent to which the rule shifts the burden of financing Superfund cleanups and related expenditures away from the public (through EPA) and toward regulated facilities. The specific steps in the analysis are as follows (step numbers refer to related boxes in the flow diagram, presented in Exhibit ES-1 below).

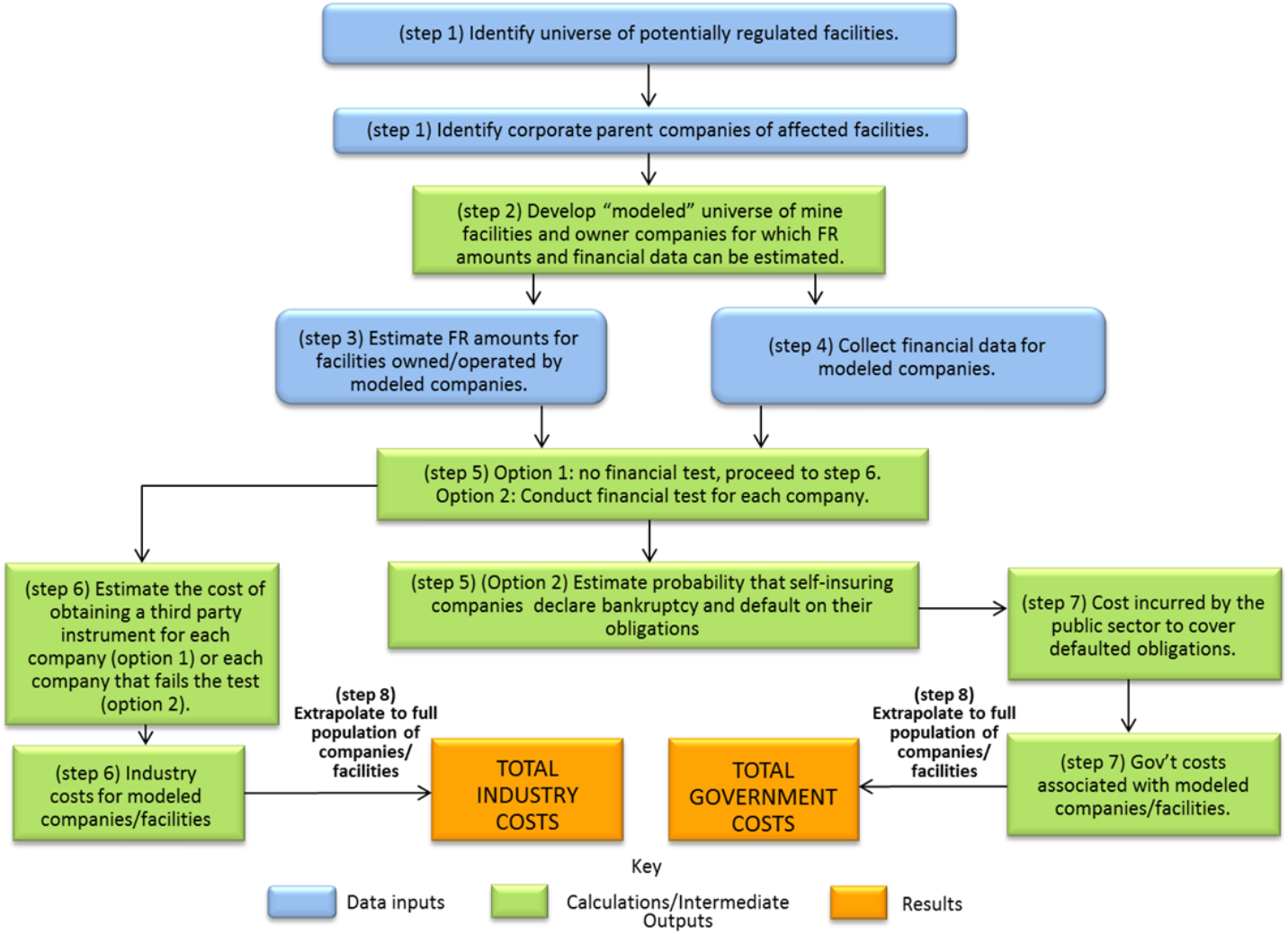
1. **Identify the universe of facilities and companies subject to the proposed rulemaking.** EPA identified a list of mines and mineral processors that may be subject to the proposed rule. From this list, EPA ultimately identified 221 facilities and 121 ultimate parent companies in the affected universe that this RIA evaluates. The facilities in the included universe were identified based on their operating status, commodity mined or processed, and other relevant characteristics. Chapter 2 describes the approach by which EPA identified the potentially regulated universe.

2. **Develop "modeled universe" of facilities.** Ideally, this analysis would rely on company-level financial information and facility-specific engineering cost estimates for each company affected by the proposed rule to estimate the impacts of obtaining financial assurance. This information, however, is not readily available for all facilities and companies. EPA therefore utilized a sample of mining facilities and related owner companies to create a modeled universe, which is assumed to be representative of the full universe. This modeled universe includes 49 individual facilities. Chapters 3 and 4 provide additional detail on development of these data sets and the potential bias they may introduce.

3. **Estimate the financial responsibility amounts for the modeled universe of facilities.** EPA estimated the financial obligations of modeled facilities based on a financial responsibility formula developed by EPA which relates the characteristics of individual facilities to facility-specific engineering cost estimates. The details of this estimation process are described in Chapter 3. EPA also evaluated whether facilities could reduce their financial responsibility liability amount based on documents laying out future reclamation actions that meet environmental performance standards.

4. **Obtain financial information for a subset of publicly-traded companies.** As indicated above, financial data are not readily available for many of the companies likely to be affected by the proposed rule. This is particularly true of privately held companies, which face less stringent financial reporting requirements than public companies. Given these limitations in the availability of financial data, the analysis is based on a sample of publicly-traded companies. Chapter 4 includes more detailed discussion of the financial information and methods utilized in the analysis.

Exhibit ES-1. Conceptual Schematic of Analytic Steps (As Described in *Section ES.3, Methodology*)



Note: Due to data limitations, this RIA estimates uniform financial responsibility amounts for primary smelters using a different method than that described in Step 8 for all other facilities. FR estimation for primary smelters is described in detail in Appendix B.5.

5. **Subject the sampled companies to the proposed financial test and the two regulatory alternatives.** Based on the financial responsibility amounts estimated in step 3 and financial data for each modeled company (when available) in step 4, EPA subjected the entities to the two regulatory alternatives: (1) the preferred option that does not contemplate the financial test (Option 1) and (2) the financial test alternative (Option 2). Under this step, a measure of default probability is derived for modeled entities in the baseline and for those entities passing a financial test under Option 2. This analysis assumes that companies that pass the financial test choose self-insurance over third-party FR instruments.

6. **Estimate *industry* costs currently incurred in the baseline and with the regulatory alternatives.** EPA defines industry costs as the resources expended to obtain third-party financial responsibility instruments for companies that are obligated to do so. In the baseline (absent the rule), industry does not face a requirement to obtain third-party instruments estimated in step 3. Under the proposed rule under Option 1, these costs are borne by all companies to secure financial responsibility amounts for the obligations estimated in step 3. Similarly, under Option 2, companies that fail the financial test will also incur these costs. For each entity, given a financial responsibility amount, this RIA separately estimates the cost of three representative FR instruments: a letter of credit, trust fund, and insurance policy. Finally, this analysis assumes that under Option 2, companies that pass the financial test may still default on their obligations (see step 5 above); however, a zero default rate is assumed for third-party FR. The methods for pricing third-party instruments and deriving related industry costs are detailed in Chapter 4. For purposes of the presentation of results, EPA assumes that companies would obtain the lowest-cost option FR.[2]

7. **Estimate *government* costs associated with the baseline and regulatory alternatives.** For the purposes of estimating changes in government burden due to the rule, this RIA calculates the government burden assuming that FR amounts are representative of costs associated with future CERCLA cleanups. Note that estimated FR amounts may not correspond to actual future CERCLA liabilities due to numerous uncertainties. In the baseline, the government is burdened with the CERCLA cost if a responsible party defaults, as no third-party instruments will be in place. In other words, this RIA assumes that in the baseline the government will carry the cost of future CERCLA liabilities of facilities within the potentially regulated universe. For the baseline, the government burden rate is estimated using the firm exit rate derived from the Census Bureau's Business

[2] Companies that do not currently possess a credit rating from a nationally recognized statistical rating organization (NRSRO) may need to obtain one to pass the financial test, mainly in instances where the company's tangible net worth exceeds the regulatory standard. The resources that companies expend to obtain a credit rating represent an incremental cost of the financial test. EPA does not consider this cost in the modeling exercise, as it likely would apply to a small number of the companies in the potentially regulated universe.

Dynamics Statistics (BDS).[3] This represents a high-end estimate that assumes exiting firms fail to meet any of their CERCLA obligations. Under Option 2, government costs are calculated based on estimated probabilities of default for firms in the modeled universe. This RIA likewise assumes that under this option, if a company passes the financial test but later files for bankruptcy and defaults on its financial responsibility obligations, EPA or other government entities will assume these obligations. Under Option 1, there are no government costs, as no company may self-insure. Third-party instruments secure all of the financial responsibility. The methods for deriving government costs are detailed in Chapters 4 and 5.

8. **Extrapolate costs for the modeled universe to the full universe of potentially regulated facilities with CERCLA financial responsibility amounts.** Based on the estimated industry and government costs associated with the modeled universe (see Steps 6 and 7), the analysis then extrapolates these results to the full universe of facilities. The extrapolation process is discussed in Chapters 3 and 5. Due to data limitations for primary smelters (not represented in the modeled universe), EPA applied a uniform FR amount to these facilities separately from the extrapolation process for other types of facilities. Appendix B.5 describes the derivation of this uniform FR amount.

EPA applies the approach outlined above to estimate the costs of the rule as well as transfers between affected parties. One of the primary economic effects of the proposed rule is to increase the likelihood that owners and operators will have funds necessary to address potential CERCLA liabilities at their facilities. While the reduction in expected government burden represents an important impact of the proposed rule, it is important to note that a majority portion of these impacts—the financial responsibility obligations assumed by government—represent a transfer of costs between parties. That is, the proposed rule primarily affects the distribution of costs between the private and public sectors. By internalizing the costs of cleanup to the responsible party, the rule should provide incentive to reduce the likelihood and magnitude of CERCLA incidents and thus may also reduce the overall magnitude of these costs. The primary industry cost of the rule is the incremental cost of procuring third-party instruments.

As discussed further in Chapter 3, this RIA distinguishes between industry costs (the costs that the owner or operator of a potentially regulated facility incurs to obtain a financial instrument that ensures that funds will be available when needed to cover the facility's CERCLA liabilities) and social costs which are primarily the cost of transactions (represented in this RIA by the fees and commissions paid to financial institutions to obtain financial instruments that provide assurance for the funding of CERCLA financial responsibility amounts as well as industry administrative costs associated with choosing FR instruments and other compliance activities).

[3] The BDS provides the number of firms operating and number of firm exits each year in the mining sector. Firm exits identify when all establishments of a firm cease operations for reasons other than reorganization, merger, or acquisition. Because of the "corporate veil" enjoyed by legal subsidiaries, this analysis uses a facility-based failure rate to model government costs in the baseline due to owner/operator failure. Compared to other measures of failure or default, the BDS firm exit rate also captures both private and public companies. The Business Dynamic Statistics can be accessed at http://www.census.gov/ces/dataproducts/bds/

On the other hand, the net acquisition cost of capital associated with these instruments is presented as a transfer in this RIA.[4]

In addition to the cost elements described above, this RIA also estimates cash-out-of-pocket (accounting) outlays incurred by the facilities to comply with the rule (*i.e.*, the cash outflows associated with compliance with the proposed rule). Note that these costs may occur in the baseline as well, but are spread over a different time period, and thus do not represent incremental costs of the rule. The results of this analysis are presented in Chapter 5.

Finally, the proposed rule could potentially affect the administrative costs incurred by industry and government (note, this RIA does not quantify the government's administrative costs). These costs are also tabulated and reported outside of the modeling exercise. As noted above, the industry's administrative costs are included in the social cost calculation.

ES.4 Analytic Results

Using a period of analysis from 2021 to 2055, the key results of the analysis for the potentially regulated universe of 221 facilities are as follows, assuming a 7 percent social discount rate:

- The proposed rule may require these facilities to secure approximately $7.1 billion in financial responsibility obligations.
- Under Option 1, third-party instruments will cover all of the above liability totals. Under Option 2, third-party instruments will cover 70 percent ($4.9 billion) of the total, with the remainder self-insured due to the availability of the financial test.
- The quantified annualized compliance cost to industry to procure third-party instruments is approximately $111 to $171 million. These values represent the proposed rule's estimated incremental costs to industry.
    - Under Option 1, the total FR amount is estimated to lead to annualized industry compliance costs of $171 million.
    - Under Option 2, the total FR amount is estimated to lead to an annualized industry compliance cost of $111 million.
- The rule's annualized social cost can be estimated as the fees and commissions paid to financial institutions to obtain financial instruments as well as the administrative costs to industry associated with compliance activities. The majority of the industry costs represent a transfer from the regulated industry to the financial industry, and hence the quantified annualized net social costs are estimated at $30 million to $44 million.
    - Under Option 1, the annualized net social costs are $44 million.
    - Under Option 2, the annualized net social costs are $30 million.
- With respect to the impacts on government burden, Option 1 is expected to transfer a burden of approximately $527 million in liability from the federal

[4] This exclusion of transfers from social costs is consistent with EPA's *Guidelines for Preparing Economic Analyses*, which state that social cost analyses "attempt to estimate the total welfare costs, net of any transfers, imposed by environmental policies." See page 1-5 of U.S. EPA (2010) *Guidelines for Preparing Economic Analyses*, p. 1-5.

government to the regulated industry, relative to the baseline. The burden transfer under Option 2 is approximately $511 million. These values are presented as a total for all time periods when the transfers may occur.

Exhibits ES-2, ES-3, and ES-4 summarize the quantified results across the two regulatory options, for both 3 percent and 7 percent social discount rates. The estimated social costs and benefits resulting from the proposed rule are summarized in Exhibit ES-5.

Exhibit ES-2.
Summary of Industry Costs for Potentially Regulated Universe

	Baseline		Option 1: No Financial Test		Option 2: Proposed Financial Test	
Social Discount Rate	**CERCLA FR Amount ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments**	**CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments ($ Millions)**	**CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments ($ Millions)**
3%	$7,064	N/A	$7,064	$222	$4,944	$145
7%	$7,064	N/A	$7,064	$171	$4,944	$111

Note:
Annualized costs represent the incremental cost of acquiring funds for compliance faced by the universe of regulated facilities, amortized over the applicable FR period for each facility. The annualized cost of third-party FR instruments reflects the cost in the first year following rule implementation. The annual cost may decline in future years if the number of facilities in operation declines.

Exhibit ES-3.
Summary of Potential Government Costs*

Cost Category	Baseline	Option 1: No Financial Test	Option 2: Proposed Financial Test
Industry Liabilities ($2015 Millions)			
CERCLA FR Amount Insured through Third-Party Instruments	N/A	$7,064	$4,944
CERCLA FR Amount Self-Insured	$7,064	$0	$2,120
Potential Government Costs ($2015 Millions)			
Government Burden Rate	7.5%	N/A	0.7%
Government Cost	$527	$0	$16
Decrease in Potential Government Costs ($2015 Millions)			
Decrease in Expected Government Costs/Increase in Expected Cleanup Funds		$527	$511

**Totals may not sum due to rounding.*

Note:

In the baseline, the government is burdened with the CERCLA cost if a responsible party defaults, as no third-party instruments will be in place. For the baseline, the government burden rate is estimated using the firm exit rate derived from the Census Bureau's Business Dynamics Statistics (BDS). This represents a high-end estimate that assumes exiting firms fail to meet any of their CERCLA obligations.

Exhibit ES-4.
Summary of Social Costs and Intra-Industry Transfers*

Social Discount Rate	Outcome	Option 1: No Financial Test			Option 2: Proposed Financial Test		
		Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)
3%	Ann. Amount	$222	$168	$54	$145	$107	$38
	Percent of Ann. Cost of Third Party Instrument	N/A	76%	24%	N/A	74%	26%
	Administrative Cost to Industry	N/A	N/A	$0.3	N/A	N/A	$0.3
	Total Social Costs and Transfers	N/A	$168	$54	N/A	$107	$38
7%	Ann. Amount	$171	$127	$44	$111	$81	$30
	Percent of Ann. Cost of Third Party Instrument	N/A	74%	26%	N/A	73%	27%
	Administrative Cost to Industry	N/A	N/A	$0.2	N/A	N/A	$0.3
	Total Social Costs and Transfers	N/A	$127	$44	N/A	$81	$30

**Totals may not sum due to rounding.*

Note:
This RIA estimates the social costs of the rule as the fees and commissions paid to financial institutions to obtain financial instruments that provide assurance for the funding of CERCLA financial responsibility amounts. These costs reflect the value of the real resources needed to comply with the rule.

ES.5 Benefits

EPA identified and evaluated a number of qualitative social benefits resulting from the proposed rule. Those benefits include potential improvements in environmental performance, the potential for faster cleanup at CERCLA-designated sites, and greater transparency in capital markets.

EPA also addressed and quantified the transfer of CERCLA-related costs from the government to private industry that the proposed rule would yield. Although this is not a social benefit, the rule's requirement that facility owners and operators acquire financial assurance if they are unable to pass a financial test would shift the burden of CERCLA costs for sites where the owner or operator has defaulted from the taxpayer to the third-party issuer of the instrument. Therefore, the proposed rule corrects a market failure by requiring facility owners and operators to internalize the risk of a negative externality that in the baseline would be imposed on the public in the future. This will give facilities greater incentives to invest in a socially efficient level of prevention against future CERCLA contamination events.

The estimated social costs and benefits resulting from the proposed rule are summarized in Exhibit ES-5.

Exhibit ES-5.
Summary of Social Benefits and Costs ($2015 Millions)

	Option 1: No Financial Test	**Option 2: Proposed Financial Test**
Ann. Quantified Costs		
Cost of Third-Party FR Instruments	$171	$111
Transfer from Mining Industry to Financial Industry	($127)	($81)
Social Costs from Fees and Commissions Paid to Financial Institutions	**$44**	**$30**
Mining Industry Administrative Compliance Costs	$0.2	$0.3
Total Quantified Social Costs	**$44**	**$30**
Unquantified Costs		
Cost of incentivized actions by mining industry to improve environmental performance.		
Benefits		
Improved efficiency in capital markets due to increased transparency of environmental liabilities.		
Decrease in human and ecosystem exposure to harmful contaminants due to more expeditious site cleanups.		
Decrease in human and ecosystem exposure to harmful contaminants due to incentivized actions by mining industry to improve environmental performance.		

Note: Annualized quantified costs presented in this exhibit are discounted using a 7 percent social discount rate.

ES.6 Equity Considerations and Other Impacts

As required by applicable statutes and executive orders, EPA assessed the potential impacts of the rule with respect to the following issues:

- **Economic impact and employment analysis:** EPA conducted a screening analysis for potentially significant economic impacts. Because detailed financial data are not available for all companies within the potentially regulated universe, the analysis compared annualized compliance costs with company revenues and operating cash flow for a subset of companies with public financial information. EPA did not have sufficient data to model and quantify the potential changes in facilities' employment levels as a result of the proposed regulation. Potential countervailing impacts on labor demand in both the mining and financial sectors make the direction of change unknown.
- **Impacts on small business and governments (regulatory flexibility):** EPA determined that 44 to 56 small businesses may be subject to the proposed rule. An initial screening analysis to determine the impact of the rule on small businesses indicated that EPA could not certify that there is no Significant Impact on a Substantial Number of Small Entities (SISNOSE). EPA worked with small entity representatives (SERs) to evaluate the impact of the proposed rule on small businesses and assess options for regulatory flexibility. EPA has received comments from the panel, and the agency is in the process of assessing the comments for applicability.
- **Environmental justice:** EPA's screening analysis indicates that the populations living in close proximity to hardrock mining and processing facilities have generally similar concentrations of minority groups and people living in poverty to national and state averages. EPA did, however, identify a number of communities with potential environmental justice concerns. These communities are likely to share in any benefits that may result from the proposed rule. EPA does not estimate that the proposed rule would result in disproportionately high or adverse impacts for minority or low-income populations. Overall, the Agency anticipates that the rule will support the safe operation and cleanup of hardrock mining and processing operations, as the rule encourages environmentally sound practices that could decrease future CERCLA liabilities.
- **Energy impacts:** Establishing financial responsibility requirements under CERCLA is not expected to impact energy production, distribution, or consumption. In addition, no measurable adverse impacts concerning energy prices or foreign supplies are expected from the proposed rule.
- **Children's health impacts:** EPA does not anticipate that the proposed rule will lead to a disproportionate negative impact on children. A screening-level proximity analysis found that overall, the number of children living close to hardrock mining and processing facilities is comparable to the proportion of children in the national population. As described in the Environmental Justice section above, the proposed rule may improve environmental performance at mining and processing facilities and accelerate the cleanup process. To the extent

that these benefits are realized, children living in close proximity to mining facilities are likely to benefit.

- **Regulatory planning and review:** The Office of Management and Budget has determined that this regulation is an economically significant regulatory action because it may have an annual effect on the economy of $100 million or more. EPA could not monetize all of the rule's benefits due to data limitations. This RIA, however, estimates that the proposed rule would lead to $511 million to $527 million in reduced cost to government over 34 years (the period of analysis) by increasing the likelihood that responsible parties would have access to the necessary funds for their CERCLA liabilities. The proposed rule would also lead to benefits, including greater transparency in capital markets, improvements in environmental performance, improvements to impaired waters, and faster site cleanups.
- **Unfunded mandates analysis:** The final CERCLA 108(b) rule is subject to the requirements of UMRA because of annual industry compliance costs greater than $100 million. This RIA addresses the requirements of UMRA through the identification of the Federal authority under which the regulation is being promulgated, a qualitative and quantitative assessment of the anticipated costs and benefits of the mandate, estimates of future compliance costs, estimates of disproportionate budgetary effects on industries within the private sector.
- **Federalism:** This proposed rule is not expected to have federalism implications. EPA does not anticipate that the proposed rule will have substantial direct effects on States, on the relationship between the national government and States, or on the distribution of power and responsibilities among the various levels of government. However, EPA welcomes comment from State and local officials in response to this proposed rulemaking.
- **Tribal governments:** EPA has determined that this action will have limited tribal implications to the extent that facilities in the regulated universe are located in close proximity to tribal lands. As no tribal governments own or operate any regulated facilities, tribal governments will not incur any direct compliance costs as a result of the proposed rule. Based on these results, the proposed rule is not expected to impose a substantial burden on tribal governments.

Chapter 1.
Introduction

CERCLA, also known as Superfund, is a federal law designed to support the cleanup of sites contaminated with hazardous substances. This Regulatory Impact Assessment, or RIA, presents EPA's assessment of the costs, benefits, and economic impacts arising from a proposed rule under CERCLA section 108(b). This proposed rule seeks to establish specific financial responsibility requirements for certain classes of mines and mineral processing facilities within the hardrock mining industry. Specifically, the proposed rule defines requirements for demonstration of financial responsibility and for maintenance of financial responsibility instruments, while also establishing criteria that owners and operators must meet to reduce the required financial responsibility level at their facilities.

Overall, the regulatory initiative endeavors to increase the likelihood that owners and operators will have funds necessary to address the CERCLA liabilities at their facilities, thus preventing the burden of cleanup from shifting to other parties, including the taxpayer. Therefore, the proposed rule corrects a market failure by requiring facility owners and operators to internalize the risk of a negative externality potentially imposed on the public in the future. This will give facilities greater incentives to invest in a socially efficient level of prevention against future CERCLA contamination events. In addition, the rule would provide an incentive for the implementation of sound practices at hardrock mining facilities that would decrease the need for future CERCLA actions.

1.1 Background and Need for Regulatory Action

1.1.1 Background

CERCLA authorizes EPA to conduct cleanup and enforcement activities at abandoned and non-operating sites contaminated with hazardous substances. CERCLA was enacted with two primary goals: (1) to provide for cleanup of hazardous substance releases or threatened hazardous substance releases; and, (2) to hold responsible parties liable for the costs of site cleanup. The Act addresses existing threats to human and environmental health while simultaneously discouraging contamination of future sites.

Under CERCLA, EPA coordinates with environmental protection and waste management agencies in each state to identify Superfund sites and conduct the monitoring and response activities under the Act. Following its promulgation in 1980, CERCLA was expanded and reauthorized under the Superfund Amendments and Reauthorization Act of 1986 (SARA). SARA amended and clarified various provisions of the law, including CERCLA section 108(b), and authorized the Emergency Planning and Community Right-to-Know Act of 1986.

Section 108(b) of CERCLA establishes the federal government's authority to promulgate financial responsibility requirements for facilities engaged in the production, transport, treatment, storage, or disposal of hazardous substances. The 1986 SARA amendments to CERCLA clarified the application of section 108(b), establishing that regulated facilities may demonstrate financial responsibility through any one or more of the following financial mechanisms: insurance, guarantee, surety bond, letter of credit, or qualification as a self-insurer.

SARA amendments to section 108(b) also authorized EPA to specify policy or other contractual terms, conditions, or defenses which are necessary for facilities to demonstrate evidence of financial responsibility. CERCLA section 108(b) regulations are intended to ensure that businesses make financial arrangements to address risks from the hazardous substances at their sites.

1.1.2 Need for Regulatory Action and Regulatory History of the Proposed Rulemaking

In late 2003, EPA's Acting Deputy Administrator Stephen L. Johnson requested a comprehensive review of the Superfund program, with the objective of identifying opportunities for program efficiencies that would enable the Agency to ultimately complete more long-term cleanups. The review, which came to be known as the "120-day Study", resulted in 102 recommendations to improve the Superfund program.[5] Recommendation 12 contemplated that EPA's Office of Solid Waste and Emergency Response (OSWER) (now Office of Land and Emergency Management) should study whether promulgating new regulations under CERCLA's broad financial assurance authority could reduce the future financial needs of the Superfund program. Following this recommendation, EPA began working to identify appropriate facility classes that would be subject to financial responsibility requirements. In an initial study of NPL sites listed after 1990 (known as the "Phase 1 Report"), EPA identified Superfund sites across eight general industry sectors for further examination. [6] These industries included manufacturing, mining, recycling, waste management, dry cleaning, retail, transportation, and agriculture.

In 2004, the EPA OIG released a report investigating the financial impact of hardrock mining sites on the Superfund Trust Fund and on states. The OIG identified 156 hardrock mining sites across the nation that had the potential to cost between $7 billion and $24 billion to cleanup. The report estimated that EPA may be responsible for covering up to $15 billion in cleanup costs at these sites. In the five years prior to the OIG report, EPA's total annual Superfund budget was approximately $1.2 billion. Consequently, the report cautioned that cleanup activities at these sites could present a management challenge and financial burden.[7]

In reports published in 2005, 2006, and 2008, the GAO reiterated these concerns, noting that the hardrock mining industry "presents taxpayers with an especially serious risk of having to pay cleanup costs for thousands of abandoned, inactive, and operating mines in the United States." [8] The 2008 report noted that from 1998 to 2007, EPA spent approximately $2.2 billion on cleanups at abandoned hardrock mining sites.[9] The GAO reports encouraged EPA to use its authority under CERCLA section 108(b) to promulgate financial assurance regulations for

[5] U.S. EPA, 2004. Superfund: Building on the Past, Looking to the Future.

[6] U.S. EPA. 2008. Superfund Sites and Financial Responsibility: Background Phase 1 Analysis in Support of Assessing the Financial Responsibility Requirements Under CERCLA 108(b): An Analysis of National Priorities List Superfund Sites to Identify Facility Classes for Further Phase 2 Analysis.

[7] U.S. EPA OIG, 2004. *Nationwide Identification of Hardrock Mining Sites*.

[8] GAO. 2005. Environmental Liabilities: EPA Should Do More to Ensure That Liable Parties Meet Their Cleanup Obligations.

[9] GAO. 2008. Hardrock Mining: Information on Abandoned Mines and Value and Coverage of Financial Assurances on BLM Land.

businesses handling hazardous substances to ensure that "those businesses that cause pollution also pay to have their contaminated sites cleaned up."[10]

The GAO reports described the nature of market failure at these sites. In the absence of the regulation, there is little incentive for the owner or operator of a potentially regulated facility to set aside funds to cover the future CERCLA liability. These costs are often incurred at the end of the active life of the facility, when the facility is no longer generating revenues. As a result, the hardrock mining industry is imposing a negative externality on taxpayers by not fully accounting for the expected future cleanup costs. In addition, a profit maximizing mine would not undertake the same level of sound mining practices it might have undertaken if these costs were fully internalized. The proposed rule would force certain classes of mines and mineral processing facilities within the hardrock mining industry to internalize the expected future costs of contaminated site cleanup. This transfer of costs will improve the efficacy of precautionary actions by the regulated industries to reduce the probability of future contamination.

In 2008, the Sierra Club and other environmental organizations brought suit against EPA for its failure to promulgate financial assurance regulations under CERCLA section 108(b). Consequently, on February 25, 2009 the United States District Court for the Northern District of California issued a ruling that ordered EPA to identify priority classes of facilities that should be subject to financial assurance requirements and to publish a notice in the Federal Register specifying these classes.

In response, on July 28, 2009, EPA published a notice in the Federal Register (the "Priority Notice") identifying classes of facilities within the hardrock mining industry as those for which the Agency would first develop financial responsibility requirements under CERCLA section 108(b). The notice defined hardrock mining facilities as "those which extract, beneficiate or process metals (*e.g.*, copper, gold, iron, lead, magnesium, molybdenum, silver, uranium, and zinc) and non-metallic, non-fuel minerals (*e.g.*, asbestos, gypsum, phosphate rock, and sulfur)." [11] The proposed rulemaking and this RIA focus on this class of facilities.

1.2 Summary of the Proposed Rule and Regulatory Alternatives

1.2.1 Facilities Subject to the Proposed Rule

The proposed rule establishes financial responsibility requirements for certain facilities within the hardrock mining industry. These facilities include: (1) mining facilities that fall within the classes described in the Priority Notice and (2) mineral processing facilities identified in the Priority Notice that receive ore from mining facilities subject to the rule.

The Priority Notice initially also identified additional mining and mineral processing facilities, but the proposed rule excludes them due to their limited operations. These facilities are: mines conducting only placer mining activities; mines conducting only exploration activities; mines of less than five acres of disturbance; and processors with less than five acres of disposal. Further, the proposed rule applies only to facilities that are operating or are inactive but not closed on the effective date of the rule.

[10] GAO. 2006. Environmental Liabilities: Hardrock Mining Cleanup Obligations.

[11] "Identification of Priority Classes of Facilities for Development of CERCLA Section 108(b) Financial Responsibility Requirements." Federal Register Vol. 74, No. 143. July 28, 2009.

1.2.2 Summary of the Proposed Rule

Owners and operators of facilities subject to this rule are required to demonstrate financial responsibility to cover costs associated with liabilities identified in CERCLA section 107, *i.e.*, for response, health assessment, natural resource damage components.

The proposed rule requires that owners and operators subject to the rule:

- Notify EPA that they are subject to the rule and intend to comply and provide basic facility information, within 30 days of the rule's effective date;
- Identify a CERCLA section 108(b) financial responsibility level for their facility;
- Demonstrate evidence of financial responsibility to EPA; and
- Maintain the required amount of financial responsibility until the requirement for financial responsibility for the facility is released by EPA.
- Develop and maintain a facility record that contains information related to the financial responsibility requirements.

The rule proposes a formula by which EPA expects owners and operators to calculate a protective financial responsibility amount. The formula is also structured to allow facilities, upon certain showings, to reduce that amount to account for enforceable reclamation plans that meet environmental performance standards. The proposed formula is designed to reflect the relative risk of facility practices for managing hazardous substances to human health and the environment, including reductions in risk that may result from compliance with other regulatory requirements or other facility practices. The formula assigns values for a facility based on facility and unit characteristics (*e.g.*, open pits, waste rock, tailings, heap leach, process ponds, water management, and operations, maintenance, and monitoring). These values correspond to calculated cost levels, and the formula then aggregates these cost levels to establish the facility-wide financial responsibility amount.

Based on the formula, the proposed rule requires owners and operators to calculate and submit to EPA an estimate of a financial responsibility amount necessary to cover the response component and to address natural resource damages. For the health assessment component, the proposal includes a level of financial responsibility established by regulation that would be applicable at all facilities subject to the rule. Owners and operators would then be required to obtain an acceptable financial responsibility instrument for that level of financial responsibility, submit evidence of the instrument to the Agency, and make information about the instrument available to the public.

The proposed rule would allow the use of third-party financial responsibility instruments identified in CERCLA section 108(b)(2), namely: insurance, surety bond, letter of credit, and trust fund. The proposal also identifies two methods through which an owner or operator could qualify as a self-insurer – passing a financial test and establishing a corporate guarantee. Alternatively, the Agency is co-proposing an approach that would not allow the use of a financial test or guarantee mechanism.

The proposed financial test under the self-insurance approach is a stringent credit rating-based test that can be used to cover all or partial costs of facility's obligations, depending on the owner or operator's credit rating and other relevant financial metrics. The proposed rule also allows the

facility to rely on a guarantee from a corporate parent, a firm owned by the same parent corporation as the owner or operator of the facility, or a firm with a substantial business relationship with the owner or operator of the facility. The details of these options include:

- ***Preferred Option 1: No Financial Test/Corporate Guarantee*.** Under this proposal, the Agency will compel owners and operators subject to this regulation to use one or a combination of the third-party financial responsibility instruments contemplated by the proposed rule.
- ***Option 2: Proposed Financial Test.*** The proposed rule contemplates a test based on long-term corporate issuer credit ratings. Under the terms of the proposed financial test, an owner or operator could assure its entire financial responsibility obligation by submitting annual verification that it holds at least one long-term corporate credit rating equal to or higher than A- as issued by Standard & Poor's (S&P) or its equivalent by another Nationally Recognized Statistical Rating Organization (NRSRO). The proposed test would further allow an owner or operator to assure one half of its obligation by submitting annual verification that it holds at least one long-term corporate credit rating of BBB+ or BBB from S&P or the equivalent from another NRSRO. In addition, an owner or operator electing to use the financial test would be required to have: (1) a tangible net worth of unencumbered funds at least six times the amount of financial responsibility obligations covered by a financial test, including the proposed test; and (2) U.S. assets equal to or greater than 90 percent of its total assets, or six times the amount of financial responsibility obligations covered by a financial test, including the proposed test.[12]
    - ***Corporate Guarantee:*** The proposed rule also allows owners and operators to demonstrate financial responsibility by obtaining a written corporate guarantee from another firm that meets the financial test requirements. The Agency will allow guarantees from the direct or higher-tier parent corporation of the owner or operator, a firm owned by the same parent corporation as the owner or operator, or a firm with a substantial business relationship with the owner or operator. Under certain conditions, EPA will also allow a guarantee from a non-U.S. guarantor that meets the financial test requirements outlined in the proposed regulations provided the guarantor has identified a registered agent for service of process in the state in which the facility covered by the guarantee is located and in the state in which it has its principal place of business.

[12] Tangible net worth (TNW) is defined as the difference between tangible assets (total assets minus intangible assets) and total liabilities. Example intangible assets include intellectual property rights (patents, copyrights, trademarks), non-compete agreements, goodwill, and brand recognition.

The proposed rule allows owners and operators to demonstrate the financial responsibility level required at a facility using one or a combination of these instruments. In addition, the proposed rule allows the owner or operator to demonstrate financial responsibility for multiple facilities using a single instrument.

CERCLA section 108(b)(3) requires a phased-in approach to implement the financial responsibility requirements of the proposed rule. Specifically, it requires that financial responsibility requirements be imposed as quickly as can reasonably be achieved but in no event more than four years after the date of promulgation of the final rule. The statute further requires that, where possible, the level of financial responsibility be achieved through incremental, annual increases.

Correspondingly, the proposed rule provides the following schedule for implementation of financial responsibility requirements, under which owners and operators would be required to demonstrate financial responsibility:

(1) For the health assessment component, 24 months after the effective date of the final rule;

(2) For 50 percent of the financial responsibility level for the response component and natural resource damages, by 36 months after the effective date of the final rule; and

(3) For the full financial responsibility level for the response component and natural resource damages, by 48 months after the effective date of the rule.

Finally, the proposed rule requires regular information submissions to assure proper maintenance of financial responsibility. These requirements include an obligation to update financial responsibility amount calculations every three years, at a minimum, and to notify EPA of changes in the information on the facility's initial notification form, facility transfer, claims filed against the instrument or owner or operator, intent to close the facility, failure of an instrument provider, instrument provider intent to cancel, and owner or operator bankruptcy.

1.3 Organization of the Report

To support the development of the proposed rule, EPA designed and conducted an analysis of the rule's costs, benefits, and economic impacts. EPA presents the data, methods, and results of this analysis in the following chapters:

- **Chapter 2 – Universe of Potentially Affected Facilities and Entities:** This chapter presents a profile of the hardrock mining facilities and their owner companies likely to be affected by the proposed rule. Information presented in this section includes the number of potentially regulated facilities as well as their location, commodity, and operating status. It also discusses the number of affected companies by industry and the annual average revenues and employment of companies in each affected industry.
- **Chapter 3 – Analytic Framework and Estimation of Financial Responsibility Amounts:** This chapter describes the analytic framework applied in the assessment of regulatory impacts for the proposed rule and outlines the approach for a key analytic step – the estimation of engineering costs that form the basis for

facility-specific CERCLA financial responsibility amounts. The chapter then presents the results of extrapolating the median FR amounts for each facility type in the modeled universe to the facility types in the potentially regulated universe.

- **Chapter 4 – Assessment of Financial Responsibility Instruments:** This chapter discusses the methods used to calculate the costs to industry and government of assuring payment of the CERCLA financial responsibility amounts.
- **Chapter 5 – Analytic Results:** This chapter presents the incremental costs of the proposed rule, including industry and government costs, social costs and transfers, cash-out-of-pocket (accounting) outlays, and administrative costs.
- **Chapter 6 – Economic Impact Screening Analysis:** This chapter discusses the economic impacts that may be experienced by companies potentially affected by the proposed rule, specifically relative to the companies' annual revenues.
- **Chapter 7 – Assessment of Benefits:** This chapter outlines the benefits of the proposed rule, including the transfer of burden from the federal government, capital market effects, improvements in site environmental performance, potential impaired water area impacts, and speed of site cleanups. Where possible, benefits are quantified and monetized. However, the majority of the discussion in this section is qualitative in nature, with the exception of impaired water impacts and costs to government subsections.
- **Chapter 8 – Equity Considerations and Other Impacts:** This chapter assesses distributional and other impacts of the proposed rule, including small entity impacts, environmental justice and children's health implications, impacts to tribal governments, assessments of the potential for unfunded mandates and regulatory takings, and federalism implications, among others.

Chapter 2.
Potentially Affected Facilities

This chapter describes the universe of facilities potentially affected by the proposed rule. Specifically, it discusses the approach EPA utilized to identify the facilities subject to the proposed rule and describes the geographic distribution of the facilities, the commodities mined or processed at these facilities, and other characteristics, such as their operating status.

The potentially regulated universe addressed in this assessment includes 221 currently operating mining and processing facilities.[13] As described below, the facilities subject to the proposed rule include surface mines, underground mines, and non-entry mines (*e.g.*, in-situ recovery, brine extraction). In addition, the processors subject to the proposed rule include facilities conducting beneficiation, primary smelting, and other forms of processing.

2.1 Identification of the Universe

Hardrock mining is the extraction and beneficiation of rock and other materials from the earth that contain a target metallic or non-fuel non-metallic mineral. Mineral processing separates and refines mineral concentrates to extract the target material.[14]

For the purposes of this RIA, EPA has identified a list of mines and mineral processors subject to the proposed rule. However, the population of mines and mineral processors that are operating at any given point in time can fluctuate. This is because mines and mineral processors sometimes operate intermittently due to fluctuating commodity prices, other business-related factors, mining and processing technical operations issues, and weather conditions in certain parts of the country. The universe of potentially regulated facilities described in this chapter represents facilities known to be operating as of July 2015.[15]

In establishing the facilities likely to be subjected to the proposed rule, EPA primarily relied on July 2015 data in the U.S. Mine Safety and Health Administration (MSHA) Mine Data Retrieval

[13] As described in Chapter 1, requirements apply to mining facilities that fall within the classes described in the Priority Notice and mineral processing facilities identified in the Priority Notice that receive ore from mining facilities subject to the rule and that are also proximate and under common operational control of the mining operation. Mining facilities that fall within the classes of facilities identified in the Priority Notice but that have limited operations also are not subject to the proposed rule. For more information, see the Preamble document for the proposed rule, which resides in the docket for this rulemaking.

[14] "Identification of Priority Classes of Facilities for Development of CERCLA Section 108(b) Financial Responsibility Requirements." Federal Register Vol. 74, No. 143. July 28, 2009.

[15] For further information on the identification of the information, see U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document," Office of Land and Emergency Management (September 2016), Chapter 4.

System (MDRS),[16] U.S. Energy Information Administration (EIA) (2015),[17] and the 2015 U.S. Geological Survey (USGS) Mineral Commodity Summaries (MCSs).[18]

- *MDRS*

  MSHA maintains information on mining and processing operations under its jurisdiction in the MDRS database and Mines Data Set. MDRS stores an overview of each mine, as well as violation histories, accident and injury information, and sampling data. MDRS can be queried by company or mine and the Mines Data Set aggregates public information on mines under MSHA's jurisdiction. Both are updated on a regular basis. As of July 2015, the Mines Data Set contained records of 84,780 mining facilities. From these initial records, EPA removed 35,103 mines identified as coal mining operations not subject to the proposed rule. Remaining non-coal facilities were retained for further analysis.

- *U.S. EIA (2015)*

  While MSHA data provided information on traditional uranium mines and processors, uranium facilities using more recent techniques (*e.g.*, in-situ recovery) were underrepresented. These facilities are, however, represented in U.S. EIA (2015). Data in this report are based primarily on information reported on Form EIA-851A, "Domestic Uranium Production Report (Annual)" and Form EIA-858, "Uranium Marketing Annual Survey." The Form EIA-851A survey collects data on uranium milling and in-situ recovery processing, feed sources, mining, employment, drilling, expenditures, and reserve estimates while the Form EIA-858 survey includes data collected on contracts and deliveries. Including the in-situ recovery uranium recovery facilities in this report resulted in an addition of eight facilities.

- *2015 MCSs*

  Certain processing facilities, including some smelters and most processors located independently from mining operations, do not fall under MSHA's jurisdiction and are not included in the MSHA data. MCSs are published on an annual basis, and furnish estimates covering nonfuel mineral industry data. Data sheets contain information on the domestic industry structure, government programs, tariffs, and five-year salient statistics for over 90 individual minerals and materials. Using these reports, EPA added 62 additional facilities from MCSs, and state regulatory programs.

- *Company and Government Agency Websites*

  To complete EPA's list of currently operating hardrock mining and processing facilities, EPA accessed company and government agency websites, as well as publicly available Internet sources, to verify and supplement information provided in MSHA, USGS, and EIA documents.

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[16] MDRS data are available at http://www.msha.gov/drs/drshome.htm and Mines Data Set, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp

[17] U.S. EIA (Energy Information Administration). 2015. 2014 Domestic Uranium Production Report. Washington, DC. April. Available online at: http://www.eia.gov/uranium/production/annual/pdf/dupr.pdf

[18] MCS can be accessed at http://minerals.usgs.gov/minerals/pubs/mcs/

From this list of potentially regulated facilities, 44,845 mines were associated with the 59 non-coal commodities previously excluded from this rulemaking in U.S. EPA (2009).[19] Several of these excluded commodities are not expected to be mined or processed in the United States in the future based on the 2015 MCS (*e.g.*, arsenic, asbestos, columbium, gallium, mercury, and thorium). After removing these facilities, EPA also removed an additional 4,548 abandoned (non-currently operating) sites. The remaining list of 354 facilities included only mining and processing facilities falling under the 33 commodities of interest presented in Exhibit 2-1 and considered to have current operations, including:

- Active facilities, which operate on a full-time basis throughout the entire year, barring temporary closure due to unforeseen circumstances such as strikes, accidents, or maintenance shutdowns;
- Intermittent facilities, which only operate during a portion of the year because of seasonal or periodic factors such as weather or economic demand; and
- Temporarily idled facilities, which have ceased all activity, but still have recoverable reserves and anticipate reopening operations.

Nothing in this analysis is meant to limit the extent of EPA's proposed rule. While these 33 commodities are the only commodities EPA believes would be covered in the currently active universe, facilities with primary commodities not on this list may operate in the future, and may still be covered by the proposed rule.

Exhibit 2-1.
Hardrock Commodities Considered for the Potentially Regulated Universe

• Antimony	• Lead
• Barium/barite	• Lithium
• Bauxite/Alumina	• Magnesium
• Beryllium	• Molybdenum
• Bismuth	• Nickel
• Boron	• Phosphate/phosphorous
• Cadmium	• Platinum
• Chromium and compounds	• Potash
• Cobalt	• Rare Earths
• Copper	• Silver
• Fluorspar/fluorite/fluoride compounds	• Titanium
• Germanium	• Tungsten
• Gold	• Uranium
• Hafnium	• Vanadium
• Indium	• Vermiculite
• Iron	• Zinc
	• Zirconium

[19] U.S. EPA. 2009. Mining Classes Not Included in Identified Hardrock Mining Classes of Facilities. Available online at: http://www.regulations.gov/contentStreamer?documentId=EPA-HQ-SFUND-2009-0265-0033&disposition=attachment&contentType=pdf

A number of mine facilities are outside the scope of the proposed rule and therefore this RIA. Specifically, EPA identified classes of facilities that may present a lower level of risk of injury than other facilities within the 2009 Priority Notice universe, and were therefore not included. Those classes are:

- *Mineral exploration projects* – defined as activities conducted to ascertain the existence, location, extent, and/or quality of a deposit of ore or other mineral that is not at an established mine, so long as exploration activities do not exceed an area of five acres of disturbance, owners and operators are required under federal or state law to address environmental matters, owners and operators are compliant with those requirements, and so long as activities do not include development or production activities. Compared to fully-developed mining operations, the impacts of mineral exploration and the volume of waste generated are relatively low.
- *Placer mines* – defined as the extraction or prospecting of materials in glacial or alluvial deposits using water to concentrate, and recover, heavy minerals from placer deposits, including recreational placer operations and suction dredging, so long as no hazardous substances are used in the concentration or processing of materials. Most modern placer mining does not utilize added chemicals, minimizing the potential for release of hazardous substances.
- *Mining operations of less than five acres that do not use hazardous substances and have no underground tunnels or adits* – while individual small mines may cause releases or contamination as a result of certain hazardous substances or mining practices used, such contamination tends to be more limited due to their lower volumes of mining. Further, small mine projects causing a surface disturbance of less than five acres are currently eligible for exemptions from certain financial responsibility requirements.
- *Processors with less than five acres of disposal* – Large surface impoundments and waste piles at mineral processing facilities may present elevated risk due to releases from tailings and wastewater stored in these units. However, the risk posed is lower at waste management units with less than five acres due to the lower qualities of hazardous substance present, the less likelihood of spills and structural instability, and the smaller expected impact of any releases.

EPA excluded 133 facilities in these classes, leaving 221 facilities in what is referred to here as the "included universe." For information on the universe of facilities and their inclusion in the analyses in the RIA, please see Appendix A.

2.2 Description of the Universe

This section describes the facilities potentially subject to the requirements of the proposed rule. Appendix A lists these facilities and reports their location (county and state), MSHA and EPA Facility Registry System (FRS) identification numbers (if applicable), primary commodity, operating status, and type of facility.

Exhibit 2-2 describes the distribution of facilities by facility type and operating status. Of the 221 facilities in the included universe, 41 facilities have co-located activities (*e.g.*, surface mining

and processing, or underground mining and processing). Surface mining is the most common activity, occurring at 92 facilities (42 percent of total). Processing other than smelting takes place at 73 facilities (33 percent of total). Primary smelting occurs at 25 facilities (11 percent of total). Underground mining occurs at 60 facilities (27 percent of total).

Of the 221 facilities, 208 facilities (94 percent) are classified by MSHA as active throughout the year. Of the 13 intermittent or temporarily idled operations, four (31 percent) are surface mines.

Exhibit 2-3 describes the distribution of commodities and the operating status of facilities. The most common commodity in the included universe is gold, representing 61 facilities. The majority of these facilities are in Nevada (34), California (7), and Alaska (4). Of the 61 gold mining and processing facilities, 6 are intermittent or temporarily idled. The primary commodities most commonly mined or processed after gold are copper (29 facilities) and iron ore (29 facilities). Copper facilities are largely located in Arizona (17), Nevada (3), and Utah (4). The majority of iron ore operations are in Minnesota (13) and California (2). Of the 208 active facilities, gold, copper, and iron ore operations account for 110 facilities (53 percent).

Exhibit 2-2.
Included Universe, by Facility Type and Operating Status

Type of Facility	Operating Status			Subtotal
	Active	Intermittent Operation	Temporarily Idled	
Brine Extraction	6			**6**
In-situ Recovery	8			**8**
Surface Mine	88	4		**92**
Underground Mine	56		4	**60**
Processing	68	4	1	**73**
Primary Smelter	25			**25**

Note: Many of the 221 facilities conduct multiple activities. Thus, facilities may be counted in multiple rows of this exhibit.

Exhibit 2-3.
Included Universe, by Commodity and Operating Status

Primary Commodity	Operating Status			Sub-Total
	Active	Intermittent Operation	Temporarily Idled	
Alumina	4			**4**
Aluminum	8			**8**
Antimony	2			**2**
Bauxite	2	1		**3**
Beryllium	3			**3**
Boron	4			**4**
Brucite	2			**2**
Copper	29			**29**
Germanium	3			**3**
Gold	55	3	3	**61**
Indium	2			**2**
Iron Ore	26	2	1	**29**

Exhibit 2-3.
Included Universe, by Commodity and Operating Status

Primary Commodity	Operating Status			Sub-Total
	Active	Intermittent Operation	Temporarily Idled	
Lead-Zinc Ore	8			**8**
Lithium	2			**2**
Magnesium	1			**1**
Molybdenum	5			**5**
Nickel	1			**1**
Phosphate Rock	13			**13**
Platinum Group Ore	2			**2**
Potash	6			**6**
Rare Earths	1	1		**2**
Silver Ore	5			**5**
Titanium	2			**2**
Tungsten	0	1		**1**
Uranium	10		1	**11**
Zinc	8			**8**
Zirconium and hafnium	4			**4**
TOTAL	**208**	**8**	**5**	**221**

Exhibit 2-4 illustrates the geographic distribution of the universe of facilities, based on the available county and state data from MSHA. The majority of these facilities are located in six states: Nevada (45), Arizona (21), Minnesota (14), Utah (14), California (12), and Idaho (9). In four of these six states a single commodity accounts for the majority of mining and mineral processing operations.

Exhibit 2-4.
Geographic Distribution of the Included Currently Operating Universe

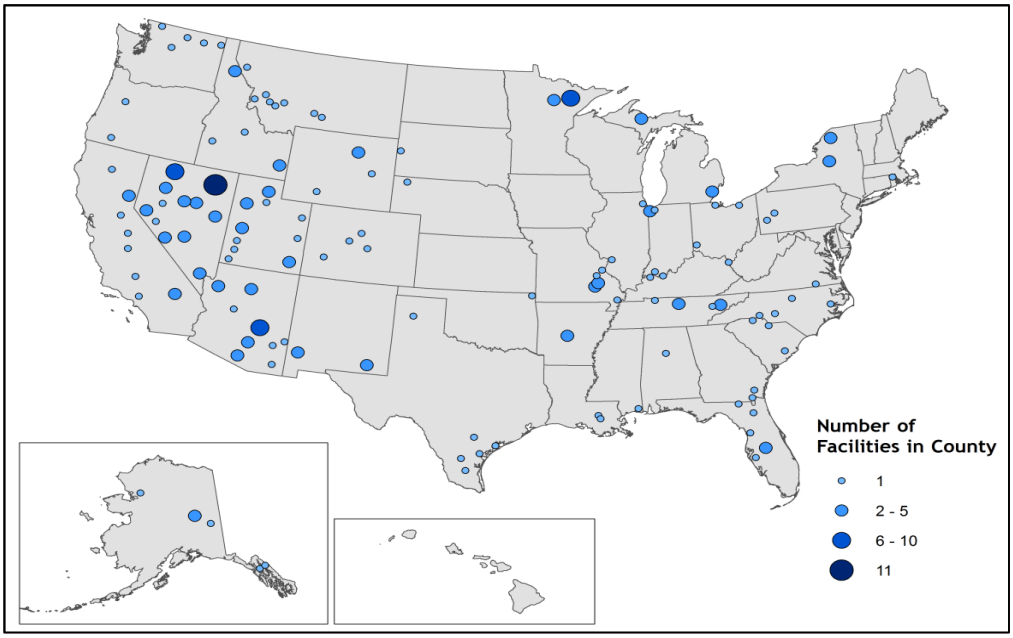


Exhibit 2-5 illustrates the regional nature of the hardrock mining and processing industry, showing the commodities mined or processed in Nevada, Arizona, Minnesota, California, Idaho, and Utah. In Nevada, 34 of 45 facilities produce gold. In Arizona, 17 of 21 facilities produce copper. Iron ore operations make up 13 of 14 facilities in Minnesota, and gold operations make up 7 of 12 facilities in California.

