From:	Larsen, Joseph
To:	Rule Making
Cc:	Eric Wilson
Subject:	BLM Idaho"s Comments on IDL"s Negotiated Rulemaking 20.03.02 and 20.03.03
Date:	Thursday, July 11, 2019 03:48:37 PM
Attachments:	Boyd, 2001, Financial Responsibility for Environmental Obligations.pdf Phosphate Reclamation Bond Guide.doc 20130910 WO Phosphate Bond Memo.pdf Second Draft Phosphate Mining Column Testing Protocol R5.pdf BLM Needs to Revise Fianancial Assurance Adequacy, GAO-12-189R.pdf BLM Needs to Better Manange RCEs to Guarantee Coverage, GAO-05-377.pdf

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Idaho BLM has enjoyed cooperation with Idaho Department of Lands in regulating mining activities within Idaho for many years and we appreciate the opportunity to comment on the IDAPA rule changes.

BLM feels our largest point of cooperation is ensuring adequate bonding and reclamation cost estimates. Attached are several documents that outline current bond estimating guidelines used by the BLM as well as several other references that discuss the complex issues of bonding for mineral development. The BLM would hope to see that through the rulemaking process and any subsequent policy implementation that any changes be congruent to what we are allowed for both reclamation cost estimations and financial guarantee requirements on Public Lands. The current draft rules include two bonding methods that are not allowed by the BLM, those being the use of corporate guarantees and real property. Those financial assurance methods were specifically removed from bonding forms allowed by the BLM in 2000. Currently the BLM is allowed to use surety bonds, cash, CDs, trusts, and insurance (43 CFR 3809.555). The BLM may participate with Idaho's bond pool, under specific guidelines (43 CFR 3809.571) The solution we propose is adopting opt-out language similar to that currently found in Rules Governing Administration of the Reclamation Fund, IDAPA 20.03.03.020. We feel by adding a clause requiring an operator to provide financial assurance in a form acceptable to the Federal Government when on Public Lands would alleviate confusion and the risk of duplicating bonding efforts of various regulatory agencies.

Thank you for the opportunity to participate in Idaho's rulemaking process. Please let me know if any clarification is needed for the above comments. We look forward to continuing our cooperative relationship into the future.

Regards,

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Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules Fulfilling Their Promise?

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Abstract

Financal assurance rules, also known as financial responsibility or bonding requirements, foster cost internalization by requiring potential polluters to demonstrate the financial resources necessary to compensate for environmental damage that may arise in the future. Accordingly, assurance is an important complement to liability rules, restoration obligations, and other regulatory compliance requirements. The paper reviews the need for assurance, given the prevalence of abandoned environmental obligations, and assesses the implementation of assurance rules in the United States. From the standpoint of both legal effectiveness and economic efficiency, assurance rules can be improved. On the whole, however, cost recovery, deterrence, and enforcement are significantly improved by the presence of existing assurance regulations.

Key Words: financial assurance, financial responsibility, bonding, environmental insurance

JEL Classification Numbers: K13, K32, Q38

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Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules Fulfilling Their Promise?

James Boyd

1. Introduction

A bedrock principle of environmental law and regulation is that pollution costs should be borne by their creators. U.S. environmental laws and regulations give this principle form by making polluters liable for property, health, and natural resource damages and unperformed resource reclamation obligations. Unfortunately, many environmental obligations, despite being well defined in theory and in law, are not always met in practice. Bankruptcy, corporate dissolution, and outright abandonment are disturbingly common means by which polluters avoid responsibility for environmental costs.[1]

Financial assurance rules, also known as financial responsibility or bonding requirements, address this policy problem. Assurance rules require potential polluters to demonstrate—before the fact—financial resources adequate to correct and compensate for environmental damage that may arise in the future. Accordingly, assurance acts as an important complement to liability rules, restoration obligations, and other compliance requirements.[2] A benefit of assurance rules is that they can harness the expertise and scrutiny of private, third-party financial providers. For their own commercial reasons, the insurers, sureties, and banks that provide the financial products used to demonstrate compliance train a self-interested set of eyes on the financial and

1 See Section 1.2 infra.

2 Liability rules create future obligations associated with damage to property, human health, and natural resources. Restoration obligations create a future liability for failure to perform necessary reclamation or restoration. In addition, assurance rules promote compliance with immediate regulatory requirements, such as monitoring, control, and reporting standards. Assurance does this by fostering the internalization of administrative penalties used to motivate such operational standards.