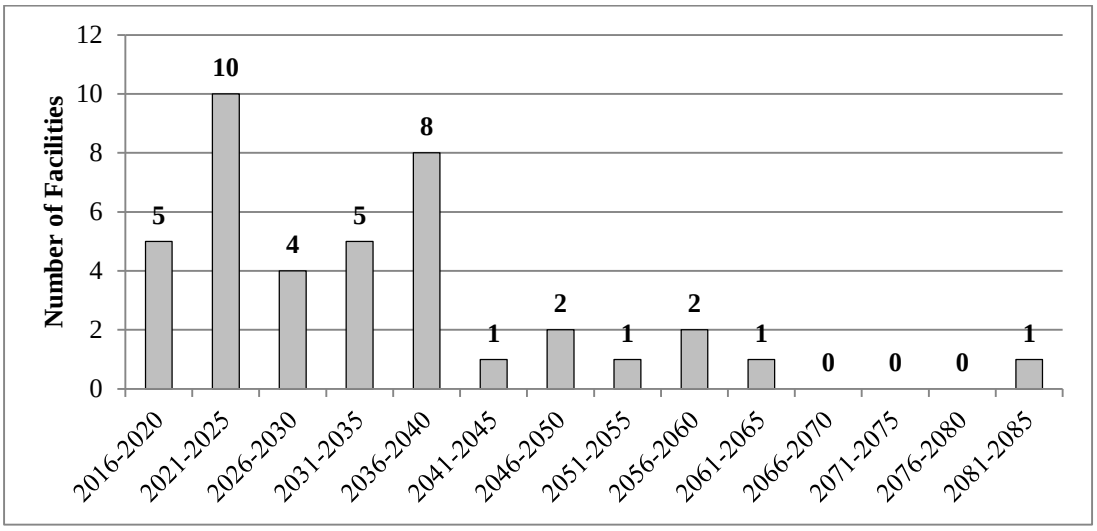
Exhibit 2-5.
Mining and Mineral Processing States, by Commodity: Nevada, Arizona, Minnesota, California, Idaho, and Utah

Commodity	NV	AZ	MN	CA	ID	UT	Sub-Total
Antimony	1	0	0	0	0	0	1
Beryllium	0	0	0	0	0	2	2
Boron	0	0	0	3	0	0	3
Brucite	2	0	0	0	0	0	2
Copper	4	17	1	0	0	3	25
Germanium	0	0	0	0	0	1	1
Gold	34	2	0	7	2	0	45
Iron Ore	0	0	13	0	0	1	14
Lithium	1	0	0	0	0	0	1
Magnesium	0	0	0	0	0	1	1
Molybdenum	2	0	0	0	1	0	3
Phosphate Rock	0	0	0	0	3	1	4
Potash	0	0	0	0	0	3	3
Rare Earths	0	0	0	1	0	0	1
Silver Ore	1	0	0	0	3	0	4
Tungsten	0	0	0	1	0	0	1
Uranium	0	2	0	0	0	1	3
Zirconium and hafnium	0	0	0	0	0	1	1
TOTAL	**45**	**21**	**14**	**12**	**9**	**14**	**115**

For a sample of 40 facilities with available data, the anticipated remaining mine life ranged between zero and 60 years.[20] As shown in Exhibit 2-6, over half (60 percent) of these facilities were projected to cease operations by 2035, while 95 percent were projected to cease operations by 2060. This sample had average and median mine life of 17 and 16 years, respectively.

[20] When available, mine life estimates were sourced from owner and operator annual financial reports. If a company did not report estimated mine life, the median active life taken from a sample of the facilities with company estimates was applied to the first year of operation reported to MSHA to calculate the remaining mine life of the facility. Two out of the 40 facilities in the sample are in the 354 facility "maximum extent" potentially regulated universe but are not within the included universe of 221. Section 4.3 provides more detail on the mine life estimates.

Exhibit 2-6.
Distribution of Mine Life for a Sample of Facilities (n=40)



2.3 Economic Profile of Affected Entities

This section provides an economic profile of owner/operator entities likely to be affected by the proposed rule. The mining and processing facilities subject to the proposed rule have a diverse group of owners, including sole proprietors, domestic and multinational corporations, and joint-venture partnerships. Furthermore, these firms span a wide range of industries, both within and outside of the hardrock mining and processing sector. For example, several mines are owned by diversified holding companies that operate in a variety of industries, including energy, oil and gas, and manufacturing. Financial data for owner/operators in the regulated universe are limited because many firms are privately-held and do not disclose their financial records. This section first describes the data collection methods used for this economic assessment and then provides a summary of potentially affected entities.

For the 221 mining and processing facilities subject to the proposed rule, EPA first identified the current owner based on information in EPA's FRS database. Then, EPA reviewed information from company websites, annual reports, and an Internet search for corporate owners and subsidiaries to identify the highest level parent company for each current owner. Using this approach, EPA identified 121 ultimate parent companies for the 221 facilities in the affected universe as of July 2015. For joint-venture partnerships, more than one parent company was identified per facility.[21]

EPA then collected operating information for these parent companies, including a primary NAICS code, annual revenues, and the number of employees for each firm. Financial information was obtained from a variety of sources, including annual company reports, S&P Compustat database, and online commercial intelligence databases—such as those published by Bloomberg, Hoovers, Manta, and Morningstar. Information for publicly-traded companies was

[21] EPA estimates there are joint-venture partnership owners for 12 facilities in the regulated universe.

generally available through S&P's Compustat database (records for 38 companies were available) or annual reports/SEC filings (records for another 1 company was obtained). However, many of the companies identified are privately-held, and financial information for them is not generally available. In some cases, limited information—such as a single recent year of financial data—was available through other commercial intelligence databases. Financial information for an additional 73 companies was obtained through a review of these online sources. However, no financial information was found for the 10 remaining entities that are not publicly traded.

Exhibit 2-7 describes the scope of industries represented by firms affected by the proposed rule and reports their average annual revenues and number of employees. Overall, industry classification is known for 90 percent of the potentially regulated universe. This list includes the ultimate parent companies of hardrock mining and processing facilities subject to the proposed rule, but may not include all such companies due to data limitations. As shown in the exhibit, approximately two-thirds of the companies for which financial data are known are primarily in mining and processing-related industries. Companies in these industries vary substantially in size. For example, approximately 31 percent of the firms have 100 or fewer employees, while the five largest firms have more than 70,000 employees each. In terms of revenue, the companies in the regulated universe have median annual revenues of $415 million and average annual revenues of over $5 billion. The industry averages among these companies are skewed by large multinational corporations, particularly diversified holding companies with business operations in a wide range of industries. For the subset of companies for which data are available, 25 percent of firms each have less than $15 million in annual revenues, while the top 25 percent of firms each generate more than $4 billion in annual revenues. These data may overstate the actual revenues of companies in the regulated universe because information is more readily available for large, publicly-traded companies. Thus, the reported financial data may not be representative of smaller entities in the regulated universe.

Exhibit 2-7.
Summary of Potentially Affected Companies

NAICS Code	Industry	Potentially Regulated Universe		
		Number of Firms	Average Annual Revenues ($2015 Millions)	Average Number of Employees
112112	Cattle Feedlots	1	$6,051	9,970
211111	Crude Petroleum and Natural Gas Extraction	1	$61	194
212210	Iron Ore Mining	3	$16,592	21,879
212221	Gold Ore Mining	18	$1,520	6,277
212222	Silver Ore Mining	2	$545	1,705
212231	Lead Ore and Zinc Ore Mining	1	$951	3,300
212234	Copper Ore and Nickel Ore Mining	8	$1,896	8,287
212291	Uranium-Radium-Vanadium Ore Mining	3	$680	1,353
212299	All Other Metal Ore Mining	3	$2,522	4,266
212391	Potash, Soda, and Borate Mineral Mining	2	$755	1,456
212392	Phosphate Rock Mining	1	$1	6

Exhibit 2-7.
Summary of Potentially Affected Companies

NAICS Code	Industry	Potentially Regulated Universe		
		Number of Firms	Average Annual Revenues ($2015 Millions)	Average Number of Employees
212393	Other Chemical and Fertilizer Mineral Mining	1	$0	3
212399	All Other Nonmetallic Mineral Mining	3	$329	173
213114	Support Activities for Metal Mining	10	$180	226
213115	Support Activities for Nonmetallic Minerals (except Fuels)	1	$0	2
236115	New Single-family Housing Construction (Except For-Sale Builders)	1	$8	10
237310	Highway, Street, and Bridge Construction	1	$204	260
238910	Site Preparation Contractors	2	$2	100
325180	Other Basic Inorganic Chemical Manufacturing	2	$168	295
325211	Plastics Material and Resin Manufacturing	1	$2,470	3,625
325311	Nitrogenous Fertilizer Manufacturing	1	$16,042	15,500
325312	Phosphatic Fertilizer Manufacturing	3	$8,327	14,638
325320	Pesticide and Other Agricultural Chemical Manufacturing	3	$17,982	31,500
325611	Soap and Other Detergent Manufacturing	1	$656	18,000
327992	Ground or Treated Mineral and Earth Manufacturing	2	$32	111
331110	Iron and Steel Mills and Ferroalloy Manufacturing	6	$12,530	24,125
331313	Alumina Refining and Primary Aluminum Production	3	$1,061	1,509
331318	Other Aluminum Rolling, Drawing, and Extruding	1	$23,906	59,000
331410	Nonferrous Metal (except Aluminum) Smelting and Refining	4	$2,468	3,493
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing and Extruding	1	Unknown	500
331492	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)	1	$480	2,500
331513	Steel Foundries (except Investment)	1	$63,578	209,404

Exhibit 2-7.
Summary of Potentially Affected Companies

NAICS Code	Industry	Potentially Regulated Universe		
		Number of Firms	Average Annual Revenues ($2015 Millions)	Average Number of Employees
334111	Electronic Computer Manufacturing	1	$54,650	187,809
334419	Other Electronic Component Manufacturing	1	$590	753
423520	Coal and Other Mineral and Ore Merchant Wholesalers	1	$15	54
522310	Mortgage and Nonmortgage Loan Brokers	1	$9	43
522390	Other Activities Related to Credit Intermediation	1	$0	1
523930	Investment Advice	1	$91	80
541330	Engineering Services	1	$17,990	92,000
541611	Administrative Management and General Management Consulting Services	1	$3,430	5,259
551112	Offices of Other Holding Companies	4	$21,995	49,447
561499	All Other Business Support Services	2	$1,535	1,326
561990	All Other Support Services	1	$0	2
722513	Limited-Service Restaurants	1	$696	809
921110	Public Administration	1	Unknown	Unknown
Unknown	Unknown	12	Unknown	Unknown
	TOTAL	**121**		

Sources: S&P Compustat, Hoover's, Bloomberg, Manta, and Company Annual Reports.

Chapter 3.
Analytic Framework and Estimation of Financial Responsibility Amounts

This chapter outlines the analytic framework applied in the assessment of regulatory impacts for the proposed rulemaking establishing financial responsibility requirements for certain classes of facilities within the hardrock mining sector under CERCLA 108(b). In addition, it outlines the approach for a key analytic step – the estimation of engineering costs that form the basis for facility-specific CERCLA financial responsibility amounts. Finally, the chapter presents the results of extrapolating the median FR amounts for each facility type in the modeled universe to the facility types in the potentially regulated universe.

3.1 Analytic Framework

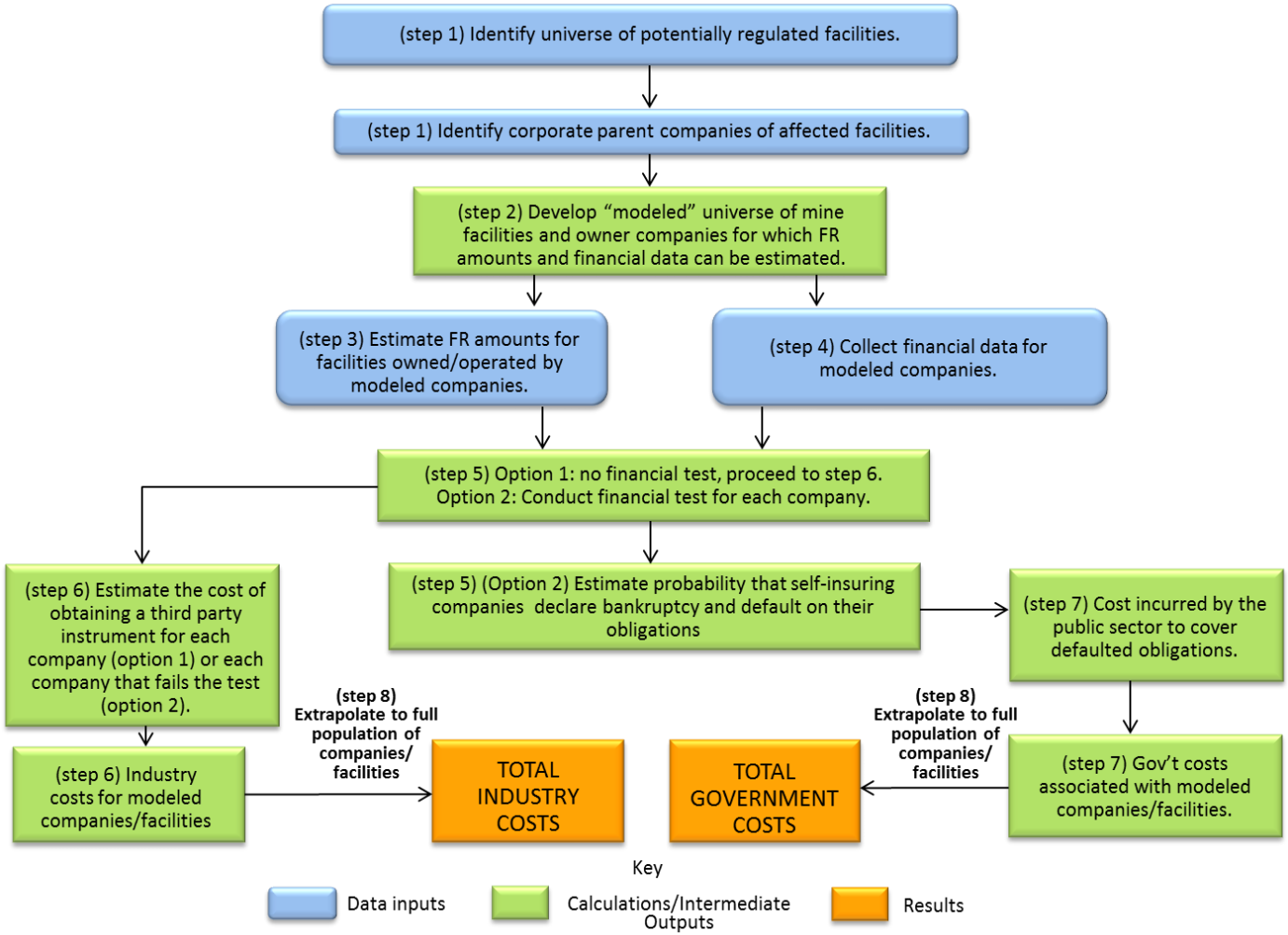
Exhibit 3-1 presents a flow diagram of the key analytic steps in this assessment of the proposed rule. As illustrated in the exhibit, EPA developed a multi-dimensional analysis to estimate the costs of the proposed rule, focusing on the private costs to industry and the change in the distribution of potential CERCLA costs between the industry and government across the baseline and regulatory scenarios. In addition, the analysis discusses whether certain components of industry costs may be considered transfers, from a social welfare standpoint, and derives a related measure of social costs. Finally, the analysis presents the impacts of the rule from an accounting standpoint, illustrating the actual cash "out-of-pocket" the regulated community may expend to procure financial responsibility instruments.

Specifically, this analysis involves identification of the regulated universe, estimation of regulated facilities' financial responsibility obligations, and assessment of the costs associated with obtaining FR instruments for those facilities. The specific steps in the analysis are as follows (step numbers refer to related boxes in the flow diagram):

1. **Identify the universe of facilities and companies subject to the proposed rulemaking.** The approach described in Chapter 2 identified 221 facilities and 121 ultimate parent companies in the affected universe.

2. **Develop "modeled universe" of facilities.** Ideally, this analysis would rely on company-level financial information and facility-specific engineering cost estimates for each company affected by the proposed rule to estimate the impacts of obtaining financial assurance. This information, however, is not readily available for all facilities and companies. EPA therefore utilizes a sample of mining facilities and related owner companies to create a modeled universe, which is assumed to be largely representative of the full universe described in the preceding chapter. This modeled universe includes 49 individual facilities. Section 3.2 of this chapter and Chapter 4 provide additional detail on development of these data sets and the potential bias they may introduce.

Exhibit 3-1.
Conceptual Schematic of Analytic Steps (As Described in *Section 3.1*)



Note: Due to data limitations, this RIA estimates uniform financial responsibility amounts for primary smelters using a different method than that described in Step 8 for all other facilities. FR estimation for primary smelters is described in detail in Appendix B.5.

3. **Estimate CERCLA financial responsibility amounts for the modeled universe of facilities**. EPA estimated the financial obligations of modeled facilities based on a regression analysis relating the characteristics of individual facilities to facility-specific engineering cost estimates. The details of this estimation process are highlighted later in this chapter. EPA also evaluated whether facilities could reduce their financial responsibility based on documents laying out future reclamation actions that meet environmental performance standards.

4. **Obtain financial information for a subset of publicly-traded companies**. As indicated above, financial data are not readily available for many of the owner/operator companies likely to be affected by the proposed rule. This is particularly true of privately held companies, which face less stringent financial reporting requirements than public companies. Given these limitations in the availability of financial data, the analysis is based on a sample of publicly-traded companies. Chapter 4 includes more detailed discussion of the financial information and methods utilized in the analysis.

5. **Subject the sampled companies to the two regulatory alternatives**. Based on the financial responsibility amounts estimated in step 3 and financial data for each modeled company, EPA subjected the entities to the two regulatory alternatives: (1) the preferred alternative that does not contemplate the financial test and (2) the proposed financial test alternative. Under this step, a measure of default probability is derived for modeled entities in the baseline and for those entities passing a financial test under Option 2. This analysis assumes that companies that pass the financial test choose to self-insure or acquire a corporate guarantee over third-party FR instruments.

6. **Estimate *industry* costs associated with the baseline and regulatory alternatives**. EPA defines industry costs as the resources expended to obtain a third-party financial instrument for companies that are obligated to procure one. In the baseline (absent the rule), industry does not face a requirement to obtain third-party instruments estimated in step 3. Under the proposed rule under Option 1, industry costs will include the costs borne by all companies to secure financial responsibility amounts for the obligations estimated in step 3. Similarly, under Option 2, companies that fail the financial test will also incur these costs. This RIA separately estimates the cost of three representative FR instruments: obtaining a letter of credit, trust fund, and insurance policy for each entity, given a financial responsibility amount. For purposes of the analysis, EPA assumes that companies would choose the lowest-cost option.[22] Finally, this analysis assumes that under Option 2, companies that pass the financial test may still default on their obligations (see step 5 above); however, a zero default rate is assumed for

[22] Companies that do not currently possess a credit rating from a nationally recognized statistical rating organization (NRSRO) may need to obtain one to pass the financial test, mainly in instances where the company's tangible net worth exceeds the regulatory standard. The resources that companies expend to obtain a credit rating represent an incremental cost of the financial test. EPA does not consider this cost in the modeling exercise, as it likely would apply to a small number of the companies in the potentially regulated universe.

third-party FR instruments. The methods for pricing third-party instruments and deriving related industry costs are detailed in Chapter 4.

7. **Estimate *government* costs associated with the baseline and regulatory alternatives.** Estimated FR amounts may not correspond to actual future CERCLA liabilities due to numerous uncertainties. For the purposes of estimating changes in government burden due to the rule, this RIA calculates the government burden assuming that FR amounts are representative of costs associated with future CERCLA cleanups. In the baseline, the government is burdened with the CERCLA cost if a responsible party defaults, as no third-party instruments will be in place. In other words, this RIA assumes that in the baseline the government will carry the cost of future CERCLA liabilities of facilities within the potentially regulated universe. For the baseline, the government burden rate is estimated using the firm exit rate derived from the Census Bureau's Business Dynamics Statistics (BDS).[23] This represents a high-end estimate that assumes exiting firms fail to meet any of their CERCLA obligations. Under Option 2, government costs are calculated based on estimated probabilities of default for firms in the modeled universe. Under this option, if a company passes the financial test but later files for bankruptcy and defaults on its financial responsibility obligations, this RIA likewise assumes that EPA or other government entities will assume these obligations. Under Option 1, there are no government costs, as no company may self-insure. Third-party instruments secure all of the financial responsibility. The methods for deriving government costs are detailed in Chapters 4 and 5.

8. **Extrapolate costs for the modeled universe to the full universe of facilities with CERCLA financial responsibility amounts**. Based on the estimated industry and government costs associated with the modeled universe (see steps 6 and 7), the analysis then extrapolates these results to the full universe of facilities. The extrapolation process is discussed later in this chapter, and in Chapter 5. Due to data limitations for primary smelters (not represented in the modeled universe), EPA applied a uniform FR amount to these facilities separately from the extrapolation process for other types of facilities. Appendix B.5 describes the derivation of this uniform FR amount.

EPA applies the approach outlined above to estimate the costs of the rule as well as the distribution of costs between affected parties. One of the primary economic effects of the proposed rule is a transfer of estimated CERCLA costs assumed by the government in the baseline to private parties under the proposed rule. While the change in government costs represents an important impact of the proposed rule, it is important to note that a portion of these impacts—the financial responsibility obligations assumed by government—represent a transfer of costs between parties. That is, although the proposed rule may affect the distribution of costs between the private and public sectors, it does not affect the overall magnitude of these costs. Under EPA's modeling approach, quantified costs associated with CERCLA cleanups remain unchanged, regardless of whether individual companies or the government incur these costs. The primary industry cost of the rule is therefore the incremental cost of procuring third party

[23] In the baseline, the government costs are calculated using the three-year average of the annual firm exit rate calculated from the BDS (7.45 percent). Section 5.3 describes the application of this assumption in more detail.

financial instruments. Estimates of administrative costs to industry are also provided. Industry costs that were not quantified, but are qualitatively discussed, include the costs of actions to improve environmental performance, which are incentivized due to the rule and the proposed reduction factors. EPA addresses the potential broader benefits of the rule related to improved facility operations, accelerated cleanups, and other factors in Chapter 7.

For purposes of estimating the cost impacts of the proposed rule, this RIA distinguishes between two types of costs: (1) the private costs imposed on facility owners and operators and (2) the social costs imposed on society as a whole. The private costs of the rule represent the costs that the owner or operator of a potentially regulated facility bears to obtain a financial instrument that ensures that funds will be available when needed to cover the facility's CERCLA liabilities. The measurement of private costs faced by different parties is required to evaluate the distributional impacts of the rule and to predict how different parties will respond to the change in regulation. For example, as described in Chapter 4, the estimated private costs of different types of financial instruments influence the choice of instruments among regulated companies.

The private costs realized by facility owners and operators to obtain a financial instrument include the fees associated with each instrument type and the incremental cost of acquiring funds to secure each instrument (*e.g.*, the cost incurred to apply collateral for a letter of credit).[24] To secure FR instruments, facility owners may use available funds or procure capital from debt or equity markets. In either case, this RIA uses each company's weighted average cost of capital (WACC) to estimate the net cost of acquiring funds. For financial instruments structured such that the facility owner or operator realizes a return on capital set aside but still must acquire incremental funds at the WACC, this RIA estimates private costs as the difference between the two, plus the costs associated with commissions and fees.

Social costs reflect the value of the real resources (*e.g.*, labor and capital) needed to comply with the rule. Discerning social costs in the context of this proposed rule presents an analytic challenge, as these costs are not fully quantifiable. However, this analysis considers the following to be social costs of the rule: (1) costs of calculating the required FR amounts; (2) the fees and commissions paid to financial institutions to obtain financial instruments that provide assurance for the funding of CERCLA financial responsibility amounts; and (3) industry administrative costs to review FA calculations and inputs, choose an FR instrument, and otherwise comply with the proposed rule.[25] On the other hand, the net acquisition cost of capital associated with these instruments is presented as a transfer in this RIA.[26] The theoretical argument supporting this presentation suggests that, even though the rule causes society to adjust its optimal portfolio of investments, the broader economy will re-equilibrate, and any incremental welfare differences may be small.

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[24] As described in Chapter 4, the structure of capital set asides varies by financial instrument. For a letter of credit, the capital set aside is collateral required by the bank. For a trust fund, the funding of the trust represents a capital set aside. For an insurance policy, the premiums paid by the facility owner or operator are capital set asides.

[25] A fourth category of social cost could include the cost of any technologies adopted as a result of having mines fully internalize the expectation of a future negative externality (*e.g.*, any engineering controls mines choose to install in order to prevent or minimize their CERCLA FR amount). This effect is separately accounted for in the estimation of reduction-based FR amounts and in the benefits discussion in Chapter 7.

[26] This exclusion of transfers from social costs is consistent with EPA's *Guidelines for Preparing Economic Analyses*, which state that social cost analyses "attempt to estimate the total welfare costs, net of any transfers, imposed by environmental policies." See U.S. EPA (2010) *Guidelines for Preparing Economic Analyses*, p. 1-5.

In addition to the cost elements described above, this RIA also estimates cash-out-of-pocket (accounting) outlays incurred by the facilities to comply with the rule (*i.e.*, the cash outflows associated with compliance with the proposed rule). Note that these costs may occur in the baseline as well, but in the baseline, the facilities determine the time period over which they save for these costs. In the regulatory scenario, a facility must set aside funds for these costs as determined by the schedule in the rule. Since these costs may be incurred in either the baseline or with the rule, these costs do not represent incremental costs of the rule. The results of this analysis are presented in Chapter 5.

Finally, the proposed rule could potentially affect the administrative costs incurred by industry and government (note, this RIA does not quantify the government's administrative costs). Industry's administrative costs are discussed above and included in the social cost calculation. Government administrative costs may include verifying financial responsibility amounts, facility inspection, follow-up with financial institutions, and reviewing other documents that owners and operators submit.

3.2 Estimation of CERCLA Liability Financial Responsibility Amounts

As described above, this chapter and subsequent chapters assess the cost to acquire and maintain financial responsibility instruments under the proposed rule. First, this RIA identified the universe of facilities covered by the proposed rule in Chapter 2. Next, to assess the impacts of the proposed rule, this RIA estimates each company's financial responsibility obligation, focusing on the obligations of the modeled universe. The amount of financial responsibility required includes the following components:

- ***Response component:*** Response activities include the full suite of cleanup costs that may be incurred at a facility. These include the costs of solid and hazardous waste disposal, various feature-specific costs (*e.g.*, engineering costs unique to open pits or waste rock piles), drainage controls, operations and maintenance (O&M) costs (distinguishing between interim, short-term, and long-term O&M), and water treatment costs.
- ***Health assessment component:*** The financial assurance obtained by regulated facilities must also cover the costs associated with all phases of a Public Health Assessment or a Health Consultation (HA) performed by the Agency for Toxic Substances and Disease Registry (ATSDR).
- ***Natural resource damages (NRD):*** CERCLA 108(b) also requires that regulated facilities obtain financial assurance to cover the natural resource damages that may result from releases of hazardous substances, inclusive of any costs associated with the assessment of these damages.
- ***Indirect costs:*** This category includes relevant overhead and oversight costs.

Exhibit 3.2 provides an example of how the EPA calculated the financial responsibility amount for an example facility.[27] The RIA estimated the financial responsibility amount using a

[27] The data used in the example for each response category comes from site conditions that exist at facilities in the modeled universe, but the below site conditions do not all exist together at the same facility.

Financial Responsibility Formula (the formula) developed by EPA.[28] This formula consists of the three components described above, including response, NRD, and health assessment. Detailed information about the formula and the method for calculating the financial responsibility amount for each facility is provided in **Appendix B**.

Exhibit 3-2.
Financial Responsibility Calculation for an Example Facility

Row	(A) Response Category	(B) Formula Input	(C) Formula FR ($ millions)	(D) Enforceable Response Plan	(E) Total FR after Reductions ($ millions)
1	Solid/Hazardous Waste Disposal	Yes	$2.60	No	$2.60
2	Open Pit	38 acres	$4.40	Yes	$0.00
3	Waste Rock	206 acres	$15.30	Yes	$0.00
4	Heap/Dump Leach	163 acres	$14.40	Yes	$0.00
5	Tailings Facility	286 acres	$16.40	Yes	$0.00
6	Process Ponds/Reservoirs	20 acres	$0.72	Yes	$0.00
7	Underground Mine	Has hydraulic head	$0.20	Yes	$0.00
8	Slag Pile	0 acres	$0.00	N/A	$0.00
9	Drainage	713 acres (total)	$1.02	Yes	$0.00
10	Interim O&M	0.7 inches net precipitation 163 acre heap/dump leach 286 acre wet tailings facility	$136.66	No	$136.66
11	Water Treatment	Not an in-situ leach facility 19 gallons per minute flow rate	$1.87	Yes	$0.00
12	Short-Term O&M/Monitoring	713 acres (total) Not all capital costs reduced	$1.97	Yes[29]	$1.97
13	Long-Term O&M/Monitoring	713 acres (total) Not all capital costs reduced	$3.82	No	$3.82
14	**Total Response Amount**	**Sum of Rows 1-13**	**$199.36**		**$145.05**
15	NRD Multiplier	13.4 percent of Response Amount	$26.71	N/A	$19.44
16	Regional and State Adjustment Factor	43 percent of Response Amount adjusted by NRD factor (Row 14 + Row 15)	$97.21	N/A	$70.73
17	Health Assessment	Yes	$0.55	N/A	$0.55
18	**Total Financial Responsibility**	**Sum of Rows 14-17**	**$323.84**		**$235.77**

[28] U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document," Office of Land and Emergency Management (September 2016).

[29] Although an enforceable response plan is in place for the short-term O&M component, the financial responsibility amount is not reduced because not all of the capital costs have been reduced (see row 1 – solid and hazardous waste disposal).

As presented in Exhibit 3-2, EPA first estimated the financial responsibility for the response component of the formula. The response component of the formula consists of sub-formulas (based on statistical regression analyses) associated with twelve categories of response activities presented in Column A. These include categories for types of engineering costs (capital costs, rows 1-9) as well as Interim Operation and Maintenance (O&M), Water Treatment, Short-term O&M, and Long-term O&M. EPA identified the presence of each of these response categories at each facility from states' closure and reclamation documents, Environmental Impact Statements (EISs), and other publically available sources. The full detailed facility-related information for modeled universe is presented in Appendix B, Exhibits B-4 and B-5.

EPA used facility-specific input data presented in Column B of Exhibit 3-2 in sub-formulas for the response categories represented in Column A, where they are present at the facility. For most response categories, the acreage of the relevant site feature was used as an input. For O&M response categories, inputs included total site-wide acreage (indicated as "acres (total)"), wet acreage (the area of heap and dump leaches and wet tailings impoundments), net precipitation (precipitation less evapotranspiration), and the gallons per minute flow rate experienced at the facility. For the solid waste/hazardous substances response category, the sub-formula is a fixed amount. Thus the presence or absence of solid waste/hazardous substances is denoted by a "yes" or "no" in Column B. For the water treatment response category, inputs are water treatment flows in gallons per minute and whether or not the facility practices in-situ recovery. EPA collected these facility-specific data from states' closure and reclamation documents, Environmental Impact Statements (EISs) and other publically available sources. Comprehensive lists of all the inputs and sources used to calculate the financial responsibility amount of the modeled universe are presented in Appendix B, Exhibits B-4 and B-5.

Estimates of financial responsibility for each response category are presented in Column C. The results of these sub-formulas are in turn aggregated to form the facility's financial responsibility amount for the response component (Row 14). The response component is then combined with the results of the other two components (discussed below) to arrive at a total financial responsibility amount for the facility. Appendix B, Exhibit B-8 provides the total financial responsibility amount for the modeled universe.

The estimation of the response components above does not reflect facility-specific measures that owners and operators will implement in the future to reduce their obligations. The proposed rule allows owners and operators to reduce financial responsibilities by demonstrating that they have existing plans backed by enforceable documents (*e.g.*, bonded reclamation plans) that will reduce the CERCLA financial responsibility at their sites. Consistent with proposed rule's structure, EPA applied reductions to the maximum financial responsibility amounts. For the purpose of the RIA, EPA assumed that where it could identify a reclamation plan backed by a financial bonding for a given response category (as denoted by "Yes" in Column D of Exhibit 3-2), the RIA applied reductions to the response categories in Column A. The RIA also assumed that facility would receive full reductions (*i.e.*, amount in Column C zeroed out in Column E) for that response category. Where EPA could not identify controls, facilities received zero reductions for the relevant response category (as denoted by "No" in column D). For the short- and long-term O&M components, facilities were required to have reduced all of their capital costs to receive a reduction for existing plans for those components backed by enforceable documents. Column E reflects the reduced financial responsibility amount after applying the reduction. Its values across various response categories are totaled in Row 14. Appendix B, Exhibits B-6 and B-7 summarize

the reduction for each response component at each facility in the modeled universe. Appendix B, Exhibit B-9 presents the reduced financial responsibility amount for the response component of the model universe.

Once EPA estimated the financial responsibility amount for the response component, EPA then adjusted the reduced FR amounts for each facility by applying the NRD component (Row 15), regional and state-specific indirect cost multipliers (Row 16), and the health assessment component (Row 17). The adjusted amount in Row 18 of Exhibit 3-2 represents the financial responsibility obligation for an example facility. For health assessment component, EPA assumes a fixed financial responsibility amount of $550,000 per facility based upon health assessment information released by the Agency for Toxic Substances and Disease Registry. For NRD, EPA estimated that such damages are on average 13.4 percent of the response component estimated for each facility. As described in Chapter 5 of the Financial Responsibility Formula Background Document, this figure reflects EPA's assessment of historical NRD settlements and historical response costs at hardrock mining and processing facilities.[30] Chapter 3 of the Financial Responsibility Formula Background Document includes additional information on these costs.

The financial responsibility amounts were estimated using cost data normalized to national values. Therefore, the financial responsibility formula is multiplied by the most current state cost adjustment factors developed by the U.S. Army Corps of Engineers (2015) to derive a state-specific cost. Appendix N of the Financial Responsibility Formula Background Document includes a list of these state-specific factors. In addition, the direct engineering costs do not include overhead and oversight costs related to mobilization and demobilization, engineering design and redesign, contingency, contractor profit and overhead, contractor liability insurance, payment and performance bonds, and direct EPA (or other government agency) contract administration and contract management. EPA adjusts the estimated response component and NRD component by the relevant state factors and indirect cost multipliers to derive the total FR obligation.[31]

Exhibit 3-3 summarizes the reduced, adjusted FR amounts for the modeled universe by facility type. The detailed financial responsibility amounts for the modeled universe are provided in Appendix B, Exhibit B-10.

EPA also developed assumptions to scale the acreages of certain features, which in turn affected the facility-wide acreage, to model facility expansion over time and the effect increasing FR amounts would have on FR instrument maintenance. When EPA calculated the cost of FR instruments, it used facility-specific FR amounts for facilities owned or operated by a company with readily available financial data. EPA evaluated the cost of acquiring an initial FR instrument immediately after rule implementation and updating and maintaining the FR instrument over the course of facility operation. Since the acreages of each feature at a facility and the facility-wide acreage drive both the capital and O&M costs and the maximum FR amounts are calculated using the estimated acreage at closure, EPA expects facilities will initially experience FR amounts lower than those at closure. FR amounts will then increase incrementally as a result of ongoing construction and disturbance over the course of operations.

[30] U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document" Office of Land and Emergency Management (September 2016).

[31] These adjustments are not applied to the health assessment component.

A full description of the development of acreage scaling rules is available in Appendix C. Chapter 4 of this document discusses FR instrument pricing and acquisition.

Exhibit 3-3.
Adjusted, Reduced FR Amounts by Facility

Facility Type	Facility FR - Median ($ Millions)	Facility FR - Average ($ Millions)
In-situ Recovery	$1.3	$59.9
Processor/Refiner	$75.6	$75.6
Surface Mine	$47.8	$135.5
Surface Mine/Processing	$28.4	$106.1
Underground Mine	$5.4	$7.2
Underground Mine/Processing	$28.6	$28.6

3.3 Extrapolation of FR Amounts from the Modeled Universe to the Regulated Universe

To extrapolate the FR amounts from the modeled universe of 49 facilities to the regulated universe of 221 facilities, EPA calculated the median FR amount for each facility type (see Exhibit 3-3). EPA then grouped the regulated universe by facility type, and applied the median FR amount for each facility type in the modeled universe to all facilities of that type in the regulated universe.

Some facility types in the regulated universe did not exist in the modeled universe. Those are brine extraction/processing facilities, surface mine/processing/primary smelter facilities, surface mine/underground mine facilities, and primary smelters. EPA calculated a uniform FR amount to apply to primary smelters. For an explanation of that calculation, see Appendix B.5. EPA assigned the other facilities the median FR amount of a proxy facility type in the modeled universe. EPA used the median FR amount for in-situ recovery facilities in the modeled universe for brine extraction/processing facilities in the regulated universe, the median FR amount for surface mine/processing facilities in the modeled universe for surface/mine/processing/primary smelter facilities in the regulated universe, and the median FR amount for surface mine facilities in the modeled universe for surface mine/underground mine facilities in the regulated universe. EPA used these proxies due to data limitations, and because they likely represent the most similar set of operational activities to the missing facility types. However, these proxies may result in overestimates or underestimates due to uncertainties in these approximations, as well as in actual facility characteristics.

Exhibit 3-4 presents the results of the extrapolation from the modeled universe to the regulated universe.

Exhibit 3-4.
Median FR Amounts per Facility: For Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Modeled Universe (n=49)	Potentially Regulated Universe (n=221)	Facility FR - Median ($2015 Millions)
Brine Extraction/Processing	(none; assume equal to ISR)	2	$1.3
In-situ recovery (ISR)	3	8	$1.3
Processor/Refiner	1	33	$75.6
Surface Mine	25	62	$47.8
Surface Mine/Processing	13	27	$28.4
Surface Mine/ Processing/ Primary Smelter	(none; assume equal to surface mine/processing)	2	$28.4
Surface/Underground mine	(none; assume equal to surface mine)	1	$47.8
Underground Mine	5	53	$5.4
Underground Mine/Processing	2	6	$28.6
Primary Smelters	(none; calculated a uniform FR amount for all primary smelters, see Appendix B.5)	23	$11.4

Chapter 4.
Assessment of Financial Responsibility Instruments

4.1 Introduction

The previous chapter discussed the methods for deriving financial responsibility amounts for mines and mineral processing facilities. This chapter discusses the methods used to calculate the costs to industry and government of assuring payment of these amounts, focusing on 21 owner/operator companies of 38 mining facilities[32] in the modeled universe.[33] This pricing analysis has two primary components: (1) subjecting the modeled universe to the proposed financial test, to identify entities that are able to self-insure; and (2) for entities unable to self-insure, estimating the cost to procure third-party financial responsibility instruments. These costs include, for example, annual commission fees paid on a LOC and the acquisition costs of capital to fund trust contributions. Exhibit 4-1 below summarizes the key inputs and analytic components, which are discussed in further detail below.

4.2 Assessment of Financial Test/Corporate Guarantee Options

As outlined in the introductory chapter, the Agency is co-proposing this rule with and without financial test and corporate guarantee options for demonstrating financial responsibility. The details of these options include:

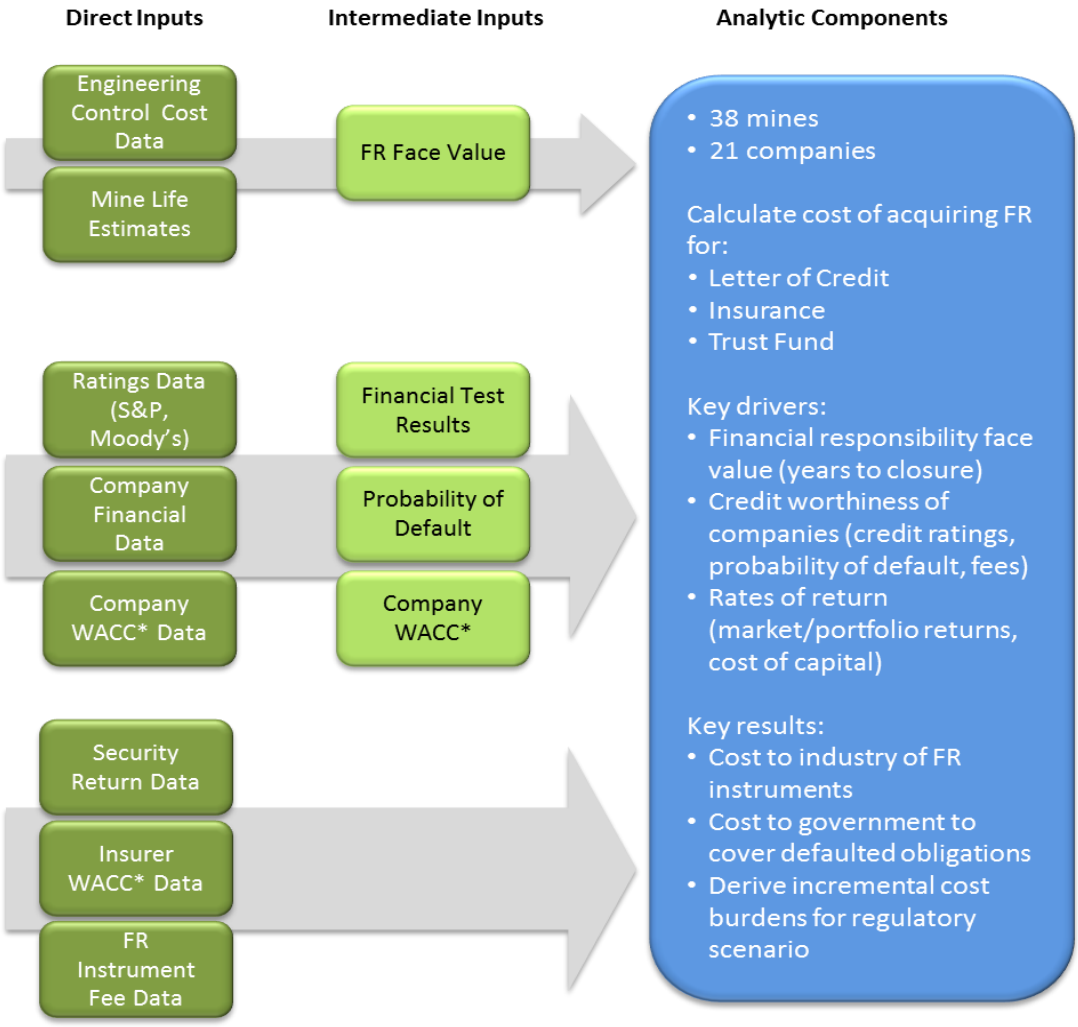
- ***Preferred Option 1: No Financial Test/Corporate Guarantee.*** Under this option, the Agency will compel owners and operators subject to this regulation to use one or a combination of the third-party financial responsibility instruments contemplated by the proposed rule.
- ***Option 2: Proposed Financial Test.*** The proposed rule contemplates a test based on long-term corporate issuer credit ratings. The test would allow owners/operators to self-insure the entire obligation by submitting annual verification that they hold at least one long-term corporate credit rating higher, and no long-term corporate credit rating lower than A- as issued by S&P, or the rating's equivalent as issued by another NRSRO. The proposed test would also allow owners/operators to self-insure one half-of their obligation by submitting annual verification that they hold at least one long-term corporate credit rating of, and no long term corporate credit rating lower than, BBB+ or BBB from S&P or the equivalent rating from another NRSRO. In addition to the ratings thresholds, a firm electing to use the financial test would be required to have a tangible net

[32] The identified owner/operator companies of the 49 facilities in the modeled universe were matched to S&P's financial database. This crosswalk identified the owner/operator companies of 40 facilities in S&P financial database. Two of these facilities have entered bankruptcy and therefore did not have the necessary recent financial data to be included in the analysis.

[33] It is important to distinguish between the mine facilities, to which the FR amount applies, and the owner/operator company that is obligated to fund, or secure, this FR amount. One owner/operator may have this obligation for more than one mine.

worth of at least six times the environmental liabilities covered by the financial test[34] and U.S. assets equal to or greater than 90 percent of its total assets, or six times the amount of financial responsibility obligations covered by a financial test. [35]

Exhibit 4-1.
Key Inputs and Analytic Components of the Pricing Analysis



*WACC – weighted average cost of capital

[34] Tangible net worth (TNW) is defined as the difference between tangible assets (total assets minus intangible assets) and total liabilities. Example intangible assets include intellectual property rights (patents, copyrights, trademarks), non-compete agreements, goodwill, and brand recognition.

[35] This RIA assumes that all firms have a sufficient volume of U.S. assets to meet this criterion. In the modeled universe, the firms that are self-insuring would still have sufficient assets to exceed the six times the financial responsibility obligations threshold even if a relatively small percentage of their total assets were U.S.-based.

- ***Corporate Guarantee:*** Option 2 also allows owners and operators to demonstrate financial responsibility by obtaining a written corporate guarantee from another firm that meets the financial test requirements. The Agency will allow guarantees from the direct or higher-tier parent corporation of the owner or operator, a firm owned by the same parent corporation as the owner or operator, or a firm with a substantial business relationship with the owner or operator. Under certain conditions, EPA will also allow a guarantee from a non-U.S. guarantor that meets the financial test requirements outlined in the proposed regulations.[36]

To determine whether the owner/operator companies in the modeled universe would pass the financial test, EPA compared the relevant financial characteristics of each company, along with the related FR amount for each affiliated mining facility, to the Option 2 test requirements. As discussed in detail in Chapter 5, where the analytic results are presented, a limited number of companies satisfy the test requirements. Thus, most owner/operator companies would be required to secure a third-party FR instrument to satisfy the standards of the proposed rule.

4.3 Cost to Industry of Financial Responsibility Instruments

EPA estimates industry costs for the owner/operator companies that are unable to utilize a self-insurance option under the proposed rule as the resources expended and/or foregone to obtain a third-party financial responsibility instrument. This estimate includes all companies under Option 1 (as the financial test option is unavailable) and those companies unable to pass the financial test under Option 2. An owner/operator of a facility subject to the proposed rule will need to establish financial responsibility for CERCLA liabilities at the facility. The proposed rule contemplates the following third-party FR instruments: letter of credit (LOC), trust fund, insurance, or surety bond. In addition, under certain conditions, an owner or operator will be able to satisfy the requirements by establishing more than one financial mechanism per facility, but the cost associated with combining multiple instruments is not estimated in this RIA due to modeling complexity. The proposed rule's FR instrument details relevant to this RIA include the following (see Appendix D for more details on these instruments):

- **Letter of Credit:** An owner or operator will be able to satisfy the requirements of the proposed rule by obtaining an irrevocable standby letter of credit. Through a letter of credit, the bank provides assurance that the owner's or operator's CERCLA liabilities will be paid. An owner or operator who uses a letter of credit to satisfy the requirements of the proposed rule will also be required to establish a standby trust fund.[37]
- **Trust Fund:** Funds transferred to the trust fund by the owners and operators would be held in the trust for the purpose of paying the owners' and operators'

[36] Note that EPA's identification of the owner/operators of the potentially regulated universe includes identification of the ultimate parent entity.

[37] In the proposed rule, a standby trust fund is similar in structure to the trust fund described below, except its main purpose is that it either hold the letter of credit or be established alongside the letter of credit to provide a repository for funds drawn from the letter of credit in instances where the issuing institution declines to extend the letter of credit. Since the standby trust simply holds the letter of credit and is not the primary method of financial assurance, costs associated with the trust are not estimated for simplification purposes.

CERCLA liabilities as prescribed by the proposed rule. Payments into the trust fund would be made by the owner or operator in accordance with the compliance schedule for the CERCLA financial responsibility regulations. Thus, the four-year implementation window established in CERCLA section 108(b)(4) would serve as the trust fund's initial pay-in period. Upon each three-year update described later in this chapter, the company will have a similar pay-in period to shore up the new financial obligation estimate.

- **Insurance:** Through the insurance policy, the insurer agrees to pay for the CERCLA liabilities of the owner or operator under certain circumstances should the owner or operator fail to do so. Finally, an owner or operator who uses insurance to satisfy the requirements of the proposed rule would also be required to establish a standby trust fund.
- **Surety Bond:** An owner or operator will be able to satisfy the financial responsibility requirements of the proposed rule by obtaining a surety bond. Through a surety bond, the Surety would guarantee that it will pay the owner/operator's CERCLA liabilities under certain circumstances in the event the owner or operator is unable to do so, up to the bond limits. An owner or operator that elected to use a surety bond to satisfy the requirements of this section will also be required to establish a standby trust fund. Note that this analysis does not model surety bond pricing outcomes, applying the assumption that they are reasonably represented by pricing outcomes for LOCs and insurance.[38]

For each facility and its estimated financial responsibility amount, EPA modeled the costs to obtain each financial responsibility instrument. The price of each financial responsibility instrument is informed by several parameters, including the specific characteristics of the mine or facility that requires coverage. For purposes of this RIA, EPA assigns the lowest cost option to each facility. Specifically, the financial health of the facility's owner or operator, the corresponding fee structure of the specific financial instrument, and the project's risk profile (including the probability and timing of costs associated with the facility's CERCLA liabilities) will inform the overall price of FR instruments.

Furthermore, the actual pricing of financial responsibility instruments is case-specific and dependent on the individual characteristics of the project or facility being underwritten, the financial profile of the owner or operator, and the estimated timing and amounts of costs likely to be due over the life of the project. Notwithstanding the individual nature of financial responsibility instrument pricing, this RIA derives an array of individualized pricing options based on mine risk curves and hypothetical price curves associated with each FR instrument. Such analysis should not be considered a perfect substitute for actual financial assurance pricing.

[38] There are two main types of surety bonds: 1) a "payment bond," wherein a company is bonded by the surety to complete a given array of activities, with the surety paying the agreed-upon amount in the case the company is not able to fulfill its obligations; and, 2) a "performance bond" wherein, if a company is unable to fulfill its obligations, the surety can either pay the agreed-upon amount or directly engage in fulfilling the obligation itself (*e.g.*, by hiring a contractor to complete closure activities). Payment and performance bonds are generally structured akin to insurance policies (*i.e.*, premiums paid to maintain the bond) or letters of credit (*i.e.*, a collateral requirement and a fee to maintain the bond).

The actual price structure of a financial instrument for a facility's CERCLA liabilities may differ from that summarized in this RIA.

Despite the subjective nature of financial assurance pricing, EPA utilizes simplified metrics to illustrate the potential impact of various price parameters on the annualized net cash flows associated with the suite of financial instruments contemplated by the proposed rule. As modeled, the annual price of financial assurance is a function of three parameters:

1. The expected FR amounts that are required to cover the facility's CERCLA liabilities under the proposed rule. As stipulated in the proposed rule, the financial responsibility amounts will be updated by the owner/operators every three years. Financial responsibility amounts are allocated over time using the scaling method described in Appendix C, and inflated to the year of update to generate an updated financial responsibility amount every three years until the facility's FR release date.[39]

   Specifically, every three years, the FR amount is updated to take into account inflation as well as the FR amounts associated with any acres that have been opened or closed in the past three years. The company then augments the financial instrument for the difference between the updated FR amount and the previous FR amount. For instance, if a company does not open any new acres in the past three years, they must update their FR amount from $10 million to $10.8 million to account for inflation. The financial instrument provider then calculates the additional cash outflows needed to secure the new $0.8 million in obligations. The additional cash outflows needed to secure the incremental amount are calculated the same as the initial financial instrument outflows.

2. The financial credit risk of the owner or operator, which informs the probability that the instrument provider will be called upon to pay for or perform the attendant financial responsibility activities. All else equal, the price of FR instruments will be highest for those owners/operators that present the greatest financial credit risk.

3. The fee structure of the financial instrument. For example, some financial instruments (*e.g.*, letter of credit) may require up-front commitments in the form of set-aside collateral, with low annual maintenance costs; whereas other financial instruments (*e.g.*, insurance) may require less cash up-front, but larger annual financing costs over time.

The analysis utilizes separate pricing modules for each financial responsibility instrument. On an instrument-by-instrument basis, inputs necessary to price the instrument include the annual expected capital and operational costs associated with the facility's financial responsibilities. Specifically, the parameters include when costs are expected to begin, when they are expected to

[39] The cost estimates in this RIA may be biased low due to the analytic treatment of the three year update schedule. The analysis uses the FR amount applicable as of the last update year. Since the FR release by EPA could happen just prior to an update year, financial responsibility amounts may not have been updated for a maximum of three years at the time of FR release. Therefore the financial responsibility amounts would not take into account inflation and expanded site features for the years in between the last three-year update and the FR release year.

end, and when the owner/operator will be required to purchase financial assurance. Based upon this policy determination, the cost streams can vary by instrument.[40]

Under the proposed rule, the full face value of the FR amount must be secured within the four-year implementation window established in CERCLA 108(b)(4). This approach will allow for the instrument to be accessed during any period during a facility's active or inactive status as a result of a CERCLA-related incident. This pricing analysis, however, requires a set of assumptions concerning the initial funding period for the instruments (*e.g.*, funding of a trust fund subsequent to the rule's implementation date) and an overall time frame, or end date, for instrument funding (*i.e.*, to derive a premium payment schedule for an insurance instrument).

For the modeled results, this RIA assumes the year of implementation is 2021, or the year before the end of the four-year implementation schedule for the rule. The estimated years of FR release for the 38 facilities are impacted by assumptions and sourced in the following ways:

- 13 facility FR release dates are sourced directly from company reports.
- Applying the median active life taken from a sample of these 13 facilities, nine additional facility FR release dates are sourced by adding this median facility life figure to the facility start date reported by MSHA.
- EPA assumed that mine and mineral processing facilities will remain active within the next four years of the implementation date, to 2025. 12 facility FR release dates are moved out to four years after the implementation date.
- The analysis recognizes that forecasting becomes increasingly difficult as the time horizon is lengthened and thus caps the facility FR release date at 34 years past the year of implementation, which is the 90th percentile of remaining time until FR release in the sample of 38 facilities. Four facility FR release dates are capped at 34 years after 2021.[41]

The credit risk of the owner/operator is a subjective determination made on an instrument-by-instrument basis. An assessment of the credit risk of an entity should take into account the financial stability and profitability of the owner/operator, as well as the non-mining business operations of the owner/operator that may impact its ability to meet future environmental obligations. Relevant financial metrics include, but are not necessarily limited to, the debt-to-equity ratio, the current ratio (equal to current assets divided by current liabilities), working capital, and operating cash flow. These financial indicators measure the company's ability to assume additional debt, meet its near-term obligations with liquid assets, and generate cash flow from its business operations. In addition, long-term issuer credit ratings from NRSROs provide a

[40] Note that all historical engineering cost estimates are inflated to constant dollars for the year in which the instrument is purchased. For example, if a financial assurance instrument is purchased in 2021, all costs similarly are inflated to year 2021 dollars.

[41] For reference, the 90th percentile of the FR release dates for the 13 facilities for which data were available directly from company reports is 26 years after 2021. Note that these 13 facilities exclude those facilities that are reported by the companies as closing before 2021 or after 2055.

reasonable proxy for a company's overall financial health.[42] Thus, the analysis utilizes credit ratings as a primary driver of pricing considerations.

The individual parameters that inform the estimated annualized price of financial assurance on an instrument-by-instrument basis are provided in Appendix D. For each instrument, EPA summarizes its purpose and structure, outlines the methods and equations for pricing it, and provides detail on key data inputs. A generic example of the pricing process is provided in Exhibit 4-2 below, and should be reviewed in conjunction with the detailed methodology presented in the appendix. Note also that the numbers are broadly rounded, and are presented for conceptual illustration purposes only. As shown in the exhibit, this generic facility has a forecasted FR release date of 2025, and faces an initial FR amount of $100 million in 2014. The face value of this amount in 2021 is $122 million, with the implementation date being 2021.

To secure the FR instrument and comply with the rule, the firm will need to acquire incremental funds. This acquisition will come at a particular price, whether these funds come from internal sources or from debt or equity markets. The weighted average cost of capital (WACC), which is 11.0 percent in the example below, is by definition the average cost of obtaining capital in the debt and equity markets. If the firm uses its internal funds to secure the FR instrument, the WACC is an appropriate approximation of the return on the projects they would have pursued if the internal funds had not been displaced due to the rule. The RIA does not attempt to predict whether the acquired funds come from internal sources or capital markets, but instead uses the WACC to estimate the net cost of acquisition of funds. Using these inputs, the exhibit walks through the calculation of net acquisition cost for each instrument. The annualized net acquisition cost represents the industry costs presented in this RIA.

Exhibit 4-2.
Generic Pricing Examples

Facility Characteristics			**Note**
Facility	Facility A		
FR Implementation Year	2021		Year of implementation is 2021, or the year before the end of the four-year implementation schedule for the rule.
FR Release Year	2025		Year in which the facility is forecasted to be released from its FR obligation.
Required amount of FR	$100,000,000		Engineering cost estimate in 2014$.
Face Value of Engineering Costs at FR Implementation Year	$122,000,000		Engineering cost estimate inflated to 2021, the implementation year, at 2.86% (based on median year-over-year change (last 50 years) of GDP Implicit Price Deflator).
Facility Owner WACC	11.0%		Calculated separately on a company basis.
Letter of Credit Details			
Face Value of Letter of Credit	$122,000,000		Face value of the letter of credit; equivalent to the face value of the last estimate of engineering costs at FR release date year.

[42] See http://www.sec.gov/ocr#.U81or-NdVc0 for a description and list of NRSROs.

Exhibit 4-2. Generic Pricing Examples			
Annual Commission Fee	$800,000	A	Commission fee paid by the facility owner to the bank that issues the letter of credit. Varies based on facility owner's probability of default.
Collateral Required	$32,000,000	B	Collateral mine owner is required to place in a collateral account; varies based on facility owner's probability of default.
Actual Balance of Collateral Account at FR Release Date Year	$34,000,000	C	Based on median rate of return of recent Treasuries with maturity similar to FR time horizon.
Actual Return on Collateral	$2,000,000	D=C-B	The difference between the actual balance of the collateral account at FR release date year and the collateral the facility owner placed in the collateral account.
LOC – Acquisition Cost to Facility Owner			
Total Acquisition Cost of the Commission Fees at FR Release Date	$4,200,000	E	Commission fee payments compounded at facility owner WACC over the FR time horizon.
Total Acquisition Cost of Collateral Account at FR Release Date	$49,000,000	F	The required collateral amount compounded at the facility owner's WACC over the FR time horizon.
Return on Collateral	$17,000,000	G=F-B	The difference between the acquisition cost of the collateral account at FR release date and the collateral required.
Net Acquisition Cost	$19,300,000	H= G-D+E	The difference between the acquisition cost of the commission fee and acquisition cost of the collateral at FR release date and the actual return on collateral at FR release date.
Annualized Net Acquisition Cost	$3,600,000		Annualized net acquisition cost calculated at a 7 percent discount rate. Annualized over a 4 year time period in this example, but varies based on year of facility FR release date.
Annual Cost as Percent of FR Amount	3.51%		Annualized net acquisition cost as a percentage of the engineering cost estimate in 2014$.
Trust Fund Details			
Trust Balance Required at the Time of Facility FR Release Date	$122,000,000	I	Trust fund balance required at the time of facility FR release date is equivalent to the face value of the last estimate of engineering costs at FR release date.
Cumulative Administrative Fees	$2,800,000		Array of fees for mutual funds. Varies based on fund management style and length of trust fund pay-in period.
Cumulative Trust Contributions	$100,500,000	J	3-year pay-in of $33,529,631 per year
Trust – Acquisition Cost to Facility Owner			
Acquisition Cost of the Administrative Fee at FR Release Date	$3,500,000	L	Stream of administrative fee payments, compounded at facility owner WACC over the FR time horizon.

Exhibit 4-2. Generic Pricing Examples			
Acquisition Cost of Trust Fund at FR Release Date	$138,00,000	M	The acquisition cost of the trust fund balance compounded at facility owner's WACC. Varies based on pay-in schedule.
Net Acquisition Cost	$16,000,000	O= M-I+L	The difference between the acquisition cost of the administrative fee and trust fund balance and the trust fund balance required at time of facility FR release date.
Annualized Net Acquisition Cost	$3,800,000		Annualized net acquisition cost calculated at a 7 percent discount rate. Annualized over a 4 year time period in this example, but varies based on year of facility FR release date.
Annual Cost as Percent of FR Amount	3.65%		Annualized net acquisition cost as a percentage of the engineering cost estimate in 2014$.
Insurance Policy Details			
Face Value of Insurance Policy	$122,000,000	P	Face value of the insurance policy is equivalent to the face value of the last estimate of engineering costs at FR release date.
Annual Insurance Premium	$24,500,000	Q	Annual payment; varies based on length of policy pay-in period.
Cumulative Insurance Premium	$98,100,000	R	Sum of insurance payments over pay-in period.
Cumulative Return on Insurance Premium	$23,900,000	S=P-R	The difference between the cumulative insurance premium and the face value of the insurance policy.
Insurance Company WACC	8.85%		Most recent WACC for SIC Code pertaining to insurance; from Ibbotson Cost of Capital Yearbook
Insurance - Acquisition Cost to Facility Owner			
Acquisition cost of Total Premiums Paid at FR Release Date	$128,200,000	T	The acquisition cost of the cumulative insurance premium compounded at the facility owner's WACC over the FR time horizon.
Net Acquisition Cost	$30,100,000	U=T-R	The difference between the acquisition cost of total premiums paid at FR release date and the cumulative insurance premium. Facility owners are reimbursed for costs related to the policy up to the total premiums paid.
Annualized Net Acquisition Cost	$5,700,000		Annualized net acquisition cost calculated at a 7 percent discount rate. Varies based on year of facility FR release date.
Annual Cost as Percent of FR Amount	5.57%		Annualized net acquisition cost as a percentage of the engineering cost estimate in 2014$.

4.3.1 Availability of Financial Responsibility Instruments

It is important to note that this pricing approach assumes that no capacity constraints exist for the issuance of third-party instruments sufficient to cover the FR amounts contemplated under the rule. To investigate the insurance industry's capacity for providing mechanisms that would cover CERCLA liabilities, EPA reviewed publicly available information from government agencies and commercial insurers and held further discussions with commercial insurers. Based on this review, EPA determined that the market for the types of FR instruments described above does not yet exist to cover financial responsibility under CERCLA 108(b). See "Evaluation of Markets for Financial Responsibility Instruments, and the Relationship of CERCLA 108(b) to Financial Responsibility Programs of Other Federal Agencies" for more information on the industry capacity study.[43]

The proposed rule, however, provides a four-year implementation window to allow the market for such instruments to develop. Observers of the insurance industry expect that the environmental FR instrument market capacity will increase, brokerage premiums will decrease, and surety premiums will hold steady or increase slightly.[44] At the same time, observers acknowledge that overall capacity for risk specific to the mining industry will decrease due to the sector's volatility.[45] As a result, EPA anticipates that the insurance market will endeavor to meet the increased demand to underwrite the financial responsibility requirements of the proposed rule through alternative risk transactions, such as layered risk management instruments, and the concurrent formation of risk retention groups. The insurance market has used similar instruments to increase capacity in other high volatility industries such as oil and gas, pharmaceuticals, and medical malpractice.[46]

4.4 Costs to Government

Under the current baseline responsible parties are liable for financial responsibility pertaining to cleanup; however, if a party defaults on all or a portion of that obligation, the firm's costs shift to the government and the public. Those costs include two components: the CERCLA costs and the incremental overhead costs for the necessary management of those liabilities. The baseline potential costs to government are therefore the sum of all financial responsibility amounts and associated costs for facilities owned by entities that default. As noted in Chapter 3, the financial responsibility cost estimates incorporate allowances for government overhead.

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[43] U.S. Environmental Protection Agency, "Evaluation of Markets for Financial Responsibility Instruments, and the Relationship of CERCLA 108(b) to Financial Responsibility Programs of Other Federal Agencies." August 25, 2016. https://www.epa.gov/sites/production/files/2016-09/documents/cercla_financial_assurance_market_study.pdf

[44] U.S. Environmental Protection Agency, "Evaluation of Markets for Financial Responsibility Instruments, and the Relationship of CERCLA 108(b) to Financial Responsibility Programs of Other Federal Agencies." August 25, 2016. p. 21. https://www.epa.gov/sites/production/files/2016-09/documents/cercla_financial_assurance_market_study.pdf

[45] U.S. Environmental Protection Agency, "Evaluation of Markets for Financial Responsibility Instruments, and the Relationship of CERCLA 108(b) to Financial Responsibility Programs of Other Federal Agencies." August 25, 2016. p.18. https://www.epa.gov/sites/production/files/2016-09/documents/cercla_financial_assurance_market_study.pdf

[46] U.S. Environmental Protection Agency, "Evaluation of Markets for Financial Responsibility Instruments, and the Relationship of CERCLA 108(b) to Financial Responsibility Programs of Other Federal Agencies." August 25, 2016. p. 2-3. https://www.epa.gov/sites/production/files/2016-09/documents/cercla_financial_assurance_market_study.pdf

Under the proposed regulation, mine and mineral processing facility owners and operators that do not pass the financial test and would have defaulted in the absence of the regulation in the baseline, now would have acquired a financial responsibility instrument to secure their CERCLA liabilities and related overhead costs. The proposed regulation reduces cost to government by transferring these costs to the responsible parties in the private sector. The government will largely incur CERCLA costs only when firms pass the financial test but later default.

The government will also incur costs in the course of administering the rule. EPA does not quantify those costs here, but the costs will include labor costs associated with confirming facility financial responsibility amount estimates, reviewing documents sent to EPA, and updating any relevant databases with facility information.

The incremental cost savings to government under the proposed regulation is therefore dependent on the total projected CERCLA costs, the predicted firm exit rates of all entities in the baseline, and the default rates of firms who pass the financial test under the regulatory scenario. The change in government costs between the baseline and regulatory scenario represents the correction of a market failure by requiring hardrock mine and mineral processor owners and operators to fully internalize the negative externality potentially imposed on the public in the future. The details of EPA's methods for estimating default rates are described in Appendix D.

Chapter 5.
Analytic Results

5.1 Introduction and Summary

This chapter presents the key results of the regulatory impact assessment, building upon the engineering cost-derived FR amount estimates presented in Chapter 3 and the pricing and related methods outlined in Chapter 4. The chapter begins with a summary of methods used to calculate compliance costs for the modeled universe. Then, the results for the full potentially regulated universe are described, including a discussion of the increased likelihood that owners and operators will have access to funds necessary to address the CERCLA liabilities at their facilities under the regulatory scenarios relative to the baseline. A discussion framing compliance costs in the context of overall social welfare impacts and intra-industry transfers follows. The subsequent section compares annualized compliance costs with cash-out-of-pocket (accounting) outlays. Finally, administrative costs attributable to the proposed rule, and not captured elsewhere in the analysis, are also presented. The chapter concludes with an itemization of important analytic uncertainties and limitations. All annualized costs presented in this chapter are discounted using a 7 percent social discount rate. Supplementary results discounted using a 3 percent social discount rate are presented in Appendix E.

The results of the analysis are presented by:

- **Regulatory option**: As described in Chapter 1, Option 1 does not include a financial test for self-insurance, while Option 2 allows for a financial test.
- **Extrapolation of FR amounts**: This chapter extrapolates FR amounts from the modeled universe to the potentially regulated universe using median FR amounts by facility type. To account for data limitations regarding the potentially regulated universe of 221 facilities, Appendix F presents results using average (mean) FR amount-based extrapolation.[47]
- **FR instrument pricing assumptions**: This chapter presents results using company-based average pricing assumptions. To account for uncertainty around the costs of obtaining FR instruments for the 121 companies in the potentially regulated universe, Appendix F presents results using facility average-based pricing assumptions.

The key results for the potentially regulated universe of 221 facilities vary by regulatory option and FR instrument pricing assumptions. Specifically, the overarching results are as follows:

- The proposed rule may require these facilities to secure approximately $7.1 billion in CERCLA financial responsibility amounts.

[47] The results vary with FR liability amount extrapolation approaches, because the distribution of modeled facilities' FR amounts includes outliers that can significantly skew the results.

- Under Option 1, third-party instruments will cover all of the above liability totals. Under Option 2, third-party instruments will cover 70 percent ($4.9 billion) of the total, with the remainder self-insured due to the availability of the financial test.
- The quantified annualized compliance cost to industry to procure third-party instruments is approximately $111 to $171 million. These values represent the estimated incremental costs to industry of the proposed rule.
    - Under Option 1, the total FR amount is estimated to lead to annualized industry compliance costs of $171 million.
    - Under Option 2, the total FR amount is estimated to lead to an annualized industry compliance cost of $111 million.
- The rule's annualized social cost can be estimated as the fees and commissions paid to financial institutions to obtain financial instruments as well as the administrative costs to industry associated with compliance activities. The majority of the industry costs represent a transfer from the regulated industry to the financial industry, and hence the quantified annualized net social costs are estimated at $30 million to $44 million.
    - Under Option 1, the annualized social costs are $44 million.
    - Under Option 2, the annualized social costs are $30 million.
- With respect to the impacts on government costs, over the 34 year period of analysis, Option 1 is estimated to cumulatively result in approximately $527 million in additional CERCLA financial responsibility incurred by industry rather than government (in instances of owner or operator failure), relative to the baseline. The amount under Option 2 is approximately $511 million.
- These results are subject to a number of analytic assumptions as outlined in the prior chapters and limitations listed at the end of this chapter. The results should be viewed with these uncertainties and limitations in mind.

5.2 Methods – Modeled Universe

To provide context for the presentation of results for the full universe and establish a basis for the extrapolation exercise, EPA first discusses the simulation of the modeled universe of 49 facilities. Exhibit 5-1 provides the overall results of the modeled universe cost analysis, which reflect the 38 facilities for which financial information could be obtained. As indicated in the exhibit, the modeled universe faces a potential CERCLA financial responsibility amount of $4.4 billion.[48] In other words, in the baseline, the government may be burdened with this liability. Under Option 1, where no financial test is allowed, the full FR amount must be secured through third-party instruments. Under Option 2, owner/operator entities must either pass the financial test or secure their CERCLA obligation through a third-party FR instrument. Based upon the financial profile of companies in this modeled universe, $3.1 billion is secured through a third-

[48] Five facilities within the modeled universe of 38 facilities are expected to close prior to rule implementation in 2021. Because new facilities may also open between rule publication and rule implementation, this analysis uses current data to approximate industry and financial conditions upon rule implementation.

party FR instrument and $1.3 billion is self-insured by those entities passing the financial test or utilizing a hybrid approach. The annualized compliance cost of securing a third-party instrument ranges between $45.3 million under Option 2 and $62.1 million under Option 1 for the modeled universe.

Exhibit 5-1.
Summary Results for Modeled Universe

Baseline		Option 1: No Financial Test		Option 2: Proposed Financial Test	
CERCLA FR Amount ($2015 Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)
$4,410	N/A	$4,410	$62	$3,086	$45

Note:
Annualized costs represent the incremental cost of acquiring funds for compliance faced by the modeled universe amortized over the time period until FR release at each facility. The annualized cost of third-party FR instruments reflects the cost in the first year following rule implementation. The annual cost may decline in future years if the number of new facilities opening is less than the number of existing facilities that close.

The simulation indicates that under Option 2, companies will utilize the full suite of available self-insurance and third-party instrument options. The results are illustrated in Exhibit 5-2, showing the simulated results for the lowest cost instrument type.[49] As shown in the exhibit, $1.3 billion, or 30 percent, of the full FR amount is secured through self-insurance. The majority of this self-insured total, or 99 percent, is secured through hybrid arrangements. Utilization of a trust instrument accounts for 74 percent of the amount secured through third-party instruments, with insurance and letters of credit representing 16 percent and 10 percent of the total, respectively.[50,51]

[49] Entities may choose a particular type of instrument for a variety of business reasons. This analysis utilizes the simulated lowest cost option here for presentation purposes.

[50] For example, in Exhibit 5-2, $2.3 billion in CERCLA liabilities are secured through trusts ($1.4 billion for those entities failing the financial test plus $0.9 billion under the hybrid outcome). This trust subtotal divided by the third-party FR total of $3.1 billion equals 74 percent.

[51] The distribution of simulated instrument utilization percentages is similar for Option 1.

Exhibit 5-2.
Modeled Universe Self-Insurance and Third-Party Instrument Utilization
(Option 2: Proposed Financial Test)

FR Category	FR Option	CERCLA FR Amount ($2015 Millions)	CERCLA FR Amount Self-Insured ($2015 Millions)	CERCLA FR Amount Insured through Third-Party Financial Instruments ($2015 Millions)
Third-Party Financial Instrument	Trust	$1,350	$0	$1,350
	Insurance	$129	$0	$129
	Letter of Credit	$304	$0	$304
Self-Insurance/Hybrid	Self-Insure	$19	$19	$0
	Hybrid/Trust	$1,873	$937	$937
	Hybrid/Insurance	$736	$368	$368
	Hybrid/Letter of Credit	$0	$0	$0
	Total	**$4,410**	**$1,323**	**$3,086**

Note:
This table only presents results for Option 2, as Option 1 requires that all CERCLA FR amounts are insured through third-party instruments. Consequently, the "CERCLA FR Amount ($2015 Millions)" column also represents the total FR amount insured through third-party instruments under Option 1.

Exhibit 5-3 summarizes the annualized compliance cost of securing a third-party instrument, as a percentage of the CERCLA FR amount secured by third-party instruments, by category of owner/operating company. It is important to emphasize that actual pricing outcomes under the proposed rule will be unique to individual company and facility characteristics. This analysis groups these pricing outcomes to facilitate extrapolation to the full universe in the next section. This analysis shows the distribution of pricing outcomes on a company average basis.[52]

As shown in the exhibit, entities with a stronger financial profile (rating BBB) are simulated to experience annualized costs of approximately 1.1 to 1.7 percent of the third-party instrument total. In general, under Option 1 companies experience marginally higher pricing due to higher amounts covered through third-party instruments and non-linearities in pricing. Pricing outcomes for weaker entities (pricing category CCC) are equal to approximately 4.0 percent of the underlying FR amount secured by third-party instruments. Overall, on a weighted average basis, annualized compliance costs as a percentage of the FR amount equal approximately 2.3 to 2.4 percent when calculated on a company basis.[53]

[52] Under the company approach, EPA first sums the FR amounts and annualized costs associated with each company's facilities before calculating and averaging the annual cost as a percentage of the FR amount at each company, weighted by bond rating, in the modeled universe.

[53] Companies were divided into four pricing categories based on bond ratings, probability of defaults, and WACCs. The four categories contain the following characteristics:

- Category BBB: Bond ratings ranging from BBB+ to BBB-, probability of defaults ranging from 0.6% to 1.6%, and WACCs ranging from 3.4% to 13.1%.

Exhibit 5-3.
Instrument Pricing Outcomes by Company Category

Company Category	Average Ann. Cost as Percentage of Third-Party Instruments	Percent of Companies in Category
BBB	1.1% to 1.7%	26.3%
BB	2.5%	26.3%
B	2.4%	36.8%
CCC	4.0%	10.5%

Note:
1. Pricing categories based on credit ratings and other financial metrics. Ranges of costs are presented for Option 2 (low) and Option 1(high).
2. This exhibit presents costs discounted using a 7 percent social discount rate. Supplementary results discounted using a 3 percent social discount rate are presented in Appendix E.

5.3 Industry Costs and Transfers from Government

To simulate impacts for the full universe of 221 facilities, this analysis follows the same general analytic approach as for the modeled universe. Due to data limitations, however, EPA makes the following adjustments and simplifying assumptions:

- **Derivation of FR amounts.** As described in Chapter 3, this RIA extrapolates facility-specific estimates for the modeled universe of facilities to the broader potentially regulated universe, shown in Exhibit 5-4. The results presented in this chapter use the extrapolation approach that relies on median FR amounts by facility type. Appendix F also presents sensitivity results for facility average-based (mean-based) extrapolation.
- **Estimation of pricing outcomes for third-party FR instruments.** For the modeled universe of facilities, the analysis applied detailed company-specific financial data to simulate instrument pricing outcomes. Such data are unavailable for the full universe. This analysis utilizes the weighted average pricing from Exhibit 5-3 above to establish company average pricing outcomes. The weighted average price, as a percent of FR liability amount secured through third-party instruments, is applied to extrapolated third-party instrument amounts; where the applied weights are based on the percent of the modeled universe falling within each of the credit rating categories in Exhibit 5-3. The implicit assumption in extrapolating the average price in this fashion is that the distribution of companies across the categories is the same in the regulated universe as in the modeled universe. Exhibit 5-4 illustrates, for each regulatory option, the estimated

- Category BB: Bond ratings ranging from BB+ to BB-, probability of defaults ranging from 2.2% to 5.8%, and WACCs ranging from 5.4% to 12.4%.

- Category B: Bond ratings ranging from B+ to B-, probability of defaults ranging from 9.8% to 19.6%, and WACCs ranging from 4.6% to 14.2%.

- Category CCC: Bond ratings ranging from CCC+ to CCC, probability of defaults of over 40%, and WACCs ranging from 9.4% to 11.4%.

In addition to company financials, facility characteristics determine financial assurance pricing, most notably estimated year of facility closure and the characteristics that determine the response component.

annualized costs of obtaining third-party FR instruments using company average-based estimated pricing. Appendix F presents results using facility average-based pricing assumptions.

- **Estimation of performance under the financial test.** For this metric, the analysis assumes the full universe of companies will perform similarly to the modeled universe of companies with respect to the financial test. Namely, the same proportion of the FR amount will be self-insured in the full universe as was simulated in the modeled universe.

The results for the potentially regulated universe are presented in Exhibit 5-5. The results are presented by the company-based pricing and median-based extrapolated FR amounts. As shown in the exhibit, the total estimated FR obligation amount for the regulated universe is $7.1 billion. Under Option 1, the amount of FR obligations covered through third-party instruments is equivalent to the total FR amount. Under Option 2, the FR amount covered through third-party instruments is lower, estimated at $4.9 billion. Under Option 2, the annualized compliance cost to secure the third-party financial instruments is $111 million. The results for Option 1 can be interpreted similarly. These values represent the range of potential incremental costs of the proposed rule to industry.

As discussed in the prior chapter, a primary effect of the proposed rule is the increased likelihood between the baseline and regulatory scenarios that owners and operators will have access to funds necessary to address the CERCLA liabilities at their facilities, reducing government burden. Because actual data on Superfund recovery rates for these companies are unavailable, this analysis uses proxy measures based on default and firm failure. The government's burden under the baseline is a function of the extent to which entities in the full regulated universe may default on their CERCLA liabilities.[54] Due to data limitations, this analysis uses the firm exit rate from the Census Bureau's Business Dynamics Statistics. This modeling assumption presents a "worst-case" scenario in that 1) all facilities incur CERCLA liabilities exactly equal to the FR amounts estimated in this analysis, and that 2) no exiting firms meet any of their potential CERCLA obligations. As a result, the baseline represented in this RIA presents estimated CERCLA FR amounts. In reality, facilities' actual future CERCLA liabilities may be either higher or lower than their FR obligations, and exiting (and even defaulting) firms may be able to meet a portion or all of their CERCLA liabilities.

[54] In the baseline, government costs are derived using a proxy measure for the extent to which mining entities may default on CERCLA liabilities: the three-year average of the annual firm exit rate calculated from the Census Bureau's Business Dynamics Statistics (BDS), which is 7.45 percent. The BDS provides the number of firms operating and number of firm exits each year in the mining sector. Firm exits identify when all establishments of a firm cease operations for reasons other than reorganization, merger, or acquisition. Because of the "corporate veil" enjoyed by legal subsidiaries, this analysis uses a facility-based failure rate to model government costs in the baseline due to owner/operator failure. Compared to other measures of failure or default, the BDS firm exit rate also captures both private and public companies.

Exhibit 5-4.
Median-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Median ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Median-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$1	$8	$5	$0.2	$0.1
In-situ recovery	8	3	$1	$10	$7	$0.2	$0.2
Processor/Refiner	33	1	$76	$2,496	$1,747	$60	$39
Surface Mine	62	25	$48	$2,961	$2,073	$72	$47
Surface Mine/Processing	27	13	$28	$766	$536	$18	$12
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$28	$57	$40	$1	$1
Surface/Underground mine	1	(none; assume equal to surface mine)	$48	$48	$33	$1	$1
Underground Mine	53	5	$5	$284	$199	$7	$4
Underground Mine/Processing	6	2	$29	$172	$120	$4	$3
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$6	$4
ALL FACILITIES	221	49	$37	$7,064	$4,944	$171	$111

Note:
This exhibit presents costs discounted using a 7 percent social discount rate. Supplementary results discounted using a 3 percent social discount rate are presented in Appendix E.

Exhibit 5-5.
Summary of Industry Costs for Potentially Regulated Universe

	Baseline		Option 1: No Financial Test		Option 2: Proposed Financial Test	
Social Discount Rate	**CERCLA FR Amount ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments**	**CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments ($ Millions)**	**CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments ($ Millions)**
7%	$7,064	N/A	$7,064	$171	$4,944	$111

Notes:
1. Annualized costs represent the incremental cost of acquiring funds for compliance faced by the universe, amortized over the applicable FR period for each facility. The annualized cost of third-party FR instruments reflects the cost in the first year following rule implementation. The annual cost may decline in future years if the number of facilities in operation declines.
2. This exhibit presents costs discounted using a 7 percent social discount rate. Supplementary results discounted using a 3 percent social discount rate are presented in Appendix E.

Under the regulatory options, this same burden is a function of the probability of default of companies that pass the financial test (either wholly or through the hybrid outcome) and then subsequently default.[55] The probability of default for the cohort of entities that pass the financial test will be lower than for the full universe, as they maintain a relatively stronger financial profile. This analysis applies government burden rates to the total FR liability amount at the FR release date, as it cannot be determined when in its operational life an owner/operator may default or fail.

Exhibit 5-6 shows the relative changes in liability risk to government across the regulatory options for the median-based extrapolated FR amount for the potentially regulated universe. Under the baseline, no financial responsibility requirements are applicable; thus the government is faced with response components that are defaulted upon. Applying the estimated government burden rate for the modeled universe (approximately 7.5 percent) to the total FR amount of $7.1 billion yields a potential, expected value, government cost of $527 million. Under Option 1, where no financial test is available, the additional amount covered by owners and operators is the full $527 million. Under Option 2, the government is assumed to be burdened only with the CERCLA remediation costs at facilities where the operator passed the financial test and self-insured the FR amount, but later defaults. To estimate this probability, this analysis applies the estimated government burden rate for companies that would pass the financial test in the modeled universe (0.7 percent), to the self-insured amount to yield an expected value government obligation of $16 million.[56] Thus, relative to the baseline, this option offers access to additional owner/operator funding for CERCLA liabilities expected to equal $511 million.

Exhibit 5-6.
Summary of Potential Government Costs

Cost Category	Baseline	Option 1: No Financial Test	Option 2: Proposed Financial Test
Industry Liabilities ($2015 Millions)			
CERCLA FR Amount Insured through Third-Party Instruments	N/A	$7,064	$4,944
CERCLA FR Amount Self-Insured	$7,064	$0	$2,120
Expected Government Costs ($2015 Millions)			
Government Burden Rate	7.5%	N/A	0.7%
Government Cost	$527	$0[57]	$16
Decrease in Expected Government Costs ($2015 Millions)			
Decrease in Expected Government Costs/Increase in Expected Industry Cleanup Funds		$527	$511

[55] Post-rule, owner/operators may secure their CERCLA FR liabilities using a financial test or third-party instrument provided by their corporate parent. Therefore, this analysis employs ultimate parent-level data when calculating government burden under Option 1 and Option 2.

[56] In the absence of specific assumptions about the distribution of defaults in the universe, this analysis presents a total expected value rather than annualized values for the reduced government burden.

[57] EPA assumes that third-party instrument providers will not default on their obligations.

5.4 Social Costs and Intra-Industry Transfers

As described in Chapter 3, this RIA estimates the social costs of the rule as the fees and commissions paid to financial institutions to obtain financial instruments that provide assurance for the funding of CERCLA financial responsibility amounts. These costs reflect the value of the real resources needed to comply with the rule. In contrast, the net incremental costs of acquiring capital to secure these instruments are treated as a transfer between the mining and financial industries in this RIA. In the baseline, firms do not incur these fees or capital acquisition costs.

Exhibit 5-7 below summarizes the results of the analysis in accordance with the analytical framework presented above. Under Option 1 (annualized cost of third-party instruments of $171 million), annualized transfers are estimated to be $127 million. Thus, the social costs are estimated to total $44 million. Option 2 engenders lower social cost estimates, corresponding to previously presented results. Under the lower bound total FR liability amounts, annualized social costs range are estimated to be $30 million. These estimates of social costs do not include administrative costs to industry, which are presented separately in Section 5.5.

5.5 Administrative Compliance Burden

This RIA also includes an estimate of administrative reporting and recordkeeping costs to industry associated with the proposed rulemaking for the potentially regulated universe. These costs consist of labor, O&M, and capital costs and include: reading the regulations, submitting initial facility information to EPA and the public, calculating FR amounts, choosing an FR instrument, acquiring and maintaining an FR instrument, recalculating FR amounts to reflect any changes in facility operations, and any functions the rule requires of owners and operators upon the transfer of a facility, owner or operator default, a CERCLA claim against the owner or operator, and release from financial responsibility. The labor costs are estimated on an annual basis, as of the first year of compliance.

Note that the analysis does not estimate the fees and other costs associated with establishing and maintaining an FR instrument (collateral, credit fee, etc.), because those costs are reflected in the FR instrument cost analysis of this RIA.[58]

Exhibit 5-8 presents the annualized administrative cost of the rule under the two options using a 7 percent social discount rate, annualized until FR release date.

[58] The estimates presented here rely on the document: U.S. EPA. *Estimating Costs for the Economic Benefits of RCRA Noncompliance.* September 1997. December 1997 Update.

Exhibit 5-7.
Summary of Social Costs and Intra-Industry Transfers

Outcome	Option 1: No Financial Test			Option 2: Proposed Financial Test		
	Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)
Ann. Amount	$171	$127	$44	$111	$81	$30
Percent of Ann. Cost of Third Party Instrument	N/A	74%	26%	N/A	73%	27%
Administrative Cost to Industry	N/A	N/A	$0.2	N/A	N/A	$0.3
Total Social Costs and Transfers	N/A	$127	$44	N/A	$81	$30

Note:
This exhibit presents costs discounted using a 7 percent social discount rate. Supplementary results discounted using a 3 percent social discount rate are presented in Appendix E.

Exhibit 5-8. Annualized Administrative Costs	
Option 1 (No Test)	**Option 2 (Financial Test)**
$225,302	$269,038
Note: This exhibit presents costs discounted using a 7 percent social discount rate. Supplementary results discounted using a 3 percent social discount rate are presented in Appendix E.	

Exhibit 5-9 summarizes the administrative costs industry will incur in the year of the rule's implementation.

Appendix H provides a full summary of the methods and data EPA used to generate its administrative cost estimate.

Exhibit 5-9.
First Year Administrative Costs[59]

Activities	Total Administrative Cost, First Year (2015 Dollars) - Option 1 (No Test)	Total Administrative Cost, First Year (2015 Dollars) - Option 2 (Financial Test)
Reading the Regulations	$65,920	$65,920
Submit Initial Notification	$19,213	$19,213
Solicit Public Involvement	$36,606	$36,606
Calculating FR Amount: Prepare Data, Calculate and Submit Written Initial Cost Estimate	$250,750	$250,750
Choosing Instrument/Evaluating Financial Test in First Year	$102,143	$102,143
Financial Test: Write and Submit Letter Signed by Chief Financial Officer; Prepare and Submit Accountant's Special Report	$0	$53,993
Letter of Credit: Obtain/Submit Letter of Credit and Establish Trust Fund; Write/Submit Letter to Accompany Letter of Credit; Submit Original Trust Agreement	$42,229	$36,951
Trust Fund: Establish Trust Fund; Submit Original Trust Agreement; Submit Receipt for First Payment Under Trust Agreement (includes Standby Trusts)	$122,910	$122,910
Insurance: Establish Insurance Policy; Submit Insurance Policy Certificate to EPA	$21,568	$21,568
Total:	**$661,339**	**$710,054**

5.6 Cash (Accounting) Outlays

[59] Costs associated with third-party certification of FR estimates are not included. EPA will include these estimates as the Agency finalizes the rule.

This RIA also estimates the cash-out-of-pocket (accounting) outlays incurred by facility owners to comply with the proposed rule. These cash outlays include collateral posting, trust pay-in, fees, and premiums representing the cash outflows associated with the acquisition of financial assurance instruments. Since these are unadjusted cash outflows, they do not represent incremental costs of the proposed rule. Potentially regulated companies may also already be incurring some of these costs in the baseline, but spread over a different time period.

Exhibits 5-10 and 5-11 indicate the annual cash-out-of-pocket costs as a percentage of total FR liability amounts from 2021 to 2055, grouped by facility FR release date. Across both regulatory options, total cash-out-of-pocket for all potentially regulated companies in aggregate in the year of rule implementation ranges from 49 percent to 54 percent of the total FR amount. However, outlays as a percentage of FR amount rapidly decline immediately following the implementation year. Additionally, the timing of cash-out-of-pocket costs varies based on each facility's FR release date. Compared with the overall universe, facilities with late FR release dates incur low cash-out-of-pocket costs in the years following rule implementation, with rising costs in the years before FR release. These facilities can spread cash costs over longer periods, but may face "catch up" costs immediately prior to their FR release dates.

Exhibit 5-10.
Annual Cash-Out-of-Pocket as a Percent of FR Amount (Option 1)

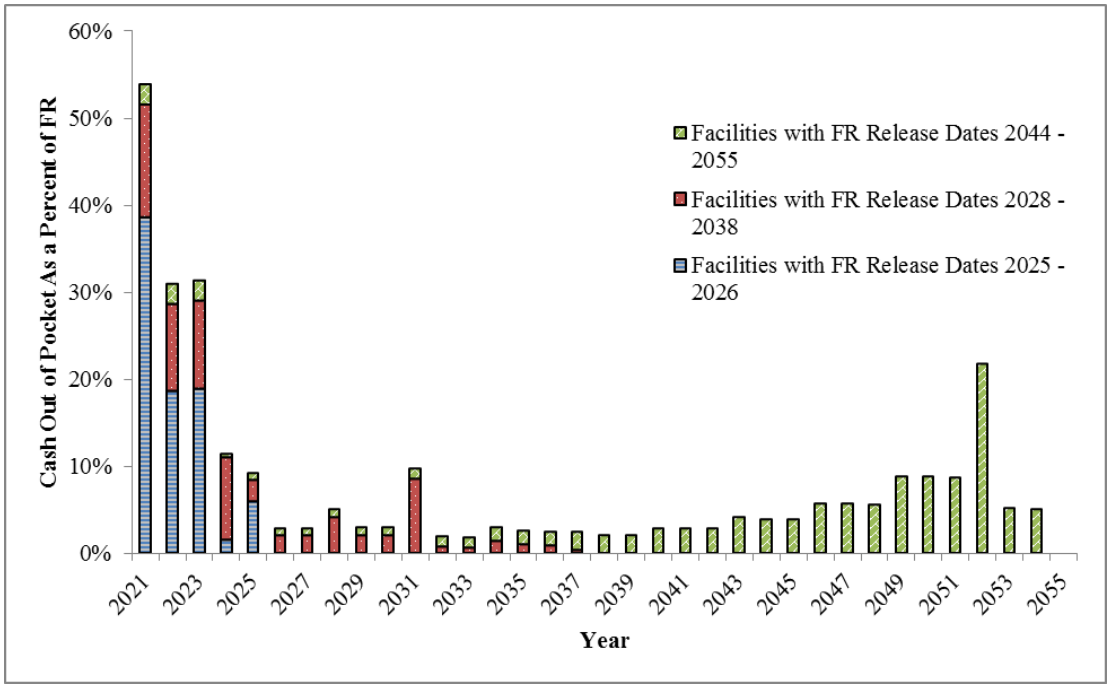
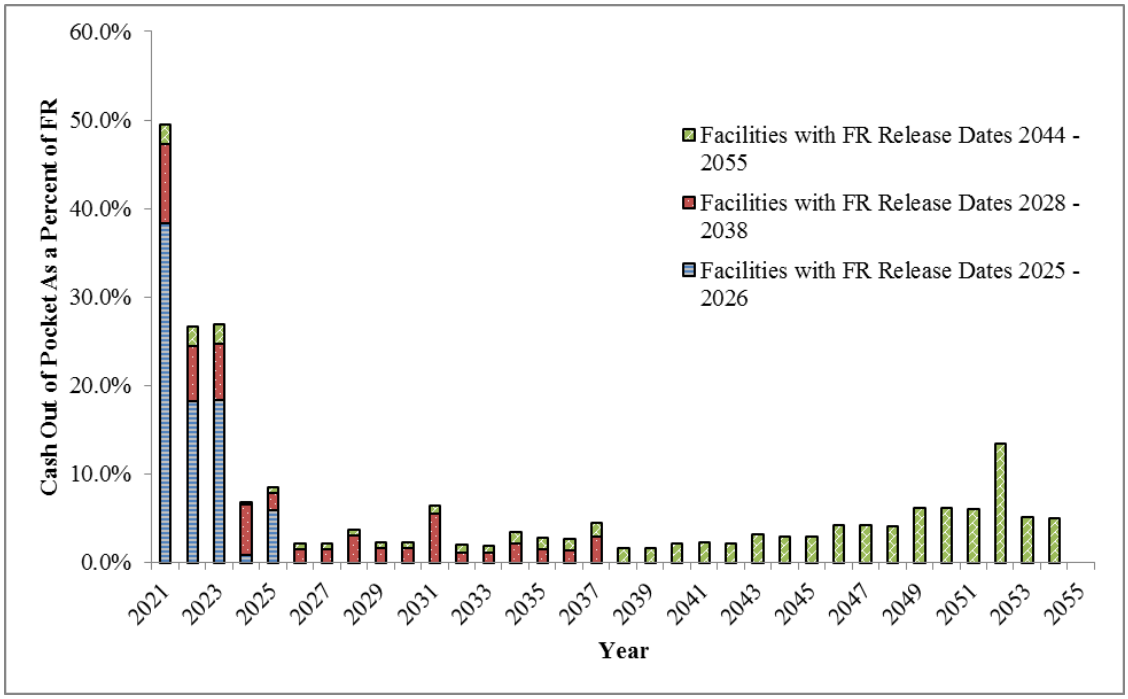


Exhibit 5-11.
Annual Cash-Out-of-Pocket as a Percent of FR Amount (Option 2)



5.7 Limitations

Given the available data, the methodology and results presented in this RIA provide a reasonable basis for assessing the costs of the proposed rule. Nevertheless, it is important to acknowledge the most significant limitations of the analysis, as summarized below:

- ***Lack of available CERCLA FR amounts for potentially regulated facilities not included in the modeled universe***. As described in Chapter 3, the estimation of these amounts requires a number of site-specific data points concerning facility attributes. These data are not available for most of the potentially-regulated universe. Thus, this analysis assumes these facilities will be burdened with the median or average FR amounts estimated for the modeled universe. It is unlikely, however, that this approach understates potential FR amounts for the full universe, as the modeled facilities are likely to be relatively larger, well-established facilities.
- ***Uncertainty of adjusted FR amounts for the modeled universe.*** As described in the Financial Responsibility Formula Background Document, the estimation of adjustments to be applied to the maximum engineering cost estimates requires a number of site-specific data points. All relevant data points were not available for all facilities in the modeled universe; thus, a reduced-form estimate of potential credits was derived for each facility. These FR amount estimates may differ from those actually associated with facilities under the proposed rule. In addition, the potential change in FR amounts for each three-year update period is uncertain.

- ***Lack of financial and operating data for companies that are not publicly traded***. EPA was unable to obtain financial data for the private companies that might be affected by the proposed rule. Therefore, this analysis assumes that the pricing outcomes and default probabilities associated with the modeled universe are generally consistent with those of the full universe. If the modeled firms are generally larger and financially stronger than those in the full universe, the analysis may: (1) overstate the percentage of firms that pass a financial test and FR amounts that are self-insured (Option 2 only); (2) understate the potential default rate, thus understating government costs; and (3) understate industry costs. The analysis endeavors to control for such bias by estimating results using a weighted average pricing approach.
- ***Uncertainty of pricing outcomes for companies in the modeled universe.*** The actual pricing of financial responsibility instruments is case-specific and dependent on the individual characteristics of the project or facility being underwritten, the financial wherewithal of the owner or operator, and the estimated timing and amounts of costs likely to be due over the life of the project. As a result, the actual price structure of a financial instrument for a facility's CERCLA liabilities may differ from that summarized in this RIA.
- ***Static simulation of potentially regulated universe.*** The U.S. hardrock mining sector operates within a volatile, global commodity industry. Companies within the sector succeed and fail, and facilities open and close, on a regular basis. This analysis largely captures how the sector may perform under the proposed rule, given market, company, and facility conditions as of 2015. The estimated annualized cost figures in this analysis remain applicable for all future years under the assumption that industry conditions, including total industry size, remain fairly constant. The economic and operating parameters of the industry may vary, however, in future years.

Chapter 6.
Economic Impact Analysis

6.1 Introduction

The previous chapters discussed the derivation of CERCLA financial responsibility amounts for the modeled universe of hardrock mining facilities and the development of the annualized cost of obtaining the prescribed financial responsibility instruments for the associated universe of owner/operator companies. In addition, those chapters addressed the extension of these modeled universe-based analyses to the entire potentially regulated universe. This chapter builds on these analyses to discuss the economic impacts that may be experienced by companies potentially affected by the proposed rule. Specifically, this chapter first considers methods used to assess the economic impacts and then develops provisional results. For this analysis, the modeled universe is utilized, focusing on an assessment of total annual FR costs relative to total revenues and operating cash flow of those modeled companies.

6.2 Industry Profile and Analytic Approach

Certain characteristics of the hardrock mining sector pose important considerations for the financial assessment of the proposed rule's impacts. For example:

- The sector is predominately a commodity-based business, with limited product differentiation;
- The industry is global in nature, with ore deposits distributed across countries and continents;
- Commodity prices are volatile and sensitive to broader macroeconomic trends, leading to boom and bust cycles;
- Mining is a labor-intensive process; mines adjust their employment levels consistent with the economic cycles; and
- The economics of individual mines varies. Mine viability is determined and affected by exploration, extraction, and processing costs, ore quality, transport costs, and overall market economics (demand and supply of particular commodity at any given point in time). Supplies of a particular commodity tend to rise and fall relatively slowly, but demand can change quickly. This mismatch can cause wide fluctuations in market prices and makes prediction of future market conditions difficult.

These characteristics yield important assumptions and aspirational goals for assessing firm and sector level impacts engendered by the proposed rule, including:[60]

[60] Data limitations constrain EPA's ability to fully incorporate each of these considerations into the analysis, but they serve as a useful guide to making appropriate simplifying assumptions when necessary.

- As commodity price-takers, mining entities likely will bear the entire burden of the added regulatory costs in the form of reduced profits;
- No backward shifting of regulatory costs will occur (*i.e.*, facilities will not be able to recover higher regulatory costs by lowering wages);
- Capital budgeting exercises considering increased compliance costs will be applied both at the mine facility level and at the level of higher corporate parents, as the parent may provide the necessary financial resources to secure an FR instrument.
- Given the sensitivity of the results to commodity price levels, the analysis ideally needs to consider ability to pay thresholds over time, and within historically realistic price ranges. The analysis should also consider impacts on industry employment.
- Differentials in mine economics across individual mines and commodities need to be considered.

Exhibit 6-1.
Summary of Relevant Financial Metrics

Financial Analysis	Ratio(s)	Description
Profitability	• Operating Profit • Net Profit • Return on Assets • Return on Equity • Costs-to-Sales	Profits are a measure of a company's operations. Profitability ratios are used to measure earnings as a percentage of other key financial indicators, including sales revenue, total costs, total assets, and equity. EPA uses these ratios to gauge the current and past performance of companies.
Cash Flow	• Net Cash Flow • Free Cash Flow	Cash Flow is defined as the movement of money into or out of a cash account. A company's capability to fund an incremental environmental compliance cost in the near term is largely dependent on the health of its cash flow.
Net Working Capital	• Receivables Collection Period • Inventory Turnover Rate • Accounts Payable Period • Cash Conversion Cycle • Current Ratio	Working capital represents the difference between a company's current assets and its current liabilities. It is possible for a company to leverage additional cash by streamlining its investments in working capital.
Debt Capacity	• Debt-to-Equity Ratio	In general, companies seek to minimize financial leverage (or debt), achieving a balance between the benefits and costs of debt financing. Companies with highly predictable cash flows can more safely undertake debt financing than firms facing a high degree of market uncertainty.
Shareholder Value	• DuPont Model — Return on Assets and Equity • Sustainable Growth Model • Share Price to Earnings Ratio	Financial analysis is concerned with trends in a company's capital structure, determining whether companies are implementing business strategies that best facilitate continued growth and maximize shareholder value. This is true regardless of whether a firm is publicly traded or privately held.

The following generally accepted financial metrics can be used to evaluate the profitability, liquidity, and solvency of entities within the regulated universe. These metrics yield insights concerning the impacts of the proposed rule on the profitability of firms or industry segments and identify potential plant closures based on a financial analysis. Specifically, the analysis focuses on five potential assessment categories: (1) Profitability; (2) Cash Flow; (3) Net Working Capital; (4) Debt Capacity; and (5) Shareholder Value. As shown in Exhibit 6-1, the approach contemplates key financial metrics within each category to inform EPA's understanding of the financial health of the relevant companies.

6.3 Discussion of Results

Detailed financial data are not available for all companies within the potentially regulated universe. Therefore, the applied analysis focuses on the modeled universe of companies, calculating several metrics that are relevant to an impacts analysis and for which sufficient data are available. These metrics include annual FR cost as a percent of: (1) revenues and (2) operating cash flow. These substitute metrics fall under the general profitability and cash flow financial analysis metrics described in Exhibit 6-1 above. This section also describes data limitations in estimating approximate levels of employment within the potentially regulated universe and the potential employment effects associated with the proposed regulation.

6.3.1 Screening Analysis for Potentially Significant Economic Impacts

To conduct the impacts analysis on the modeled universe of companies, the modeled facility-specific annualized FR instrument costs are aggregated at the company level.[61, 62] These aggregated FR costs are then compared to the companies' relevant financial metrics (revenues and operating cash flow).

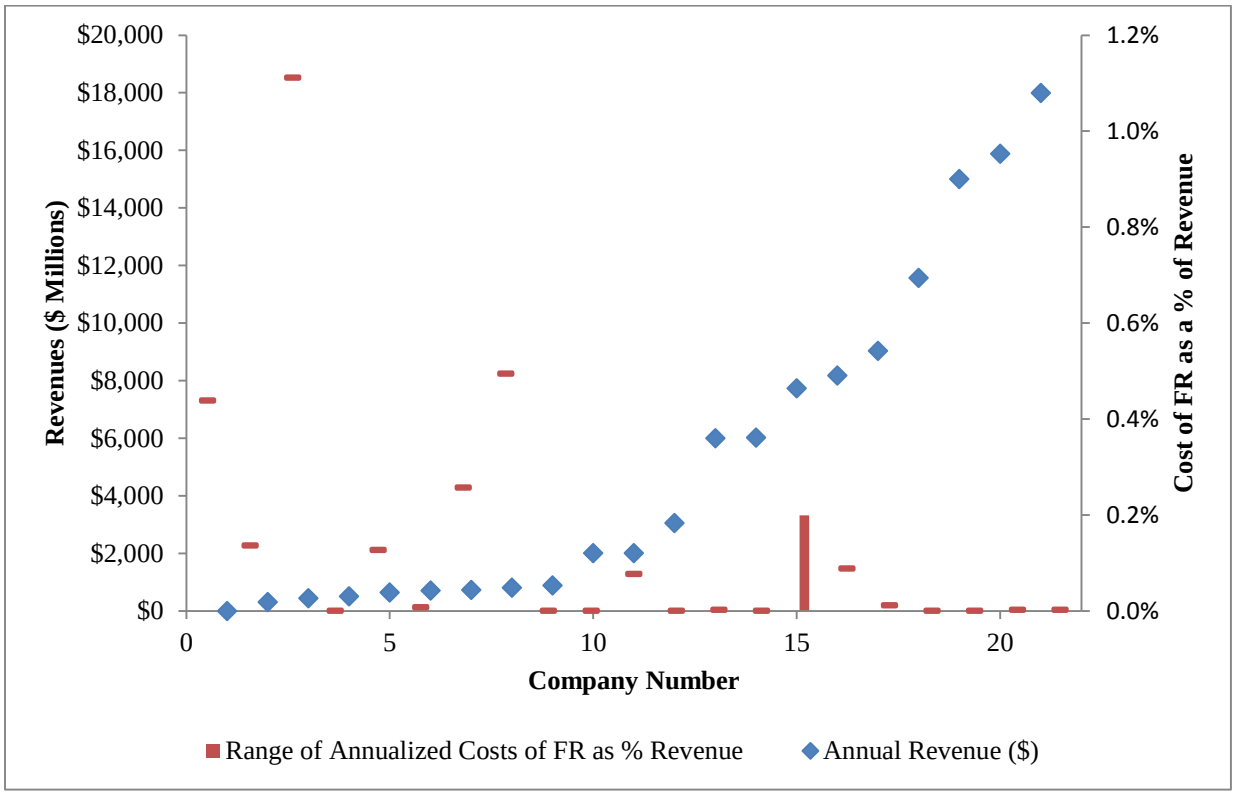
The companies' annual revenues range from approximately $300 million to over $60 billion. Their annual cash flow from operations (cash flow associated with their primary business activity) ranges from $800,000 to over $3 billion.

Relative to the companies' revenues, the per-company annualized costs of FR range from nearly zero percent to 1.1 percent, with the majority of companies (20 out of 21) falling between zero and 1 percent. Exhibit 6-2 presents the distribution of FR costs and revenues for the modeled universe of companies, with the cost of FR as a percent of revenue ranging across the regulatory options.

[61] This simplifying assumption disregards the economies of scale, the companies' other existing FR and financial assurance obligations, and other factors that may affect the pricing of FR instruments for companies that have to procure FR instruments for multiple facilities.