Although liability and restoration obligations feature most prominently in the following analysis, it should be emphasized that the deterrent effect of—and thus the value of asurance to—any type of penalty is blunted by insolvency or abandonment. For a particularly dramatic example, see In re Gary Lazar and Divine Grace Lazar, U.S. Bankr. Cent. D. CA, Case No. LA 92-39039 SB, October 24, 1996 (administrative fines totaling hundreds of millions of dollars, associated with violations of gas station operating standards, most failing to receive priority in bankruptcy).

environmental risks posed by potential polluters. In this way, assurance rules can yield a flexible, market-based approach to compliance and monitoring.

Financial assurance is demanded of a wide variety of U.S. commercial operations, including municipal landfills, ships carrying oil or hazardous cargo, hazardous waste treatment facilities, offshore oil and gas installations, underground gas tanks, wells, nuclear power stations, and mines. Firms needing assurance can purchase it in the form of insurance, surety obligations, bank letters of credit, and deposit certificates. Alternatively, firms can establish trust funds or escrow accounts dedicated to future obligations. Most programs allow wealthy and financially stable firms to comply by demonstrating an adequate domestic asset base and high-quality bond rating. A wealthy financial parent can in some cases guarantee the obligations of a subsidiary or affiliate via an indemnity agreement.

This study provides an overview of financial assurance policies based on a review of the rules' implementation in the United States. Relatively little analysis of the rules' practical implementation exists.[3] The goal is not an exhaustive review of specific regulatory programs, but rather a synthetic overview of the many issues common to environmental assurance programs. From the standpoint of both economic efficiency and legal effectiveness, assurance rules can be improved. Assurance programs raise a set of design issues, including the level of assurance to be required, the financial mechanisms to be allowed, the conditions under which bonds are released, and the interaction of assurance rules with other areas of law—most importantly, bankruptcy law. This report illustrates those issues and identifies a set of correctable weaknesses present in some assurance programs. For instance, in some regulatory contexts, inappropriately low levels of assurance are required; in others, the mechanisms used to demonstrate responsibility undermine the goal of cost internalization.

Despite its criticisms regarding the details of policy, this report should be read as a spirited defense of financial assurance's desirability as a regulatory tool. Absent assurance, too many firms can and do abandon obligations. As will be evident from the cases and data cited in this report, the evasion of environmental liabilities and cost internalization by defunct or insolvent firms is relatively common. On average, 60,000 U.S. firms declare bankruptcy each year, and an untold number cease or abandon operations without even entering legal bankruptcy

3 See, however, EPA Office of the Inspector General, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001.

proceedings.[4] Clearly, not all of these firms leave unfunded environmental obligations behind them, but many do. Mandatory assurance addresses the insolvency problem in a direct way and thereby strengthens the effectiveness of environmental regulation and law.

1.1 The Problem: Unmet Obligations and Nonrecoverable Liabilities

Conceptually, polluter cost internalization is nearly unassailable as a guiding principle for environmental regulation. Cost internalization by responsible parties yields the most equitable means of victim compensation, the alternatives being no compensation or compensation provided by public funds. Polluter cost internalization also promotes deterrence, risk reduction, and innovations to reduce environmental harm.[5] Accordingly, with few exceptions, most U.S. environmental laws make polluters liable for damages caused by commercial activities that injure the public health or cause property or natural resource damage.