[62] The analysis also removes two bankrupt companies because the FR instrument cost was not modeled for their companies.

Exhibit 6-2.
Cost of FR as a Percent of Revenue, by Revenue Volume (Modeled Universe)[63]



Relative to operating cash flow, the range of annualized FR cost percentages is wider: from zero to over 160 percent (the latter is for the company whose operating cash flow is under $1 million). Approximately 80 percent of all companies experience impacts that are under 1 percent of operating cash flow and approximately 95 percent of companies experience impacts under 10 percent.

6.3.2 Employment Impacts

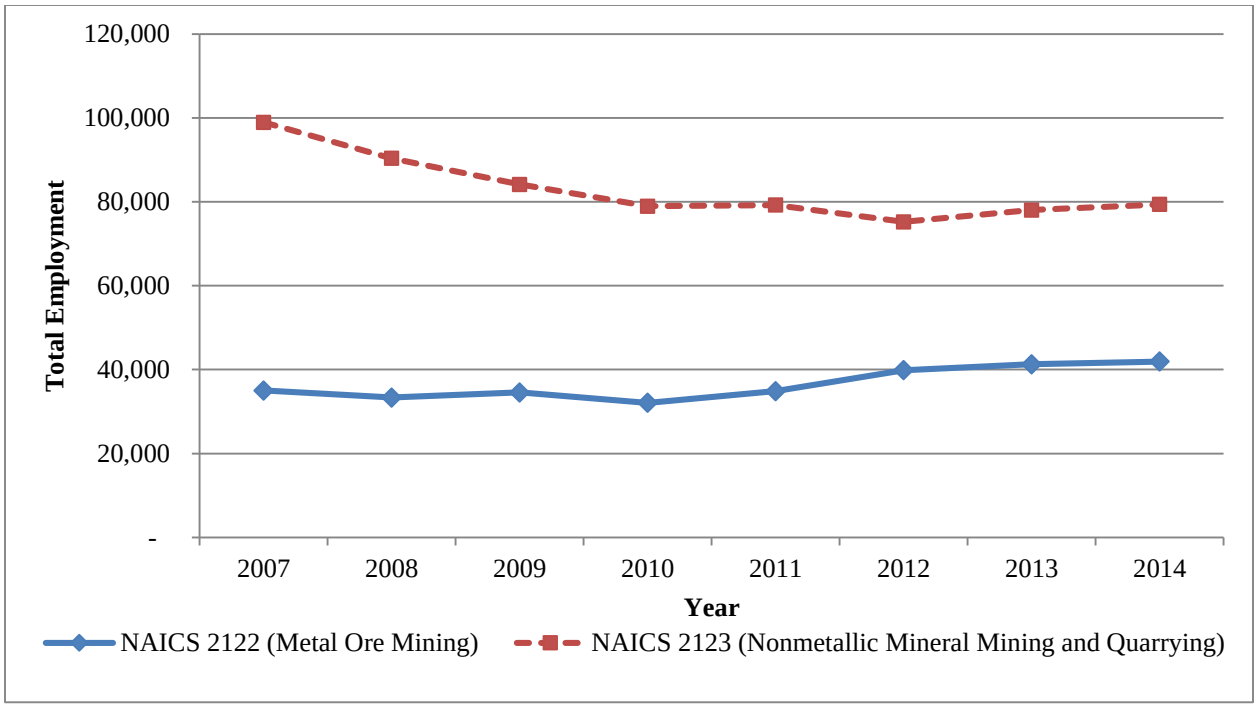
EPA routinely assesses the employment impacts of economically significant regulations. Executive Order 13563, "Improving Regulation and Regulatory Review," states, "Our regulatory system must protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and *job creation*" (emphasis added). In general, the national employment effects of environmental regulation are complex and multi-faceted and very likely involve both negative and positive shifts. Neoclassical theory of production and factor demand provides a constructive framework for understanding and conducting employment impacts analysis of environmental regulations. It describes how firms adjust their demand for inputs, such as labor, in response to changes in economic conditions.[64] Theory predicts that

[63] This chart excludes one company with revenues of over $60 billion.

[64] For an overview of textbook discussions of the neoclassical theory of production and factor demand, see, for example, Layard and Walters, *Microeconomic Theory* (1978), chapter 9 "The Derived Demand for Factors".

regulated firms will respond to regulation by adjusting input demands and output. The theory suggests the direction of the total impact of a regulation on the demand for labor in the regulated sector is indeterminate.[65]

Exhibit 6-3.
Historical Employment in Mining Industries



Source: Economic Census (2007, 2012), County Business Patterns (interim years), U.S. Census Bureau

EPA did not have sufficient data to model and quantify the potential changes in mines' employment levels as a result of the proposed regulation. Analysis provided by the U.S. Geological Survey (USGS) suggests that "the primary metals industry and the nonmetallic minerals products industry are fundamentally cyclical." The industries are affected both by the domestic business cycle and the global economic environment. Composite indices constructed by USGS suggest that the industry experienced significantly decreased activity surrounding the Great Recession. In 2014, the most recent year analyzed by USGS, industry growth rates were positive.[66]

No information is available regarding employment at the specific facilities in the modeled universe. However, the U.S. Census Bureau provides data on employment in NAICS 2122 Metal Ore Mining and NAICS 2123 Nonmetallic Mineral Mining and Quarrying. While there is not a one to one correspondence between the firm census counts in these industries and the regulated

[65] For theoretic frameworks that conceptualize and incorporate the impacts of regulation, see Berman and Bui, 2001 or Deschenes, 2012, 2014.

[66] See pages 4 and 7 in U.S. Geological Survey, Mineral Commodity Summaries 2015. The USGS generates composite indexes for primary metals and separately for nonmetallic mineral products. Their indices are intended to measure economic activity in these industries using production, employment, and shipments data.

universe (the full set of industries in the potentially regulated universe is described in Chapter 2), we summarize information on employment in these industries. Exhibit 6-3 shows that in NAICS 2122, employment has increased roughly 20 percent from 2007 to 2014; in NAICS 2123, employment has decreased roughly 20 percent.

Data are not available on the share of labor costs in the firms' overall cost structure or the labor intensity metrics of the modeled universe, making predictions of the changes in employment levels associated with the proposed rulemaking difficult. Industry-level sources may provide information about the average characteristics of the of these sectors; however, the potentially regulated universe spans numerous sectors, including several sectors not directly related to mining, and mining operations may only constitute a subsidiary or division. For example, several facilities in the modeled universe are owned by diversified multinational conglomerates. As suggested by economic theory, it is possible that increased compliance costs will cause individual mines to adjust their employment levels to maintain overall profitability. Conceptually, potential countervailing impacts on labor demand make the direction of change unknown, though negative employment effects on the mining sector are possible. EPA also anticipates potential positive employment effects as a result of the labor required to provide third-party financial responsibility instruments to the regulated facilities and as a result of increased borrowing due to the additional funds held by the financial sector. The magnitude and net impact of these changes on employment is highly uncertain.

Chapter 7.
Benefits of Proposed CERCLA Financial Responsibility Requirements

7.1 Introduction

As discussed in previous chapters, the proposed rule establishes financial responsibility requirements for certain classes of hardrock mines and mineral processors under CERCLA section 108(b). It requires mine owners and operators to demonstrate financial responsibility, stipulates and describes the maintenance of financial responsibility instruments, and establishes certain conditions under which owners and operators may self-insure to fulfill financial responsibility requirements. It thereby provides an economic incentive for owners and operators to employ sound practices that could decrease their future CERCLA liabilities. EPA envisions that the rule will yield social welfare benefits, which are discussed below.

7.1.1 Methodological Approach

The primary purpose of the proposed rule is to ensure that hardrock mine and mineral processor operators and owners have the funds necessary to address the CERCLA liabilities at their facilities, should future response actions be required. A reduction in overall mining facility CERCLA liabilities and an increase in the proportion of those liabilities borne by the private sector through financial responsibility instruments would indicate the proposed rule's efficacy. The benefits of the proposed rule include a greater transparency in capital markets, fewer future environmental liabilities related to mining sites, avoided impacts to impaired waters, and faster cleanups.

None of the above benefits can be measured with sufficient accuracy to permit a quantitative assessment. Existing literature does not directly address the relationship between financial responsibility mechanisms and capital markets or environmental performance, either in the hardrock mining industry or any industry. In addition, modern mining operations have long life cycles and there is often a delay of many years between active operations and the creation of environmental liabilities arising out of activities at the site[67]. As a result, no specific context, data, or methodology can be used to quantify the benefits of the proposed rule. Instead, the assessment uses literature on related topics, such as the effect of environmental disclosure on financial markets, to discuss the qualitative benefits of the proposed rule.

7.1.2 Overview of Benefits

The proposed rule requiring financial responsibility for hardrock mining operations under CERCLA section 108(b) will yield a range of benefits to society. These benefits include the following:

[67] The model makes a simplifying assumption that the facility operations will be released from their FR amount when the facilities are no longer active. While this may not be the case in actuality, it was determined to be the most reasonable estimate of FR release.

- ***Capital market effects:*** Greater transparency and risk mitigation associated with financial responsibility may reduce uncertainty and improve the functioning of capital markets. A more stringent CERCLA financial responsibility regime may force hardrock mining entities to more explicitly collateralize their potential environmental obligations. This disclosure may provide clearer insight to investors and capital markets concerning life cycle risks and returns of the sector.

- ***Improvements in site environmental performance:*** The proposed regulation forces regulated entities to internalize the expectation of environmental costs they may impose in the future. The financial responsibility requirements may provide an incentive for regulated entities to minimize future environmental obligations. This may lead to environmental improvements at regulated sites and surrounding areas. Similarly, by explicitly accounting for potential natural resource damages in establishing the FR amount, the rule will help to ensure that natural resource damages are assessed and lost ecosystem services more promptly and completely restored.

  For example, improvements in environmental performance as a result of the proposed rule may reduce acid mine drainage and other discharges into waterways caused by mining activities. Such reductions would benefit waterways identified as impaired waters by the Clean Water Act (CWA) and waters identified as wild and scenic rivers under the Wild and Scenic Rivers Act the most.

- ***Speed of site cleanups:*** Site cleanups may occur in a timelier manner under the proposed rule. If properly structured, a financial responsibility program should help to ensure that a responsible party is known and funds are adequate and accessible, when needed. With more expeditious cleanups, human and ecosystem exposure to harmful contaminants may decline.

EPA characterizes each of these categories of benefits in the sections that follow.

7.2 Capital Market Effects

The proposed financial assurance requirements for the hardrock mining sector may yield benefits associated with increased efficiency in debt and equity markets. The establishment of such requirements will increase transparency and reduce uncertainty with respect to the potential environmental liabilities of regulated firms, as well as their ability to fund these liabilities. This reduced uncertainty may be reflected in the market capitalization or cost of capital of firms engaged in hardrock mining activities. Such changes represent a benefit to society, as they facilitate a more efficient allocation of financial capital than under baseline conditions, thereby increasing social welfare, and possibly expanding the productive capacity of the economy. EPA notes that these changes in capital markets may include increases or decreases in the market capitalization or cost of capital for regulated firms. Both effects may be indicative of benefits to the U.S. economy, as changes in both directions may enable financial markets to operate with greater efficiency.

This regulatory impact analysis ideally would quantify the capital market effects of the proposed rule, but the current literature does not support a quantitative assessment. EPA identified no

studies in the literature that estimated the market capitalization or cost of capital effects associated with financial responsibility or similar mechanisms for the hardrock mining sector or any other industry. Nevertheless, EPA has identified a limited number of studies that quantify the relationship between a firm's market value and the uncertainty surrounding its environmental liabilities. In addition, several literature sources examine the relationship between the disclosure of environmental liabilities and firms' market value (or the cost of capital). While not directly transferable to the proposed rule, this literature may provide insights into the *potential* magnitude of the proposed rule's capital market effects because disclosure, like financial responsibility, reduces uncertainty in capital markets.

EPA notes that the data and methods employed in this literature vary by study. Important differences include geographic scope (*i.e.*, U.S. versus non-U.S.), the industry(s) analyzed, the time horizon of the analysis, the metrics of uncertainty and disclosure, and the metrics of market valuation. EPA highlights many of these differences in the discussion below.

7.2.1 Liability Uncertainty and Market Valuation

The financial responsibility requirements included in the proposed rule will reduce the uncertainty surrounding regulated firms' environmental liabilities, enabling financial markets to value these firms more accurately. *A priori*, it is not clear that such a change in uncertainty would have an appreciable effect on firms' market value, as the literature does not contain many empirical studies that examine the uncertainty-valuation relationship. The two studies that EPA identified, however, both show a statistically significant relationship between a firm's environmental liabilities and its market valuation.

Campbell et al. (1998)[68] analyzed the relationship between uncertainty specific to a firm's Superfund liabilities and the market value of the firm's common stock. Focusing on the chemical, paper, and machinery industries in the United States from 1987 to 1993, the authors found that the magnitude and significance of this relationship varies across industries, but the overall conclusion was that environmental uncertainty negatively impacts the market's perception of a firm and thereby, decreases the firm's market value. More specifically, the study found that significant uncertainty surrounding a firm's Superfund liabilities could decrease its market value by more than $4 per share per Superfund site.[69]

Although it was not the main focus of their work, Barth and McNichols (1994)[70] studied the relationship between disclosures of estimated Superfund cleanup costs and investors' assessments of firms' unrecognized environmental liabilities. The study found that investors' average assessment of firms' unrecognized environmental liabilities is 28.6 percent of equity (*i.e.*, environmental liabilities are 28.6 percent of market value). Although this study does not directly analyze the relationship between uncertainty and market valuation, the results demonstrate that uncertainty can impact market value and by extension, the efficiency of

[68] Campbell, Katherine, Stephan E. Sefcik and Naomi S. Soderstrom. "Site uncertainty, allocation uncertainty, and superfund liability valuation." *Journal of Accounting and Public Policy* 17: 331-366. 1998.

[69] This was the average across the entire sample. For the chemical industry, the study found that the impact of significant uncertainty could decrease a firm's market value by more than $19 per share.

[70] Barth, Mary E., and Maureen F. McNichols. "Estimation and Market Valuation of Environmental Liabilities Relating to Superfund Sites." *Journal of Accounting Research* 32: 177-209. 1994.

financial markets. In addition, the findings of the study suggest that inaccurate assessment of a firm's Superfund liabilities may lead markets to over- or under-value the firm.

The results of the Campbell *et al*. and Barth and McNichols studies imply that reductions in uncertainty similar to those likely to result from the proposed rule affect the valuation of regulated firms. These changes in valuation reflect investors' expectations of future profitability, which may lead investors to more efficiently allocate capital across the economy. To the extent that capital is reallocated to investments yielding a higher return, this would increase the productive capacity of the economy.[71]

7.2.2 Disclosure and Market Valuation

While the literature examining the relationship between market valuation and environmental liability uncertainty includes only a minimal number of studies, several peer-reviewed papers quantify the impact of disclosing these liabilities on a firm's market valuation. This literature may provide useful insights into the potential financial market benefits of the proposed rule because disclosure, like financial responsibility, reduces uncertainty about a company's ability to meet its financial obligations.

Campbell et al. (2001)[72] examines the effects of disclosing Superfund liabilities on a firm's market value for the U.S. chemical industry from 1987 to 1992. The paper focuses on disclosures related to the cost of remediation and the allocation of the cleanup costs across potentially responsible parties (PRPs). Consistent with the "efficient market hypothesis"[73] the authors find that financial disclosures related to Superfund liabilities provide the market with additional information, thus reducing the uncertainty surrounding the value of a company and enabling a more informed valuation of liabilities. In addition, when a firm's site-specific uncertainty (*i.e.*, uncertainty related to cleanup costs at the sites it owns) is high, the authors found a positive correlation between financial disclosures related to Superfund liabilities and market valuation.[74] That is, the disclosure of Superfund liabilities had a positive impact on firms' market value because of reduced uncertainty.

Blacconiere and Patten (1994)[75] analyze the relationship between a firm's environmental disclosures and the decline in its share price after a major environmental event, such as a chemical leak. They find that more extensive environmental disclosures somewhat mitigate the negative share price impacts after a chemical leak. Their conclusion suggests that environmental disclosures enable the market to value companies' risks more accurately by reducing the uncertainty surrounding the financial implications of the environmental event. These results

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[71] Solow, Robert M. "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics* 70, no. 1: 65-94.1956.

[72] Campbell, Katherine, Stephan E. Sefcik, and Naomi S. Soderstrom. "Disclosure of Private Information and Reduction of Uncertainty: Environmental Liabilities in the Chemical Industry." *Review of Quantitative Finance and Accounting* 21: 349–378. 2001.

[73] The efficient market hypothesis argues that the market value of a firm (*i.e.*, stock price) reflects all available information.

[74] This relationship was statistically significant only when the amount of information disclosed was high.

[75] Blacconiere, W.G., and D.M. Patten. "Environmental disclosures, regulatory costs and changes in share value." *Journal of Accounting and Economics*. 18: 357-377. 1994.

further suggest that increased disclosure helps financial markets react to such events more efficiently.

Aerts *et al*. (2006)[76] approaches the question differently by assessing the relationship between corporate environmental disclosures and financial analysts' earnings forecasts. The paper finds that in general, increased environmental disclosures decrease the variation, or "dispersion", of analysts' earnings forecasts for the specified company. This suggests that increased environmental disclosure decreases uncertainty and enables financial analysts to value firms more accurately, allowing investment capital to be allocated more efficiently.

Comier *et al*. (2009)[77] examined the relationship between environmental disclosures and share price volatility. The study focused on a sample of 137 non-financial firms from the Toronto Stock Exchange, using data for 2004 and 2005. Based on the available disclosure information for the 137 firms, the authors concluded that increased paper-based disclosure (*i.e*. disclosures published in annual reports rather than on a company's website) was correlated with a decrease in share price volatility. This reduction in volatility suggests a decrease in market uncertainty, enabling financial markets to operate more efficiently.

Other studies evaluate the effects of the *type* of disclosure on a company's market valuation or performance. Specifically, Cox and Douthett (2009) [78] analyze the relationship between Generally Accepted Accounting Principles (GAAP) environmental disclosures in companies' annual (10-K) reports and their profits by type of disclosure. The authors divide disclosures into two categories, confirmatory and non-confirmatory. Confirmatory disclosures are designed to *confirm* that the company's profits have not been and will not be at the expense of the environment, while non-confirmatory disclosures convey information without context and allow the reader to draw their own conclusions. The paper finds that confirmatory disclosures result in an increase in profits while non-confirmatory disclosures result in a reduction in profits. Additionally, confirmatory and non-confirmatory GAAP disclosures both reduce market valuation, though the reduction is less for confirmatory disclosures than for non-confirmatory disclosure.

Moneva and Cuellar (2009)[79] analyze the relationship between environmental reporting and financial performance, based on a sample of publicly-traded Spanish companies for the period 1996 to 2004. This time frame captures a period of time with and without environmental disclosure requirements. The paper first evaluates the presence of a market value impact associated with financial versus non-financial environmental disclosures. The study concludes that financial environmental disclosures impact a company's market value, but non-financial environmental disclosures do not. More specifically, according to the authors, investors perceive non-financial disclosures as insignificant information. With respect to financial disclosures, the study found that information pertaining to expenditures on environmental activities and

[76] Aerts, Walter, Denis Cormier, and Michel Magnan. "Corporate environmental disclosure, financial markets and the media: An international perspective." *Ecological Economics* 64.3 (2008): 643-659.

[77] Cormier, Denis, Marie-Josee Ledoux and Michel Magnan, "The Informational Contribution of Social and Environmental Disclosures for Investors." 2009.

[78] Cox, Carol A., and Edward B. Douthett, Jr. "Further Evidence on the Factors and Valuation Associated with the Level of Environmental Liability Disclosures," *Academy of Accounting and Financial Studies Journal* 13 (3): 2009.

[79] Moneva, Jose M., and Beatriz Cuellar. "The Value Relevance of Financial and Non-Financial environmental reporting." *Environmental and Resource Economics*, 44 (3): 441-456. 2009

provisions for contingencies have a negative impact on a firm's market valuation. The authors explain that investors do not perceive environmental expenditures and contingencies as future improvements but rather as expenses that result in lower future earnings. However, disclosures including information on a firm's R&D intensity have a positive effect on a firm's market valuation. In addition, the study examined the impact that the introduction of environmental reporting regulations had on the market valuation significance of disclosures. The authors explain that disclosures became more significant to market valuation after the introduction of reporting regulations. Although the results of this study can be generalized only for firms in Spain, the basic relationship is important to note for the purposes of evaluating the proposed rule. The paper suggests that financial disclosures, especially after disclosure regulations were enacted, became value relevant.

7.2.3 Impact of Disclosure on Cost of Capital

Similarly to the studies summarized above, several papers also analyze the effects of disclosures on a firm's cost of capital. Focusing on firms in five major U.S. industries (oil and gas, chemical, food/beverage, pharmaceutical, and electric utilities) for the 2000-2005 period, Plumlee et al. (2009) [80] find that the quality of voluntary environmental disclosure is positively related to the cost of capital. In contrast, Clarkson et al. (2010) [81], analyzes the impact of voluntary environmental disclosures (in standalone environmental reports, corporate social responsibility reports, and corporate web sites) on the cost of capital and firm value. The study analyzes a sample of firms across five major polluting industries (pulp and paper, chemicals, oil and gas, metals and mining, and utilities) for the years 2003 and 2006. Across multiple model specifications, Clarkson et al. (2010)[82] find that voluntary environmental disclosures are not associated with a firm's cost of capital. Thus, unlike most of the other studies reviewed in this section, this paper suggests that disclosure would not significantly affect the efficiency of financial markets.

Botosan (1997) [83] estimates the relationship between voluntary environmental disclosures and the cost of capital based on a disclosure index. Botosan's disclosure index produces a cross-sectional ranking of disclosure levels based on the amount of voluntary disclosure provided in annual reports. The index focuses on five categories of disclosure from annual reports: background information, historical results, non-financial statistics, projected information (*e.g.*, forecasted market share and cash flow), and management discussion and analysis. Botosan's analysis also accounts for firms' analyst following as a measure of disclosure not reflected in annual reports. This captures information disclosed to analysts that is not included in annual reports. Using this approach, Botosan found a negative relationship between disclosures and the cost of capital for

[80] Plumlee, M., D. Brown, and S. Marshall. "Voluntary environmental disclosure quality and firm value: the role of venue and industry type." *Working Paper. University of Utah*. 2009.

[81] Clarkson, Peter M., Xiao Hua Fang, Yue Li, and Gordon Richardson. "The Relevance of Environmental Disclosures for Investors and Other Stakeholder Groups: Which Audience are Firms Speaking to?" *working paper*. 2010.

[82] Clarkson, Peter M., Xiao Hua Fang, Yue Li, and Gordon Richardson. "The Relevance of Environmental Disclosures for Investors and Other Stakeholder Groups: Which Audience are Firms Speaking to?" *working paper*. 2010.

[83] Botosan, C. "Disclosure level and the cost of equity capital." *The Accounting Review.* 72: 323-349. 1997.

firms without a close analyst following but found no such relationship for firms that have a close analyst following. Botosan concludes that this result reflects the fact that firms with a high analyst following make information available to analysts that is not available in annual reports. Therefore, the information made available to analysts preempts or negates any cost of capital effect that may result from the annual report disclosures observed in the model.

Similar to Botosan, Richardson and Welker (2001)[84] assess the impacts of both disclosure and a firm's analyst following on the cost of capital. The authors quantify disclosure using an index that captures the completeness and level of information included in specific disclosures. Examining the impact of both financial and social disclosures[85] for Canadian firms between 1990 and 1992, the study found that an increase in the index score for financial disclosures reduces the cost of capital, but only for firms with a low analyst following. This is consistent with the result from Botosan (1997).[86] In contrast, Richardson and Welker find that an increase in the index score for social disclosures increases the cost of capital.

Dhaliwal et al. (2009)[87] examines the relationship between the cost of capital and voluntary non-financial social corporate disclosures (Corporate Social Responsibility "CSR"). The paper finds that firms with CSR performance superior to their industry peers experience a negative relationship between CSR disclosure and the cost of capital.[88] However, there is no significant relationship between CSR disclosure and the cost of capital for firms with lower CSR performance.

7.2.4 Implications

The body of evidence from the studies described in this section suggests that the disclosure of information related to environmental liabilities is likely to affect firms' market value as well as their cost of capital. Both of these effects help participants in financial markets allocate capital resources more efficiently, expanding the productive capacity of the economy and, by extension, potentially increasing economic output and income. These changes in financial markets and the broader economy reflect the reduction in uncertainty associated with disclosure as well as the information contained in disclosures. In the context of the proposed rule, EPA expects that the CERCLA financial responsibility requirements will also reduce uncertainty and provide information to markets regarding firms' ability to cover their CERCLA liabilities.

[84] Richardson, Alan J., and Michael Welker. "Social disclosure, financial disclosure and the cost of equity capital." *Accounting, Organizations and Society* 26: 597-616. 2001.

[85] Financial disclosures include information pertaining to a firm's financial performance. Social disclosures include information pertaining to a firm's social performance (*i.e.* dedication to environmental practices or donations to a charity)

[86] Botosan, C. "Disclosure level and the cost of equity capital." *The Accounting Review.* 72: 323-349. 1997.

[87] Dhaliwal, Dan, and Albert Tsang. "Voluntary Non-Financial Disclosure and the Cost of Equity Capital: The Case of Corporate Social Responsibility Reporting." 2009.

[88] The paper uses a CSR strength ranking score that accounts for a company's: community involvement, corporate governance, diversity, employee relations, environment, human rights, and product.

7.3 Improvements in Environmental Performance

Financial assurance may provide incentives for owners and operators of hardrock mining facilities to improve their environmental performance relative to baseline conditions. To the extent that the costs of obtaining financial responsibility are linked to firms' potential CERCLA liabilities, firms will have an incentive to minimize these liabilities, by taking actions to reduce the probability and magnitude of these future liabilities. In addition, when regulated entities rely on a letter of credit, insurance policy, or other third-party instrument to meet financial responsibility requirements, the issuer will have an incentive to require sound environmental management as a condition for providing access to these instruments. Although improved environmental performance may carry costs associated with purchasing equipment, improving management practices, and other activities, EPA assumes that such costs will be rationally incurred, such that the overall net benefit (benefit less cost) is positive.

The following sections review the available literature on the relationship between financial responsibility regimes and environmental performance and discuss the benefits improved environmental performance by hardrock mining facilities would provide to impaired and scenic rivers.

7.3.1 Literature on Environmental Performance and Financial Responsibility

The magnitude of these benefits in the context of the proposed rule is contingent upon changes in behavior among regulated entities to reduce the environmental risk associated with their hardrock mining operations. The degree to which the proposed rule would result in such change is uncertain, but the literature examining the relationship between environmental performance and financial responsibility provides insights into the potential for such changes. Much of this literature is theoretical in that it describes the conceptual foundations for this relationship; few studies have attempted to quantify changes in environmental performance associated with financial responsibility or similar mechanisms.

The limited empirical literature on this topic focuses on financial assurance in the context of underground storage tank (UST) cleanup programs. In one empirical study, Yin (2005)[89] examines UST facility releases under two assurance regimes: government assurance programs without risk-based pricing mechanisms and private insurance with risk-based premiums. Focusing on UST releases in Illinois, Indiana, and Michigan, Yin finds that the introduction of risk-based premiums in Michigan mitigated moral hazard and encouraged risk reduction behaviors among the insured. More specifically, Michigan's transition to risk-based pricing mechanisms helped to reduce the UST facility release rate and improve overall environmental performance. In all, eliminating the state-level government assurance program and switching to private insurance markets reduced the frequency of underground fuel tank leaks by approximately 21 percent. Yin estimates that approximately 2,500 UST releases were avoided from 1996 to 2003 because of the transition to private insurance.

[89] Yin, David Hai-Tao (2005). "Risk-Based Pricing and Risk Prevention: Does the Private Insurance Market Help Reduce UST Release Rates?", working paper, November 15, 2005.

Yin *et al.* (2009)[90] similarly find that UST facilities with private insurance are less likely to have accidental fuel tank leaks than UST facilities participating in state assurance fund programs. Using the same data set as Yin (2005), Yin *et al*. (2009) present empirical evidence indicating that the reduction in Michigan's release rate exceeded the reduction in adjacent states (with state assurance programs) by 20 percent after Michigan required UST owners/operators to obtain insurance in private markets, where premiums are based on risk. Overall, Yin *et al*. (2009) estimate that this policy change prevented more than 3,000 fuel tank releases at UST facilities over an eight-year period, representing approximately $400 million in avoided cleanup costs.[91]

Yin *et al.*(2009)[92] note that these savings and the more rapid reduction in the release rate in Michigan may reflect two changes in behavior among UST owners/operators. First, owners may have made capital investments and improved maintenance practices to reduce the likelihood of a tank system leak. Because tank insurance premiums are dependent on factors such as (1) tank and piping material and coatings, (2) tank design (single- or double-walled), (3) whether tank maintenance is performed by a third-party provider approved by the insurer[93], and (4) the history of prior leaks at the facility, tank owner/operators are, in effect, rewarded for improving their environmental performance. The second change in behavior highlighted by Yin *et al*. (2009) is that an owner may opt to close a leak-prone facility entirely, thus reducing releases from that facility. This may occur at facilities where the risk of a leak and cost of insurance are both high.

Many of the behavioral dynamics highlighted in the Yin (2005) and Yin *et al.* (2009) studies would apply directly to hardrock mining companies affected by the CERCLA financial assurance requirements. Under current regulation, Superfund site remediation is often financed by Superfund itself in cases where site owners are insolvent. This funding mechanism is similar to state assurance programs for USTs in that it provides a more limited incentive for environmental performance. The financial assurance requirements included in the proposed rule, however, would (partially) shift the financing of remediation from Superfund as a collective financing mechanism to individual site owners; thus causing these owners to further internalize the negative externality they would have potentially imposed in the future. To comply with these requirements, affected firms may obtain financial assurance in private markets, where banks, insurers, and other financial institutions will price assurance instruments based on risk, much like the insurance purchased by UST owners in Michigan. To minimize the cost of obtaining

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[90] Yin, Hai-tao, Kunreuther, Howard, and White, Mathew (2009). "Risk-Based Pricing and Risk-Reducing Effort: Does the Private Insurance Market Reduce Environmental Accidents?" *National Bureau of Economic Research.* June 2009.

[91] The data indicate that on an average annual basis, Michigan's total release rate fell from 6.51 to 2.56 per 100 facilities before-versus-after the policy change, a drop of 60.6 percent. By contrast, the total release rate in Illinois was lower initially and declined by less: 5.23 to 2.82 per 100 facilities, a reduction of 46.2 percent. The ratio of relative risk changes (60.6 / 46.2), known generally as the etiologic ratio, is 1.31. It indicates that Michigan's relative risk reduction exceeded Illinois' by 31 percent. The relative risk reduction in Michigan exceeded Indiana's by a similar amount, 24 percent.

[92] Yin, Hai-tao, Kunreuther, Howard, and White, Mathew (2009). "Risk-Based Pricing and Risk-Reducing Effort: Does the Private Insurance Market Reduce Environmental Accidents?" *National Bureau of Economic Research.* June 2009.

[93] For example, the American Insurance Group's Environmental Insurance unit provides premium discounts to tank system owners who purchase compliance management and monitoring services from Tanknology-NDE International, a firm that specializes in tank system engineering and monitoring equipment.

financial assurance, hardrock mining firms will have an incentive to implement measures that would reduce risk, including measures that would improve environmental performance and reduce the probability (and perhaps magnitude) of site contamination. For example, mines and mineral processors could put various mechanisms in place to improve the treatment of wastewater, promote better management of tailings and waste rock, encourage more efficient metal recovery technologies, and minimize acid drainage (from either mines or from waste rock and tailings disposal areas), thus reducing the environmental damage per unit of output (*i.e.*, reducing the marginal negative externality).[94] At the same time, just as Yin *et al*. (2009) note that some UST facilities may close, by causing mines to further internalize the negative externality, the proposed rule may lead to partial equilibrium effects, reducing the level of output from hardrock mines and processors and the associated environmental damage.[95]

Similar to the arguments of Yin (2005) and Yin *et al*. (2009), Boyd and Kunreuther (1995)[96] argue that market-based enforcement mechanisms promote UST safety though risk-based premiums and the potential denial of coverage. They also note that financial responsibility requirements (FRRs) are particularly desirable for the regulation of USTs. FRRs provide a direct incentive for firms to upgrade tanks and mitigate existing pollution sources, as firms must bear the costs of any future liabilities with their own resources or via private insurance coverage. Other work by Boyd (1996, 2001)[97] expands beyond underground storage tanks and argues that there is a strong incentive for the provider of financial assurance to monitor environmental safety in order to guard against moral hazard. That is, it is in the best interest of third parties providing financial instruments to effectively monitor the environmental performance of the firm. This monitoring may lead to improvements in the environmental performance of the assured firm.

Offering additional data indicating that financial responsibility may improve environmental performance, Miller (1998)[98] summarizes the results of a survey asking member companies of the International Council on Metals and the Environment whether environmental surety instruments promote environmental protection. Survey respondents indicated that assurance instruments may have particular application for small, one-property operators and are effective for enforcing environmental responsibility among these operators. Miller (2005) echoes this view stating that smaller companies may not have the financial resources to reclaim sites if they are no longer viable.

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[94] These particular issues were identified as areas of environmental concern in EPA's National Hardrock Mining Framework, September 1997. Available at: http://www.epa.gov/aml/policy/hardrock.pdf.

[95] For a theoretical explanation please see Appendix A in US EPA's "Guidelines for Preparing Economic Analyses", December 2010. Available at: https://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-50.pdf/$file/EE-0568-50.pdf.

[96] Boyd, James; Kunreuther, Howard. "Retrospective Liability and Future Risk: The Optimal Regulation of Underground Storage Tanks." Resources for the Future: Discussion Paper 96-02. October 1995.

[97] Boyd, James. "Banking on "Green Money": Are Environmental Financial Responsibility Rules Fulfilling their Promise?" Resources for the Future: Discussion Paper 96-26. July 1996; and Boyd, James. "Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules Fulfilling Their Promise?" Resources for the Futures: Discussion Paper 01-42. August 2001.

[98] Miller, George C. "Use of financial surety for environmental purposes." A study prepared for the International Council on Metals and the Environment. October 1998.

On a broad conceptual level, Peck and Sinding (2009)[99] assert that financial assurance instruments are increasingly accepted by industry as perhaps the most effective manner with which to ensure that environmental protection can be achieved and that public expectations can be met in the mining sphere. The authors note that financial assurance protects against unfunded reclamation needs and that posting financial assurance is a form of environmental commitment by mine and processor company managers. The authors also argue that concurrent remediation of environmental (and social) impacts during the life of facilities would be more efficient than post-mining cleanup.

An extensive body of literature examines the incentives that bonding requirements provide for improvements in environmental performance. Kysar (2010)[100] asserts that the pricing of surety bond financial instruments provides incentives for environmental improvements because surety companies price bonding services, in part, based on the estimated likelihood and severity of harm occurring. This creates a strong incentive for firms to reduce the uncertainty surrounding their activities, either by investing in the advancement of scientific knowledge or switching to less dangerous alternative activities. Costanza and Perrings (1990)[101] make similar arguments. In addition, Mathis and Baker (2002)[102] note that requiring firms to obtain environmental assurance bonds (EABs) may induce firms to develop new production technologies that are less environmentally harmful and invest in improved monitoring techniques. The combined effects of these improvements would increase the likelihood that firms would be refunded the full amount of their bonds and would reduce the cost of future EABs. Offering a slightly different perspective on these incentives, Shogren, *et al.* (1992)[103] contend that environmental bonds force firms to internalize social welfare costs that are not reflected in the prices they charge to consumers, as doing so is necessary to ensure the recovery of their bonds. This incentivizes firms to provide a socially optimal level of pollution control, given the cost of shirking. Similarly, Spaeter and Tsakis (2005)[104] present a conceptual model showing that re-estimated environmental bond contracts (*i.e.*, bonds where the underlying cost of remediation is adjusted based on site inspections) create an incentive for firms to invest in pollution prevention to avoid upward revisions to the underlying value of the bond.

[99] Peck, Philip and Sinding, Knud. "Financial assurance and mine closure: Stakeholder expectations and effects on operating decisions." *Resources Policy* 34 (2009), 227-233.

[100] Kysar, Douglous. "Ecologic: Nanotechnology, Environmental Assurance Bonding, and Symmetric Humility." 28 *UCLA J. Environmental. Law & Policy* 201 2010. Content downloaded/printed from HeinOnline: 4/13/2011.

[101] Costanza, R. and Perrings, C. 1990. "A flexible assurance bonding system for improved environmental management." *Ecological Economics*, 2:57-75.

[102] Mathis, Mitchell L. and Baker, Pamela B. (2002) 'Assurance bonds: A tool for managing environmental costs in aquaculture'. *Aquaculture Economics & management*, 6:1, 1-17.

[103] Shogren, J.F., Herriges, J.A. and Govinfasamy, R., 1993. "Limits to environmental bonds." *Ecological Economics*, 8:109-133.

[104] Spaeter, Sandrine and Tsakiris, Panagiotis (2005). "Environmental Risks and Financial Guarantees Improving Prevention in the Mining Industry, working paper, January 2005.

Kahn *et al*. (2001)[105] describe a system combining flexible performance bonds with insurance. Under Kahn et al.'s proposed system, mines would not forfeit the full amount of the bond if they failed to meet the minimum or optimum standards set forth in the bond, but would instead be penalized in increments. This structure would help avoid situations where a mine loses the incentive to maintain environmental quality because it falls just short of optimal ecological standards and forfeits the full value of the bond. Thus, this bond would provide an incentive for sound environmental performance as long as the mine has the prospect of being refunded a portion of the bonded amount. Despite this advantage over traditional environmental bonds, Kahn *et al.* argue these flexible bonding instruments would not necessarily be sufficient for post-closure monitoring, maintenance, and preventive action. To address this issue, the authors recommend that insurance to cover post-closure costs be purchased prior to receiving the performance bond. The insurer would then have an incentive to ensure that the mine is closed with an adequate margin of environmental safety and would also have an incentive hire a third-party for monitoring and other prevention activities.

Poulin and Jacques (2008)[106] also propose a combined bond and insurance system for the mining sector. Because of remediation cost overruns, bonding is not always sufficient to finance the cleanup of mining sites. Requiring insurance to cover these potential cost overruns would enhance incentives to reduce uncertain environmental risks via improved technology or management, as doing so would reduce the premium charged to a mine.

Although the proposed rule would not require the use of environmental assurance bonds and the other instruments outlined above, the incentives that these instruments provide for improved environmental performance would apply to other forms of financial assurance that hardrock mining firms may secure under the proposed rule. Any third-party provider of a financial assurance instrument will price that instrument based on (1) the likelihood that the assured party will exercise the assurance instrument and (2) the expected value of the funding required by the assured party. Both of these factors are partially dependent on the environmental performance of assured firms. Thus, in the context of the proposed rule, financial assurance provides an incentive for hardrock mining firms to reduce the magnitude of their environmental liabilities. Operational changes instituted in response to these incentives may reduce pollution from the hardrock mining sector.

Improved environmental performance may also have an associated cost—owners and operators of the potentially regulated facilities may experience increased operational costs to implement the improvement. However, EPA is unable to quantify this cost given the available data.

7.3.2 Effect on Impaired Waters and Wild and Scenic Rivers

Hardrock mining and processing facilities may adversely affect the environment through hazardous substance releases to land, air, and surface water. In particular, acid mine drainage (AMD) can cause releases of heavy metals and acidic water to watersheds that support communities of aquatic organisms. The harmful effects of the introduction of AMD into waters

[105] Kahn, James R., Franceschi, Dina, Curi, Adolson, and Vale, Eduardo. "Economic and financial aspects of mine closure." Natural Resources Forum 25 (2001), 265-274.

[106] Poulin, Richard and Jacques, Michel. "Mine reclamation bonding and environmental insurance." *International Journal of Risk Assessment and Management,* Vol 7, No. 5, 2007.

have been well documented. As indicated in Williamson et al. (2007)[107] and Earle and Callaghan (1998)[108], AMD introduces metals and other contaminants that can lower the pH of affected water bodies to the point that specific species, food sources, and habitats cannot sustain life.[109] Wireman (2001)[110] notes that human health effects are associated with the ingestion of AMD-contaminated water and discusses the challenges and high costs associated with the treatment or replacement of contaminated public water supplies.

In addition to acid mine drainage, the literature identifies several other adverse impacts to waterways associated with hardrock mining activities. Courtney and Clements (2002) explain that the deposition of mining waste material into substrate and sediment can physically damage aquatic habitat. [111] As described in Wireman (2001), hardrock mining activities can also result in erosion and sedimentation, depositing quantities of waste rock and harmful minerals into nearby rivers and streams.

The effects outlined above may be particularly acute for waterways classified as impaired waters under Section 303(d) of the CWA and waters identified as wild and scenic rivers under the 1968 Wild and Scenic Rivers Act. With respect to CWA impaired waters, water pollution from mining activities may lead to difficulty in meeting the Total Maximum Daily Load (TMDL) limits established for these waterways and increase the cost of meeting the TMDL requirements. Similarly, water pollution from mining may limit recreation and other uses in and along wild and scenic rivers. To the extent that the proposed rule leads to improvements in the environmental performance of mines, these adverse impacts may be reduced or avoided.

Because EPA cannot quantify estimated improvements in environmental performance at hardrock mining and processing facilities, EPA cannot develop quantitative estimates of the benefits to impaired waters and wild and scenic rivers from the proposed rule. However, to gauge the potential magnitude of the benefits associated with any avoided environmental impacts, EPA identified the number of sites in the potentially regulated universe that are located near CWA impaired waters or wild and scenic rivers. For the purposes of this analysis, a waterway at an affected site is considered to be near an impaired water or a wild and scenic river if it is within a 24-hour travel distance.[112] Waters within a 24-hour travel distance of hardrock

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[107] Williamson, James M., Hale W. Thurston, and Matthew T. Heberling. (2007). "Valuing acid mine drainage remediation in West Virginia: benefit transfer with preference calibration." *Environmental Economics and Policy Studies* 8:271-293.

[108] Earle, James and Thomas Callaghan. (1998). "Impacts of Mine Drainage on Aquatic Life, Water Uses, and Man-Made Structures." *Deleterious Effects of Mine Drainage*.

[109] The AMD-contaminated water contains particles of minerals found in the sedimentary rock as well as chemicals used in the mining process.

[110] Wireman, Mike. (2001). "Potential Water-Quality Impact of Hard-Rock Mining." *EPA Update Summer 2001 GWMR* 40-51.

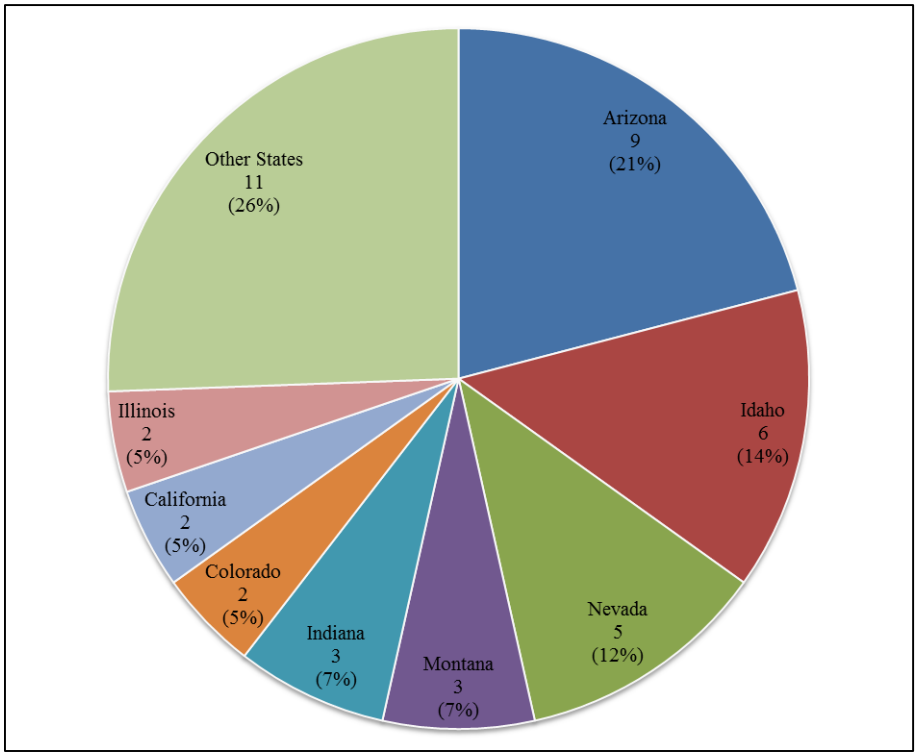
[111] Courtney, Lisa A. and William H. Clements. (2002). "Assessing the influence of water and substratum quality on benthic macroinvertebrate communities in a metal-polluted stream: an experimental approach." *Freshwater Biology* 47:1766-1778.

[112] The "24-hour travel distance" is the distance from a given point that a river flows in a 24 hour period. The 24-hour travel distance has been employed as a method to geographically delineate source water protection areas to assess contaminant concentration from discrete source points in river systems. See Timothy Lanier and W. Fred Falls. (1999). "Methods for Segmentation of Source-Water Protection Areas and Susceptibility Assessment to Contamination for Public Surface Water systems, and Their Application to an Intake, Aiken, South Carolina."

mining and processing facilities were identified in ArcGIS using the National Hydrography Dataset Plus, jointly developed by EPA and USGS.[113]

Of the 221 facilities in the potentially regulated universe, EPA identified the status of waterways adjacent to 172 facilities. Out of these 172 facilities, 43 facilities, or approximately 25 percent, are located near CWA section 303(d) impaired waters. Only one facility was located within a 24-hour travel distance of a wild and scenic river. Assuming that the 172 facilities are representative of the full included universe, the proposed rule is likely to yield greater benefits for CWA impaired waters than wild and scenic rivers. Exhibit 7-1 presents a breakdown of the facilities near CWA impaired waters by state. As the exhibit demonstrates, the majority of the 43 facilities located near CWA impaired waters are concentrated in western states and particularly in Arizona, Idaho, and Nevada.

Exhibit 7-1.
Facilities Within 24-Hour Travel Distance of CWA Impaired Waters by State[114]



Proceedings of the 1999 Georgia Water Resources Conference. Ed. Kathryn J. Hatcher. EPA uses the 24-hour travel distance as the boundary of impact analyses on affected ecological receptors in proximity to contaminant sources and to determine assessment areas for analyses of surface water systems. See U.S. Environmental Protection Agency (U.S. EPA). (2006). "How-To Manual: Update and Enhance Your Local Source Water Protection Assessments." Office of Water: EPA816-8-06-004.

[113] U.S. EPA and the USGS. (2006). "National Hydrography Dataset Plus – NHDPlus."

[114] "Other States" include Utah, Missouri, Florida, New Mexico, Mississippi, Tennessee, Pennsylvania, and Oklahoma. All of these states have one facility located near CWA impaired waters.

7.4 Speed of Site Cleanups

In cases where the owner or operator of a site is insolvent or otherwise unable to pay for site remediation, the securing of cleanup funds through financial assurance *may* allow remediation to begin more quickly than would otherwise be possible. If a site owner or operator defaults on its Superfund obligations under the baseline, EPA typically assumes responsibility for cleanup. Due to budget constraints, however, the Agency does not usually initiate remediation of the site immediately upon taking on this responsibility. EPA instead places the site in a queue of remediation projects ranked according to the risk they pose to human health and the environment. A site may remain in this queue for an extended period of time. During this time, contamination from the site may damage the local environment. Moreover, in some cases, the spatial extent of contamination may spread, causing more damage and increasing the costs of the eventual cleanup.

Under the financial responsibility requirements outlined in the proposed rule, the cleanup of sites owned by companies in default could begin more rapidly than under the baseline. Because funding for site remediation would be secured prior to a company's insolvency, the initiation of cleanup would not be delayed by EPA's budget constraints. In addition, the expeditious initiation of cleanups under this scenario would help avoid much of the environmental degradation that would occur in the baseline between the time of default and the beginning of the eventual cleanup effort.

The extent to which the proposed rule would hasten the initiation of site cleanups is uncertain. *Ex ante*, it is not clear how quickly site cleanups would begin under the proposed financial responsibility requirements. Although funds would be available, a responsible party or EPA would still need to select a remedy for affected sites and hire an engineering firm to conduct the remediation once the funds have been released from the instrument.

Chapter 8.
Equity Considerations and Other Impacts

8.1 Introduction

As required by applicable statutes and executive orders, this chapter summarizes EPA's analyses of equity considerations and other regulatory concerns associated with the proposed CERCLA 108(b) rule. This chapter assesses potential impacts with respect to the following issues:

- **Impacts on small business and governments:** EPA's regulatory flexibility analysis considers the potential for regulatory costs to have a significant impact on a substantial number of small entities (SISNOSE).
- **Environmental justice:** EPA analyzes the characteristics of the populations living in proximity to hard-rock mines and mineral processors to determine potential environmental justice concerns of the CERCLA 108(b) rulemaking.
- **Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use:** EPA considers the potential for this regulation to affect the supply, distribution, or use of energy, including changes in the price of fuel.
- **Children's health impacts:** EPA considers the potential for the proposed CERCLA 108(b) regulation to have a significant or disproportionate impact on the health of children.
- **Regulatory planning and review 12866:** EPA must examine whether the regulatory action is "significant" and therefore subject to review by the Office of Management and Budget (OMB).
- **Unfunded mandates analysis:** EPA describes prior consultation with representatives of affected state, local, and tribal governments.
- **Federalism:** EPA considers potential issues related to state sovereignty.
- **Tribal governments:** EPA evaluates federal unfunded mandates that include impacts on tribal governments and their communities.

8.2 Impacts on Small Business and Governments: Regulatory Flexibility Analysis

The Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), 5 USC 601 et seq., generally requires EPA to prepare a regulatory flexibility analysis of any regulation subject to notice and comment under the Administrative Procedure Act or any other statute. For the Proposed Rule, this analysis takes the form of an initial regulatory flexibility analysis (IRFA). This analysis must be completed unless the agency certifies that the regulation will not have a significant economic impact on a substantial number of small entities. If a regulation is found to have a significant impact on a substantial number of small entities, further analysis must be performed to determine what can be done to lessen the impact. Small entities include small businesses, small organizations, and

small governmental jurisdictions. EPA developed a screening analysis and supplemental analysis consistent with the requirements under IRFA; this section presents a summary of these findings.

For purposes of assessing the impacts of this regulation on small entities, a small entity is defined as: (1) a small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR Part 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

As described in Section 2.3, EPA used publicly available information to develop the economic profile of affected entities, including identification of small businesses using February 2016 Small Business Administration thresholds. For this analysis, EPA considers estimates of greater than 20 percent of total small entities in the affected universe as indications that a substantial number of small entities may be affected by the rule. EPA identified 221 mines/processing facilities in the potentially included universe; of these, 53 facilities are estimated to have a parent firm classified as small (including joint ventures), corresponding to 44 firms. Twelve additional mines have parent firms of unknown size, due to lack of data. Most (38) of these 53 facilities engage in mining/extraction; 15 facilities engage in processing/refining only. Exhibit 8-1 below identifies the industries (by 6-digit NAICS codes) that contain small businesses and lists summary information on the small entity universe. The 44 known small firms span 23 industries, while 12 firms could not be classified by size or industry, and may potentially be small entities. Exhibit 8-2 distributes small entities by facility type.

EPA conducted screening-level assessment of these 44 to 56 small entities. Using 1) the extrapolated facility-level financial responsibility amounts developed in Chapter 3 (median FR approach) and 2) the average cost of obtaining financial assurance (as a percentage of third-party instrument face value) calculated in Chapter 5 (company average approach), EPA estimated the annualized compliance cost of the rule for each facility. EPA then compared these annualized compliance costs to the annual revenues of these small entities in each industry to determine the impact of the rule on small firms, as a percent of annual revenues. As shown in Exhibit 8-1, EPA found that, out of 44 to 56 small entities, annualized compliance costs from the rule may exceed one percent of average revenues for small entities for 35 to 49 firms and may exceed three percent of average revenues for small entities for 25 to 42 firms.

The results of this analysis of impacts on small entities do not vary significantly between the two regulatory options. However, impacts are generally lower under Option 2 due to the lower compliance costs when a financial test is available. Under Option 2, between 35 and 47 firms face impacts of at least 1 percent of revenues, and between 35 and 37 firms face impacts of at least 3 percent of revenues. As discussed in Chapter 5, when evaluated on the basis of cash (accounting) outlays, which are not amortized over the period from rule implementation to FR release date, impacts for small entities are higher, particularly in the first year. EPA conducted a SBAR Panel with small entity representatives (SERs) from the mining industry to evaluate the impact of the proposed rule on small businesses.

Because of data limitations, the screening level analysis relies upon estimated financial responsibility amounts for each facility based on facility type, rather than actual size and nature of operations. Further, reliable and current revenues information for small, private firms was not

readily available. As a result, these results are not suggestive of impacts for any specific company or entity.

Exhibit 8-1.
Summary of Small Business Statistics (Company Revenues)

NAICS Code	Industry	SBA Small Business Size Standard (As of February 2016)		Number of Small Firms	Average Annual Revenues of Small Firms ($Millions)	Average Number of Employees of Small Firms	Number of Small Firms Facing Annual Compliance Costs >1% (Median)*	Number of Small Firms Facing Annual Compliance Costs >3% (Median)*
		Revenues ($Millions)	Employees					
211111	Crude Petroleum and Natural Gas Extraction		1250	1	$61	194	1	0-1
212210	Iron Ore Mining		750	1	$100	475	1	0-1
212221	Gold Ore Mining		1500	10	$96	261	6-7	5-6
212234	Copper Ore and Nickel Ore Mining		1500	5	$22	80	5	4
212291	Uranium-Radium-Vanadium Ore Mining		250	2	$15	48	1	0-1
212392	Phosphate Rock Mining		1000	1	<$1	6	1	1
212393	Other Chemical and Fertilizer Mineral Mining		500	1	<$1	3	1	1
212399	All Other Nonmetallic Mineral Mining		500	3	$329	173	2	2
213114	Support Activities for Metal Mining	20.5		2	<$1	7	2	2
213115	Support Activities for Nonmetallic Minerals (except Fuels)	7.5		1	<$1	2	1	1
236115	New Single-family Housing Construction (Except For-Sale Builders)	36.5		1	$8	10	1	0
238910	Site Preparation Contractors	15		2	$2	100	2	1
325180	Other Basic Inorganic Chemical Manufacturing		1000	2	$168	295	0-1	0
325312	Phosphatic Fertilizer Manufacturing		750	1	$47	315	1	0-1
327992	Ground or Treated Mineral and Earth Manufacturing		500	2	$32	111	2	1
331313	Alumina Refining and Primary Aluminum Production		1000	1	$2	550	1	1
331410	Nonferrous Metal (except Aluminum) Smelting and Refining		1000	1	$13	83	1	0
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing and Extruding		750	1	$34	500	1	1
423520	Coal and Other Mineral and Ore Merchant Wholesalers		100	1	$15	54	0	0
522390	Other Activities Related to Credit Intermediation	20.5		1	<$1	1	1	1
551112	Offices of Other Holding Companies	20.5		2	<$1	2	2	2
561499	All Other Business Support Services	15		1	<$1	1	1	1
561990	All Other Support Services	11		1	<$1	2	1	1
Unknown	Unknown			Up to 12 additional firms	Unknown	Unknown	Up to 12 additional firms	Up to 12 additional firms

TOTAL			**44 to 56 firms**			**35 to 49 firms**	**25 to 42 firms**

*Note: Where ranges are presented, these ranges represent results of Option 2 (lower number) and Option 1 (higher number).

Exhibit 8-2. Distribution of Small Entities by Facility Type		
Facility Type	**Facilities Owned by Small Companies**	**Facilities Owned by Unknown Companies**
Brine Extraction/Processing	0	0
In-situ Recovery	5	0
Processor/Refiner	14	4
Surface Mine	16	4
Surface Mine/Processing	3	0
Underground Mine	14	4
Primary Smelter	1	0
TOTAL	**53**	**12**

8.3 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires EPA to conduct an environmental justice analysis as part of the CERCLA 108(b) hardrock mining and primary processing regulatory impact analysis.[115] Specifically, the executive order requires EPA to identify and address any disproportionately high and adverse human health or environmental impacts of the CERCLA 108(b) rulemaking on minority or low-income populations.

This analysis considers the spatial distribution of low-income and minority groups to determine whether these groups are more or less represented in the populations in proximity to hardrock mining and mineral processing sites. Groups within the specified distance radii from the mining site are expected to benefit from the environmental performance improvement and other benefits of the rule. If the population within a specified radii distance has a larger proportion of minority or low-income families than the state or national average, it may indicate that the proposed rule may benefit communities that have been historically exposed to a disproportionate share of environmental impacts and thus contribute to redressing existing EJ concerns.

EPA's preliminary screening analysis indicates that, overall, the populations surrounding hardrock mining and processing facilities have minority concentrations and poverty rates that are generally similar to state and national averages. However, EPA identified a number of census block groups in close proximity to hardrock mining and primary processing facilities within the potentially regulated universe with potential environmental justice concerns. These concerns include poverty levels and percent of minority population (particularly Hispanic or Latino origin and American Indian/Alaska Native) higher than respective state or national averages.

EPA identified and analyzed the demographic characteristics of populations in close proximity to the mines and processors that constitute the 108(b) universe. The analysis relies on geographic information on the locations of currently operating facilities, and demographic data from the U.S. Census Bureau's 2014 five-year American Community Survey (ACS). The universe reviewed in

[115] 59 FR 7629, Feb. 16, 1994.

this RIA contains 221 potentially regulated facilities. The locations of these facilities were identified primarily through the Mines Data Set available from the MSHA.[116, 117]

To evaluate the demographic characteristics of populations in close proximity to the hardrock mines and primary processors that make up the potentially regulated universe, EPA identified the census block groups located partially or wholly within one mile, five mile, 15 mile, and 25 mile radii of hardrock mining and primary processing facilities. Block groups are the smallest statistical areas for which the U.S. Census Bureau publishes ACS demographic data. Most block groups (nearly 90 percent) contain between 600 and 3,000 people, though some block groups contain no population, and more than 35,000 people live in the largest block group. Geographic information on the boundaries of each block group was accessed through a U.S. Census Bureau GIS dataset.[118]

The block groups identified in the western United States cover a much larger area than the block groups identified in the eastern United States. However, due to higher population densities, a significantly larger number of block groups and people are located within close proximity to the mining facilities in the eastern United States.

The number of block groups identified varied considerably among each of the four distance criteria. Of the 220,333 block groups in the United States:

- 634 block groups fall partially or wholly within a one mile radius of a potentially regulated facility.
- 4,203 block groups fall partially or wholly within a five mile radius of a potentially regulated facility.
- 17,905 block groups fall partially or wholly within a 15 mile radius of a potentially regulated facility.
- 33,401 block groups fall partially or wholly within a 25 mile radius of a potentially regulated facility.

The demographic characteristics of the people living within these block groups were identified and compared to national averages, as shown in Exhibit 8-3. Specifically, EPA examined the number and percentage of people in these block groups living in poverty, as defined by the 2014 five-year ACS, and the percentage of people in these block groups that belong to minority groups.

Approximately 775,000 people live in block groups that are partially or wholly located within one mile of facilities in the 108(b) universe. Approximately 157,000 of these people, or 21 percent, have incomes below the poverty thresholds defined by the ACS based on household

[116] MSHA. "Mines Data Set." Accessed at: http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp

[117] The Mines Data Set contained geographic coordinates for 155 facilities. EPA's FRS database included geographic information on 12 additional facilities that did not have MSHA IDs. Geographic coordinates for 16 of the remaining facilities were identified through targeted research on Google Earth, company websites, and any descriptive geographic information available in the MSHA Mines Data Set.

[118] U.S. Census Bureau. (2014). TIGER/Line Geodatabase, Census Block Groups National File." Accessed at: https://www.census.gov/geo/maps-data/data/tiger-data.html

characteristics.[119] When block groups up to 25 miles away from a potentially regulated facility are included, 16 percent of the population has incomes below the ACS poverty threshold. Nationally, approximately 16 percent of the population lives below the ACS poverty threshold, a similar percentage to that observed in the block groups with relative proximity to mining facilities.

Of the population living partially or wholly within one mile of a hardrock mining or processing facility, approximately 260,000 people, or 34 percent, belong to a minority group. When block groups up to 25 miles away from a potentially regulated facility are included, 36 percent of the population belongs to a minority group. In the United States overall, approximately 37 percent of people belong to a minority group. Exhibit 8-3 lists the number and percentage of people in the four sets of block groups that belong to minority groups and that have incomes below the poverty threshold.

Exhibit 8-3.
Baseline Demographics for Census Block Groups

Geographic Area	Minority Population	Population Living in Poverty
Census block groups within 1 mile of a potentially regulated facility	262,113 (34%)	157,418 (21%)
Census block groups within 5 miles of a potentially regulated facility	2,067,411 (40%)	1,041,095 (20%)
Census block groups within 15 miles of a potentially regulated facility	9,099,941 (37%)	4,105,852 (17%)
Census block groups within 25 miles of a potentially regulated facility	17,014,669 (36%)	7,469,769 (16%)
National Average	(37%)	(16%)

Exhibit 8-4 provides further detail on the percentage of people belonging to various minority groups in the block groups in close proximity to mining facilities. The proportion of the population in close proximity to potentially regulated facilities belonging to a minority group was lower than the national average across all minority groups except for "Black or African American alone," across all distance criteria, and "American Indian and Alaska Native alone," among block groups within one mile and five miles of a potentially regulated facility. Depending on the distance criterion used, between 14 percent and 22 percent of people in close proximity to hardrock mining and processing facilities identify as Black or African American alone, compared to 13 percent nationwide. Two percent of people living in block groups within one mile of a potentially regulated facility identify as American Indian and Alaska Native alone, compared to one percent nationwide. The proportion of people that identify as American Indian and Alaska Native alone is also slightly higher than the national proportion in block groups

[119] The ACS defines a set of poverty thresholds that vary based on family size, number of children, and age of householder. More information on ACS poverty thresholds is available at: https://www.census.gov/hhes/www/poverty/data/#acs

Minority population is defined as the portion of the population not included in the category "White alone, not Hispanic or Latino."

within five miles of a potentially regulated facility. Exhibit 8-5 summarizes the number and percent of block groups that exceed the national average for each distance criterion.

Exhibit 8-4.
Baseline Minority Group Demographics for Census Block Groups

Geographic Area	Black or African American alone	American Indian and Alaska Native alone	Asian alone	Native Hawaiian and Other Pacific Islander alone	Hispanic or Latino origin
Census Block Groups within 1 mile of a potentially regulated facility	110,180 (14%)	13,844 (2%)	16,065 (2%)	593 (0%)	109,163 (14%)
Census Block Groups within 5 miles of a potentially regulated facility	1,127,215 (22%)	43,190 (0.8%)	124,636 (2%)	4,459 (0%)	688,898 (13%)
Census Block Groups within 15 miles of a potentially regulated facility	4,299,347 (18%)	167,382 (0.7%)	734,155 (3%)	30,843 (0%)	3,471,932 (14%)
Census Block Groups within 25 miles of a potentially regulated facility	6,611,197 (14%)	340,893 (0.7%)	1,850,306 (4%)	66,188 (0%)	7,348,690 (15%)
National Average	(13%)	(0.8%)	(5%)	(0%)	(17%)

Exhibit 8-5.
Number and Percentage of Census Block Groups Exceeding National Minority and Poverty Percentages

Geographic Area	Minority Criterion	Poverty Criterion
Census block groups within 1 mile of a potentially regulated facility	230 (36%)	356 (56%)
Census block groups within 5 miles of a potentially regulated facility	1,946 (46%)	2,319 (55%)
Census block groups within 15 miles of a potentially regulated facility	7,506 (42%)	8,428 (47%)
Census block groups within 25 miles of a potentially regulated facility	12,886 (39%)	14,247 (43%)

This analysis also compared the concentrations of minority groups and people living in poverty in individual block groups to state averages. Because hardrock mining and mineral processing are highly regional industries within the United States, state populations offer more regional comparison groups. The block groups identified through this analysis represent communities with potential environmental justice concerns. Exhibit 8-6 below summarizes the number and percent of block groups that exceed state-wide averages for all four sets of distance criteria. Depending on the distance criterion used, between 50 and 59 percent of census block groups within close proximity to a regulated facility contain higher concentrations of minority groups than the state average. Similarly, between 42 and 56 percent of census block groups within close proximity to a regulated facility contain higher concentrations of people living in poverty than the state average. Appendix G provides additional tables and figures, including a state-by-state

analysis of block groups that exceed state-wide minority percentages and poverty benchmarks, and an analysis of the census block groups exceeding national benchmarks.

Exhibit 8-6.
Number and Percentage of Census Block Groups Exceeding State-wide Minority and Poverty Percentages

Geographic Area	Minority Criterion	Poverty Criterion
Census block groups within one mile radius of a potentially regulated facility	318 (50%)	358 (56%)
Census block groups within five mile radius of a potentially regulated facility	2,495 (59%)	2,295 (55%)
Census block groups within 15 mile radius of a potentially regulated facility	10,213 (57%)	8,293 (46%)
Census block groups within 25 mile radius of a potentially regulated facility	17,919 (54%)	14,004 (42%)

Overall, EPA's analysis indicates that the populations living in proximity to hardrock mining sites contain concentrations of minority groups and people living in poverty that are generally similar to state and national averages. However, EPA did identify a number of communities with potential environmental justice concerns, including census block groups with concentrations of minority groups and people living in poverty in excess of state and national averages. These communities are likely to share in any of the benefits that may result from promulgation of the proposed rule.

8.4 Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use

Executive Order 13211, *Actions Concerning Regulations That Affect Energy Supply, Distribution, or Use* (May 18, 2001), addresses the need for regulators to consider the potential energy impacts of the proposed CERCLA 108(b) rule and resulting actions. Under Executive Order 13211, agencies are required to prepare a Statement of Energy Effects when a regulatory action may have significant adverse effects on energy supply, distribution, or use, including impacts on price and foreign supplies. Additionally, the requirements obligate agencies to consider reasonable alternatives to regulatory actions with adverse effects and the impacts that such alternatives might have on energy supply, distribution, or use.

This proposed rule would establish financial responsibility requirements under CERCLA designed to assure that owners and operators of facilities provide funds to address CERCLA liabilities at their sites, and to create incentives for sound practices that will minimize the likelihood of a need for a future CERCLA response. The financial responsibility requirements would extend to all CERCLA liabilities at the site.

The Proposed Rule is not expected to impact energy production, distribution, or consumption. This rule may be subject to Executive Order 13211 since it is considered an economically significant action under EO 12866. Since the changes in energy production and consumption under the rule are likely to be minimal, the rule is not expected to have a significant adverse

effect on energy supply, distribution, or use. In addition, no measurable adverse impacts concerning energy prices or foreign supplies are expected from the rule.

8.5 Executive Order 13045: Protection of Children from Environmental Health & Safety Risks

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 FR 19885, April 23, 1997), applies to any regulation that: (1) is determined to be "economically significant" as defined under E.O. 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned regulation on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This action may be subject to Executive Order 13045 because it is economically significant as defined in Executive Order 12866.

EPA conducted a geographic analysis to identify the number and proportion of children living in close proximity to the facilities in the regulated universe. This analysis used the same methodology and data sources outlined above concerning Environmental Justice. EPA's analysis indicates that overall, the number of children living in close proximity to hardrock mining and processing facilities is comparable to the proportion of children in the national population. Of the 775,000 people living within one mile of a regulated facility, approximately 188,000, or 24.3 percent, are under the age of 18. Nationwide, approximately 23.5 percent of the population is under the age of 18. Exhibit 8-7 and Exhibit 8-8 present the number and proportion of children that live within each of the four distance criteria from a mining facility and the number exceeding state-wide averages.

As discussed in the benefits chapter, this rulemaking may improve site environmental performance and accelerate the cleanup process. To the extent that environmental conditions surrounding mine and mineral processor sites improve following this rule, the children living in close proximity to mining facilities are likely to benefit.

Exhibit 8-7.
Baseline Demographics for Census Block Groups

Geographic Area	Population Under 18 Years
Census block groups within one mile radius of a potentially regulated facility	188,101 (24.3%)
Census block groups within five mile radius of a potentially regulated facility	1,256,547 (24.1%)
Census block groups within 15 mile radius of a potentially regulated facility	5,788,688 (23.9%)
Census block groups within 25 mile radius of a potentially regulated facility	11,327,194 (23.7%)
National Average	(23.5%)

Exhibit 8-8. Number and Percentage of Census Block Groups Exceeding State-wide Under 18 Percentages	
Geographic Area	**Population Under 18 Years**
Census block groups within one mile radius of a potentially regulated facility	304 (48%)
Census block groups within five mile radius of a potentially regulated facility	1,995 (47%)
Census block groups within 15 miles radius of a potentially regulated facility	8,230 (46%)
Census block groups within 25 mile radius of a potentially regulated facility	15,243 (46%)

8.6 Executive Order 12866: Regulatory Planning and Review Executive Order 13563: Improving Regulation and Regulatory Review

Under Executive Order 12866 (58 FR 51735, October 4, 1993), EPA, in conjunction with the OMB's Office of Information and Regulatory Affairs (OIRA), must determine whether a regulatory action is "significant" and therefore subject to OMB review and the full requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a regulation that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, the Agency has determined that this regulation is an economically significant regulatory action because it may have an annual effect on the economy of $100 million or more, as defined under part 3(f)(1) of the Order, and as documented in the results chapter of this RIA.

In addition to an assessment of regulatory costs, the Executive Order also requires Federal agencies to assess benefits and, "recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs."[120] As described in Chapter 7, EPA could not monetize all the rule's benefits given limitations in the available data. This RIA, however, estimates that

[120] See Section 1(b)(6) of Executive Order 12866.

the proposed rule would lead to reduced cost to government of $511 million to $527 million over 34 years (the period of analysis) as a result of increased industry access to funds for CERCLA cleanup and NRD costs and reduced government costs, as described in Chapter 5. The proposed rule would also lead to other benefits, including greater transparency in capital markets, improvements in site environmental performance, improvements to impaired waters and wild and scenic rivers, and faster site cleanups.

8.7 Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act (UMRA), promulgated in 1995, requires all federal agencies to provide a statement to support the need to issue any regulation containing an unfunded federal mandate, and describe prior consultation with representatives of affected state, local, and tribal governments.

The final CERCLA 108(b) rule is subject to the requirements of sections 202 and 205 of UMRA. In general, a regulation is subject to the requirements of these sections if it contains "Federal mandates" that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year. As discussed in Chapter 5, under median-based extrapolation and company average pricing, EPA estimates that the regulation will have aggregate annual compliance costs of $171 million under Option 1 and $111 million under Option 2 (not including administrative reporting costs). Thus, this rule is subject to the following requirements of these sections. This RIA addresses these requirements.

- An identification of the provision of Federal law under which the regulation is being promulgated.
- A qualitative and quantitative assessment of the anticipated costs and benefits of the Federal mandate;
    - Costs and benefits to State, local, and tribal governments and the private sector
    - Effect on health, safety, and the natural environment
    - Analysis of extent to which such costs may be paid with Federal financial assistance (or otherwise paid for by the Federal government)
    - Analysis of the extent to which there are available Federal resources to carry out this mandate
- Estimates of future compliance costs with the mandate.
- Estimates of disproportionate budgetary effects on any type of government or segment of the private sector.
- Estimates of the effect on the national economy (if relevant and possible).

8.8 Executive Order 13132: Federalism

Executive Order 13132, *Federalism* (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure "meaningful and timely input by state and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" is defined in the Executive Order to include regulations that have

"substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government." EPA typically considers a policy to have federalism implications if it results in the expenditure by State and/or local governments in the aggregate of $25 million or more in any one year.

Under Executive Order 13132, EPA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, or EPA consults with State and local officials early in the process of developing the regulation.

This rule is not expected to have federalism implications. EPA does not anticipate that the proposed rule will have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in the Order. The rule would establish financial responsibility requirements under CERCLA designed to assure that owners and operators of facilities provide funds to address CERCLA liabilities at their sites, without affecting the relationships between Federal and State governments. Thus, Executive Order 13132 does not apply to this rule. Nevertheless, EPA welcomes comment from State and local officials in response to this proposed rulemaking.

8.9 Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, *Consultation and Coordination With Indian Tribal Governments* (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications."

To assess the impact on Tribal Governments, EPA identified tribal lands and associated tribes that overlap with the "included" universe of currently operating facilities potentially subject to the CERCLA 108(b) rulemaking. The analysis relies on geographic information on the locations of both tribal lands and currently operating facilities; ArcGIS was used to identify any facilities that overlap tribal lands.

Tribal lands were identified through a GIS dataset available from the U.S. Census Bureau.[121] The Census Bureau dataset includes the following legal and statistical entities:

- Federally recognized American Indian reservations and off-reservation trust land areas;[122]

[121] U.S. Census Bureau. (2014). "TIGER/Line Shapefile, 2014, Series Information File for the Current American Indian/Alaska Native/Native Hawaiian Areas National (AIANNH) National Shapefile." Accessed at: https://catalog.data.gov/dataset/tiger-line-shapefile-2014-series-information-file-for-the-current-american-indian-ala

[122] The Census Bureau defines off-reservation trust land as "areas for which the United States holds title in trust for the benefit of a tribe (tribal trust land) or for an individual American Indian (individual trust land). Trust lands can be alienated or encumbered only by the owner with the approval of the Secretary of the Interior or his/her authorized representative. Trust lands may be located on or off a reservation; however, the Census Bureau tabulates data only

- State-recognized American Indian reservations;
- Hawaiian home lands (HHLs);
- Alaska Native village statistical areas (ANVSAs);
- Oklahoma tribal statistical areas (OTSAs);
- Tribal-designated statistical areas (TDSAs); and
- State-designated tribal statistical areas (SDTSAs).

To estimate the physical extent of the facilities, buffers of varying sizes were projected around these coordinates in ArcGIS. Half-mile, one-mile, and ten-mile buffers were projected around each set of coordinates. Facilities with each of these buffer sizes were then analyzed in ArcGIS to identify any overlapping tribal lands. Exhibit 8-9 displays the distribution of facilities and tribal lands in the contiguous United States. As the map shows, the majority of tribal lands as well as the majority of facilities are located in the western United States.

The number of facilities overlapping tribal lands varied considerably depending on the size of the buffer used:

- With the half-mile buffer, 4 facilities overlapped 3 tribal land areas.
- With the one-mile buffer, 6 facilities overlapped 4 tribal land areas.
- With the ten-mile buffer, 35 facilities overlapped 38 tribal land areas.

Exhibit 8-10, Exhibit 8-11, and Exhibit 8-12 list the facilities that overlap with tribal lands given different buffer sizes, as well as the associated tribal land and tribe names. While the Census Bureau dataset does not include information on the names of the tribes associated with each land area, this information was ascertained from a list of tribal entities provided by the Bureau of Indian Affairs.[123]

EPA has concluded that this action will have limited tribal implications to the extent that the facilities in its regulated universe listed below are located close to tribal lands. As no tribal governments own or operate any of the regulated facilities, and therefore will not incur any direct compliance costs as a result of the proposed rule, Executive Order 13175 does not apply to this rule.

for off-reservation trust lands with the off-reservation trust lands always associated with a specific federally recognized reservation and/or tribal government."

U.S. Census Bureau. "Geographic Terms and Concepts - American Indian, Alaska Native, and Native Hawaiian Areas." Accessed August 21, 2015 at: https://www.census.gov/geo/reference/gtc/gtc_aiannha.html

[123] Department of the Interior, Bureau of Indian Affairs. (2015). "Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs." Accessed at: http://www.loc.gov/catdir/cpso/biaind.pdf

Exhibit 8-9.
Map of Tribal Lands and Facilities in the Regulated Universe

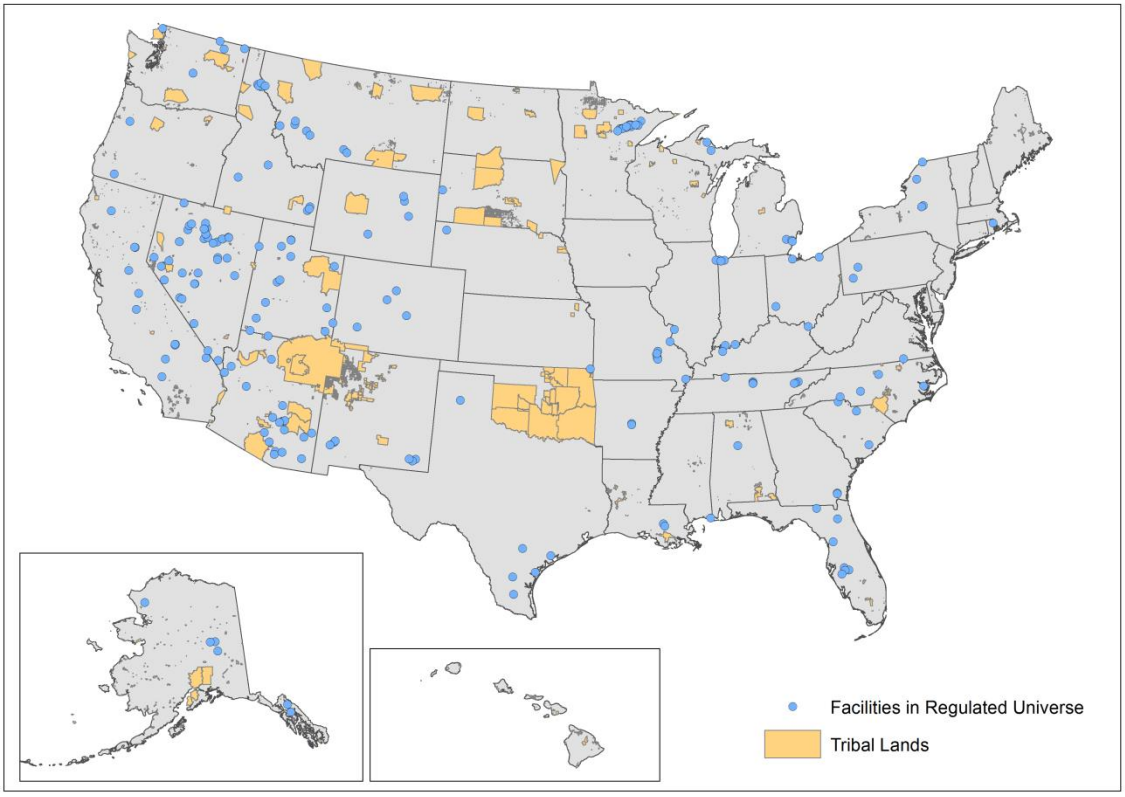


Exhibit 8-10.
Tribal Lands Intersecting with Half-Mile Buffer

Facility Name	Tribal Land Name	Tribe Name	State	County	MSHA ID	FRS ID
First Liberty Lovelock	Lovelock Indian Colony	Lovelock Paiute Tribe	NV	Pershing	N/A	N/A
Umicore Germanium	Quapaw OTSA	The Quapaw Tribe of Indians	OK	Ottawa	N/A	110015742800
Asarco Mission	Tohono O'odham Nation Reservation	Tohono O'odham Nation	AZ	Pima	200135	110011660020
Cyprus Tohono			AZ	Pinal	202579	110008254580

Sources:

1. U.S. Census Bureau. (2014). "TIGER/Line Shapefile, 2014, Series Information File for the Current American Indian/Alaska Native/Native Hawaiian Areas National (AIANNH) National Shapefile." Accessed at: https://catalog.data.gov/dataset/tiger-line-shapefile-2014-series-information-file-for-the-current-american-indian-ala
2. Department of the Interior, Bureau of Indian Affairs. (2015). "Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs." Accessed at: http://www.loc.gov/catdir/cpso/biaind.pdf

Exhibit 8-11.
Tribal Lands Intersecting with One-Mile Buffer

Facility Name	Tribal Land Name	Tribe Name	State	County	MSHA ID	FRS ID
Veris Gold Saval 4- Jerritt Canyon	Elko Colony	Te-Moak Tribe of Western Shoshone Indians of Nevada - Elko Band	NV	Elko	2602742	110043970400
Coeur Rochester	Lovelock Indian Colony	Lovelock Paiute Tribe	NV	Pershing	2601941	110000472890
First Liberty Lovelock			NV	Pershing	N/A	N/A
Umicore Germanium	Quapaw OTSA	The Quapaw Tribe of Indians	OK	Ottawa	N/A	110015742800
Asarco Mission	Tohono O'odham Nation Reservation	Tohono O'odham Nation	AZ	Pima	200135	110011660020
Cyprus Tohono			AZ	Pinal	202579	110008254580

Sources:

1. U.S. Census Bureau. (2014). "TIGER/Line Shapefile, 2014, Series Information File for the Current American Indian/Alaska Native/Native Hawaiian Areas National (AIANNH) National Shapefile." Accessed at: https://catalog.data.gov/dataset/tiger-line-shapefile-2014-series-information-file-for-the-current-american-indian-ala
2. Department of the Interior, Bureau of Indian Affairs. (2015). "Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs." Accessed at: http://www.loc.gov/catdir/cpso/biaind.pdf

Exhibit 8-12.
Tribal Lands Intersecting with Ten-Mile Buffer

Facility Name	Tribal Land Name	Tribe Name	State	County	MSHA ID	FRS ID
Comstock Mining	Battle Mountain	Battle Mountain Reservation	NV	Storey	2601871	
Marigold Mine			NV	Humboldt	2602081	110016767122
Newmont Lone Tree			NV	Humboldt	2602159	110007980435
Nevada Copper Pumpkin Hollow	Campbell	Campbell Ranch	NV	Lyon	2602711	
Geo Nevada Spring Valley	Carson	Carson Colony	NV	Lyon	2602470	110027825030
Umicore Germanium	Cherokee	Cherokee OTSA	OK	Ottawa		110015742801
Hecla Greens Creek	Douglas	Douglas ANVSA	AK	Juneau	5001267	110032882735
Umicore Germanium	Eastern Shawnee	Eastern Shawnee OTSA	OK	Ottawa		110015742801
Newmont Emigrant/Mill 6	Elko	Elko Colony	NV	Elko	2602697	
Veris Gold Saval 4- Jerritt Canyon			NV	Elko	2602742	110043970398
Robinson Nevada	Ely	Ely Reservation	NV	White Pine	2601916	110042080832
Mojave Gold Road Mine	Fort Mojave	Fort Mojave Reservation	AZ	Mohave	202620	
Sutter Gold Lincoln Mine	Ione Band of Miwok	Ione Band of Miwok TDSA	CA	Amador	405038	
Sutter Gold Lincoln Mine	Jackson	Jackson Rancheria	CA	Amador	405038	
Energy Fuels Pinenut Mine	Kaibab	Kaibab Indian Reservation	AZ	Mohave	202286	110015941294
Coeur Rochester	Lovelock	Lovelock Indian Colony	NV	Pershing	2601941	110000472890
First Liberty Lovelock			NV	Pershing		
Alcoa Intalco	Lummi	Lummi Reservation	WA	Ferndale		110040947820
Umicore Germanium	Miami	Miami OTSA	OK	Ottawa		110015742801
Umicore Germanium	Miami/Peoria	Miami/Peoria joint-use OTSA	OK	Ottawa		110015742801
ArcelorMittal Minorca	Minnesota Chippewa	Minnesota Chippewa Trust Land	MN	St Louis	2102449	110008799390
Minntac Screening			MN	St Louis	2103770	
United Taconite Thunderbird Mine			MN	St Louis	2103403	110007372093
USSteel Minntac			MN	St Louis	2100282	110008476988; 110038160076
Umicore Germanium	Modoc	Modoc OTSA	OK	Ottawa		110015742801
Energy Fuels White Mesa Mill	Navajo Nation	Navajo Nation Reservation	UT	San Juan	4201429	110000879425
Resco Hillsborough	Occaneechi-Saponi	Occaneechi-Saponi SDTSA	NC	Orange	3100233	110018633816

Exhibit 8-12.
Tribal Lands Intersecting with Ten-Mile Buffer

Facility Name	Tribal Land Name	Tribe Name	State	County	MSHA ID	FRS ID
Umicore Germanium	Ottawa	Ottawa OTSA	OK	Ottawa		110015742801
CML Iron Mountain	Paiute (UT)	Paiute (UT) Reservation	UT	Washington	4201927	110043433111
Asarco Mission	Pascua Pueblo Yaqui	Pascua Pueblo Yaqui Off-Reservation Trust Land	AZ	Pima	200135	110011660023
Asarco Mission		Pascua Pueblo Yaqui Reservation	AZ	Pima	200135	110011660023
Umicore Germanium	Peoria	Peoria OTSA	OK	Ottawa		110015742801
Umicore Germanium	Quapaw	Quapaw OTSA	OK	Ottawa		110015742801
Alcoa Intalco	Samish	Samish TDSA	WA	Ferndale		110040947820
Freeport McMoRan Miami	San Carlos	San Carlos Reservation	AZ	Gila	200112	110008254423
Freeport McMoRan Morenci			AZ	Greenlee	200024	110000600724
Asarco Ray Hayden			AZ	Gila		110000471338
BHP Copper Cities			AZ	Gila		110015967621
Carlota Copper			AZ	Gila	202653	110039495588
Freeport McMoRan Miami			AZ	Gila	200112	110008254423
Veris Gold Saval 4- Jerritt Canyon	South Fork	South Fork Off-Reservation Trust Land	NV	Elko	2602742	110043970398
Newmont Emigrant/Mill 6			NV	Elko	2602697	
Veris Gold Saval 4- Jerritt Canyon		South Fork Reservation	NV	Elko	2602742	110043970398
Newmont Emigrant/Mill 6			NV	Elko	2602697	
Alcoa Massena West	St. Regis Mohawk	St. Regis Mohawk Reservation	NY	Massena		110000582735
Asarco Mission	Tohono O'odham Nation	Tohono O'odham Nation Reservation	AZ	Pima	200135	110011660023
Asarco Silver Bell			AZ	Pima	200134	110010063563
Cyprus Tohono			AZ	Pinal	202579	110008254584
Freeport McMoRan Sierrita			AZ	Pima	200144	110000471837
Energy Fuels White Mesa Mill	Ute Mountain	Ute Mountain Off-Reservation Trust Land	UT	San Juan	4201429	110000879425
Energy Fuels White Mesa Mill		Ute Mountain Reservation	UT	San Juan	4201429	110000879425
Denton-Rawhide Mine	Walker River	Walker River Reservation	NV	Mineral	2601030	110000600993
Geo Nevada Spring Valley	Washoe Ranches	Washoe Ranches Trust Land	NV	Lyon	2602470	110027825030
Century Mount Holly	Wassamasaw	Wassamasaw SDTSA	SC	Goose Creek		110002329454
Nevada Copper Pumpkin Hollow	Yerington	Yerington Colony	NV	Lyon	2602711	

Exhibit 8-12.
Tribal Lands Intersecting with Ten-Mile Buffer

Facility Name	Tribal Land Name	Tribe Name	State	County	MSHA ID	FRS ID

Sources:

1. U.S. Census Bureau. (2014). "TIGER/Line Shapefile, 2014, Series Information File for the Current American Indian/Alaska Native/Native Hawaiian Areas National (AIANNH) National Shapefile." Accessed at: https://catalog.data.gov/dataset/tiger-line-shapefile-2014-series-information-file-for-the-current-american-indian-ala
2. 2. Department of the Interior, Bureau of Indian Affairs. (2015). "Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs." Accessed at: http://www.loc.gov/catdir/cpso/biaind.pdf

Appendices

Appendix A. "Maximum Extent" Potentially Regulated Universe"

Facility #	Assigned Facility Name	ST	County	MSHA ID	FRS ID	Type of Facility	Commodity	Commodity Group	Operating Status	Excluded Facilities?
1	Agrium/NuWest Rasmussen Ridge	ID	Caribou	1002177	110000468351	Surface Mine	Phosphate Rock	Phosphates	Active	
2	Airport Equipment Fish Creek	AK	Fairbanks North Star	5001556		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
3	AK Steel Ashland	KY	Ashland			Primary Smelter	Iron Ore	Ferrous Metals	Active	
4	AK Steel Middletown	OH	Middletown			Primary Smelter	Iron Ore	Ferrous Metals	Active	
5	Alaska Gold Nanuuq	AK	Nome	5001850	110024260440	Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
6	Alcoa Intalco	WA	Ferndale		110040947820	Primary Smelter	Aluminum	Aluminum	Active	
7	Alcoa Massena West	NY	Massena		110000582735	Primary Smelter	Aluminum	Aluminum	Active	
8	Alcoa Point Comfort	TX	Point Comfort	4100320	110000606997	Processor/Refiner	Alumina	Aluminum	Active	
9	Alcoa Warrick	IN	Newburgh		110000602045	Primary Smelter	Aluminum	Aluminum	Active	
10	Alcoa Wenatchee	WA	Malaga		110000491156	Primary Smelter	Aluminum	Aluminum	Active	
11	Almatis Premium Alumina	LA	Burnside		110013406732	Processor/Refiner	Alumina	Aluminum	Active	
12	Ancient Alien Mining DeFord1	OR	Baker	3503792		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
13	Anderson & Sons Mining	AK	Nome	5001759		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
14	Anglogold Cresson	CO	Teller	0503695	110022508534	Surface Mine	Gold	Non-Ferrous Metals	Active	
15	Anvil Creek	AK	Yukon-Koyukuk	5001974		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
16	Apache Mining Old Wasp Mine	AZ	Pinal	0203246		Surface Mine	Gold	Non-Ferrous Metals	Active	
17	ArcelorMittal Burns Harbor	IN	East Chicago			Primary Smelter	Iron Ore	Ferrous Metals	Active	
18	ArcelorMittal Cleveland	OH	Cleveland			Primary Smelter	Iron Ore	Ferrous Metals	Active	
19	ArcelorMittal Indiana Harbor	IN	East Chicago			Primary Smelter	Iron Ore	Ferrous Metals	Active	
20	ArcelorMittal Minorca	MN	St Louis	2102449	110008799390	Surface Mine	Iron Ore	Ferrous Metals	Active	
21	ArcelorMittal Riverdale	IL	Riverdale			Primary Smelter	Iron Ore	Ferrous Metals	Active	
22	Asarco Amarillo	TX				Processor/Refiner	Copper	Non-Ferrous Metals	Active	
23	Asarco Mission	AZ	Pima	0200135	110011660023	Surface Mine	Copper	Non-Ferrous Metals	Active	

Facility #	Assigned Facility Name	ST	County	MSHA ID	FRS ID	Type of Facility	Commodity	Commodity Group	Operating Status	Excluded Facilities?
24	Asarco Ray	AZ	Gila	0200150	110013883805	Surface Mine	Copper	Non-Ferrous Metals	Active	
25	Asarco Ray Hayden	AZ	Gila		110000471338	Primary Smelter	Copper	Non-Ferrous Metals	Active	
26	Asarco Silver Bell	AZ	Pima	0200134	110010063563	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
27	Ashdown	NV	Humboldt	2600578	110020577632	Underground Mine	Molybdenum	Non-Ferrous Metals	Active	
28	ATI Wah Chang	OR	Linn		110000488035	Processor/Refiner	Zirconium and hafnium	Rare Earth Minerals	Active	
29	Atna Resources Pinson Mine	NV	Humboldt	2601597		Underground Mine	Gold	Non-Ferrous Metals	Active	
30	AU Mines Manhattan Gulch	NV	Nye	2602658		Surface Mine	Gold	Non-Ferrous Metals	Active	
31	Bailey Mining	AK	Yukon-Koyukuk	5001389		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
32	Baker Hughes Argenta	NV	Lander	2601152		Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded
33	Baker Hughes Slaven	NV	Lander	2602730		Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded
34	Barrick Bald Mountain	NV	White Pine	2601842	110000608441	Surface Mine	Gold	Non-Ferrous Metals	Active	
35	Barrick Cortez	NV	Lander	2600827; 2602573	110041618666	Surface-Underground Mine	Gold	Non-Ferrous Metals	Active	
36	Barrick Golden Sunlight Mine	MT	Jefferson	2401417	110000428564	Surface Mine	Gold	Non-Ferrous Metals	Active	
37	Barrick Goldstrike Mine/Mill/Roaster	NV	Eureka	2601089; 2602674; 2602673	110043802178	Surface Mine/Processing	Gold	Non-Ferrous Metals	Active	
38	Barrick Meikle	NV	Eureka	2602246		Underground Mine	Gold	Non-Ferrous Metals	Active	
39	Barrick Storm Exploration	NV	Eureka	2602300	110027839828	Underground Mine	Gold	Non-Ferrous Metals	Active	
40	Barrick Turquois Ridge	NV	Humboldt	2602286	110002048025	Underground Mine	Gold	Non-Ferrous Metals	Active	
41	Bear Creek Placer	MT	Granite	2402573		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
42	Bessemer Peterson	MI	Gogebic	2003372		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
43	BHP Copper Cities	AZ	Gila		110015967621	Surface Mine	Copper	Non-Ferrous Metals	Active	
44	Black Butte	MT	Meagher	2402423	110001473815	Surface Mine	Iron Ore	Ferrous Metals	Temporarily idled	Excluded
45	Blue Ribbon Gold Cahoon#1	AK	Haines	5002004		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded

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46	Borealis Mine	NV	Mineral	2601655		Surface Mine	Gold	Non-Ferrous Metals	Active	
47	Bromide Mining Project	UT	Garfield	4202579		Underground Mine	Copper	Non-Ferrous Metals	Active	Excluded
48	Buckeye Olive Creek	AK	Fairbanks North Star	5000304		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
49	Cal Sierra Dredge 17	CA	Yuba	0402386	110014377021	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
50	CalPortland Baxter Mine	CA	San Bernardino	0403569		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
51	Cameco Crow Butte	NE	Dawes		110002358788	In-situ Leaching	Uranium	Radioactive Metals	Active	
52	Canon Resources Gold King Creek	AK	Fairbanks North Star	5001921		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
53	Capstone Pinto Valley	AZ	Gila	0201049	110038167710	Surface Mine	Copper	Non-Ferrous Metals	Active	
54	Carlota Copper	AZ	Gila	0202653	110039495588	Surface Mine	Copper	Non-Ferrous Metals	Active	
55	CCR Mine	AK	Fairbanks North Star	5001983		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
56	Century	UT	Box Elder	4202596		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
57	Century Hawesville	KY	North Hawesville		110000380917	Primary Smelter	Aluminum	Aluminum	Active	
58	Century Mount Holly	SC	Goose Creek		110002329454	Primary Smelter	Aluminum	Aluminum	Active	
59	Century Seebree	KY	Robards		110038162118	Primary Smelter	Aluminum	Aluminum	Active	
60	CFI Pit	SD	Lawrence	3900925	110004948647	Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
61	Childs and Nicholls CN Portable1	MT	Gallatin	2402666		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
62	Cliffs Natural Resources-Empire	MI	Marquette	2001012	110038173437	Surface Mine	Iron Ore	Ferrous Metals	Active	
63	Cliffs Natural Resources-Tilden	MI	Marquette	2000422	110041006416	Surface Mine	Iron Ore	Ferrous Metals	Active	
64	CML Iron Mountain	UT	Washington	4201927; 4202624	110043433111	Surface Mine	Iron Ore	Ferrous Metals	Active	
65	Coeur Kensington	AK	Juneau	5001544	110041400427	Underground Mine	Gold	Non-Ferrous Metals	Active	
66	Coeur Rochester	NV	Pershing	2601941	110000472890	Surface Mine	Silver Ore	Non-Ferrous Metals	Active	
67	Columbus Project	NV	Esmeralda	2601674	110027832638	Surface Mine	Rare Earths	Rare Earth Minerals	Active	Excluded
68	Comstock Mining	NV	Storey	2601871		Surface Mine	Gold	Non-Ferrous Metals	Active	
69	Contact Concentrator	MT	Granite	2401648		Processor/Refiner	Gold	Non-Ferrous Metals	Intermittent operation	

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70	Coyote Blossom Mine	NV	Clark	2602745		Underground Mine	Gold	Non-Ferrous Metals	Active	
71	CR Briggs	CA	Inyo	0405276	110000602232	Surface Mine	Gold	Non-Ferrous Metals	Active	
72	CS Mining OK and Hidden Treasure	UT	Beaver	4202431	110043669544	Surface Mine	Copper	Non-Ferrous Metals	Active	
73	Curtis Tungsten	CA		0405092		Surface Mine	Tungsten	Non-Ferrous Metals	Intermittent operation	
74	Cyprus Tohono	AZ	Pinal	0202579	110008254584	Surface Mine	Copper	Non-Ferrous Metals	Active	
75	D&S Mining Ohio Mine	MT	Broadwater	2401779		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
76	Daniel Even	AK	Yukon-Koyukuk	5002001		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
77	Davis Creek	AK	Yukon-Koyukuk	5001956		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
78	DDCMine	AK	Fairbanks North Star	5002015		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
79	Degerstrom Rossi	NV	Eureka	2602735		Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded
80	Degerstrom Screen Plant	NV	Humboldt	2602739		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
81	Degerstrom Slaven	NV	Lander	2602749	110041418427	Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded
82	Denton-Rawhide Mine	NV	Mineral	2601030	110000600993	Surface Mine	Gold	Non-Ferrous Metals	Active	
83	Desrt Hawk Kiewit Mine	UT	Tooele	4202560		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
84	Dig M Storey Claim	NV	White Pine	2602601		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
85	Dobson Wild Goose	AK	Fairbanks North Star	5001957		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
86	Doe Run Brushy Creek	MO	Reynolds	2300499	110018008920	Underground Mine	Lead-Zinc Ore	Non-Ferrous Metals	Active	
87	Doe Run Buick	MO	Iron	2300457	110044834061	Underground Mine	Lead-Zinc Ore	Non-Ferrous Metals	Active	
88	Doe Run Fletcher	MO	Reynolds	2300409	110000596016	Underground Mine	Lead-Zinc Ore	Non-Ferrous Metals	Active	
89	Doe Run Sweetwater	MO	Reynolds	2300458	110042676299	Underground Mine	Lead-Zinc Ore	Non-Ferrous Metals	Active	
90	Doe Run Viburnum	MO	Washington	2300495	110041118493	Underground Mine	Lead-Zinc Ore	Non-Ferrous Metals	Active	
91	Doe Run Viburnum Casteel	MO	Iron	2301800	110007374527	Underground Mine	Lead-Zinc Ore	Non-Ferrous Metals	Active	
92	Drake	AZ		0203299		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded

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93	Dun Glen Placer Mine	NV	Pershing	2602750		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
94	DuPont Florida	FL	Clay	0800225	110007242947	Surface Mine	Titanium	Non-Ferrous Metals	Active	
95	Eagle Humboldt	MI	Marquette	2000420	110040612717	Surface Mine	Iron Ore	Ferrous Metals	Active	Excluded
96	Earth Movers Cleary Creek	AK	Fairbanks North Star	5001650		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
97	Ellet Channel Quest	AK	Denali	5001875	110037094738	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
98	Emmetts Mockingbird Mine	CA	Mariposa	0405781		Underground Mine	Gold	Non-Ferrous Metals	Active	
99	Energy Fuels Canyon Mine	AZ	Coconino	0203305		Underground Mine	Uranium	Radioactive Metals	Temporarily idled	
100	Energy Fuels Pinenut Mine	AZ	Mohave	0202286	110015941294	Underground Mine	Uranium	Radioactive Metals	Active	
101	Energy Fuels White Mesa Mill	UT	San Juan	4201429	110000879425	Processor/Refiner	Uranium	Radioactive Metals	Active	
102	Essar Steel	MN	Itasca	2103751		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	
103	Eureka Moly Mount Hope	NV	Eureka	2602729		Surface Mine	Molybdenum	Non-Ferrous Metals	Active	
104	Fairbanks Creek Mine	AK	Fairbanks North Star	5001562		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
105	First Liberty Fencemaker	NV	Pershing	2601650	110043236744	Underground Mine	Antimony	Non-Ferrous Metals	Active	Excluded
106	First Liberty Lovelock	NV				Processor/Refiner	Antimony	Non-Ferrous Metals	Active	
107	Florida Canyon Mine	NV	Pershing	2601947	110007978581	Surface Mine	Gold	Non-Ferrous Metals	Active	
108	FMC Bessemer Lithium	NC	Gaston		110002444249	Processor/Refiner	Lithium	Non-Ferrous Metals	Active	
109	Fox Iron Creek Placer	SD	Lawrence	3901592		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
110	Freeport McMoRan Bagdad	AZ	Yavapai	0200137	110010378661	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
111	Freeport McMoRan Chino	NM	Grant	2900708		Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
112	Freeport McMoRan Climax	CO	Lake	0502256	110022511174	Underground Mine/Processing	Molybdenum	Non-Ferrous Metals	Active	
113	Freeport McMoRan Cobre Continental	NM	Grant	2900725; 2900731	110001549922	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
114	Freeport McMoRan Henderson	CO	Clear Creek	0500790	11000599759; 110000600190	Underground Mine/Processing	Molybdenum	Non-Ferrous Metals	Active	

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115	Freeport McMoRan Miami	AZ	Gila	0200112	110008254423	Surface Mine/Processing/ Primary Smelter	Copper	Non-Ferrous Metals	Active	
116	Freeport McMoRan Morenci	AZ	Greenlee	0200024	110000600724	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
117	Freeport McMoRan Safford	AZ	Graham	0203131	110037149519	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
118	Freeport McMoRan Sierrita	AZ	Pima	0200144	110000471837	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
119	Freeport McMoRan Tyrone	NM	Grant	2900159	110042056333	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
120	French Gulch Washington Mine	CA	Shasta	0403425		Underground Mine	Gold	Non-Ferrous Metals	Active	
121	Geo Nevada Spring Valley	NV	Lyon	2602470	110027825030	Surface Mine	Gold	Non-Ferrous Metals	Active	
122	Glacier Mining	AK	Yukon-Koyukuk	5001386		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
123	Glitter Enterprises Gold Bug	SD	Custer	3901595		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
124	Gold Acquisition Relief Canyon	NV	Pershing	2602657		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
125	Gold Rule Placer Mine	MT	Powell	2402582		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
126	Gold Run Creek	AK	Northwest Arctic	5001440		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
127	Golden Bear	OR	Josephine	3503780		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
128	Golden Queen Soledad Mountain	CA	Kern	0405319		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
129	Goldrich GNP	AK	Yukon-Koyukuk	5001402		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
130	GoldWedge	NV	Nye	2602542		Underground Mine	Gold	Non-Ferrous Metals	Active	
131	Great Salt Lake Minerals Ogden	UT			110000469920	Brine Extraction/ Processing	Potash	Industrial Rock	Active	
132	Greyhound Golden Eagle	ID	Ada	1002155	110046356144	Underground Mine	Gold	Non-Ferrous Metals	Active	
133	Gunsinger Golden Jubilee Mine	MT	Granite	2402187		Underground Mine	Gold	Non-Ferrous Metals	Active	
134	Hahm International Silverlake	CA	San Bernardino	0405281		Surface Mine	Iron Ore	Ferrous Metals	Active	Excluded
135	Haile Gold Mine	SC	Lancaster	3800600		Surface Mine	Gold	Non-Ferrous Metals	Active	
136	Halliburton Rossi	NV	Elko	2602239	110040938821	Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded

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137	Hareventure Golddust	AK	Fairbanks North Star	5001969		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
138	Hastie Mining Klondike II	KY	Livingston	1519209		Surface Mine	Fluorspar	Industrial Rock	Active	Excluded
139	Hecla Greens Creek	AK	Juneau	5001267	110032882735	Underground Mine	Silver Ore	Non-Ferrous Metals	Active	
140	Hecla Lucky Friday	ID	Shoshone	1000088	110041927378	Underground Mine	Silver Ore	Non-Ferrous Metals	Active	
141	Hector Placer Mine	CO	Park	0504989		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
142	Hibbing Taconite	MN	St Louis	2101600	110008799185	Surface Mine	Iron Ore	Ferrous Metals	Active	
143	Hoffman Middle Fork	AK	Southeast Fairbanks	5001549		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
144	Homestake Ruby Hill	NV	Eureka	2602307	110015844176	Surface Mine	Gold	Non-Ferrous Metals	Active	
145	Hurt MK Falls	AK	Haines	5002005		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
146	Hycroft Resources	NV	Humboldt	2601962	110007980453	Surface Mine	Gold	Non-Ferrous Metals	Active	
147	Idaho State Gold Hill	ID	Boise	1002209		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
148	Iluka Resources Brink-Concord-Stony Creek	VA	Greensville/ Sussex	4407250; 4407222; 4407221	110041948015; 110029527493; 110001908534	Surface Mine/Processing	Titanium	Non-Ferrous Metals	Active	
149	Indium Germanium	NY	Oneida		110009488125	Processor/Refiner	Germanium	Non-Ferrous Metals	Active	
150	Indium New York	NY	Oneida		110004393754	Processor/Refiner	Indium	Non-Ferrous Metals	Active	
151	Industrial Minerals Plant 2	SC	Cherokee	3800388		Processor/Refiner	Boron	Industrial Rock	Active	
152	Intrepid Moab	UT			110020098758	Brine Extraction/ Processing	Potash	Industrial Rock	Active	
153	Intrepid PotashEast/West	NM	Eddy	2900170	110022747553	Underground Mine	Potash	Industrial Rock	Active	
154	Intrepid PotashNorth	NM	Lea	2902028	110007975076	Processor/Refiner	Potash	Industrial Rock	Active	
155	Intrepid Wendover	UT			110055002848	Brine Extraction/ Processing	Potash	Industrial Rock	Active	
156	Jones Mining	AK	Yukon-Koyukuk	5001952		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
157	Jubilee Mine	AK	Yukon-Koyukuk	5001961		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
158	Jubilee Venture Eagle Mine Project	CO	Moffat	0504985		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded

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159	Kenwin #7 Below Discovery	AK	Matanuska-Susitna	5001677		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
160	Kinross Crown Resources Buckhorn Mine	WA	Okanogan	4503615		Underground Mine/Processing	Gold	Non-Ferrous Metals	Active	
161	Kinross Fairbanks Gold Fort Knox	AK	Fairbanks North Star	5001616	110007347120	Surface Mine	Gold	Non-Ferrous Metals	Active	
162	Kinross Kettle River Mill	WA	Ferry	4503283		Processor/Refiner	Gold	Non-Ferrous Metals	Active	
163	Kirtley Creek Mine	ID	Lemhi	1001895		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
164	Klondex Gold Fire Creek	NV	Lander	2602691		Underground Mine	Gold	Non-Ferrous Metals	Active	
165	Klondex Midas	NV	Elko	2602314		Underground Mine	Gold	Non-Ferrous Metals	Active	
166	KMI Zeolite Shenandoah	NV	Clark	2602408		Processor/Refiner	Brucite	Non-Ferrous Metals	Active	
167	Landview Mastadon Creek	AK	Fairbanks North Star	5001976		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
168	Last Chance Ranch	OR	Baker	3503819		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
169	Liberty	CO	Ouray	0504893		Underground Mine	Gold	Non-Ferrous Metals	Temporarily idled	
170	Lindberg SP13	MI	Marquette	2003314	110021101350	Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
171	Lindberg SP14	MI	Marquette	2003336		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
172	Lindberg SP16	MI	Marquette	2003408	110021101350	Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
173	Lisbon Valley	UT	San Juan	4202406	110025331843	Surface Mine	Copper	Non-Ferrous Metals	Active	
174	LNT Goldndreams	AK	Yukon-Koyukuk	5001970		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
175	Lost Channel Mine	AK	Haines	5001973		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
176	Lost Creek	WY	Sweetwater			In-situ Leaching	Uranium	Radioactive Metals	Active	
177	LuDan Sulivan Pit	OR	Baker	3503673		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
178	Lundin Eagle Mine-Humboldt Mill	MI	Marquette	2003454	110040612717	Underground Mine/Processing	Nickel	Non-Ferrous Metals	Active	
179	M&W Prospect Mine	MT	Madison	2401991	110017852536	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
180	Maccor Last Mine	AK	Fairbanks North Star	5001763	110013347903	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
181	Magnetation Mesabi Chief	MN		2103655		Processor/Refiner	Iron Ore	Ferrous Metals	Active	

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182	Magnetation Plant 1	MN				Processor/Refiner	Iron Ore	Ferrous Metals	Temporarily idled	
183	Magnetation Plant 2	MN				Processor/Refiner	Iron Ore	Ferrous Metals	Active	
184	Manko 5	FL	Citrus	0800222		Surface Mine	Phosphate Rock	Phosphates	Active	
185	Marigold Mine	NV	Humboldt	2602081	110016767122	Surface Mine	Gold	Non-Ferrous Metals	Active	
186	Martinique Crescent Creek	UT	Garfield	4202188		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
187	Marvel Creek	AK	Bethel	5000298		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
188	Materion Delta	UT	Millard		110008175232	Processor/Refiner	Beryllium	Rare Earth Minerals	Active	
189	Materion Elmore	OH	Ottawa		110000383184	Processor/Refiner	Beryllium	Rare Earth Minerals	Active	
190	Materion Natural Resources Utah	UT	Juab	4200706	110041366009	Surface Mine	Beryllium	Rare Earth Minerals	Active	
191	McDonald Mammoth Mine	MT	Madison	2401524		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
192	Mesabi Nugget	MN	St. Louis	2103689	110037418979	Processor/Refiner	Iron Ore	Ferrous Metals	Active	
193	Mestena Alta Mesa	TX	Brooks			In-situ Leaching	Uranium	Radioactive Metals	Active	
194	M-I Greystone	NV	Lander	2600411	110027807489	Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded
195	MicroLite	KS	Wilson	1400868	110011223540	Surface Mine	Potash	Industrial Rock	Active	Excluded
196	Midway Gold Pan	NV	White Pine	2602755		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
197	Miller Ketchem Creek	AK	Yukon-Koyukuk	5001592	110037263181	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
198	Miller Sandborn Gravel Pit	CO	Park	0504998		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
199	Mineral Park	AZ	Mohave	0200843	110000600804	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
200	Mineral Ridge Gold	NV	Esmeralda	2602302		Surface Mine	Gold	Non-Ferrous Metals	Active	
201	Minerals Development MDG Portable 1	MT	Gallatin	2402674		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
202	Mining Resources LLC	MN				Processor/Refiner	Iron Ore	Ferrous Metals	Active	
203	Minntac Screening	MN		2103770		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	
204	Mississippi Phosphates	MS			110000546053	Processor/Refiner	Phosphate Rock	Phosphates	Active	

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205	Mojave Gold Road Mine	AZ	Mohave	0202620		Underground Mine	Gold	Non-Ferrous Metals	Active	
206	Molycorp Mountain Pass	CA	San Bernardino	0402542		Surface Mine/Processing	Rare Earths	Rare Earth Minerals	Active	
207	Monsanto/P4 South Rasmussen-Blackfoot Bridge	ID	Caribou	1001854	110000743982	Surface Mine/Processing	Phosphate Rock	Phosphates	Active	
208	Montana Resources Continental	MT	Silver Bow	2400338	110000428555	Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
209	Mosaic Four Corners	FL	Polk	0801117	110027948292	Surface Mine	Phosphate Rock	Phosphates	Active	
210	Mosaic PotashCarlsbad	NM	Eddy	2900802	110022763393	Underground Mine	Potash	Industrial Rock	Active	
211	Mosaic South Fort Meade	FL	Polk	0801183	110041971925	Surface Mine	Phosphate Rock	Phosphates	Active	
212	Mosaic South Pasture Hardee	FL	Hardee	0800903	110005990963	Surface Mine	Phosphate Rock	Phosphates	Active	
213	Mosaic Uncle Sam	LA			110006020215	Processor/Refiner	Phosphate Rock	Phosphates	Active	
214	Mosaic Wingate	FL	Manatee	0800981	110040491973	Surface Mine	Phosphate Rock	Phosphates	Active	
215	Nevada Barth	NV	Eureka	2600078	110041292357	Surface Mine	Iron Ore	Ferrous Metals	Active	Excluded
216	Nevada Copper Pumpkin Hollow	NV	Lyon	2602711		Underground Mine	Copper	Non-Ferrous Metals	Active	
217	Nevada Rae Black Rock Canyon	NV	Lander	2602572		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
218	New Jersey Mill	ID	Shoshone	1001913		Processor/Refiner	Gold	Non-Ferrous Metals	Intermittent operation	
219	New Riverside Ochre	GA	Bartow	0900245	110001328019	Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded
220	Newmont Chukar	NV	Eureka	2602481		Underground Mine	Gold	Non-Ferrous Metals	Active	
221	Newmont Emigrant/Mill 6	NV	Elko	2602697; 2602678		Surface Mine/Processing	Gold	Non-Ferrous Metals	Active	
222	Newmont Exodus	NV	Eureka	2602661		Underground Mine	Gold	Non-Ferrous Metals	Active	
223	Newmont Genesis	NV	Eureka	2600062	110027793617	Surface Mine	Gold	Non-Ferrous Metals	Active	
224	Newmont Leeville	NV	Eureka	2602512		Underground Mine	Gold	Non-Ferrous Metals	Active	
225	Newmont Lone Tree	NV	Humboldt	2602159	110007980435	Surface Mine	Gold	Non-Ferrous Metals	Active	
226	Newmont Pete Bajo	NV	Eureka	2602689	110000608334	Underground Mine	Gold	Non-Ferrous Metals	Active	
227	Newmont Phoenix	NV	Lander			Surface Mine	Gold	Non-Ferrous Metals	Active	

Facility #	Assigned Facility Name	ST	County	MSHA ID	FRS ID	Type of Facility	Commodity	Commodity Group	Operating Status	Excluded Facilities?
228	Newmont Phoenix	NV	Lander			Surface Mine/Processing	Copper	Non-Ferrous Metals	Active	
229	Newmont South Area	NV	Eureka	2600500		Surface Mine	Gold	Non-Ferrous Metals	Active	
230	Newmont Twin Creeks	NV	Humboldt	2601942	110000601028	Surface Mine	Gold	Non-Ferrous Metals	Active	
231	NH Gold Dewey Mine	MT	Granite	2402668		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
232	NM Operations Mammoth Valley	AK	Nome	5002020		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
233	Nome Gold Maine Monroeville	AK	Nome	5001031		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
234	Noranda Gramercy	LA	Gramercy	1600352	110041016646	Processor/Refiner	Alumina	Aluminum	Active	
235	Noranda New Madrid	MO	New Madrid		110017980639	Primary Smelter	Aluminum	Aluminum	Active	
236	Nord Johnson Camp	AZ	Cochise	0202824	110000917483	Surface Mine	Copper	Non-Ferrous Metals	Active	
237	Northshore Mining Babbitt-Silver Bay	MN	St Louis	2100209; 2100831	110008800048; 110000910453	Surface Mine/Processing	Iron Ore	Ferrous Metals	Active	
238	Northwest Gold Cripple Creek	AK	Fairbanks North Star	5001452		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
239	NOV Big Ledge-Dry Creek Mill	NV	Elko	2602603	110027820776	Surface Mine/Processing	Barite Barium Ore	Industrial Rock	Intermittent operation	Excluded
240	Nutritional Additives Sexton	NV	Pershing	2600734	110021331432	Surface Mine	Barite Barium Ore	Industrial Rock	Active	Excluded
241	NYAC Mining	AK	Bethel	5001035	110009037425	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
242	Nyrstar Clarksville	TN	Montgomery		110024424078	Primary Smelter	Zinc	Non-Ferrous Metals	Active	
243	Nyrstar East Tennessee Complex- Coy	TN	Jefferson	4000166	110027729484	Underground Mine	Zinc	Non-Ferrous Metals	Active	
244	Nyrstar East Tennessee Complex-Immel	TN	Jefferson	4000168		Underground Mine	Zinc	Non-Ferrous Metals	Active	
245	Nyrstar East Tennessee Complex-Young	TN	Knox	4000170	110027672953	Underground Mine	Zinc	Non-Ferrous Metals	Active	
246	Nyrstar Middle Tennessee Complex- Cumberland	TN	Smith	4002213	110000375415	Underground Mine	Zinc	Non-Ferrous Metals	Active	
247	Nyrstar Middle Tennessee Complex-Elmwood/Gordonsville	TN	Smith	4000864	110000375415	Underground Mine	Zinc	Non-Ferrous Metals	Active	
248	Nyrstar Middle Tennessee Complex- Gordonsville	TN				Underground Mine	Zinc	Non-Ferrous Metals	Active	
249	Old Camp Mine	AK	Yukon-Koyukuk	5001903		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
250	Olsen	ID	Boise	1002236		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded

Facility #	Assigned Facility Name	ST	County	MSHA ID	FRS ID	Type of Facility	Commodity	Commodity Group	Operating Status	Excluded Facilities?
251	Oregon Belle Mine	OR	Jackson	3503513		Underground Mine	Gold	Non-Ferrous Metals	Temporarily idled	
252	Paradise Valley Triple Creek	AK	Nome	5001953		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
253	PCS Lee Creek Aurora	NC	Beaufort	3100212	110000586376	Surface Mine/Processing	Phosphate Rock	Phosphates	Active	
254	PCS Swift Creek/WhiteSprings	FL	Hamilton	0800798	110028016368	Surface Mine	Phosphate Rock	Phosphates	Active	
255	Pea Ridge	MO	Washington	2302356	110042518068	Surface Mine	Iron Ore	Ferrous Metals	Active	Excluded
256	Penn Mag Plant1	PA	Armstrong	3607767	110001085851	Surface Mine/Processing	Iron Ore	Ferrous Metals	Active	
257	PennMag Plant2	PA	Blair	3607535	110001085851	Surface Mine	Chromite Chromium Ore	Non-Ferrous Metals	Active	Excluded
258	Pickett Mining Group	NC	Stanly	3102224		Processor/Refiner	Gold	Non-Ferrous Metals	Intermittent operation	
259	Plumbago Mine	CA	Sierra	0403065		Underground Mine	Gold	Non-Ferrous Metals	Active	
260	Polar Mining Fox Mine	AK	Fairbanks North Star	5001557	110008998371	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
261	PolyMet Hoyt Lakes	MN	St Louis	2103658	110008800262	Surface Mine	Copper	Non-Ferrous Metals	Active	
262	Premier Chemicals Gabbs	NV	Nye			Surface Mine	Brucite	Industrial Rock	Active	
263	Quality Magnetite	IN	Posey	1202459		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
264	Queen Resources Malheur Queen	OR	Baker	3503799		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
265	R&B Gravel	AK	Fairbanks North Star	5001854		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
266	Reiss Viking	WV	Putnam	4608672	110009117641	Surface Mine	Iron Ore	Ferrous Metals	Active	Excluded
267	Resco Hillsborough	NC	Orange	3100233	110018633816	Surface Mine	Bauxite	Aluminum	Active	
268	Resolution Copper	AZ	Pinal	0200152	110013282401	Underground Mine	Copper	Non-Ferrous Metals	Active	
269	Rio Tinto Borax	CA	Kern	0400743	110017972826	Surface Mine	Boron	Industrial Rock	Active	
270	Rio Tinto Kennecott Bingham Canyon-Copperton-Magna	UT	Salt Lake	4200149; 4201996	110042022085; 110002380405; 110009506347	Surface Mine/Processing/ Primary Smelter	Copper	Non-Ferrous Metals	Active	
271	RM Ester Sand & Gravel	AK	Fairbanks North Star	5001670	110037094578	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
272	Robert Cook	AK	Southeast Fairbanks	5001550		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded

Facility #	Assigned Facility Name	ST	County	MSHA ID	FRS ID	Type of Facility	Commodity	Commodity Group	Operating Status	Excluded Facilities?
273	Robinson Nevada	NV	White Pine	2601916	110042080832	Surface Mine	Copper	Non-Ferrous Metals	Active	
274	Rockwood Lithium	NV				Brine Extraction/ Processing	Lithium	Non-Ferrous Metals	Active	
275	Rosemont Copper	AZ	Pima	0203256	110039337376	Surface Mine	Copper	Non-Ferrous Metals	Active	
276	Round Mountain Smoky Valley	NV	Nye	2600594	110041296772	Surface Mine	Gold	Non-Ferrous Metals	Active	
277	RTD Mining Magnet & Gold Creek	AK	Fairbanks North Star	5001754	110008998335	Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
278	Ruby Mining Nome Anvil Creek Mine	AK	Nome	5001846	110037228069	Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
279	Rye Creek	MT	Mineral	2402602		Processor/Refiner	Rare Earths	Rare Earth Minerals	Intermittent operation	
280	Saint Gobain Bauxite Mine/Calciner	AR	Saline	0300261	110001710890	Surface Mine/Processing	Bauxite	Aluminum	Active	
281	Saint Lawrence Balmat	NY	St Lawrence	3001185	110001175139	Underground Mine	Lead-Zinc Ore	Non-Ferrous Metals	Active	
282	Scabtron	AK	Fairbanks North Star	5001614		Underground Mine	Gold	Non-Ferrous Metals	Active	
283	Searles Valley Minerals Trona	CA	San Bernadino			Brine Extraction/ Processing	Boron	Industrial Rock	Active	
284	Searles Valley Minerals Westend	CA	San Bernadino			Processor/Refiner	Boron	Industrial Rock	Active	
285	SEMCOA Section 27 Mine	AR	Saline	0301979		Surface Mine	Bauxite	Aluminum	Intermittent operation	
286	Severstal Dearborn	MI	Dearborn			Primary Smelter	Iron Ore	Ferrous Metals	Active	
287	Sherlund Ketchum Creek	AK	Fairbanks North Star	5001865	110022285007	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
288	Sherwin Alumina	TX	Corpus Christi	4100906	110014436707	Processor/Refiner	Alumina	Aluminum	Active	
289	Silver Falcon Diamond Creek	ID	Owyhee	1002202		Surface Mine	Silver Ore	Non-Ferrous Metals	Intermittent operation	Excluded
290	Simplot Smoky Canyon/Don	ID	Caribou; Power	1001590	110005783731; 110000600421	Surface Mine/Processing	Phosphate Rock	Phosphates	Active	
291	Simplot Vernal/Rock Springs	UT/ WY	Uintah; Sweetwater	4200998	110000912335; 110000600369	Surface Mine/Processing	Phosphate Rock	Phosphates	Active	
292	Sixteen To One Mine	CA	Sierra	0401299	110010058427	Underground Mine	Gold	Non-Ferrous Metals	Active	
293	Skidmore Vault Mine	AK	Fairbanks North Star	5001679		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
294	Slisco Nolan Valley	AK	Yukon-Koyukuk	5001959		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
295	Small Mine Development Lee Smith	NV	Elko	2602397		Underground Mine	Gold	Non-Ferrous Metals	Active	Excluded

Facility #	Assigned Facility Name	ST	County	MSHA ID	FRS ID	Type of Facility	Commodity	Commodity Group	Operating Status	Excluded Facilities?
296	Small Mine Development SSX	NV	Elko	2602299		Underground Mine	Gold	Non-Ferrous Metals	Active	Excluded
297	Small Mine Development Starvation Canyon	NV	Elko	2602634		Underground Mine	Gold	Non-Ferrous Metals	Active	Excluded
298	Smith Ranch Highland	WY	Converse		110043529580	In-situ Leaching	Uranium	Radioactive Metals	Active	
299	Solauro Tonopah	NV	Nye	2602718		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
300	South Texas Mining Hobson	TX	Karnes			In-situ Leaching	Uranium	Radioactive Metals	Active	
301	South Texas Mining LaPalangana	TX	Duval			In-situ Leaching	Uranium	Radioactive Metals	Active	
302	Southern Ionics Mission North Mine	GA	Brantley	0901230		Surface Mine	Zirconium and hafnium	Rare Earth Minerals	Active	
303	Southern Ionics Mission South Mine	GA	Charlton			Surface Mine	Zirconium and hafnium	Rare Earth Minerals	Active	
304	Specialty Vermiculite	SC	Laurens	3800085		Surface Mine	Vermiculite	Industrial Rock	Active	Excluded
305	Star Minerals Bear Creek	MT	Granite	2402676		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
306	Sterling Mine	NV	Nye	2601503	110007981130	Underground Mine	Gold	Non-Ferrous Metals	Temporarily idled	
307	Stillwater East Boulder	MT	Sweet Grass	2401879	110007110474	Underground Mine	Platinum Group Ore	Non-Ferrous Metals	Active	
308	Stillwater Stillwater/Columbus	MT	Stillwater	2401490		Underground Mine/Processing	Platinum Group Ore	Non-Ferrous Metals	Active	
309	Stocks Trucking Amy Mine	NV	Elko	2602666		Underground Mine	Gold	Non-Ferrous Metals	Active	Excluded
310	Sumitomo Pogo	AK	Southeast Fairbanks	5001642	110009058802	Underground Mine	Gold	Non-Ferrous Metals	Active	
311	Sunrise	WY	Platte	4801764		Surface Mine	Iron Ore	Ferrous Metals	Intermittent operation	Excluded
312	Sunrise Minerals Gold Placer Mine	NV	Pershing	2602635	110041524801	Surface Mine	Gold	Non-Ferrous Metals	Active	Excluded
313	Sunshine Mine	ID	Shoshone	1000089	110017860117	Underground Mine	Silver Ore	Non-Ferrous Metals	Active	
314	Sutter Gold Lincoln Mine	CA	Amador	0405038		Underground Mine	Gold	Non-Ferrous Metals	Active	
315	Sylarus Germanium	UT				Processor/Refiner	Germanium	Non-Ferrous Metals	Active	
316	Taiga Mining Hog River	AK	Yukon-Koyukuk	5001603	110008998497	Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
317	Tara Minerals Ponderosa	ID	Idaho	1002237		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
318	Teck Alaska Red Dog	AK	Northwest Arctic	5001545	110000601705	Surface Mine/Processing	Lead-Zinc Ore	Non-Ferrous Metals	Active	

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319	Teck Washington Pend Oreille	WA	Pend Oreille	4500366	110042071441	Underground Mine	Zinc	Non-Ferrous Metals	Active	
320	Terra	AK	Matanuska-Susitna	5001991		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
321	Thomas SK Sweepstakes	AK	Nome	5001981		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
322	Thompson Creek	ID	Custer	1000531	110000600430	Surface Mine	Molybdenum	Non-Ferrous Metals	Active	
323	TNT Ventures Big Canyon Mine	NV	Lyon	2602672		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
324	Tracy Brant	AK	Yukon-Koyukuk	5002002		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
325	Tweet Kougarok Dredge Pit	AK	Nome	5000482		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
326	Umicore Germanium	OK	Ottawa		110015742801	Processor/Refiner	Germanium	Non-Ferrous Metals	Active	
327	UmicoreRhode Island	RI	Providence		110000313018	Processor/Refiner	Indium	Non-Ferrous Metals	Active	
328	United Taconite Thunderbird Mine	MN	St Louis	2103403; 2103404	110007372093	Surface Mine/Processing	Iron Ore	Ferrous Metals	Active	
329	Upstream Big Nugget Mine	AK	Haines	5000931		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
330	Uranerz Energy Nichols Ranch	WY				In-situ Leaching	Uranium	Radioactive Metals	Active	
331	Uranium One Willow Creek	WY	Johnson		110009758459; 110009753695	In-situ Leaching	Uranium	Radioactive Metals	Active	
332	US AntimonyMontana	MT	Sanders		110000497472	Primary Smelter	Antimony	Non-Ferrous Metals	Active	
333	US Magnesium	UT			110045587352	Brine Extraction/ Processing	Magnesium	Non-Ferrous Metals	Active	
334	US Silver Galena	ID	Shoshone	1000082	110000600537	Underground Mine	Silver Ore	Non-Ferrous Metals	Active	
335	US Steel Fairfield	AL	Fairfield			Primary Smelter	Iron Ore	Ferrous Metals	Active	
336	US Steel Gary	IN	Gary			Primary Smelter	Iron Ore	Ferrous Metals	Active	
337	US Steel Granite City	IL	Granite City			Primary Smelter	Iron Ore	Ferrous Metals	Active	
338	US Steel Great Lakes Ecorse	MI	Ecorse			Primary Smelter	Iron Ore	Ferrous Metals	Active	
339	US Steel Mon Valley Edgar Thompson	PA	Braddock			Primary Smelter	Iron Ore	Ferrous Metals	Active	
340	USSteel Keetac	MN	St Louis	2103352	110008797864	Surface Mine/Processing	Iron Ore	Ferrous Metals	Active	
341	USSteel Minntac	MN	St Louis	2100282; 2100820	110008476988; 110038160076	Surface Mine/Processing	Iron Ore	Ferrous Metals	Active	

Facility #	Assigned Facility Name	ST	County	MSHA ID	FRS ID	Type of Facility	Commodity	Commodity Group	Operating Status	Excluded Facilities?
342	Valdez White Creek Mine	AK	Matanuska-Susitna	5001994		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
343	Valley Excavating Nick Mine	NV	Pershing	2602687		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
344	Veris Gold Saval 4- Jerritt Canyon	NV	Elko	2602742; 2601621	110043970398	Underground Mine/Processing	Gold	Non-Ferrous Metals	Active	
345	Virginia Vermiculite	VA	Louisa	4405101		Surface Mine	Vermiculite	Industrial Rock	Active	Excluded
346	Voytilla Ester	AK	Fairbanks North Star	5001524		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
347	Waterton Global Hollister Mine	NV	Humboldt	2602535	110039495622	Underground Mine	Gold	Non-Ferrous Metals	Active	
348	Western Mesquite	CA	Imperial	0404614		Surface Mine	Gold	Non-Ferrous Metals	Active	
349	Western Mine Dev Buckland Mine	OR	Baker	3503663		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
350	Western Zirconium	UT	Weber		110000758378	Processor/Refiner	Zirconium and hafnium	Rare Earth Minerals	Active	
351	Wharf Mine	SD	Lawrence	3901282	110000594973	Surface Mine	Gold	Non-Ferrous Metals	Active	
352	White Water Mining Portable Wash	AZ	Mohave	0203330		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded
353	Willow Creek Mine	CO	Lake	0504855		Surface Mine	Gold	Non-Ferrous Metals	Intermittent operation	Excluded
354	Winston Realty	MT	Broadwater	2402651		Surface Mine	Gold	Non-Ferrous Metals	Temporarily idled	Excluded

Appendix B. Technical Background on the Development of the Maximum Financial Responsibility and Reduction Formulas

This appendix describes the development of the formulas used to calculate the financial responsibility amount and applicable reductions under the performance standard reduction regime for the modeled universe. It then presents the results of the financial responsibility and reductions formulas on a cost by cost basis for each facility in the modeled universe.

B.1. Financial Responsibility Formula

To estimate the maximum financial responsibility obligation for the sample of 49 currently operating facilities, EPA first analyzed the transactional and consequential payment experience of Superfund. EPA was ultimately unable to categorize the transactional payments expended by Superfund into consequential activities. In the absence of useable transactional data, EPA developed and applied the cost formula described in the Financial Responsibility Formula Background Document based on activities that reflected the payment experience of the fund.[124] This section provide summary of the cost formula, and the estimation maximum financial responsibility amount for 49 facilities in the modeled universe.

Summary of Cost Formula

EPA developed the nationally applicable cost formula to calculate financial responsibility (FR) for hardrock mining facilities (HRMFs). The formula accounts all CERCLA Section 107 liabilities, which include the natural resource damages (NRD), health assessment (HA) component, and response components. The formula is an Excel based spreadsheet that automatically calculates site-based FR based on facility-specific and environmental data.

The cost formula was developed using data from a sample of currently operating facilities with available data. The criteria for the sample selection were the following: (1) collect data for a set of facilities with the highest quality cost information available and (2) select a set of facilities representative of the range of states and commodities that comprise the full universe. To ensure high quality cost data, the formula uses data for facilities with reclamation and closure plans and similar documents generated in the past ten years providing engineering cost estimates for closure and post-closure tasks. To ensure geographic representativeness, the formula uses data for eight states that, together, contain over 60 percent of the universe: Nevada, Alaska, Arizona, Montana, Utah, California, Idaho, and Minnesota. Where available, the model relies upon publicly available data collected from state government websites and personnel at state agencies. To select the sample, the model uses a set of facilities that matched the distribution of facilities in the full universe in terms of geography and commodities produced for which high quality engineering cost estimates were available. For example, engineering cost data were available for more facilities in Nevada than any other state; however, to ensure the overall representativeness of the sample, the model includes more facilities located in other states and omits some facilities in Nevada so that one state was not over-represented in the sample.

[124] U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document," Office of Land and Emergency Management (September 2016).

Ultimately, EPA collected data from cost estimates generated by a sample of 63 currently operating facilities. EPA found that the sample did not provide sufficient data on water treatments costs, and supplemented the sample with water treatment cost data from an additional three historical CERCLA sites.[125]

To estimate the response component for the sample of facilities, the engineering cost formula relies on a series of regression analyses that relate specific types of response component categories (*e.g.*, capital costs to complete source control for an open pit, annual O&M costs for water treatment) to various facility-specific characteristics (*e.g.*, disturbed acres of open pit, total facility-wide acreage). The engineering estimates from the reclamation and closure plans described above are the dependent variables. The same plans include information on feature-specific and facility-specific acreages, which are among the independent (or explanatory) variables considered in the regression analysis. To further explain variation in the estimated response components of facilities in the sample, the model uses additional facility-specific independent variables. Specifically, EPA collected data, where available, from facility-specific reports typically submitted to state or federal regulatory agencies.[126] The most common data sources used were environmental impact statements. EPA also gathered information on operations, such as the presence of source controls for various facility features aligned with each cost category, and environmental data, such as the net precipitation and distance to surface water at each facility.

Exhibit B-1 reports the specific types of response component categories estimated and the explanatory variables used in the regression analyses. Note that the regression model for each category of the response component shown in the left-hand column of the exhibit is based upon a unique combination of explanatory variables from the right-hand column. In addition, in developing the regression model for each response component category listed in Exhibit B-1, explanatory variables not shown in the exhibit were also considered. Due to data limitations, regression formulas were not developed for two response component categories. Instead, the financial responsibility formula uses an average cost for each.

EPA did not know which of the explanatory variables it collected would be most significant in deriving costs for the task and feature-based response component at each facility. To develop a maximum financial responsibility formula for the sample and the regulated universe, EPA needed to further determine how exactly the explanatory variables contributed to the estimated response component in the sample of currently operating facilities. Ultimately, EPA conducted a bidirectional stepwise regression analysis of each cost category.[127] Exhibit B-2 presents the

[125] For a complete description of the selection of the cost estimate sample, see Chapter 4 of U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document" Office of Land and Emergency Management (September 2016).

[126] EPA generated the source base for the sample given the available and relevant documents for each facility from a suite of federal and state government agency produced or required facility evaluation documents. Those documents included environmental impact statements, environmental assessments, reclamation and closure plans, and national pollutant discharge elimination system permits, among others. EPA then developed a hierarchy to govern data collection protocol from those documents. For a full description of explanatory variable data collection see U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document" Office of Land and Emergency Management (September 2016).

[127] Bidirectional stepwise regression is a hybrid of two other step-wise regression approaches: forward selection and backward elimination. Forward selection starts with no independent variables then adds the variable (if any) that

formulas that resulted from the regression analysis for each cost category. Based on initial data analysis, EPA determined that the dependent and explanatory variables, with three exceptions, were not normally distributed, but rather lognormally distributed. Therefore, EPA performed a log transformation of the relevant data and estimated econometric models using a log-log regression.

Exhibit B-1.
Response Component Categories Estimated by EPA and the Associated Explanatory Variables

Categories of Response Component Estimated[1]	Explanatory Variables
• Capital costs of covering an open pit($CC2_{OP}$) • Capital costs of closing underground workings($CC3_{UG}$) • Capital costs of covering a waste rock pile($CC4_{WR}$) • Capital costs of covering a heap or dump leach($CC5_{HDL}$) • Capital costs of covering a tailings impoundment or dry stack($CC6_{Tail}$) • Capital costs of covering a process pond or reservoir($CC7_{PPR}$) • Capital costs of installing drainage ditches and other drainage features($CC8_{Drain}$) • Short-term emergency O&M and heap/dump leaches & tailings impoundment draindown($O\&M1_{Int}$) • Long-term O&M costs for water treatment($O\&M2_{WT}$) • Short-term O&M costs for short-term O&M and monitoring($O\&M3_{ST}$) • Long-term O&M costs for long-term O&M and monitoring($O\&M4_{LT}$)	• Open pit acreage • Waste rock acreage • Heap/dump leach acreage • Tailings facility acreage • Wet tailings acreage • Process pond and reservoir acreage • Total facility-wide acreage • Water flows requiring long-term treatment • Use of in-situ recovery • Whether open pit capital costs include source controls • Whether underground workings include a pressurized bulkhead • Whether waste rock pile capital costs include source controls • Whether heap or dump leach capital costs include source controls • Whether tailings impoundment or dry stack capital costs include source controls • Distance to the nearest perennial surface water • Presence or absence of pumped water obtaining treatment

Notes:
1. EPA did not estimate regression models for the following response component categories due to data limitations; instead this RIA uses an average cost for each.
- Capital costs of hazardous materials management and decontamination
- Capital costs of covering a slag pile

improves the model the most using a chosen statistical criterion. This process is repeated until the regression can no longer be improved. Backward elimination starts with a full suite of independent variables then removes the variable (if any) that is the least statistically significant using a chosen elimination criterion. This process is repeated until the regression can no longer be improved. Bidirectional elimination consists of a combination of the two approaches, testing the addition or removal of variables at each step through the forward selection or backward elimination processes above.

Exhibit B-2. Stepwise Regression Results	
Log(cost)	**Fitted Regression**
$CC2_{OP}$	$2.88 + 1.08 \times acres_{OP} + 1.36 \times SC_{OP}$
$CC4_{WR}$	$4.45 + 0.75 \times acres_{WR} + 0.73 \times SC_{WR}$
$CC5_{HDL}$	$3.87 + 1.01 \times acres_{HDL} + 0.70 \times SC_{HDL}$
$CC6_{Tail}$	$4.73 + 0.68 \times acres_{TF} + 0.59 \times SC_{TF}$
$CC7_{PPR}$	$4.29 + 1.03 \times acres_{PP}$
$CC3_{UG}$	$4.96 + 1.35 \times PG_{UG}$
$CC8_{Drain}$	$3.42 + 0.57 \times acres_{Total+1}$
$CC1_{HW}$	Fixed cost per facility of $2,600,000
$C9_{Slag}$	Fixed cost per acre of $64,000
$O\&M3_{ST}$	$4.01 + 0.38 \times acres_{Total+1}$
$O\&M4_{LT}$	$3.12 + 0.58 \times acres_{Total+1}$
$O\&M1_{Int}$	$6.04 + 0.01 \times NP + 0.34 \times acres_{HDL+1} + 0.10 \times wetacres_{TF+1}$
$O\&M2_{WT}$	$2.16 + 1.10 \times GPM + 1.06 \times Treat + 0.70 \times Alk$

Because EPA estimated formulas using a log-log transformation, the results of the regression analysis reflect a known prediction bias inherent to the performance of linear regressions on variables that have undergone logarithmic transformation. EPA corrected for this bias through the application of an adjustment factor, or "smearing factor," to the retransformed regression results.[128] The O&M formulas described above were estimated using annualized data. Therefore, EPA converted the annualized interim and short-term O&M costs into a single net present value (NPV) cost, assuming a ten-year payment period. The annualized long-term O&M and water treatment costs were also converted into a single NPV figure, assuming the payments would continue in perpetuity.

EPA's assessment of NRD and health assessment components followed a simpler approach than the Agency's analysis of response components. For NRD, EPA estimated that such damages are 13.4 percent of the response components estimated for each facility. As described in Chapter 5 of the Financial Responsibility Formula Background document, this figure reflects EPA's assessment of historical NRD settlements and historical response costs at hardrock mining and processing facilities. For the health assessment component, EPA assumes a fixed financial responsibility amount of $550,000 per facility based upon health assessment information

[128] Duan, N. 1983. Smearing estimate: A nonparametric retransformation method. *Journal of the American Statistical Association*. 78: 605-610.

released by the Agency for Toxic Substances and Disease Registry. Chapter 3 of the Financial Responsibility Formula Background Document includes additional information on these costs.

The financial responsibility amounts were estimated using cost data normalized to national values. Therefore, the financial responsibility formula is multiplied by the most current state cost adjustment factors developed by the U.S. Army Corps of Engineers (2015) to derive a state-specific cost. Appendix N of the Financial Responsibility Formula Background Document includes a list of these state-specific factors. In addition, the direct engineering costs do not include overhead and oversight costs related to mobilization and demobilization, engineering design and redesign, contingency, contractor profit and overhead, contractor liability insurance, payment and performance bonds, and direct EPA (or other government agency) contract administration and contract management. EPA adjusts the estimated response component and NRD component by the relevant state factors and indirect cost multipliers to derive the total FR obligation.[129]

Data Inputs /Processing Data

To calculate the maximum financial responsibilities amounts, EPA relied on the data collected for the development of cost estimation formula. As part of this effort, EPA collected data that influence the CERCLA response component from states closure and reclamation documents, Environmental Impact Statement (EIS) and other publically available sources. The collected data include site-specific data (*e.g.*, facility features, acreage), environmental and climate data (precipitation, evaporation and distance to surface water). Exhibits B-3 and B-4 present the collected data that were the inputs for the financial responsibility formula. Comprehensive lists of all data sources are available in Appendices B through J of the Financial Responsibility Formula Background Document.[130]

Estimation of Total Financial Responsivity Amount

EPA first identified the 49 facilities from the sample of 63 that are in the regulated universe.[131] EPA used those 49 facilities as the "modeled universe" to which EPA applied the cost estimation model. Using the relevant formulas for each response component category shown in Exhibit B-2 with the inputs located in Exhibits B-3 and B-4, EPA then developed a total cost estimate that represents each facility's potential CERCLA liabilities. These FR amounts are reported on a cost-by-cost basis in Exhibit B-7.

To develop estimates of CERCLA liabilities that reflect the benefits of controls already in place at individual facilities, EPA developed a series of cost reduction credits that may be applied to the response amounts.

B.2. Reductions

Performance Standard Reductions

Many facilities have developed reclamation and closure plans that include CERCLA response-like tasks or practices that reduce the risk of hazardous releases under existing state, federal, tribal, and local regulatory regimes. In some cases, facilities have also backed the

[129] These adjustments are not applied to the health assessment component.

[130] U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document" Office of Land and Emergency Management (September 2016).

[131] For the identification of the regulated universe, see Chapter 2 of this RIA.

implementation of those tasks through financial assurance. Under the proposed rule, facilities will receive a 100 percent reduction for applicable cost components if they: 1) demonstrate that they have planned and acquired sufficient financial assurance for tasks that would create post-closure conditions that meet EPA's performance standards; and 2) demonstrate that those future controls are enforceable against them through federal, state, tribal, or local agencies.

All cost components of the maximum financial responsibility estimate are eligible for this reduction: capital costs (open pits, underground mines, waste rock, heap and dump leach, tailings facilities, process ponds, slag piles, hazardous waste, and surface drainage), short-term O&M, interim O&M, long-term O&M, and water treatment.

To assess the impact of these reductions on the modeled universe, EPA determined which facilities had reclamation and closure plans that described future engineering controls that met the above performance standards. If a cost estimate accompanied the proposed control, EPA gave a full reduction to the relevant cost component. Exhibits B-5 and B-6 summarize the performance standard reductions for each component at each facility in the modeled universe. Exhibit B-8 presents the response amounts after the application of the performance standard reductions.

B.3. Calculation of Final Reduced Financial Responsibility Amounts

EPA then adjusted the reduced financial assurance amounts for each facility by assessing the NRD and health assessment components, and applying federal and state-specific indirect cost multipliers.

Exhibit B-9 presents the reduced, adjusted, final financial responsibility total for each facility in the modeled universe.

B.4. Financial Responsibility Formula Inputs and Results

Exhibit B-3.
Inputs to the Capital Components of the Financial Responsibility Formula for the Modeled Universe

Site	MSHA ID	Solid/Hazardous Waste	Open Pit	Waste Rock	Heap/Dump Leach	Tailings Facility	Process Ponds	Underground	Slag Pile	Drainage
		Yes/No	Acres	Acres	Acres	Acres	Acres	Hydraulic Head	Acres	Total Acres
1	5001616	Yes	660	865	556	1069	191	N/A	N/A	3341
2	5001267	Yes	N/A	70	N/A	349	14	No	N/A	433
3	5001544	Yes	N/A	N/A	N/A	86	N/A	N/A	N/A	86
4	5001642	Yes	N/A	N/A	N/A	149	N/A	Yes	N/A	149
5	5001545	Yes	307	190	N/A	77	N/A	N/A	N/A	574
6	200137	Yes	1400	1625	730	3230	4	N/A	N/A	6989
7	202824	Yes	145	168	356	N/A	20	N/A	N/A	689
8	200135	Yes	1614	3398	N/A	2106	N/A	N/A	N/A	7118
9	201049	Yes	705	367	762	1586	59	N/A	N/A	3479
10	203256	Yes	402	1600	N/A	4140	20	N/A	N/A	6162
11	203131	Yes	105	660	739	N/A	N/A	N/A	N/A	1504
12	200150	Yes	1509	2966	445	1970	11	N/A	N/A	6901
13	200851	Yes	1094	145	1214	1013	N/A	N/A	N/A	3466
14	405276	Yes	112	129	150	N/A	N/A	N/A	N/A	391
15	404614	Yes	1290	1204	783	N/A	31	N/A	N/A	3308
16	402542	Yes	69	168	N/A	119	N/A	N/A	N/A	356
17	502256	Yes	100	852	N/A	698	N/A	Yes	N/A	1650
18	503695	Yes	899	740	936	N/A	N/A	N/A	N/A	2575
19	1001854	Yes	426	206	N/A	N/A	9	N/A	N/A	641
20	1001590	Yes	197	N/A	N/A	N/A	N/A	N/A	N/A	197
21	1000531	Yes	443	850	N/A	609	N/A	N/A	N/A	1902
22	2103751	Yes	26	157	N/A	137	N/A	N/A	N/A	320
23	2101600	Yes	126	1147	N/A	6200	N/A	N/A	N/A	7473
24	2103770	Yes	628	483	N/A	200	N/A	N/A	N/A	1311
25	2100209; 2100831	Yes	N/A	42	N/A	N/A	N/A	N/A	N/A	42
26	2103767	Yes	N/A	N/A	N/A	600	N/A	N/A	N/A	600
27	2900725; 2900731	Yes	648	475	398	355	N/A	N/A	N/A	1876
28	2401879	Yes	N/A	N/A	N/A	103	N/A	No	N/A	103
29	2401417	Yes	218	480	N/A	286	N/A	N/A	N/A	984
30	2601842	Yes	268	3968	1093	N/A	34	No	N/A	5363
31	2602697; 2602678	Yes	33	106	130	N/A	N/A	N/A	N/A	269
32	2601089; 2602674; 2602673	Yes	112	3749	161	2114	216	No	N/A	6352

Exhibit B-3.
Inputs to the Capital Components of the Financial Responsibility Formula for the Modeled Universe

Site	MSHA ID	Solid/Hazardous Waste	Open Pit	Waste Rock	Heap/Dump Leach	Tailings Facility	Process Ponds	Underground	Slag Pile	Drainage
		Yes/No	Acres	Acres	Acres	Acres	Acres	Hydraulic Head	Acres	Total Acres
33	2602535	Yes	4	8	N/A	N/A	1	No	N/A	13
34	2601962	Yes	1282	1757	1321	N/A	51	N/A	N/A	4411
35	2602742; 2601621	Yes	896	1095	23	361	N/A	No	N/A	2375
36	2602159	Yes	58	1220	308	320	43	N/A	N/A	1949
37	2602081	Yes	239	1011	802	184	28	N/A	N/A	2264
38	2601916	Yes	199	2904	163	1639	6	N/A	N/A	4911
39	2601941	Yes	46	402	129	N/A	38	N/A	N/A	615
40	2600594	Yes	119	2024	995	1051	141	N/A	N/A	4330
41	2602307	Yes	36	691	130	N/A	19	N/A	N/A	876
42	2600500	Yes	87	2764	1289	2316	28	N/A	N/A	6484
43	2900708	Yes	1500	2438	N/A	4229	N/A	N/A	25	8192
44	2900159	Yes	1600	2426	273	N/A	21	N/A	N/A	4320
45	3800600	Yes	182	683	N/A	396	N/A	N/A	N/A	1261
46	4202406	Yes	100	419	185	N/A	15	N/A	N/A	719
47	2501034	Yes	N/A	N/A	N/A	N/A	30	N/A	N/A	30
48	N/A	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
49	N/A	Yes	N/A	N/A	N/A	N/A	38	N/A	N/A	38

Exhibit B-4.
Inputs to the O&M Components of the Financial Responsibility Formula for the Modeled Universe

		Short-Term O&M	Interim O&M			Long-Term O&M	Water Treatment	
Site	MSHA ID	Total Acres	Net Precip.	Heap/Dump Leach Acres	Wet Tailings Acres	Total Acres	In-Situ Leach	Gallons Per Minute Flow
1	5001616	3341	-6.0	556	1069	3341	No	103
2	5001267	433	45.4	N/A	N/A	433	No	67
3	5001544	86	41.2	N/A	86	86	No	13
4	5001642	149	1.0	N/A	N/A	149	No	7
5	5001545	574	9.5	N/A	77	574	No	27
6	200137	6989	-59.3	730	3230	6989	No	247
7	202824	689	-83.0	356	N/A	689	No	27
8	200135	7118	-97.7	N/A	2106	7118	No	244
9	201049	3479	-72.2	762	1586	3479	No	214
10	203256	6162	-77.6	N/A	N/A	6162	No	283
11	203131	1504	-84.5	739	N/A	1504	No	52
12	200150	6901	-82.3	445	1970	6901	No	240
13	200851	3466	-98.5	1214	N/A	3466	No	112
14	405276	391	-145.2	150	N/A	391	No	4
15	404614	3308	-103.7	783	N/A	3308	No	26
16	402542	356	-109.1	N/A	N/A	356	No	6
17	502256	1650	5.7	N/A	698	1650	No	105
18	503695	2575	-40.2	936	N/A	2575	No	126
19	1001854	641	-34.4	N/A	N/A	641	No	28
20	1001590	197	4.5	N/A	N/A	197	No	17
21	1000531	1902	-20.3	N/A	609	1902	No	102
22	2103751	320	-8.0	N/A	137	320	No	23
23	2101600	7473	-6.0	N/A	N/A	7473	No	578
24	2103770	1311	-10.0	N/A	200	1311	No	88
25	2100209; 2100831	42	-7.2	N/A	N/A	42	No	3
26	2103767	600	0.7	N/A	600	600	No	42
27	2900725; 2900731	1876	-17.0	398	355	1876	No	63
28	2401879	103	-18.5	N/A	103	103	No	6
29	2401417	984	-17.0	N/A	286	984	No	33
30	2601842	5363	-19.0	1093	N/A	5363	No	221
31	2602697; 2602678	269	-51.6	130	N/A	269	No	7

Exhibit B-4.
Inputs to the O&M Components of the Financial Responsibility Formula for the Modeled Universe

Site	MSHA ID	Short-Term O&M	Interim O&M			Long-Term O&M	Water Treatment	
		Total Acres	Net Precip.	Heap/Dump Leach Acres	Wet Tailings Acres	Total Acres	In-Situ Leach	Gallons Per Minute Flow
32	2601089; 2602674; 2602673	6352	-36.0	161	2114	6352	No	246
33	2602535	13	-38.7	N/A	N/A	13	No	0
34	2601962	4411	-48.9	1321	N/A	4411	No	119
35	2602742; 2601621	2375	-27.0	23	361	2375	No	147
36	2602159	1949	-46.2	308	320	1949	No	45
37	2602081	2264	-44.5	802	184	2264	No	38
38	2601916	4911	-38.0	163	1639	4911	No	165
39	2601941	615	-28.9	129	N/A	615	No	14
40	2600594	4330	-60.4	995	1051	4330	No	67
41	2602307	876	-48.3	130	N/A	876	No	26
42	2600500	6484	-30.3	1289	2316	6484	No	163
43	2900708	8192	-84.0	N/A	4229	8192	No	338
44	2900159	4320	-85.0	273	N/A	4320	No	178
45	3800600	1261	-18.0	N/A	396	1261	No	150
46	4202406	719	-35.6	185	N/A	719	No	27
47	2501034	30	-1.4	N/A	N/A	30	Yes	173
48	N/A	0	-37.0	N/A	N/A	0	Yes	50
49	N/A	38	-62.0	N/A	N/A	38	Yes	250

Exhibit B-5.
Reductions to the Capital Components of the Financial Responsibility Formula for the Modeled Universe

Site	MSHA ID	Solid/ Hazardous Waste	Open Pit	Waste Rock	Heap/Dump Leach	Tailings Facility	Process Ponds	Underground	Slag Pile	Drainage	
										Enforceable Plan	Diversion
1	5001616	No	Yes	Yes	Yes	Yes	No	Not Applicable	Not Applicable	No	Yes
2	5001267	No	Not Applicable	Yes	Not Applicable	Yes	Yes	Yes	Not Applicable	Yes	Yes
3	5001544	Yes	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
4	5001642	No	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Yes	Not Applicable	Yes	Yes
5	5001545	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
6	200137	No	No	No	Yes	Yes	Yes	Not Applicable	Not Applicable	No	Yes
7	202824	No	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
8	200135	No	No	No	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
9	201049	Yes	No	Yes	Yes	Yes	Yes	Not Applicable	Not Applicable	No	Yes
10	203256	No	Yes	Yes	Not Applicable	Yes	Yes	Not Applicable	Not Applicable	No	Yes
11	203131	No	Yes	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No	Yes
12	200150	No	No	No	No	Yes	Yes	Not Applicable	Not Applicable	No	Yes
13	200851	No	No	No	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
14	405276	Yes	No	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No	Yes
15	404614	No	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
16	402542	No	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
17	502256	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Yes	Not Applicable	Yes	Yes
18	503695	No	Yes	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No	Yes
19	1001854	No	Yes	Yes	Not Applicable	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
20	1001590	No	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No	Yes
21	1000531	No	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
22	2103751	No	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
23	2101600	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
24	2103770	No	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
25	2100209; 2100831	No	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No	Yes
26	2103767	No	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
27	2900725; 2900731	No	Yes	Yes	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
28	2401879	Yes	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Yes	Not Applicable	Yes	Yes
29	2401417	No	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
30	2601842	Yes	Yes	Yes	Yes	Not Applicable	Yes	Yes	Not Applicable	Yes	Yes
31	2602697; 2602678	No	Yes	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No	Yes
32	2601089; 2602674; 2602673	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not Applicable	Yes	Yes
33	2602535	Yes	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Yes	Yes
34	2601962	Yes	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
35	2602742; 2601621	No	Yes	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Yes	Yes
36	2602159	Yes	Yes	Yes	Yes	Yes	Yes	Not Applicable	Not Applicable	No	Yes
37	2602081	No	Yes	Yes	Yes	Yes	Yes	Not Applicable	Not Applicable	No	Yes
38	2601916	Yes	Yes	Yes	Yes	Yes	Yes	Not Applicable	Not Applicable	No	Yes
39	2601941	Yes	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes

Exhibit B-5.
Reductions to the Capital Components of the Financial Responsibility Formula for the Modeled Universe

Site	MSHA ID	Solid/ Hazardous Waste	Open Pit	Waste Rock	Heap/Dump Leach	Tailings Facility	Process Ponds	Underground	Slag Pile	Drainage	
										Enforceable Plan	Diversion
40	2600594	Yes	Yes	Yes	Yes	Yes	Yes	Not Applicable	Not Applicable	No	Yes
41	2602307	Yes	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
42	2600500	Yes	Yes	Yes	Yes	Yes	Yes	Not Applicable	Not Applicable	No	Yes
43	2900708	No	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Yes	No	Yes
44	2900159	No	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
45	3800600	No	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	Not Applicable	No	Yes
46	4202406	No	Yes	Yes	Yes	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
47	2501034	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes
48	N/A	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No	Yes
49	N/A	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Not Applicable	No	Yes

Exhibit B-6.
Reductions to the O&M Components of the Financial Responsibility Formula for the Modeled Universe

Site	MSHA ID	Short-Term O&M		Interim O&M	Long-Term O&M		Water Treatment
		Enforceable Plan	All Capital Costs Reduced	Enforceable Plan	Enforceable Plan	All Capital Costs Reduced	Enforceable Plan
1	5001616	Yes	No	Yes	Yes	No	Yes
2	5001267	Yes	No	Yes	Yes	No	Yes
3	5001544	Yes	Yes	Yes	No	Yes	No
4	5001642	Yes	No	Yes	Yes	No	Yes
5	5001545	Yes	Yes	Yes	No	Yes	Yes
6	200137	No	No	No	Yes	No	Yes
7	202824	No	No	No	No	No	No
8	200135	Yes	No	No	Yes	No	No
9	201049	Yes	No	No	Yes	No	No
10	203256	No	No	No	No	No	No
11	203131	No	No	No	No	No	No
12	200150	Yes	No	Yes	No	No	No
13	200851	Yes	No	Yes	No	No	No
14	405276	Yes	No	Yes	No	No	No
15	404614	Yes	No	Yes	No	No	No
16	402542	Yes	No	No	No	No	No
17	502256	Yes	Yes	Yes	No	Yes	No
18	503695	Yes	No	Yes	No	No	No
19	1001854	Yes	No	Not Applicable	Yes	No	No
20	1001590	Yes	No	Not Applicable	No	No	No
21	1000531	Yes	No	Yes	No	No	No
22	2103751	Yes	No	No	No	No	No
23	2101600	Yes	Yes	No	No	Yes	No
24	2103770	Yes	No	No	No	No	No
25	2100209; 2100831	Yes	No	Not Applicable	No	No	No
26	2103767	No	No	No	No	No	No
27	2900725; 2900731	Yes	No	Yes	No	No	No
28	2401879	Yes	Yes	Yes	No	Yes	Yes
29	2401417	Yes	No	Yes	Yes	No	Yes
30	2601842	Yes	Yes	Yes	No	Yes	No

Exhibit B-6.
Reductions to the O&M Components of the Financial Responsibility Formula for the Modeled Universe

Site	MSHA ID	Short-Term O&M		Interim O&M	Long-Term O&M		Water Treatment
		Enforceable Plan	All Capital Costs Reduced	Enforceable Plan	Enforceable Plan	All Capital Costs Reduced	Enforceable Plan
31	2602697; 2602678	Yes	No	Yes	Yes	No	No
32	2601089; 2602674; 2602673	Yes	Yes	Yes	No	Yes	No
33	2602535	Yes	Yes	Not Applicable	No	Yes	No
34	2601962	Yes	Yes	Yes	No	Yes	No
35	2602742; 2601621	Yes	No	Yes	No	No	Yes
36	2602159	Yes	Yes	Yes	No	Yes	No
37	2602081	Yes	No	Yes	No	No	No
38	2601916	Yes	Yes	Yes	Yes	Yes	Yes
39	2601941	Yes	Yes	No	No	Yes	No
40	2600594	Yes	Yes	Yes	No	Yes	No
41	2602307	Yes	Yes	Yes	No	Yes	No
42	2600500	Yes	Yes	No	No	Yes	No
43	2900708	Yes	No	Yes	Yes	No	Yes
44	2900159	No	No	Yes	Yes	No	Yes
45	3800600	Yes	No	No	No	No	Yes
46	4202406	Yes	No	Yes	No	No	No
47	2501034	No	Yes	Not Applicable	No	Yes	No
48	N/A	No	Yes	Not Applicable	No	Yes	Yes
49	N/A	No	Yes	Not Applicable	No	Yes	Yes

Exhibit B-7.
Total Financial Responsibility for the Modeled Universe (No Reductions) ($2014 Millions)

Site	MSHA ID	SHW	OP	WR	HDL	TF	PPR	UG	Slag	Drain	STOM	IOM	LTOM	WT
1	5001616	$2.6	$96.7	$45.0	$49.5	$40.1	$7.4	$0.0	$0.0	$2.5	$3.5	$209.0	$9.4	$12.0
2	5001267	$2.6	$0.0	$6.8	$0.0	$18.8	$0.5	$0.2	$0.0	$0.8	$1.6	$30.4	$2.9	$7.5
3	5001544	$2.6	$0.0	$0.0	$0.0	$7.3	$0.0	$0.0	$0.0	$0.3	$0.9	$43.2	$1.1	$1.2
4	5001642	$2.6	$0.0	$0.0	$0.0	$10.5	$0.0	$4.5	$0.0	$0.4	$1.1	$14.2	$1.5	$0.6
5	5001545	$2.6	$42.3	$14.4	$0.0	$6.7	$0.0	$0.0	$0.0	$0.9	$1.8	$24.8	$3.4	$2.8
6	200137	$2.6	$217.6	$72.4	$65.1	$84.8	$0.1	$0.0	$0.0	$3.8	$4.7	$101.8	$14.5	$31.3
7	202824	$2.6	$18.8	$13.1	$31.6	$0.0	$0.7	$0.0	$0.0	$1.0	$1.9	$24.6	$3.7	$2.7
8	200135	$2.6	$253.7	$126.2	$0.0	$63.5	$0.0	$0.0	$0.0	$3.8	$4.7	$5.4	$14.6	$30.9
9	201049	$2.6	$103.8	$23.6	$67.9	$52.4	$2.2	$0.0	$0.0	$2.5	$3.6	$77.4	$9.6	$26.7
10	203256	$2.6	$56.6	$71.6	$0.0	$100.3	$0.7	$0.0	$0.0	$3.5	$4.5	$3.7	$13.4	$36.3
11	203131	$2.6	$13.3	$36.7	$65.9	$0.0	$0.0	$0.0	$0.0	$1.6	$2.6	$30.8	$5.9	$5.7
12	200150	$2.6	$236.0	$113.9	$39.5	$60.6	$0.4	$0.0	$0.0	$3.7	$4.7	$55.3	$14.4	$30.3
13	200851	$2.6	$166.8	$11.7	$108.6	$38.6	$0.0	$0.0	$0.0	$2.5	$3.6	$28.6	$9.6	$13.1
14	405276	$2.6	$14.3	$10.7	$13.2	$0.0	$0.0	$0.0	$0.0	$0.7	$1.6	$6.3	$2.7	$0.3
15	404614	$2.6	$199.2	$57.8	$69.8	$0.0	$1.1	$0.0	$0.0	$2.5	$3.5	$22.6	$9.3	$2.6
16	402542	$2.6	$8.4	$13.1	$0.0	$9.1	$0.0	$0.0	$0.0	$0.7	$1.5	$2.1	$2.5	$0.6
17	502256	$2.6	$12.6	$44.5	$0.0	$30.0	$0.0	$4.5	$0.0	$1.7	$2.7	$28.6	$6.2	$12.2
18	503695	$2.6	$134.9	$40.0	$83.6	$0.0	$0.0	$0.0	$0.0	$2.1	$3.2	$71.4	$8.1	$14.8
19	1001854	$2.6	$60.3	$15.3	$0.0	$0.0	$0.3	$0.0	$0.0	$1.0	$1.9	$0.0	$3.6	$2.9
20	1001590	$2.6	$26.2	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.5	$1.2	$0.0	$1.8	$1.6
21	1000531	$2.6	$62.9	$44.4	$0.0	$27.4	$0.0	$0.0	$0.0	$1.8	$2.9	$18.1	$6.8	$11.8
22	2103751	$2.6	$2.9	$12.4	$0.0	$10.0	$0.0	$0.0	$0.0	$0.7	$1.5	$19.4	$2.4	$2.3
23	2101600	$2.6	$16.2	$55.7	$0.0	$131.9	$0.0	$0.0	$0.0	$3.9	$4.8	$12.6	$15.0	$79.9
24	2103770	$2.6	$91.6	$29.0	$0.0	$12.9	$0.0	$0.0	$0.0	$1.5	$2.5	$19.4	$5.4	$10.0
25	2100209; 2100831	$2.6	$0.0	$4.6	$0.0	$0.0	$0.0	$0.0	$0.0	$0.2	$0.7	$0.0	$0.7	$0.2
26	2103767	$2.6	$0.0	$0.0	$0.0	$27.1	$0.0	$0.0	$0.0	$0.9	$1.8	$25.9	$3.5	$4.5
27	2900725; 2900731	$2.6	$94.8	$28.7	$35.3	$19.0	$0.0	$0.0	$0.0	$1.8	$2.8	$139.1	$6.7	$6.9

Exhibit B-7.
Total Financial Responsibility for the Modeled Universe (No Reductions) ($2014 Millions)

Site	MSHA ID	SHW	OP	WR	HDL	TF	PPR	UG	Slag	Drain	STOM	IOM	LTOM	WT
28	2401879	$2.6	$0.0	$0.0	$0.0	$8.2	$0.0	$0.2	$0.0	$0.3	$0.9	$15.7	$1.2	$0.5
29	2401417	$2.6	$29.2	$28.9	$0.0	$16.4	$0.0	$0.0	$0.0	$1.2	$2.2	$17.8	$4.6	$3.4
30	2601842	$2.6	$36.5	$141.9	$97.7	$0.0	$1.2	$0.2	$0.0	$3.2	$4.2	$108.4	$12.4	$27.7
31	2602697; 2602678	$2.6	$3.8	$9.3	$11.4	$0.0	$0.0	$0.0	$0.0	$0.6	$1.4	$30.0	$2.2	$0.6
32	2601089; 2602674; 2602673	$2.6	$14.3	$135.9	$14.2	$63.6	$8.4	$0.2	$0.0	$3.6	$4.5	$87.5	$13.7	$31.1
33	2602535	$2.6	$0.4	$1.3	$0.0	$0.0	$0.0	$0.2	$0.0	$0.1	$0.4	$0.0	$0.4	$0.0
34	2601962	$2.6	$197.9	$76.8	$118.2	$0.0	$1.9	$0.0	$0.0	$2.9	$3.9	$69.1	$11.1	$14.1
35	2602742; 2601621	$2.6	$134.4	$53.8	$2.0	$19.2	$0.0	$0.2	$0.0	$2.0	$3.1	$45.1	$7.7	$17.7
36	2602159	$2.6	$7.0	$58.3	$27.3	$17.7	$1.6	$0.0	$0.0	$1.8	$2.9	$76.5	$6.9	$4.7
37	2602081	$2.6	$32.3	$50.6	$71.5	$12.2	$1.0	$0.0	$0.0	$2.0	$3.1	$103.3	$7.5	$4.0
38	2601916	$2.6	$26.5	$112.1	$14.4	$53.5	$0.2	$0.0	$0.0	$3.1	$4.1	$82.8	$11.8	$20.0
39	2601941	$2.6	$5.5	$25.3	$11.4	$0.0	$1.4	$0.0	$0.0	$1.0	$1.9	$44.3	$3.5	$1.3
40	2600594	$2.6	$15.2	$85.4	$88.9	$39.6	$5.4	$0.0	$0.0	$2.9	$3.9	$99.8	$10.9	$7.4
41	2602307	$2.6	$4.2	$38.0	$11.4	$0.0	$0.7	$0.0	$0.0	$1.2	$2.1	$31.8	$4.3	$2.7
42	2600500	$2.6	$10.8	$108.0	$115.3	$67.7	$1.0	$0.0	$0.0	$3.6	$4.6	$197.2	$13.8	$19.8
43	2900708	$2.6	$234.5	$98.3	$0.0	$101.8	$0.0	$0.0	$1.6	$4.1	$5.0	$7.3	$15.9	$44.2
44	2900159	$2.6	$251.4	$97.9	$24.2	$0.0	$0.8	$0.0	$0.0	$2.9	$3.9	$21.8	$10.9	$21.8
45	3800600	$2.6	$24.1	$37.7	$0.0	$20.4	$0.0	$0.0	$0.0	$1.4	$2.4	$18.0	$5.3	$18.0
46	4202406	$2.6	$12.6	$26.1	$16.3	$0.0	$0.5	$0.0	$0.0	$1.0	$2.0	$44.6	$3.8	$2.7
47	2501034	$2.6	$0.0	$0.0	$0.0	$0.0	$1.1	$0.0	$0.0	$0.2	$0.6	$0.0	$0.6	$104.6
48	N/A	$2.6	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.2	$0.0	$0.1	$26.7
49	N/A	$2.6	$0.0	$0.0	$0.0	$0.0	$0.1	$0.0	$0.0	$0.1	$0.3	$0.0	$0.2	$157.1

Exhibit B-8.
Reduced Financial Responsibility for the Modeled Universe ($2014)

Site	MSHA ID	SHW	OP	WR	HDL	TF	PPR	UG	Slag	Drain	STOM	IOM	LTOM	WT
1	5001616	$2,600,000	$0	$0	$0	$0	$7,415,301	$0	$0	$0	$3,537,537	$0	$9,399,692	$0
2	5001267	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,628,321	$0	$2,854,630	$0
3	5001544	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,117,024	$1,213,594
4	5001642	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,087,338	$0	$1,535,244	$0
5	5001545	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,364,182	$0
6	200137	$2,600,000	$217,634,886	$72,405,692	$0	$0	$0	$0	$0	$0	$4,682,851	$101,820,702	$14,461,389	$0
7	202824	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,942,119	$24,632,433	$3,742,027	$2,692,466
8	200135	$2,600,000	$253,748,666	$126,225,684	$0	$0	$0	$0	$0	$0	$4,715,514	$5,366,519	$14,616,607	$30,908,912
9	201049	$0	$103,790,686	$0	$0	$0	$0	$0	$0	$0	$3,592,363	$77,351,403	$9,624,384	$26,652,421
10	203256	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$4,464,007	$3,665,712	$13,436,431	$36,307,047
11	203131	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$2,612,217	$30,756,362	$5,899,816	$5,665,434
12	200150	$2,600,000	$235,978,441	$113,934,765	$39,520,049	$0	$0	$0	$0	$0	$4,660,355	$0	$14,354,818	$30,349,892
13	200851	$2,600,000	$166,771,658	$11,723,665	$0	$0	$0	$0	$0	$0	$3,587,257	$0	$9,603,377	$13,079,845
14	405276	$0	$14,250,050	$0	$0	$0	$0	$0	$0	$0	$1,566,529	$0	$2,689,942	$317,814
15	404614	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$3,524,219	$0	$9,345,393	$2,574,750
16	402542	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,511,819	$2,131,335	$2,547,003	$552,976
17	502256	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,227,505	$12,211,980
18	503695	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$3,204,255	$0	$8,074,337	$14,841,702
19	1001854	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,889,616	$0	$3,587,775	$2,891,214
20	1001590	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,208,354	$0	$1,805,388	$1,588,728
21	1000531	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$2,855,893	$0	$6,765,981	$11,750,804
22	2103751	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,451,956	$19,370,591	$2,393,749	$2,300,621
23	2101600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,552,637	$15,037,825	$79,853,662
24	2103770	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$2,479,446	$19,396,521	$5,445,546	$10,025,333
25	2100209; 2100831	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$676,264	$0	$740,261	$249,507

Exhibit B-8.
Reduced Financial Responsibility for the Modeled Universe ($2014)

Site	MSHA ID	SHW	OP	WR	HDL	TF	PPR	UG	Slag	Drain	STOM	IOM	LTOM	WT
26	2103767	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,842,807	$25,887,879	$3,452,174	$4,489,871
27	2900725; 2900731	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$2,840,999	$0	$6,711,858	$6,932,960
28	2401879	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,239,700	$0
29	2401417	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$2,223,482	$0	$4,606,356	$0
30	2601842	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,390,184	$27,720,962
31	2602697; 2602678	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,359,542	$0	$2,163,764	$591,013
32	2601089; 2602674; 2602673	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$13,676,739	$31,110,344
33	2602535	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$384,474	$27,170
34	2601962	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,054,496	$14,053,490
35	2602742; 2601621	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$3,107,320	$0	$7,702,208	$0
36	2602159	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,863,044	$4,733,768
37	2602081	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$3,051,324	$0	$7,490,047	$3,967,295
38	2601916	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
39	2601941	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$44,310,210	$3,502,218	$1,288,828
40	2600594	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,935,554	$7,433,158
41	2602307	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,304,391	$2,667,852
42	2600500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$197,158,291	$13,841,932	$19,754,155
43	2900708	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$4,974,208	$0	$15,866,218	$0
44	2900159	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$3,900,418	$0	$10,920,806	$0
45	3800600	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$2,443,097	$18,032,629	$5,323,408	$0
46	4202406	$2,600,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,973,792	$0	$3,836,170	$2,699,869
47	2501034	$0	$0	$0	$0	$0	$0	$0	$0	$0	$597,176	$0	$611,534	$104,598,125
48	N/A	$0	$0	$0	$0	$0	$0	$0	$0	$0	$161,898	$0	$82,364	$0

Exhibit B-8.
Reduced Financial Responsibility for the Modeled Universe ($2014)

Site	MSHA ID	SHW	OP	WR	HDL	TF	PPR	UG	Slag	Drain	STOM	IOM	LTOM	WT
49	N/A	$0	$0	$0	$0	$0	$0	$0	$0	$0	$274,210	$0	$185,025	$0

Exhibit B-9.
Final (Adjusted) Financial Responsibility for the Modeled Universe ($2014)

Site	MSHA ID	State	Unadjusted Reduced FR	NRD Multiplier	Regional Adjustment	Health Assessment	Final Reduced FR
1	5001616	Alaska	$22,952,529	1.134	1.76	$550,000	$46,434,173
2	5001267	Alaska	$7,082,951	1.134	1.76	$550,000	$14,709,457
3	5001544	Alaska	$2,330,618	1.134	1.76	$550,000	$5,209,115
4	5001642	Alaska	$5,222,582	1.134	1.76	$550,000	$10,990,412
5	5001545	Alaska	$3,364,182	1.134	1.76	$550,000	$7,275,303
6	200137	Arizona	$413,605,520	1.134	1.43	$550,000	$670,232,872
7	202824	Arizona	$35,609,045	1.134	1.43	$550,000	$58,205,825
8	200135	Arizona	$438,181,902	1.134	1.43	$550,000	$710,025,334
9	201049	Arizona	$221,011,257	1.134	1.43	$550,000	$358,396,901
10	203256	Arizona	$60,473,197	1.134	1.43	$550,000	$98,464,225
11	203131	Arizona	$47,533,829	1.134	1.43	$550,000	$77,513,652
12	200150	Arizona	$441,398,321	1.134	1.43	$550,000	$715,233,149
13	200851	Arizona	$207,365,801	1.134	1.43	$550,000	$336,303,076
14	405276	California	$18,824,336	1.134	1.74	$550,000	$37,696,436
15	404614	California	$18,044,361	1.134	1.74	$550,000	$36,157,297
16	402542	California	$9,343,134	1.134	1.74	$550,000	$18,986,993
17	502256	Colorado	$18,439,485	1.134	1.44	$550,000	$30,607,473
18	503695	Colorado	$28,720,295	1.134	1.44	$550,000	$47,365,814
19	1001854	Idaho	$10,968,605	1.134	1.44	$550,000	$18,423,455
20	1001590	Idaho	$7,202,470	1.134	1.44	$550,000	$12,286,500
21	1000531	Idaho	$23,972,678	1.134	1.44	$550,000	$39,613,727
22	2103751	Minnesota	$28,116,917	1.134	1.68	$550,000	$54,162,525
23	2101600	Minnesota	$107,444,124	1.134	1.68	$550,000	$205,421,350
24	2103770	Minnesota	$39,946,845	1.134	1.68	$550,000	$76,719,490
25	2100209; 2100831	Minnesota	$4,266,032	1.134	1.68	$550,000	$8,684,347

Exhibit B-9.
Final (Adjusted) Financial Responsibility for the Modeled Universe ($2014)

Site	MSHA ID	State	Unadjusted Reduced FR	NRD Multiplier	Regional Adjustment	Health Assessment	Final Reduced FR
26	2103767	Minnesota	$38,272,731	1.134	1.68	$550,000	$73,527,338
27	2900725; 2900731	Montana	$19,085,817	1.134	1.44	$550,000	$31,661,034
28	2401879	Montana	$1,239,700	1.134	1.44	$550,000	$2,570,786
29	2401417	Montana	$9,429,839	1.134	1.44	$550,000	$15,921,206
30	2601842	Nevada	$40,111,147	1.134	1.61	$550,000	$73,613,499
31	2602697; 2602678	Nevada	$6,714,319	1.134	1.61	$550,000	$12,780,307
32	2601089; 2602674; 2602673	Nevada	$44,787,083	1.134	1.61	$550,000	$82,130,838
33	2602535	Nevada	$411,644	1.134	1.61	$550,000	$1,299,821
34	2601962	Nevada	$25,107,987	1.134	1.61	$550,000	$46,284,852
35	2602742; 2601621	Nevada	$13,409,528	1.134	1.61	$550,000	$24,975,805
36	2602159	Nevada	$11,596,812	1.134	1.61	$550,000	$21,673,896
37	2602081	Nevada	$17,108,666	1.134	1.61	$550,000	$31,713,881
38	2601916	Nevada	$0	1.134	1.61	$550,000	$550,000
39	2601941	Nevada	$49,101,255	1.134	1.61	$550,000	$89,989,216
40	2600594	Nevada	$18,368,712	1.134	1.61	$550,000	$34,009,087
41	2602307	Nevada	$6,972,243	1.134	1.61	$550,000	$13,250,123
42	2600500	Nevada	$230,754,377	1.134	1.61	$550,000	$420,875,110
43	2900708	New Mexico	$23,440,426	1.134	1.37	$550,000	$36,904,695
44	2900159	New Mexico	$17,421,224	1.134	1.37	$550,000	$27,569,274
45	3800600	South Carolina	$28,399,134	1.134	1.30	$550,000	$42,456,549
46	4202406	Utah	$11,109,830	1.134	1.41	$550,000	$18,286,298
47	2501034	Nebraska	$105,806,834	1.134	1.43	$550,000	$172,369,769

Exhibit B-9.
Final (Adjusted) Financial Responsibility for the Modeled Universe ($2014)

Site	MSHA ID	State	Unadjusted Reduced FR	NRD Multiplier	Regional Adjustment	Health Assessment	Final Reduced FR
48	N/A	Wyoming	$244,262	1.134	1.36	$550,000	$927,639
49	N/A	Wyoming	$459,235	1.134	1.36	$550,000	$1,259,994

B.5 Estimation of CERCLA Liability Financial Responsibility Amounts at Primary Smelters

EPA could not locate sufficiently detailed data to develop a financial responsibility formula for features specific to primary smelter facilities. Instead, EPA calculated a uniform FR amount that it applied to each of the 23 primary smelters in the potentially regulated universe. The FR amount comprised estimates for the components present at primary smelters that EPA determined were analogous to components for which EPA had developed FR formulas. Those components are: solid and hazardous waste disposal, process ponds, and slag piles.[132] EPA then collected data on slag pile and process pond acreage at both currently operating and historical (CERCLA) primary smelter facilities. EPA collected data from publicly available sources such as Remedial Investigations/Feasibility Studies, Five-Year Review Reports, and Public Health Assessments.

EPA took the average of the process pond acreages and slag pile acreages and ran those averages through the FR formulas for those features, described above in Exhibit B-2. To those two components, EPA added the flat $2.6 million solid and hazardous waste disposal component. EPA did not estimate FR for the primary smelter-specific capital components and did not calculate any O&M components. EPA did not locate bonding information for smelters and so did not apply reductions. As with the other types of facilities, EPA took the unadjusted FR amount, here comprised of the solid and hazardous waste, process pond, and slag pile components, applied the NRD multiplier, applied a weighted average geographic adjustment factor using the known locations of the smelters in the potentially regulated universe, and added the health assessment costs. EPA then assigned this adjusted FR amount to each smelter in the potentially regulated universe.

Exhibit B-10 summarizes the FR components and total FR amounts for smelters.

Exhibit B-10.
Summary of Financial Responsibility Assigned to Smelters

Solid and Hazardous Waste	Process Ponds	Slag Piles	Unadjusted FR	NRD Multiplier	Regional Adjustment	Health Assessment	Final Adjusted FR
$2,600,000	$699,559	$3,010,453	$6,310,013	1.134	1.52	$550,000	$11,438,311

[132] As a result, the FR amounts EPA applies to primary smelter sites in this RIA likely represent partial FR. EPA did not have a basis on which to estimate capital costs pertaining to primary smelter-specific features, and did not have a basis to estimate any O&M costs. The FR amounts presented in Exhibit B-10 thus may be lower than the amount a primary smelter may ultimately need to secure.

Appendix C. Acreage Scaling

EPA used the acreages that the facilities in the modeled universe provided in their cost estimate documents as a variable in the generation of response component estimates. Those acreages reflected the amount of disturbed acres the facilities expected to exist at closure. However, the rule requires facilities to provide cost estimates based on the conditions as they exist at the time of the estimate. Disturbed acreage increases over the course of a facility's operating life; as such a facility may have a lower financial responsibility amount at a given point before closure than at closure. To estimate the growth of disturbed acreage and the effect reduced acreages relative to closure date would have on financial responsibility requirements over the course of operations, EPA reviewed available operational documents, such as environmental impact statements (EIS) and reclamation and closure plans, for facilities in the modeled universe that tracked acreage expansion. Comprehensive lists of all data sources are available in Appendices B through J of the Financial Responsibility Formula Background Document.[133] Based on this review, EPA generated scaling rules to model the expansion of features found to experience acreage growth. EPA then applied the results of that scaling to the cost estimate formula.[134]

To analyze the potential increase in disturbed acreage over the facility life of various facilities, EPA collected data for a sample of 40 facilities from engineering cost estimate and financial assurance documents, as well as reclamation and closure plans, environmental impact statements, and aquifer protection permits. Generally, facility operators report the number of disturbed acres they expect to reclaim for each feature at the facility at closure. Sometimes, facility operators also report the number of disturbed acres for each feature as of the estimate date in addition to the anticipated closure date. Where available, EPA collected data on disturbed acres as of the year of the estimate and the expected/planned disturbed acres at closure for the following five features: open pits, waste rock disposal facilities, heap/dump leaches, tailings facilities, and process ponds. EPA also attempted to collect similar data on site-wide acreage.

The data collection process generally yielded two data points per facility (a snapshot of disturbed acreage at the time of the estimate and a projected disturbed acreage at facility closure) for each feature. Some facilities had multiple snapshots of disturbed acreage due to multiple estimates or year-by-year projections of feature expansion. Acreage data were available for at least two points in time for the following facility features: open pits (18 facilities); waste rock disposals (18 facilities); heap/dump leaches (13 facilities); and tailings impoundments (13 facilities). There were insufficient data to analyze changes in disturbed acreage for process ponds. Moreover, the data indicated that process ponds do not experience expansion that would significantly affect the cost of environmental liabilities over the course of the facility life. There were also insufficient data to analyze changes in site-wide acreage, even though there were sometimes data for individual facility features.[135]

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[133] U.S. Environmental Protection Agency, "CERCLA 108(b) Financial Responsibility Formula for Hardrock Mining Facilities Background Document" Office of Land and Emergency Management (September 2016).

[134] EPA assumes patterns of past expansion are indicative of future expansion for the modeled universe.

[135] Site-wide acreage is a driving variable in the drainage, short-term O&M, and long-term O&M cost formulas in the Cost Estimate Model. For these formulas, site-wide acreage is calculated as the sum of all of the feature

To account for differences in facility size, the growth (or expansion) rate for each feature is calculated as the percentage difference between current disturbed acreage at the time of the estimate and the expected disturbed acreage at closure divided by the amount of time between the two estimates expressed as a percentage of the facility's life. For example, the estimated growth rate for an open pit between 47 percent of its expected disturbed acreage at closure at 17 percent of the facility's life and 100 percent of its expected disturbed acreage at 100 percent of the facility's life is 0.64. This implies that for each one percent increase in the facility's life, the open pit will expand an additional 0.64 percent of its expected disturbed acreage at closure. Thus, the size of the open pit will increase by 53 percent of its size at closure over the last 83 percent of the facility's life. Note that for some facilities certain facility features were completed much earlier in their life cycles (*e.g.*, 100 percent of the predicted closure acreage at 40 percent of the facility's life) and had little to no growth during the time frame analyzed, while other facilities had features that were relatively undeveloped in the time period analyzed and anticipated scaling up rapidly before closure.

EPA calculated the acreage expansion rate for each facility (*i.e.*, the slope of the snapshot of disturbed acreage at a given estimate to the expected disturbed acreage at closure). Then, EPA calculated the average of those facility-specific expansion rates. The average of the facility-specific expansion rates captures the relationship between the data points collected for each facility, rather than treating each observed acreage at a given point in a facility's operating life as independent. Therefore, facilities for which more than one data point was collected are not over-represented in the average.

A limitation to the average growth rate approach is that the linear model it creates does not capture that many facilities had completed the expansion of a feature before the end of their operations. By the same token, anecdotal evidence from the few sites with more than two data points suggested that facilities experience a rapid acreage expansion in the first years of facility life, followed by a decreased growth rate during the remaining facility life. Ultimately, EPA lacked sufficient data to generate a nonlinear model.

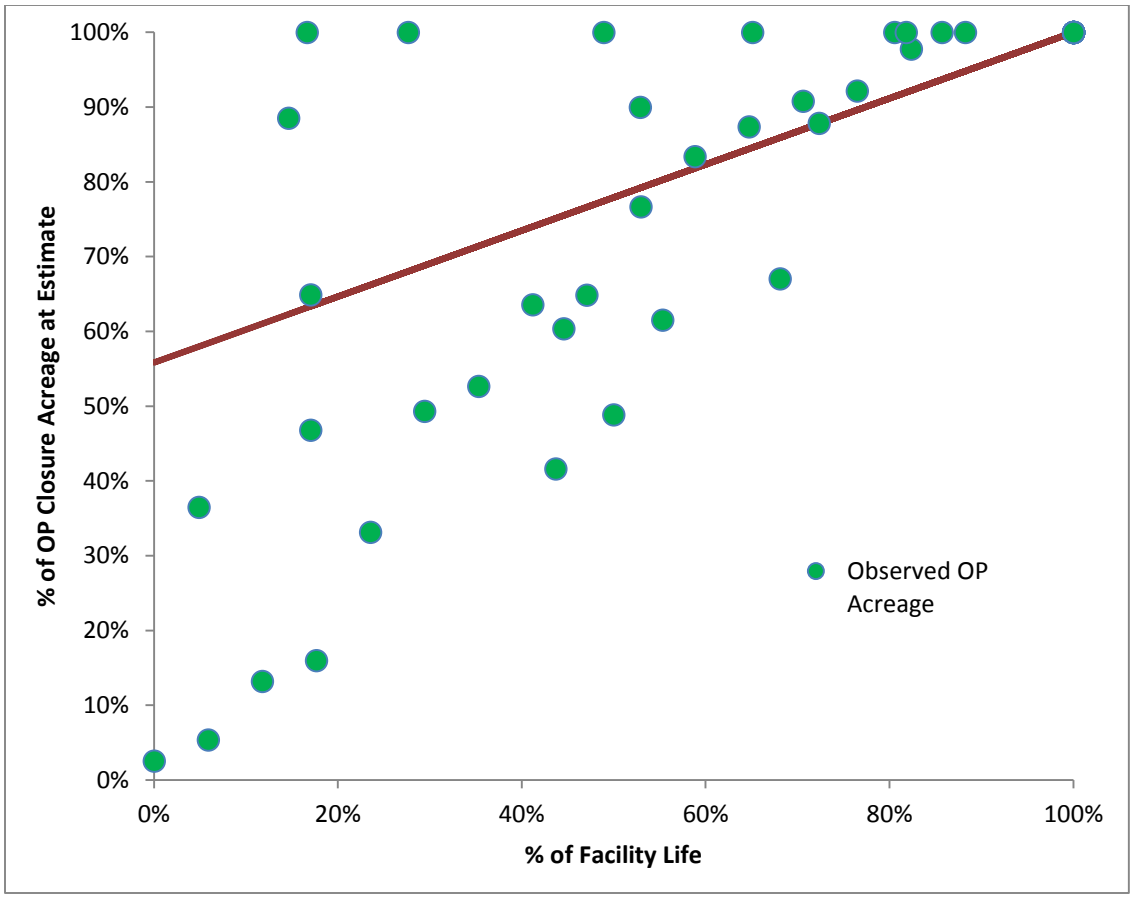
The scatter plots and formulas that resulted from EPA's analysis, and that EPA applied to the financial responsibility estimates, are reported below in Exhibits C-1 through C-4.

acreages. Therefore, scaling the acreages for relevant features will also scale the acreage used in the drainage and O&M formulas.

Exhibit C-1. Open Pit Scaling

$$A_{Est} = \left(\frac{Est - Op}{Cl - Op}\right) \times 0.4419 + 0.5702$$

Where:
A_{Est} = Acreage at a given estimate year
Est = Estimate year
Op = Year facility opened
Cl = Year facility expects to close

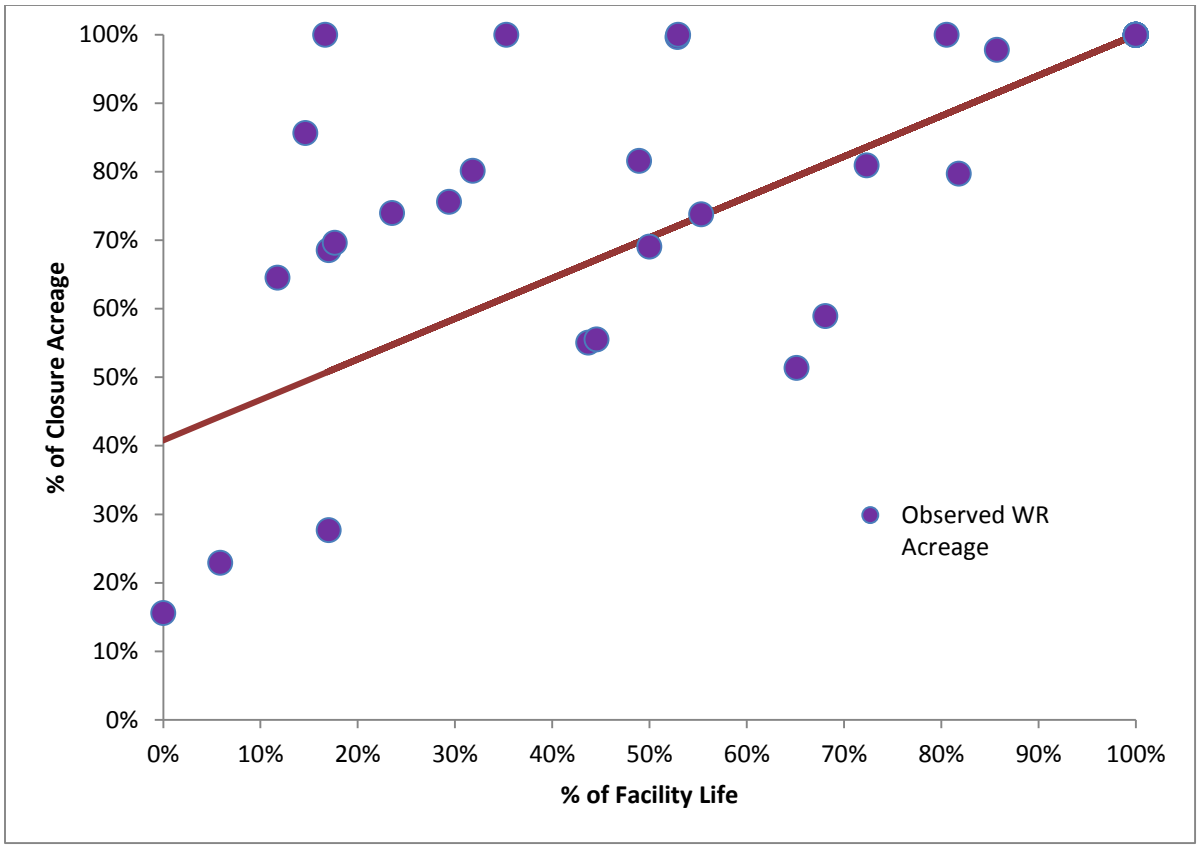


Sample Size = 52

Exhibit C-2. Waste Rock Scaling

$$A_{Est} = \left(\frac{Est - Op}{Cl - Op}\right) \times 0.5921 + 0.4222$$

Where:
A_{Est} = Acreage at a given estimate year
Est = Estimate year
Op = Year facility opened
Cl = Year facility expects to close

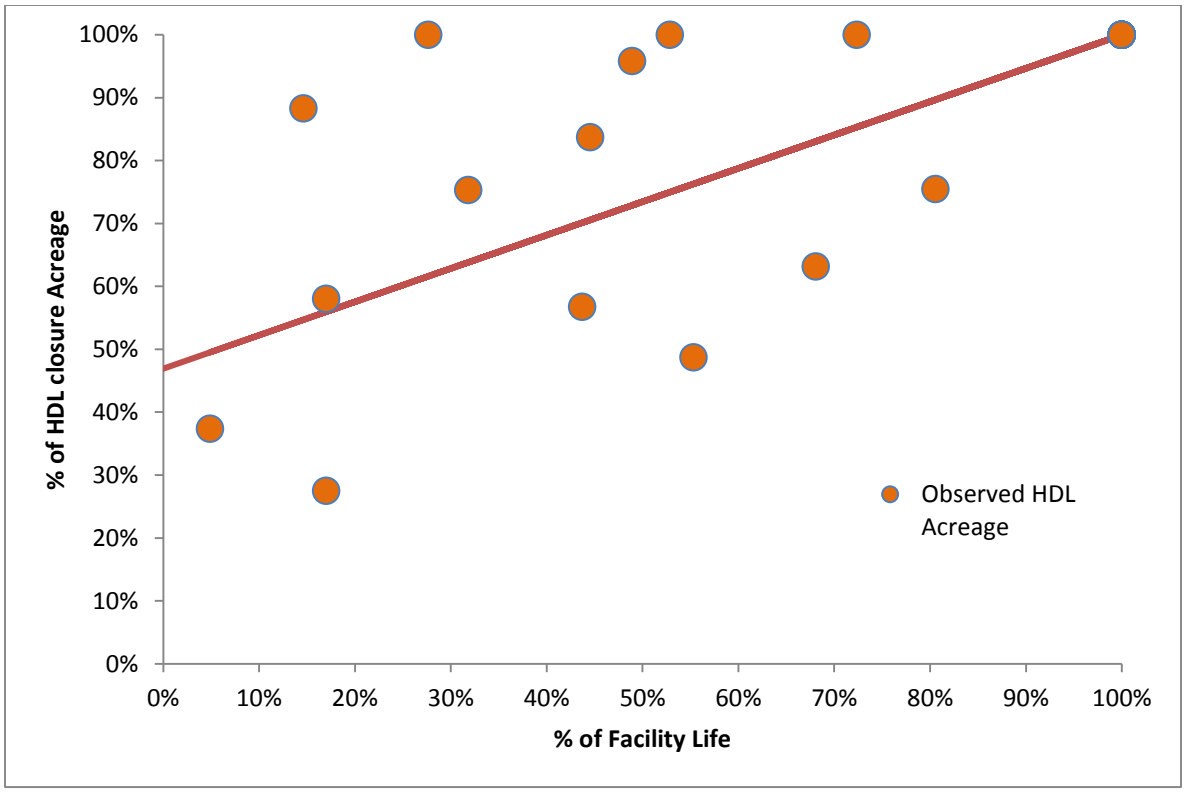


Sample Size = 44

Exhibit C-3. Heap/Dump Leach Scaling

$$A_{Est} = \left(\frac{Est - Op}{Cl - Op}\right) \times 0.5307 + 0.4713$$

Where:
A_{Est} = Acreage at a given estimate year
Est = Estimate year
Op = Year facility opened
Cl = Year facility expects to close

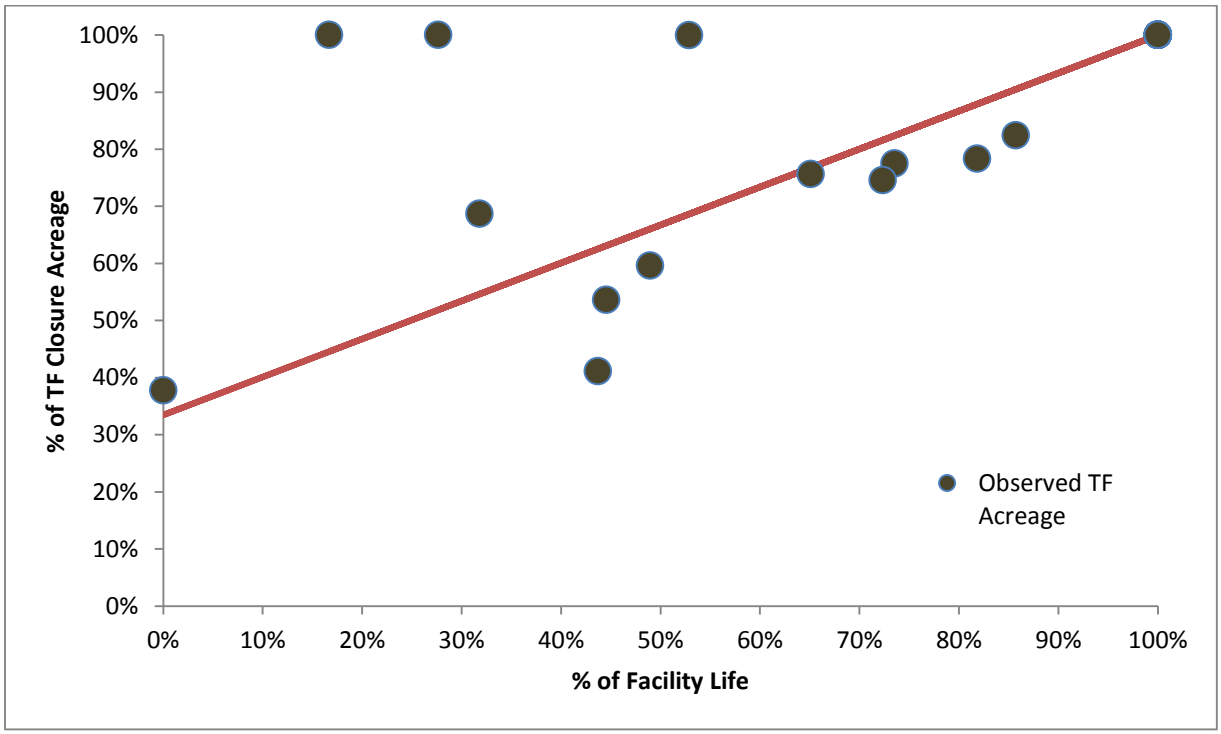


Sample Size = 27

Exhibit C-4. Tailings Facility Scaling

$$A_{Est} = \left(\frac{Est - Op}{Cl - Op}\right) \times 0.6652 + 0.3348$$

Where:
A_{Est} = Acreage at a given estimate year
Est = Estimate year
Op = Year facility opened
Cl = Year facility expects to close



Sample Size = 26

Appendix D. Parameters and Methods that Inform the Annualized Price of Financial Assurance

This appendix details the data requirements, methods, and other parameters of the pricing simulation for each third party instrument included in the simulation. It then provides information concerning the generic financial metrics that are relevant to the calculations, including inflation rates, costs of capital for the mining and insurance sectors, and default probabilities. The methods utilize generally accepted finance theory to capture the effects of differential cash flows and rates of return. The pricing methods are based on standard industry practice for underwriting these instruments, and are consistent with prior analyses assessing the economic effects of financial responsibility regulatory initiatives.[136]

D.1 Letter of Credit

Overview

A Letter of Credit ("LOC") is a document issued by a financial institution (*e.g.*, a bank) that guarantees the payment of a customer's obligations up to a stated amount for a specified period of time. For purposes of CERCLA 108(b) financial responsibility, the owner/operator arranges with a financial institution to issue an LOC. The LOC provides assurance to the regulator that the company will pay for its covered environmental obligations when necessary. Essentially, an LOC substitutes the bank's credit for the company's. In general, a financially healthy company will pay less to post an LOC of equal value than a company facing possible financial distress. If the regulator determines that the company has failed to perform its obligations as required and needs to draw on the LOC to pay for these costs, the regulator can direct the bank to deposit cash into a standby trust fund. The regulator directs payment of the requisite monies from the standby trust to pay for required activities. The company is legally obligated to repay the bank the principal amounts drawn on the LOC plus interest.

Method

The annualized net cash flow associated with a letter of credit reflects the following three components: (1) a one-time, upfront cash outflow for collateral; (2) annual cash outflows for commission fees; and (3) annual cash inflows for interest earned on the collateral account. The face value of the letter of credit is equal to the sum of the annual stream of costs. The collateral requirement is a subjective determination based on the financial credit risk of the owner/operator. Similarly, the annual commission fee reflects the financial credit risk of the owner/operator. In general, all else being equal, the higher the financial credit risk of the owner/operator, the higher the upfront collateral requirement and the higher the annual fee. For purposes of illustration, EPA modeled interest earned on the collateral account according to historical returns data for money market accounts. Supporting calculations are as follows:

[136] See, for example: "Preliminary Regulatory Impact Analysis of the Financial Assurance and Liability Insurance Regulations, Under the Resource Conservation and Recovery Act of 1976," U.S. Environmental Protection Agency, 11 September 1981; and, "Estimating Costs for the Economic Benefits of RCRA Noncompliance," U.S. Environmental Protection Agency, December 1997 Update.

[1] $Collateral_t$ = Collateral Requirement % * Face Value of Instrument in Current Year Dollars, if t = 1.

[2] $Collateral_t$ = Collateral Requirement % * Face Value of Instrument in Current Year Dollars * Estimated Nominal Return on Collateral Account if t > 1.

[3] Fee_t = Face Value of Instrument in Current Year Dollars * Annual Fee % Required to Maintain Letter of Credit for all t.

The owner/operator's total acquisition cost of an LOC is modeled as the sum of two components: 1) the acquisition cost of the fees paid over the life of the instrument, compounded at the owner/operator's WACC; and 2) the net acquisition cost of collateral, calculated as the difference between the cost to the owner/operator of acquiring the collateral amount internally or from capital markets (*i.e.*, the amount compounded at the owner/operator's WACC) and what the owner/operator *actually* earned on the collateral account.

Supporting Inputs

As noted in the equations above, the Letter of Credit calculations are dependent on key inputs. The collateral rate and the administrative fee are calculated by using the following algorithms, which vary with a company's probability of default (stylized here as p(default)):

Collateral Rate = 0.2+ 1.67*p(default). The collateral rate is a percentage of face value and capped at 100 percent.

Administrative Fee= 0.014 * p(default) + 0.006. The administrative fee is a percentage of face value, and ranges from 0.6 percent to 2.0 percent in accordance with this formula.

The return on the collateral account for LOC is given by Exhibit D-1. The treasury security used is matched to the length of time until the FR release date. So if the LOC is expected to come due in eleven years, 10-Year treasuries are used as the return on the collateral account.

Exhibit D-1.
Median and Average Nominal Risk-Free Returns, by Duration and Period
Financial Instrument: Letter of Credit

Security/Portfolio	Time Horizon	Period	Median
5-Year Treasuries	5 years	2011-2016	1.44%
10-Year Treasuries	5 years	2011-2016	2.23%
20-Year Treasuries	5 years	2011-2016	2.80%
30-Year Treasuries	5 years	2011-2016	3.13%

Source: Yields on various treasuries and bonds available from the Federal Reserve Board of Governors, Economic Research & Data, H.15: Selected Interest Rates, http://www.federalreserve.gov/Releases/h15/data.htm.

Data reflect the series-specific start date through March 2016. Time Horizon is equivalent to the duration, in years, of the historical period over which data were used to calculate summary statistics for the respective securities. The duration of the treasury security used were selected to align to the expected future time periods of various project phases associated with the facility for which the LOC is being estimated.

D.2 Trust Fund

Overview

A trust fund is an agreement between three parties. One party (the grantor) transfers assets to a trust that a second party (the trustee) holds and administers for the benefit of a third party (the beneficiary). For purposes of financial assurance, the owner/operator ("the company") is the grantor. It transfers funds to a financial institution, which acts as trustee. The regulator is the beneficiary. The funds are held in trust for the purpose of paying expenses related to stated environmental obligations – in this case, the FR amounts. Depending on the situation, the regulator may allow the company to deposit funds in phases. The schedule and size of payments depend on: 1) the value of the trust fund at the time; 2) the current cost estimates subject to financial responsibility; and 3) the period of time over which payments are to be made. A trust fund may be used in combination with other financial responsibility mechanisms. If the company does not perform its stated obligations, the regulator may direct the trustee to release funds to another party that is authorized to conduct the activity.

Method

The annualized net cash flow associated with a trust fund or an escrow account reflects two components: (1) the upfront cash outflow to fund the trust or escrow account, with a pay-in period of one or multiple years, and (2) periodic investments (as necessary) to true-up the value of the trust or escrow account if it does not generate sufficient interest to remain solvent over the life of the project. The initial estimated cash outflows impute the timing and amounts of costs, as well as the expected annual return on the trust or escrow account. For illustrative purposes, the initial trust or escrow account investment is equal to the present value of the stream of future costs, wherein the discount rate reflects the expected return on the trust or escrow account adjusted for inflation (if applicable), fees, and taxes. The subjective credit risk of the owner/operator informs the pay-in period over which the trust or escrow account is funded. All else being equal, owner/operators with poor financial credit risk tend to be subject to shorter pay-in periods when compared to their less financially risky counterparts.

Interest earned on the trust or escrow account reflects the expected return on the portfolio of securities in which fund assets are invested. EPA assumes that the owner/operator is reimbursed for costs in the year in which the costs are incurred, and set this year to the FR release date. In other words, the calculation assumes that the trust funding, plus returns on these funds up to the end of facility life, equal the FR amount as of that time.[137] Supporting calculations are as follows:

[1] Present Value of Cost Stream = Annual $Cost_t/(1+\text{Fee Adjusted Real Return})^{\wedge t}$ + Annual $Cost_{t+1}/(1+\text{Fee Adjusted Real Return})^{\wedge t+1}$ +…+ Annual $Cost_{t+n}/(1+\text{Fee Adjusted Real Return})^{\wedge t+n}$ for all t

[2] Annual Investment in $Trust_t = \frac{\text{Financial Responsibility Amount} * \text{Return on Trust}}{(1+\text{Return on Trust})^{\text{Number of Years to Pay-In}-1}}$ if t ≤number of years in pay-in period, 0 otherwise.

[3] $Interest_t$ =[Beginning Year Trust $Balance_t$ + Annual Investment in $Trust_t$]*Rate of Return for all t

[137] In practice, to the extent interest earned on the trust account after adjustments for inflation does not exceed the taxes, fees, and reimbursement costs in a given year, the owner/operator will be subject to a cash outflow to true-up the value of its financial responsibility instrument.

[4] $Fees_t$ = [Beginning Year Trust $Balance_t$ + Annual Investment in $Trust_t$ + $Interest_t$] * Annual Administrative Fee % for all t.

[5] Ending $Balance_t$ = Beginning $Balance_t$ + Annual Investment in $Trust_t$ + $Interest_t$ for all t

[6] Beginning $Balance_{t+1}$ = Ending $Balance_t$ for all t

The total acquisition cost of a trust fund/escrow account is modeled as the sum of two components: 1) the acquisition cost of the administrative fees paid over the life of the instrument, compounded at the owner/operator's WACC; and 2) the acquisition cost of the amount invested in the trust, calculated as the difference between what the cost of obtaining funds for the owner/operator, which accrues either through using available funds or procuring capital from debt or equity markets (*i.e.*, both instances are modeled at the owner/operator's WACC) and what the owner/operator *actually* earned on the amount invested in the trust.

Supporting Inputs

Exhibits D-2 and D-3 summarize the key additional inputs for the Trust Fund calculations. Exhibit D-2 shows the pay-in periods used for owners according to their risk characterization. The return on the trust fund is estimated using the median return of a diversified group of securities, which are listed in Exhibit D-3**.** Since this group of securities is relatively diversified, the management fee charged to the trust is estimated using the median management fee on hybrid funds from 2000-2014, which is 0.81%. [138]

Exhibit D-2.
Trust Fund or Escrow Account Pay-In Period
Financial Instruments: Trust Fund and Escrow Account

Risk Characterization of Owner/Operator	Period
Low Risk	4-Year
Medium Risk	3-Year
High Risk	1-Year
Note: Proposed rule contemplates a 4-year pay-in period.	

[138] Source: Investment Company Institute, 2015 Investment Company Factbook, Chapter 5, Mutual Fund Expenses and Fees http://www.icifactbook.org/fb_ch5.html.

Exhibit D-3.
Median and Average Nominal Security Return by Period
Financial Instrument: Trust Fund

Security	Time Horizon	Period	Median	Mean
Municipal Bonds	All available data	1953-2016	5.1%	5.4%
1-Year Treasuries	All available data	1962-2016	5.9%	6.1%
5-Year Treasuries	All available data	1962-2016	6.1%	6.4%
10-Year Treasuries	All available data	1977-2016	7.0%	7.2%
30-Year Treasuries	All available data	1966-2016	5.5%	5.5%
Aaa Corp. Bonds	All available data	1962-2016	7.2%	7.4%
Baa Corp. Bonds	All available data	1962-2016	8.1%	8.4%
Equities (S&P 500)	All available data	1951-2013	9.4%	8.5%
Median of all Security Returns	**All available data**		**6.55%**	

Source: Yields on various treasuries and bonds available from the Federal Reserve Board of Governors, Economic Research & Data, H.15: Selected Interest Rates, http://www.federalreserve.gov/Releases/h15/data.htm. Historical prices for the S&P 500 index were obtained from Yahoo! Finance for all available dates (start date = January 3, 1950), http://finance.yahoo.com/q/hp?s=^GSPC+Historical+Prices. Data reflect the series-specific start date through February 2013. Time Horizon is equivalent to the duration, in years, of the historical period over which data were used to calculate summary statistics for the respective securities.

D.3 Insurance

Overview

An insurance policy is a contract between two parties. One party (the insurer) agrees to pay, on behalf of the second party (the policyholder) for claims made against the policyholder or the policy up to a pre-established limit of liability. For purposes of financial assurance, the owner/operator ("the company") is the policyholder.

Through a policy, the insurer agrees to reimburse the company (or another party) upon direction from the regulator, for costs incurred that are explicitly covered (not excluded) by the policy. In general, there are two types of insurance policies. The first type, risk transfer, assumes the transfer of a future expected loss (or liability) from the company to the insurer. In exchange, the insurer receives a premium payment from the company over the life of the policy. Often, general liability (*e.g.*, automobile) insurance is issued on a risk-transfer basis, because a loss under the policy has a relatively low probability of occurring.

The second type, fully-funded, assumes the transfer of a future expected liability from the company to the insurer only for a specific or 'finite' amount. Essentially, the company pays the insurer an up-front premium equal to the net present value of the expected amount of the environmental liability. Depending on the situation, the insurer may allow the company to pay in phases. For purposes of this simulation, the insurance policy provides a company insurance against bankruptcy, so if a company goes bankrupt before the facility closes, the insurance company will be responsible for paying the CERCLA costs. The model also includes cost reimbursement, meaning if a company is still operating at time of facility end of life, the company will be responsible for paying the CERCLA costs and can ask for reimbursement from the insurance company up to the amount of total premiums paid in.

EPA models this second type of insurance product in the pricing simulation. Risk transfer policies are no longer widely used for environmental liabilities. Many insurers underwriting environmental obligations do so using only finite (or fully-funded) policies. These policies tend to more closely resemble trust funds than conventional general liability insurance policies, limiting the liability (or risk exposure) of the insurer.

Method

The face value of an insurance policy (*i.e.*, the policy's limit of liability) is equal to the estimate of financial responsibility derived from engineering costs. The insurer must receive premium payments in an amount sufficient to ensure that, assuming the insurer reinvests the funds in its own operations at its WACC (as a proxy for the insurer's internal hurdle rate), sufficient funds are available to cover the complete sum of obligations at the time of facility end of life. In other words, the insurer will require premium payments such that, when the payment streams are compounded at the insurer's WACC, the total accumulated dollars equal the face value of the policy in the year of closure.

The insurer assesses the relative risk of the owner/operator in order to determine the period over which the premium must be paid. Lower-risk owner/operators (as measured by the owner/operator's probability of default) may have the option of paying annual premiums over the life of the policy, while riskier entities may need to pay the entirety of the premium amount over one or several years in the beginning of the policy's life. All else equal, owner/operators with questionable financial health tend to be subject to higher premium payments over shorter time horizons, *i.e.*, pay-in periods. Supporting calculations are as follows:

[1] Present Value of Cost Stream = Total $Cost_c$ /(1+Insurer WACC)$^{\wedge c-p}$ where c is the facility end of life year and p is the last year of the pay-in period

[2] $$\text{Premium Payment}_t = \frac{\text{Financial Responsibility Amount} * \text{Insurer WACC}}{(1+\text{Insurer WACC})^{\text{Number of Years to Pay-In}-1}}$$

The acquisition cost of insurance to owner/operators consists of the premium payments made by the owner/operator, compounded at the owner/operator's WACC. The cost equation assumes that the insurance policies in question feature cost reimbursement up to the total amount of premium paid by the company, such that the owner/operator is reimbursed fully for the premium payments made. Therefore, the total acquisition cost of insurance is the foregone value of the premium payments, compounded at the owner/operator's WACC, *less* the premiums actually paid to the insurer.

Supporting Inputs

The insurer's cost of capital is estimated using the median WACC for SIC Code 63, Insurance Carriers, from the Ibbotson Cost of Capital Yearbook 2013, which is 8.85 percent.

Exhibit D-4 shows the pay-in periods used for owners according to their risk characterization.

Exhibit D-4. Assumptions for Insurance Pay-In Period *Financial Instrument: Insurance*	
Risk Characterization of Owner/Operator	**Period**
Low Risk	Annual (Remaining Life of Project)
Med-High Risk	5-Year
High Risk	3-Year
Source: Options for period lengths reflect discussions with insurance representatives. All else equal, the high financial risk owner/operators tend to be subject to shorter pay-in periods than their low risk counterparts.	

D.4 Other Relevant Parameters

Inflation

Measures of inflation are relevant to adjusting the engineering cost estimate to a face value of the FR instrument as of the facility end of life. Engineering costs are inflated forward using median year of year change of the GDP Implicit Price Deflator from 1966-2016, which is 2.86 percent.[139]

Derivation of Default Probabilities

For rated companies, EPA determines the probability of default through S&P Annual Global Corporate Default and Rating Transitions Studies. These studies provide, for each rating, the probability that a company holding that rating will default within a given time horizon. Specifically, EPA uses the three-year probability of default for each rating to determine the relevant probability of default.[140,141] The range of the probabilities of default associated with various bond ratings is provided in Exhibit D-5.

To estimate the baseline industry failure rate, EPA used the firm exit rate derived from the Census' Business Dynamic Statistics (BDS), which is 7.45 percent for the latest three years in the dataset. Under Option 2, the facilities at risk of default are facilities with parent companies that pass the financial test and choose to self-insure. As a result, EPA estimated the industry

[139] Source: US. Bureau of Economic Analysis, Gross Domestic Product: Implicit Price Deflator [GDPDEF], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/GDPDEF

[140] Standard & Poor's Ratings Services, *2014 Annual Global Corporate Default Study And Rating Transitions*, April 30, 2015, available online at: https://www.nact.org/resources/2014_SP_Global_Corporate_Default_Study.pdf.

[141] One company in the modeled universe is unrated. For this firm, EPA calculates the probability of default as follows: first, EPA applies the Altman Z-score formula to the company's financials to derive its Altman Z-score. Each credit rating corresponds to a range of Altman Z-scores; therefore, EPA uses the calculated Altman Z-score for unrated company to determine the appropriate corresponding credit rating. Then, EPA uses the appropriate three-year probability of default for that credit rating as the company's probability of default. Altman, Edward I. "An emerging market credit scoring system for corporate bonds," *Emerging Markets Review*, Vol. 6, 2005, p. 313. See p. 314 for the calibration of Altman Z-scores with S&P credit ratings.

default rate under Option 2 by averaging the default rates associated with the parent companies for each facility that fully or partially passed the financial test.

Weighted Average Cost of Capital (WACC)

The weighted average cost of capital (WACC) was calculated with the following formula[142] that uses the debt to equity ratio to weight the cost of equity and the cost of debt to calculate the firm's overall cost of capital:

$$\mathrm{WACC} = \mathrm{k_e} * \frac{\mathrm{E}}{(\mathrm{D}+\mathrm{E})} + \mathrm{k_d} * [1-\mathrm{t}] * \frac{\mathrm{D}}{(\mathrm{D}+\mathrm{E})}$$

where k_e is the cost of equity as determined by the Capital Asset Pricing Model (CAPM), k_d is the cost of debt as determined by the interest expense, E is total equity, D is total debt, and t is the company's tax rate. For the mining industry overall, the median WACC was 9.4 percent, with equity making up 69.2 percent of total capital.[143] Exhibit D-5 shows the ranges of WACCs associated with the modeled companies.

Exhibit D-5.
Summary of Pricing Parameters

Pricing Category	Bond Ratings	Probabilities of Default	WACC
1	BBB+ To BBB-	0.6% To 1.6%	3.4% To 13.1%
2	BB+ To BB-	2.2% To 5.8%	5.4% To 12.4%
3	B+ To B-	9.8% To 19.6%	4.6% To 14.2%
4	CCC+ To CCC	Over 40%	9.5% To 11.4%

[142] The WACC for many of the modeled companies was calculated using the formula provided by the financial website gurufocus.com. When the company was not covered by gurufocus.com, it was calculated using publically available financial data using the same formula.

[143] Duff & Phelps, *2016 Valuation Handbook Industry Cost of Capital,* March 2016, data for SIC 1.

Appendix E. Results Using the 3 Percent Social Discount Rate

This appendix presents the analytic results from Chapter 5 using a 3 percent social discount rate. While Chapter 5 only presents results using median FR amounts to extrapolate from the modeled universe to the regulated universe and company-based average pricing assumptions, this appendix presents results using both median and average FR amounts for extrapolation and company- and facility-based average pricing assumptions.

Exhibit E-1.
Summary Results for Modeled Universe

Baseline		Option 1: No Financial Test		Option 2: Proposed Financial Test	
CERCLA FR Amount ($2015 Millions)	**Ann. Cost of Third-Party FR Instruments ($ Millions)**	**CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments ($ Millions)**	**CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)**	**Ann. Cost of Third-Party FR Instruments ($ Millions)**
$4,410	N/A	$4,410	$88	$3,086	$62

Note:
Annualized costs represent the incremental cost of acquiring funds for compliance faced by the modeled universe amortized over the time period until FR release at each facility. The annualized cost of third-party FR instruments reflects the cost in the first year following rule implementation. The annual cost may decline in future years if the number of new facilities opening is less than the number of existing facilities that close.

Exhibit E-2.
Self-Insurance Amounts and Third-Party Instrument Utilization (Option 2: Proposed Financial Test)

FR Category	FR Option	CERCLA FR Amount ($2015 Millions)	CERCLA FR Amount Self-Insured ($2015 Millions)	CERCLA FR Amount Insured through Third-Party Financial Instruments ($2015 Millions)
Third-Party Financial Instrument	Trust	$1,350	$0	$1,350
	Insurance	$129	$0	$129
	Letter of Credit	$304	$0	$304
Self-Insurance/Hybrid	Self-Insure	$19	$19	$0
	Hybrid/Trust	$1,873	$937	$937
	Hybrid/Insurance	$736	$368	$368
	Hybrid/Letter of Credit	$0	$0	$0
	Total	**$4,410**	**$1,323**	**$3,086**

Note:
This table only presents results for Option 2, as Option 1 requires that all CERCLA FR amounts are insured through third-party instruments. Consequently, the "CERCLA FR Amount ($2015 Millions)" column also represents the total FR amount insured through third-party instruments under Option 1.

Exhibit E-3.
Instrument Pricing Outcomes by Facility and Company Category

Pricing Category	Facilities		Companies	
	Average Ann. Cost as Percentage of FR Amount	**Percent of Facilities in Category**	**Average Ann. Cost as Percentage of FR Amount**	**Percent of Facilities in Category**
BBB	1.8% to 2.0%	44.7%	1.4% to 2.2%	26.3%
BB	2.0%	28.9%	2.8%	26.3%
B	3.2%	21.1%	3.6%	36.8%
CCC	4.5%	5.3%	4.5%	10.5%

Note:
Pricing categories based on credit ratings and other financial metrics. Ranges of costs are presented for Option 2 (low) and Option 1 (high).

Exhibit E-4.
Median-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Median ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Median-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$1	$8	$5	$0	$0
In-situ recovery	8	3	$1	$10	$7	$0	$0
Processor/Refiner	33	1	$76	$2,496	$1,747	$78	$51
Surface Mine	62	25	$48	$2,961	$2,073	$93	$61
Surface Mine/Processing	27	13	$28	$766	$536	$24	$16
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$28	$57	$40	$2	$1
Surface/Underground mine	1	(none; assume equal to surface mine)	$48	$48	$33	$1	$1
Underground Mine	53	5	$5	$284	$199	$9	$6
Underground Mine/Processing	6	2	$29	$172	$120	$5	$4
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$8	$5
ALL FACILITIES	221	49	$37	$7,064	$4,944	$222	$145

Exhibit E-5.
Median-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe (Facility Avg. Pricing)

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Median ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Median-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 (Facility Avg. Pricing) ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 (Facility Avg. Pricing) ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$1	$8	$5	$0	$0
In-situ recovery	8	3	$1	$10	$7	$0	$0
Processor/Refiner	33	1	$76	$2,496	$1,747	$60	$40
Surface Mine	62	25	$48	$2,961	$2,073	$71	$48
Surface Mine/Processing	27	13	$28	$766	$536	$18	$12
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$28	$57	$40	$1	$1
Surface/Underground mine	1	(none; assume equal to surface mine)	$48	$48	$33	$1	$1
Underground Mine	53	5	$5	$284	$199	$7	$5
Underground Mine/Processing	6	2	$29	$172	$120	$4	$3
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$6	$4
ALL FACILITIES	221	49	$37	$7,064	$4,944	$170	$114

Exhibit E-6.
Average-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Average ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Average-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 (Company Avg. Pricing) ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 (Company Avg. Pricing) ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$60	$359	$251	$11	$7
In-situ recovery	8	3	$60	$479	$335	$15	$10
Processor/Refiner	33	1	$76	$2,496	$1,747	$78	$51
Surface Mine	62	25	$135	$8,399	$5,878	$263	$173
Surface Mine/Processing	27	13	$106	$2,864	$2,005	$90	$59
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$106	$212	$148	$7	$4
Surface/Underground mine	1	(none; assume equal to surface mine)	$135	$135	$95	$4	$3
Underground Mine	53	5	$7	$379	$265	$12	$8
Underground Mine/Processing	6	2	$29	$172	$120	$5	$4
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$8	$5
ALL FACILITIES	221	49	$104	$15,758	$11,029	$494	$324

Exhibit E-7.
Average-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe (Facility Avg. Pricing)

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Average ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Average-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 (Facility Avg. Pricing) ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 (Facility Avg. Pricing) ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$60	$359	$251	$9	$6
In-situ recovery	8	3	$60	$479	$335	$12	$8
Processor/Refiner	33	1	$76	$2,496	$1,747	$60	$40
Surface Mine	62	25	$135	$8,399	$5,878	$202	$135
Surface Mine/Processing	27	13	$106	$2,864	$2,005	$69	$46
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$106	$212	$148	$5	$3
Surface/Underground mine	1	(none; assume equal to surface mine)	$135	$135	$95	$3	$2
Underground Mine	53	5	$7	$379	$265	$9	$6
Underground Mine/Processing	6	2	$29	$172	$120	$4	$3
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$6	$4
ALL FACILITIES	221	49	$104	$15,758	$11,029	$379	$254

Exhibit E-8.
Summary of Industry Costs for Potentially Regulated Universe

Distribution of Bond Ratings and Pricing	Scaling Method	Baseline		Option 1: No Financial Test		Option 2: Proposed Financial Test	
		CERCLA FR Amount ($2015 Millions)	Ann. Cost of Third-Party FR Instruments	CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)
Distributed by Facility Averages	Scaled by Average FR Amount	$15,758	N/A	$15,758	$379	$11,029	$254
	Scaled by Median FR Amount	$7,064	N/A	$7,064	$170	$4,944	$114
Distributed by Company Averages	Scaled by Average FR Amount	$15,758	N/A	$15,758	$494	$11,029	$324
	Scaled by Median FR Amount	$7,064	N/A	$7,064	$222	$4,944	$145

Note:
Annualized costs represent the incremental cost of acquiring funds for compliance faced by the universe, amortized over the applicable FR period for each facility. The annualized cost of third-party FR instruments reflects the cost in the first year following rule implementation. The annual cost may decline in future years if the number of facilities in operation declines.

Exhibit E-9.
Summary of Social Costs and Intra-Industry Transfers

Cost Category	Scaling Method	Option 1: No Financial Test			Option 2: Proposed Financial Test		
		Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)
Distributed by Facility Averages	Scaled by Average FR Amount	$379	$287	$92	$254	$188	$66
	Scaled by Median FR Amount	$170	$129	$41	$114	$84	$30
Distributed by Company Averages	Scaled by Average FR Amount	$494	$375	$120	$324	$240	$84
	Scaled by Median FR Amount	$222	$168	$54	$145	$107	$38
Percent of Ann. Cost of Third Party Instrument		N/A	76%	24%	N/A	74%	26%

Exhibit E-10. Annualized Administrative Costs	
Option 1 (No Test)	**Option 2 (Financial Test)**
$259,425	$289,155

Appendix F. Results Using Average FR-Based Extrapolation and Facility-Based Pricing

This appendix presents the analytic results under the full suite of conditions: using both average and median FR amounts to extrapolate from the modeled universe to the regulated universe using a 7 percent social discount rate; and using both company-based and facility-based average pricing assumptions. Chapter 5 presents the analytic results only using median FR amounts to extrapolate, and using company-based pricing assumptions.

Exhibit F-1.
Instrument Pricing Outcomes by Company Category

	Facilities		Companies	
Company Category	**Average Ann. Cost as Percentage of Third-Party Instruments**	**Percent of Facilities in Category**	**Average Ann. Cost as Percentage of Third-Party Instruments**	**Percent of Companies in Category**
BBB	1.4% to 1.6%	44.7%	1.1% to 1.7%	26.3%
BB	1.7%	28.9%	2.5%	26.3%
B	2.1%	21.1%	2.4%	36.8%
CCC	4.0%	5.3%	4.0%	10.5%

Note:
Pricing categories based on credit ratings and other financial metrics. Ranges of costs are presented for Option 2 (low) and Option 1 (high).

Exhibit F-2.
Median-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Median ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Median-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 (Company Avg. Pricing) ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 (Company Avg. Pricing) ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$1	$8	$5	$0	$0
In-situ recovery	8	3	$1	$10	$7	$0	$0
Processor/Refiner	33	1	$76	$2,496	$1,747	$60	$39
Surface Mine	62	25	$48	$2,961	$2,073	$72	$47
Surface Mine/Processing	27	13	$28	$766	$536	$18	$12
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$28	$57	$40	$1	$1
Surface/Underground mine	1	(none; assume equal to surface mine)	$48	$48	$33	$1	$1
Underground Mine	53	5	$5	$284	$199	$7	$4
Underground Mine/Processing	6	2	$29	$172	$120	$4	$3
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$6	$4
ALL FACILITIES	221	49	$37	$7,064	$4,944	$171	$111

Exhibit F-3.
Median-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Median ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Median-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 (Facility Avg. Pricing) ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 (Facility Avg. Pricing) ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$1	$8	$5	$0	$0
In-situ recovery	8	3	$1	$10	$7	$0	$0
Processor/Refiner	33	1	$76	$2,496	$1,747	$46	$31
Surface Mine	62	25	$48	$2,961	$2,073	$55	$37
Surface Mine/Processing	27	13	$28	$766	$536	$14	$9
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$28	$57	$40	$1	$1
Surface/Underground mine	1	(none; assume equal to surface mine)	$48	$48	$33	$1	$1
Underground Mine	53	5	$5	$284	$199	$5	$4
Underground Mine/Processing	6	2	$29	$172	$120	$3	$2
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$5	$3
ALL FACILITIES	221	49	$37	$7,064	$4,944	$131	$88

Exhibit F-4.
Average-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Average ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Average-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 (Company Avg. Pricing) ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 (Company Avg. Pricing) ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$60	$359	$251	$9	$6
In-situ recovery	8	3	$60	$479	$335	$12	$8
Processor/Refiner	33	1	$76	$2,496	$1,747	$60	$39
Surface Mine	62	25	$135	$8,399	$5,878	$203	$132
Surface Mine/Processing	27	13	$106	$2,864	$2,005	$69	$45
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$106	$212	$148	$5	$3
Surface/Underground mine	1	(none; assume equal to surface mine)	$135	$135	$95	$3	$2
Underground Mine	53	5	$7	$379	$265	$9	$6
Underground Mine/Processing	6	2	$29	$172	$120	$4	$3
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$6	$4
ALL FACILITIES	221	49	$104	$15,758	$11,029	$381	$248

Exhibit F-5.
Average-Based Extrapolation from the Modeled Universe to the Potentially Regulated Universe

Facility Type	Potentially Regulated Universe (n=221)	Modeled Universe (n=49)	Modeled Universe Facility FR - Average ($2015 Millions)	Potentially Regulated Universe Total FR Amount Across Facilities, Average-Based Extrapolation ($2015 Millions)	Third-Party FR Instruments – Option 2 ($2015 Millions)	Ann. Cost of Third-Party FR Instruments - Option 1 (Facility Avg. Pricing) ($ Millions)	Ann. Cost of Third-Party FR Instruments - Option 2 (Facility Avg. Pricing) ($ Millions)
Brine Extraction/Processing	6	(none; assume equal to ISR)	$60	$359	$251	$7	$4
In-situ recovery	8	3	$60	$479	$335	$9	$6
Processor/Refiner	33	1	$76	$2,496	$1,747	$46	$31
Surface Mine	62	25	$135	$8,399	$5,878	$156	$104
Surface Mine/Processing	27	13	$106	$2,864	$2,005	$53	$35
Surface Mine/Processing/Primary Smelter	2	(none; assume equal to surface mine/processing)	$106	$212	$148	$4	$3
Surface/Underground mine	1	(none; assume equal to surface mine)	$135	$135	$95	$3	$2
Underground Mine	53	5	$7	$379	$265	$7	$5
Underground Mine/Processing	6	2	$29	$172	$120	$3	$2
Primary Smelter	23	(none; approximated separately)	$11	$263	$184	$5	$3
ALL FACILITIES	221	49	$104	$15,758	$11,029	$292	$195

Exhibit F-6.
Summary of Industry Costs for Potentially Regulated Universe

Distribution of Bond Ratings and Pricing	Scaling Method	Baseline		Option 1: No Financial Test		Option 2: Proposed Financial Test	
		CERCLA FR Amount ($2015 Millions)	Ann. Cost of Third-Party FR Instruments	CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	CERCLA FR Amount Insured through Third-Party Instruments ($2015 Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)
Distributed by Facility Averages	Scaled by Average FR Amount	$15,758	N/A	$15,758	$292	$11,029	$195
	Scaled by Median FR Amount	$7,064	N/A	$7,064	$131	$4,944	$88
Distributed by Company Averages	Scaled by Average FR Amount	$15,758	N/A	$15,758	$381	$11,029	$248
	Scaled by Median FR Amount	$7,064	N/A	$7,064	$171	$4,944	$111

Note:
Annualized costs represent the incremental cost of acquiring funds for compliance faced by the universe, amortized over the applicable FR period for each facility. The annualized cost of third-party FR instruments reflects the cost in the first year following rule implementation. The annual cost may decline in future years if the number of facilities in operation declines.

Exhibit F-7. Summary of Potential Government Costs			
Cost Category	**Baseline**	**Option 1: No Financial Test**	**Option 2: Proposed Financial Test**
Industry Liabilities ($2015 Millions)			
CERCLA FR Amount Insured through Third-Party Instruments	N/A	$15,758	$11,029
CERCLA FR Amount Self-Insured	$15,758	$0	$4,729
Expected Government Costs ($2015 Millions)			
Government Burden Rate	7.5%	N/A	0.7%
Government Cost	$1,175	$0	$35
Decrease in Expected Government Costs ($2015 Millions)			
Decrease in Expected Government Costs/Increase in Expected Industry Cleanup Funds		$1,175	$1,139

Exhibit F-8.
Summary of Social Costs and Intra-Industry Transfers

Cost Category	Scaling Method	Option 1: No Financial Test			Option 2: Proposed Financial Test		
		Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)	Ann. Cost of Third-Party FR Instruments ($ Millions)	Transfer from Mining Industry to Other Industries ($ Millions)	Ann. Social Cost ($ Millions)
Distributed by Facility Averages	Scaled by Average FR Amount	$292	$217	$75	$195	$143	$53
	Scaled by Median FR Amount	$131	$97	$34	$88	$64	$24
Distributed by Company Averages	Scaled by Average FR Amount	$381	$283	$98	$248	$182	$67
	Scaled by Median FR Amount	$171	$127	$44	$111	$81	$30
Percent of Ann. Cost of Third Party Instrument		N/A	74%	26%	N/A	73%	27%

Note: Administrative compliance costs to industry, an additional component of social costs, are not included in this exhibit because they do not vary based on the scaling method or cost category.

Appendix G. Environmental Justice Analyses

This appendix provides additional tables and figures regarding the environmental justice analysis in Chapter 8, including state-level analysis of census block groups that exceed average minority population and poverty levels.

Exhibit G-1. Census Block Groups in Close Proximity to Facilities in the Included Universe

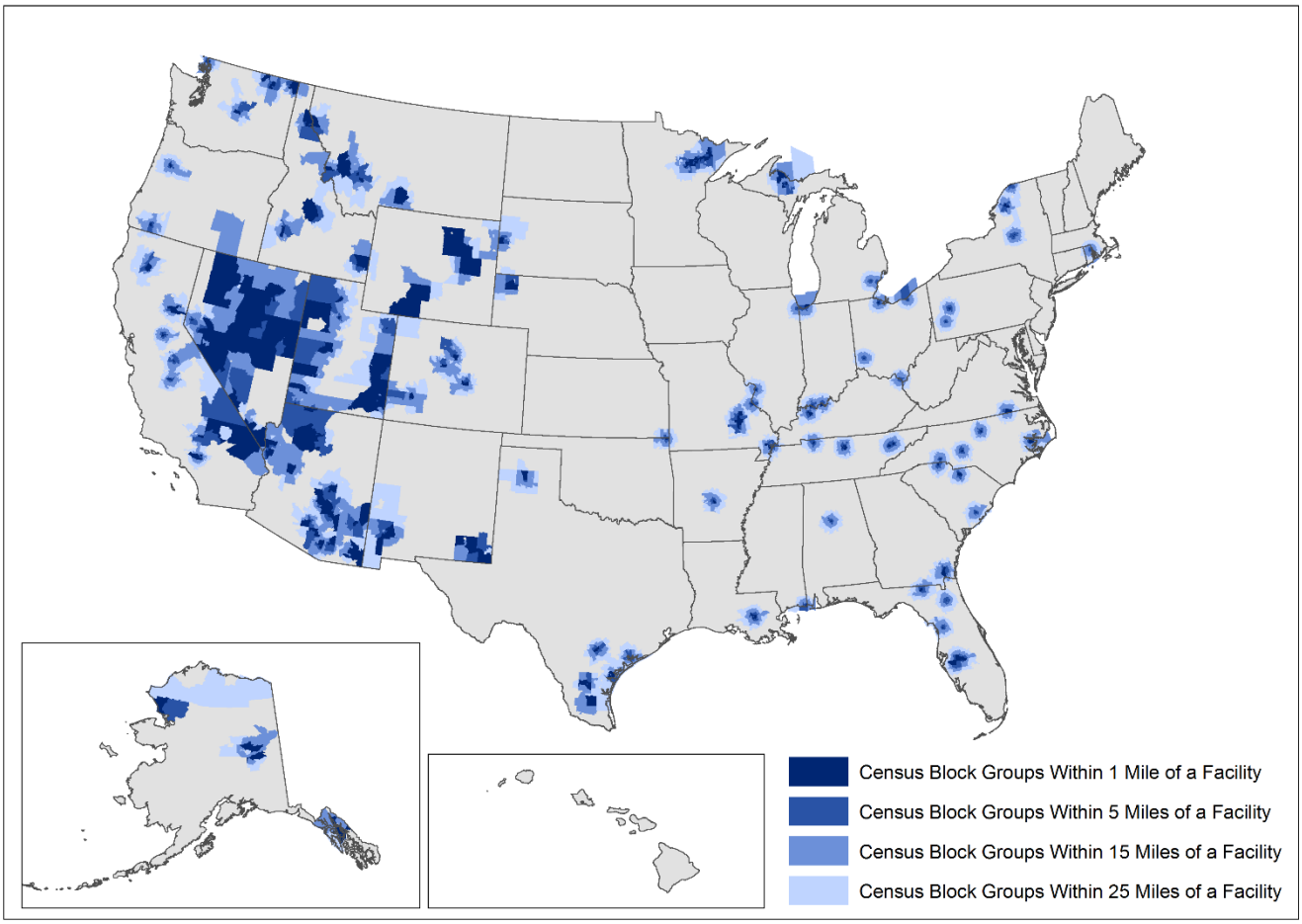


Exhibit G-2. Census Block Groups within 25 Miles of a Potentially Regulated Facility that Exceed State-wide Concentrations of Minority Groups

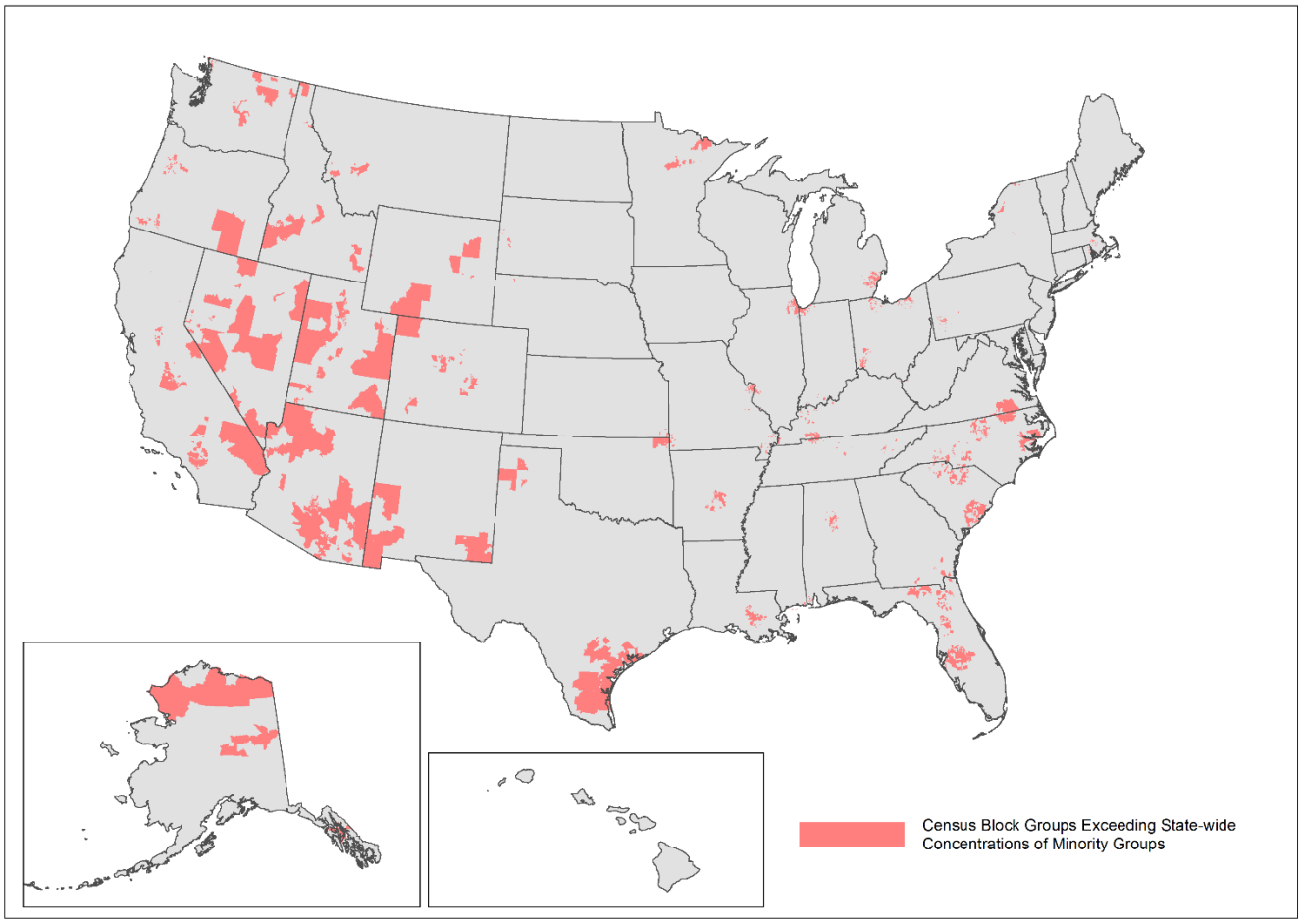


Exhibit G-3. Census Block Groups within 25 Miles of a Potentially Regulated Facility that Exceed State-wide Poverty Rates

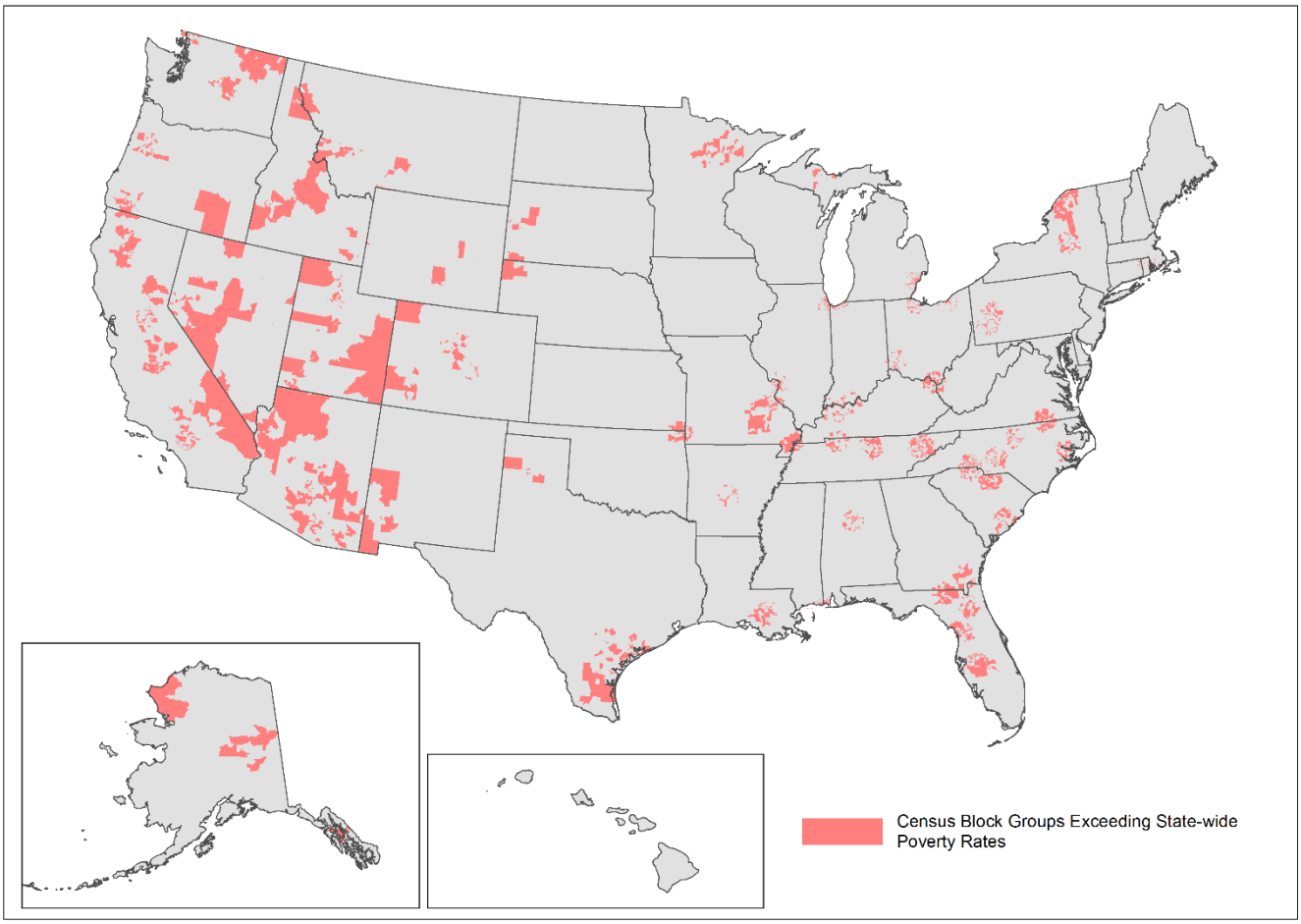


Exhibit G-4. Number and Percentage of Census Block Groups Exceeding State-wide Minority Benchmarks, by State

State	Block Groups within 1 mile Exceeding State-wide Benchmark	Block Groups within 5 miles Exceeding State-wide Benchmark	Block Groups within 15 miles Exceeding State-wide Benchmark	Block Groups within 25 miles Exceeding State-wide Benchmark
Alabama	11 (100%)	135 (92%)	316 (61%)	370 (52%)
Alaska	2 (29%)	3 (38%)	6 (22%)	36 (37%)
Arizona	32 (71%)	84 (65%)	480 (68%)	1,289 (71%)
Arkansas	1 (17%)	10 (24%)	110 (57%)	216 (57%)
California	12 (40%)	102 (58%)	905 (77%)	2,358 (77%)
Colorado	1 (17%)	6 (33%)	30 (29%)	311 (60%)
Connecticut	N/A (N/A)	N/A (N/A)	N/A (N/A)	4 (8%)
Florida	7 (54%)	26 (39%)	141 (43%)	668 (52%)
Georgia	1 (50%)	1 (20%)	5 (17%)	29 (30%)
Idaho	4 (29%)	10 (38%)	77 (63%)	144 (62%)
Illinois	26 (79%)	354 (83%)	1,653 (77%)	2,947 (69%)
Indiana	17 (68%)	189 (78%)	413 (61%)	424 (53%)
Iowa	N/A (N/A)	N/A (N/A)	N/A (N/A)	N/A (N/A)
Kansas	N/A (N/A)	2 (29%)	6 (32%)	9 (33%)
Kentucky	3 (27%)	8 (14%)	49 (28%)	112 (32%)
Louisiana	3 (100%)	14 (67%)	45 (42%)	187 (45%)
Massachusetts	N/A (N/A)	0 (0%)	14 (11%)	96 (20%)
Michigan	22 (45%)	331 (56%)	1,672 (64%)	1,980 (55%)
Minnesota	3 (11%)	9 (10%)	13 (10%)	15 (10%)
Mississippi	1 (33%)	25 (63%)	32 (43%)	46 (36%)
Missouri	0 (0%)	54 (64%)	650 (66%)	779 (50%)
Montana	7 (30%)	14 (27%)	19 (24%)	27 (22%)
Nebraska	0 (0%)	0 (0%)	0 (0%)	4 (36%)

State	Block Groups within 1 mile Exceeding State-wide Benchmark	Block Groups within 5 miles Exceeding State-wide Benchmark	Block Groups within 15 miles Exceeding State-wide Benchmark	Block Groups within 25 miles Exceeding State-wide Benchmark
Nevada	20 (42%)	31 (40%)	64 (31%)	253 (48%)
New Mexico	5 (83%)	17 (89%)	52 (84%)	54 (81%)
New York	15 (37%)	33 (23%)	39 (13%)	48 (11%)
North Carolina	5 (28%)	30 (33%)	297 (44%)	703 (48%)
Ohio	19 (51%)	391 (71%)	972 (52%)	1,784 (47%)
Oklahoma	2 (100%)	7 (88%)	25 (86%)	30 (70%)
Oregon	3 (43%)	23 (47%)	116 (42%)	252 (49%)
Pennsylvania	15 (65%)	165 (53%)	424 (34%)	471 (27%)
Rhode Island	49 (94%)	251 (70%)	313 (47%)	330 (44%)
South Carolina	1 (17%)	23 (35%)	167 (51%)	313 (45%)
South Dakota	0 (0%)	0 (0%)	2 (9%)	4 (10%)
Tennessee	2 (9%)	34 (33%)	116 (29%)	151 (19%)
Texas	7 (78%)	46 (82%)	319 (79%)	531 (79%)
Utah	16 (55%)	55 (58%)	546 (67%)	767 (61%)
Virginia	2 (100%)	3 (100%)	19 (76%)	36 (75%)
Washington	2 (25%)	7 (26%)	70 (40%)	91 (36%)
West Virginia	N/A (N/A)	N/A (N/A)	32 (51%)	39 (36%)
Wisconsin	N/A (N/A)	N/A (N/A)	N/A (N/A)	N/A (N/A)
Wyoming	2 (50%)	2 (50%)	4 (36%)	11 (39%)

Note: "N/A" indicates that no block groups were identified in a state for a given distance criterion. "0" indicates that block groups were identified in a state for a given distance criterion, though none of the block groups exceeded the state-wide benchmark.

Exhibit G-5. Number and Percentage of Census Block Groups Exceeding State-wide Poverty Benchmarks, by State

State	Block Groups within 1 mile Exceeding State-wide Benchmark	Block Groups within 5 miles Exceeding State-wide Benchmark	Block Groups within 15 miles Exceeding State-wide Benchmark	Block Groups within 25 miles Exceeding State-wide Benchmark
Alabama	8 (73%)	99 (68%)	247 (48%)	301 (42%)
Alaska	2 (29%)	3 (38%)	7 (26%)	34 (35%)
Arizona	16 (36%)	46 (35%)	289 (41%)	680 (38%)
Arkansas	2 (33%)	5 (12%)	60 (31%)	123 (33%)
California	12 (40%)	84 (48%)	583 (49%)	1,355 (44%)
Colorado	1 (17%)	3 (17%)	28 (27%)	201 (39%)
Connecticut	N/A (N/A)	N/A (N/A)	N/A (N/A)	18 (36%)
Florida	11 (85%)	45 (68%)	177 (53%)	562 (44%)
Georgia	1 (50%)	3 (60%)	17 (59%)	50 (52%)
Idaho	5 (36%)	11 (42%)	51 (41%)	90 (38%)
Illinois	29 (88%)	257 (60%)	1,244 (58%)	2,021 (47%)
Indiana	17 (68%)	164 (68%)	328 (49%)	361 (45%)
Iowa	N/A (N/A)	N/A (N/A)	N/A (N/A)	N/A (N/A)
Kansas	N/A (N/A)	5 (71%)	11 (58%)	16 (59%)
Kentucky	5 (45%)	24 (41%)	68 (39%)	138 (40%)
Louisiana	2 (67%)	9 (43%)	38 (36%)	150 (36%)
Massachusetts	N/A (N/A)	1 (17%)	19 (15%)	121 (25%)
Michigan	23 (47%)	326 (55%)	1,355 (52%)	1,584 (44%)
Minnesota	16 (57%)	50 (58%)	64 (50%)	71 (50%)
Mississippi	2 (67%)	17 (43%)	25 (34%)	39 (31%)
Missouri	3 (33%)	59 (69%)	493 (50%)	661 (42%)
Montana	16 (70%)	26 (51%)	37 (47%)	57 (46%)
Nebraska	1 (100%)	2 (67%)	3 (60%)	6 (55%)

State	Block Groups within 1 mile Exceeding State-wide Benchmark	Block Groups within 5 miles Exceeding State-wide Benchmark	Block Groups within 15 miles Exceeding State-wide Benchmark	Block Groups within 25 miles Exceeding State-wide Benchmark
Nevada	15 (31%)	24 (31%)	64 (31%)	182 (34%)
New Mexico	1 (17%)	5 (26%)	17 (27%)	19 (28%)
New York	30 (73%)	68 (47%)	138 (47%)	197 (44%)
North Carolina	6 (33%)	44 (48%)	302 (45%)	617 (42%)
Ohio	30 (81%)	393 (72%)	760 (41%)	1,562 (41%)
Oklahoma	1 (50%)	4 (50%)	21 (72%)	29 (67%)
Oregon	3 (43%)	26 (53%)	131 (47%)	243 (47%)
Pennsylvania	15 (65%)	153 (50%)	482 (39%)	647 (37%)
Rhode Island	44 (85%)	194 (54%)	272 (41%)	289 (38%)
South Carolina	3 (50%)	20 (30%)	156 (47%)	303 (44%)
South Dakota	0 (0%)	2 (25%)	7 (32%)	13 (33%)
Tennessee	13 (59%)	43 (42%)	182 (45%)	336 (41%)
Texas	4 (44%)	21 (38%)	180 (44%)	268 (40%)
Utah	15 (52%)	39 (41%)	303 (37%)	460 (37%)
Virginia	1 (50%)	2 (67%)	18 (72%)	32 (67%)
Washington	5 (63%)	18 (67%)	78 (45%)	111 (44%)
West Virginia	N/A (N/A)	N/A (N/A)	36 (57%)	51 (47%)
Wisconsin	N/A (N/A)	N/A (N/A)	N/A (N/A)	N/A (N/A)
Wyoming	0 (0%)	0 (0%)	2 (18%)	6 (21%)

Note: "N/A" indicates that no block groups were identified in a state for a given distance criterion. "0" indicates that block groups were identified in a state for a given distance criterion, though none of the block groups exceeded the state-wide benchmark.

Appendix H. Calculating Administrative Costs to Industry

Appendix H describes the methods EPA used to calculate the administrative costs to industry. EPA first determined the administrative tasks the rule would require industry to perform. EPA anticipates industry will incur labor, O&M, and capital costs associated with the following tasks as a result of the rule:

- Reading the regulations.
- Providing initial notification to EPA.
- Soliciting public involvement through the establishment of a webpage on the company's website.
- Evaluating financial responsibility instruments.
- Calculating financial responsibility amounts.
- Establishing financial responsibility through the acquisition of a financial responsibility instrument.
- Recalculating financial responsibility once every three years starting four years after finalizing the initial financial responsibility amount.
- Acquiring additional financial responsibility through a new or existing instrument as a result of the above recalculation.
- Notifying EPA upon owner or operator incapacity.
- Notifying EPA and providing relevant court documents when a CERCLA claim is brought against the owner or operator.
- Notifying EPA and performing any of the above relevant tasks when a new or owner or operator acquires a facility.
- Tasks related to release from financial responsibility upon facility closure or transfer of ownership.[144]
- Retain records of documents related to all of the above tasks.

Using the text of the rule and available documents, EPA then determined the frequency with which industry will have to perform the above tasks and calculated the total cost industry will incur as a result of each of the above tasks. EPA then generated streams of future administrative costs for the modeled universe based on task frequency, cost, and expected closure dates, and annualized those costs using the 3 and 7 percent social discount rates.

[144] EPA gathered the above tasks from the text of the rule and the preamble, as well as from U.S. EPA. *Estimating Costs for the Economic Benefits of RCRA Noncompliance.* September 1997. December 1997 Update.

Frequency of Tasks

To calculate the annualized administrative cost of the rule, EPA determined how frequently owners and operators would need to perform each task during the period this RIA considers (from implementation until 2055). In some cases, the text of the rule itself indicated when and how often each task would occur. Initial notification and soliciting public involvement will occur in the year of implementation and upon facility transfer. Calculating (and recalculating) financial responsibility amounts and acquiring financial responsibility instruments reflective of those amounts would occur in three of the first four years following implementation, due to the gradual ramp up of financial responsibility, and once every three years after the end of the ramp up period until facility closure. EPA relied on additional documents to determine that reading the regulations and evaluating financial responsibility amounts would occur in the year of implementation and upon facility transfer.[145] EPA used the trailing 12-month incapacity or default rate in the metals mining industry of 3.9 percent to estimate the frequency of owner incapacity on an annual basis.[146] EPA collected data on the number of facilities in its modeled universe that were on the National Priorities List over the previous five years over the total number of facilities in the universe, then divided that number by five.[147] The result, 1.67 percent, represents the likelihood that a CERCLA claim will be brought against an owner or operator in a given year. EPA collected data on closure rates and the annualized rate of facility transfer through MSHA.[148] Following that data collection, EPA set the annual rate of facility transfer at 3.33 percent and assigned each facility in the modeled universe its MSHA closure year. Recordkeeping is an ongoing task which EPA treats as the capital cost required to purchase the file cabinet capacity necessary to store the required records.

Labor Costs

Exhibit H-1 summarizes the labor burden by task and wage category.[149]

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[145] U.S. EPA. *Estimating Costs for the Economic Benefits of RCRA Noncompliance.* September 1997. December 1997 Update.

[146] The trailing 12-month incapacity or default rate in the metals/mining industry was 3.9 percent as of April 13, 2016. See Fitch Ratings, "Fitch: Peabody Pushes US Metals/Mining Loan Default Rate to 29%," accessed 21 July 2016 at https://www.fitchratings.com/site/pressrelease?id=1002413/.

[147] Two of the 40 facilities in the modeled financial universe were on the National Priorities List at some point in the previous five years (through 2013, inclusive). Search for facilities conducted at EPA, "Search Superfund Site Information," accessed 21 July 2016 at https://cumulis.epa.gov/supercpad/CurSites/srchsites.cfm/.

[148] Search for facility operator information conducted at U.S. Department of Labor, Mine Safety and Health Administration, Mine Data Retrieval System, accessed 21 July 2016 at http://arlweb.msha.gov/drs/drshome.htm/.

[149] Labor burden for each task from U.S. EPA. *Estimating Costs for the Economic Benefits of RCRA Noncompliance.* September 1997. December 1997 Update. Mean wages from "Occupational Employment Statistics: May 2015 Industry-Specific Occupational Employment and Wage Estimates - NAICS 212200 - Metal Ore Mining," Bureau of Labor Statistics, last modified 30 March 2016, accessed at: http://www.bls.gov/oes/current/naics4_212200.htm. Wages were adjusted using a load factor of 1.5260 to reflect fringe benefits and overhead, derived from "Circular No. A-76 Revised," Office of Management and Budget, 29 May 2003 corrected 6 September 2013, accessed at http://www.whitehouse.gov/omb/circulars_a076_a76_incl_tech_correction. Although Circular A-76 was not originally developed to be used in regulatory analysis, EPA still believes it is the best available source for overhead costs. Wages then adjusted to December 2015 using Bureau of Labor Statistics, Employment Cost Index Historical Listing Current-dollar March 2001 – December 2015, Table 1: Employment Cost Index for Total Compensation, by Occupational Group and Industry (Seasonally Adjusted), accessed at http://www.bls.gov/web/eci/echistrynaics.pdf.

Exhibit H-1. Labor Burden (Hours) for Each Administrative Activity						
	Labor Burden					
Administrative Activity	Legal $107.45/hr	Managerial $101.97/hr	Engineer $65.84/hr	Accounting $56.19/hr	IT $53.61/hr	Clerical $32.95
Reading the Regulations	0.00	1.00	1.50	1.50	0.00	0.00
Initial Notification	0.00	0.25	0.75	0.00	0.00	0.25
Public Involvement	0.00	0.25	0.25	0.00	2.00	0.50
Evaluating Instruments	2.00	1.00	0.00	2.00	0.00	1.00
Calculating Applicable FR	0.00	1.00	14.00	0.00	0.00	3.00
Calculating Applicable FR (subsequent)	0.00	1.00	14.00	0.50	0.00	3.00
Establishing FR						
Financial Test	1.00	0.25	0.00	10.00	0.00	1.75
Insurance	4.00	1.50	0.00	2.00	0.00	1.00
Letter of Credit	5.25	1.75	0.00	2.00	0.00	1.00
Trust	4.00	1.50	0.00	2.00	0.00	4.50
Maintaining FR						
Financial Test	0.00	0.00	0.00	8.00	0.00	4.00
Operator Incapacity	0.00	0.25	0.00	0.00	0.25	1.50
CERCLA Claim	0.00	0.25	0.00	0.00	0.00	2.25
Facility Transfer (Test)	2.00	3.50	16.50	3.50	2.00	4.75
Facility Transfer (No Test)	2.00	3.50	16.50	3.50	2.00	4.75
Release from FR	0.00	0.30	0.00	0.00	0.30	1.60

O&M Costs

EPA currently plans to require owners and operators to submit information electronically. However, EPA does not know when it will have the capability to receive electronic submissions. As such, owners and operators will submit information in paper format, through certified mail, until EPA has achieved electronic capability, at which point owners and operators must submit information electronically. Therefore, O&M costs include the cost of submitting information to EPA through certified mail. The cost of mailing information through certified mail includes the following components: $0.47 for postage,[150] $3.30 for the certified mail fee,[151] and $0.03 for an envelope.[152] The role of O&M costs in the proposed rule is discussed in section 5.5 of this RIA.

Capital Costs

Capital costs include any produced physical good necessary to fulfill the information collection requirements of the rule, such as machinery, computers, and other equipment. EPA anticipates that respondents will incur capital costs related to the acquisition of file cabinets to fulfill the recordkeeping requirements of the rule. To estimate the capital costs associated with the purchase of file cabinets, EPA took the following steps:

[150] "Mailing & Shipping Prices," United States Postal Service, accessed at: https://www.usps.com/business/prices.htm, last accessed on August 1, 2016.

[151] "Notice 123 – Effective April 10, 2016: Price List," United States Postal Service, accessed at: http://pe.usps.com/text/dmm300/Notice123.htm, last accessed August 1, 2016.

[152] Standard-size envelope cost based on current market price, as of August 17, 2016 (i.e., box of 500 standard business gummed envelopes at $14.99).

1. *Estimate total volume of paper to be stored by respondents*. The rule dictates that respondents must develop and maintain a facility record that includes information documenting compliance with the financial responsibility requirements of this proposed rule until three years after the Agency releases the owner or operator from the requirement for financial responsibility. In addition to assigning a labor and O&M cost to each task, EPA also assigned the number of pages each task would generate and estimated a stream of pages industry would generate as a result of the rule. EPA supplemented the pages generated by the fulfillment of administrative tasks with an estimate of the number of pages owners and operators would generate from documents supporting their financial responsibility calculations and ongoing environmental and operational evaluations of each facility (environmental impact statements, reclamation closure plans, etc.).

2. Estimate the cost-per page of storage. EPA estimates that a standard-size, lateral file cabinet holds approximately 25,000 pages. The current market price for one standard-sized, five-drawer, lateral file cabinet is $829.99[153]. Dividing $829.99 by 25,000 yields the cost per page of acquiring storage capacity: $0.0332.

EPA applied that cost per page to each page it anticipated that industry would generate as a result of administrative tasks from the implementation year to closure, and assigned the cost as a recordkeeping cost for each given year.

Total Cost Per Activity

Exhibit H-2 summarizes the expected administrative cost industry will incur for each administrative activity.

[153] Standard-size, five-drawer, lateral file cabinet cost based on current market price as of August 1, 2016.

Exhibit H-2.
Total Costs for Each Administrative Activity

Administrative Activity	Labor Cost Burden by Category						Total Costs Per Activity			
	Legal $107.45/hr	Managerial $101.97/hr	Engineer $65.84/hr	Accounting $56.19/hr	IT $53.61/hr	Clerical $32.95	Labor Costs	Capital Costs	O&M Costs	TOTAL COST
Reading the Regulations	$-	$101.97	$98.75	$84.28	$-	$-	$285.00	$ 13.28	$0	$298.28
Initial Notification	$-	$25.49	$49.38	$-	$-	$8.24	$83.11	$0.03	$4	$86.94
Public Involvement	$-	$25.49	$16.46	$-	$107.21	$16.47	$165.64	$-	$0	$166
Evaluating Instruments	$214.90	$101.97	$-	$112.37	$-	$32.95	$462.19	$-	$0	$462
Calculating Applicable FR	$-	$101.97	$921.70	$-	$-	$98.85	$1,122.52	$8.30	$4	$1,135
Calculating Applicable FR (subsequent)	$-	$101.97	$921.70	$28.09	$-	$98.85	$1,150.61	$8.30	$4	$1,163
Establishing FR										
Financial Test	$107.45	$25.49	$-	$561.86	$-	$57.66	$752.46	$ 3.42	$8	$763
Insurance	$429.80	$152.95	$-	$112.37	$-	$32.95	$728.07	$ 0.07	$4	$732
Letter of Credit	$564.11	$178.44	$-	$112.37	$-	$32.95	$887.87	$ 0.23	$8	$896
Trust	$429.80	$152.95	$-	$112.37	$-	$148.27	$843.39	$ 0.27	$8	$851
Maintaining FR										
Financial Test	$-	$-	$-	$449.49	$-	$131.79	$581.28	$ 3.35	$8	$592
Operator Incapacity	$-	$25.49	$-	$-	$13.40	$49.42	$88.32	$ 0.03	$4	$92
CERCLA Claim	$-	$25.49	$-	$-	$-	$74.13	$99.63	$ 6.67	$8	$114
Facility Transfer (Test)	$692.69	$518.67	$1,086.29	$485.82	$107.21	$282.37	$3,173.06	$ 9.65	$14	$3,197
Facility Transfer (No Test)	$673.35	$515.27	$1,086.29	$309.02	$107.21	$264.80	$2,955.95	$ 8.57	$14	$2,979
Release from FR	$-	$30.59	$-	$-	$16.08	$52.72	$99.39	$ 0.03	$0	$99
Recordkeeping	$-	$-	$-	$-	$-	$-	$-	$ 16.60	$0	$17

Results

EPA used the frequency of each task the total cost per task to generate a stream of administrative costs from the implementation year through 2055, then calculated annualized administrative costs using the 3 and 7 percent social discount rates. EPA then extrapolated the annualized cost from the modeled universe to the respondent universe of 221. Exhibit H-3 presents the annualized administrative cost to industry under the 3 and 7 percent discount rates.

Exhibit H-3.
Annualized Administrative Costs

Social Discount Rate	Option 1 (No Test)	Option 2 (Financial Test)
3%	$259,425	$289,155
7%	$225,302	$269,038