Unfortunately, cost internalization's importance in law and regulation is not always matched by its achievement in practice. Even the most unassailable legal obligation can quickly evaporate when presented to a bankrupt, dissolved, or absent polluter. Consider first the implications of bankruptcy. Generally speaking, debtors are protected from creditors by the "automatic stay" provision of the U.S. bankruptcy code.[6] This means that both private and public environmental claims can be discharged in bankruptcy.[7] In other words, environmental costs are only partially recoverable once bankruptcy occurs, if they are recoverable at all.[8] To compound the problem, firms may purposefully increase the likelihood of bankruptcy by divesting themselves of capturable assets in order to externalize costs. In industries where liability costs

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4 American Bankruptcy Institute statistics for annual business bankruptcy filings, 1980–2000. Available at http://www.abiworld.org/stats/1980annual.html.

5 An important exception is the cost internalization achieved by so-called retroactive liability. Since retroactive liability, by definition, is not anticipated by potential defendants, it does not promote deterrence. See 4.3 infra.

6 11 U.S.C. § 362(a).

7 Bankruptcy may be forced by environmental obligations themselves or by conditions unrelated to those obligations. In either case, environmental obligations can be discharged.

8 See Section 6.2 infra. In general, environmental claims do not enjoy any special priority over other creditor claims. There is an important exception, however. In some cases governments can employ the "police and regulatory power exception" to the automatic stay. The exception states that the automatic stay does not apply to the "commencement or continuation of an action or proceeding by a governmental unit to enforce such governmental unit's police or regulatory power," 11 U.S.C. § 362(b)(4). In some cases, this exception can improve the government's ability to recover funds from a bankrupt polluter, though it is no guarantee of full recovery. See Richard L. Epling, Impact of Environmental Law on Bankruptcy Cases, 26 Wake Forest Law Review, 69, 1991.

are potentially significant, firms' business organization and capital investment and retention decisions may be influenced by the desire to externalize liabilities. For instance, firms may avoid retained earnings, choose not to vertically or horizontally integrate, or shelter assets overseas.[9]

Environmental cost recovery can also be defeated if a polluter has legally dissolved prior to the realization of liabilities or performance of obligations. There are limits to this strategy. A liable firm that is simply sold does not automatically escape liability, since those liabilities will be transferred to the purchasing firm.[10] If assets are sold piecemeal or simply retired over time, however, environmental costs can more effectively be externalized. This possibility is enhanced by the nature of many environmental risks and obligations, which often materialize only after a period of years or decades.[11] Dissolution can be a rational, if socially irresponsible, way to avoid future obligations. Irrespective of the precise strategy used to avoid liability and reclamation obligations, the lack of a solvent defendant defeats the ability of victims or governments to collect compensation. And insolvency undermines the law's ability to deter environmental injuries in the first place.

9 To investigate the impact of liability on firm scale, Ringleb and Wiggins (1990) explored the rate of small firm incorporation as a function of the riskiness of a given industry. Their evidence suggests that liability has a direct impact on enterprise scale. They compared the number of small firms in 1967—a period before the routine use of strict liability for tort claims——with the number of such firms in 1980, when the use of strict liability was routine and expected. Their analysis suggests that the incentive to avoid liability led to a 20% increase in the number of small corporations in the U.S. economy between the two periods. For a description of offshore financial havens, or "asset protection trusts," see Salting it Away, The Economist, Oct. 5, 1991, at 32.

10 Whether liability is inherited normally hinges on a determination of the degree to which there is a continuation of the seller's business. See Ray v. Alad Corp. 19 Cal. 3d 22 (1977) (136 Cal.Rptr. 574, 560 P.2d 3), which held that in appropriate circumstances, the successor to the manufacturer of a defective product may be held liable for damages caused by the product after the successor acquired the manufacturer. Specifically, the purchaser assumes liability if (1) there is an express or implied agreement of assumption, (2) the transaction amounts to a merger or consolidation of the two corporations, (3) the purchasing corporation is a mere continuation of the seller, or (4) the transfer of assets to the purchaser is for the fraudulent purpose of escaping liability for the seller's debts.

11 The fact that exit can create inefficiencies through risk externalization is discussed extensively in Hansmann and Kraakman, Toward Unlimited Shareholder Liability for Corporate Torts, 100 Yale Law Journal 1879, 1991, who argue that "[a factor creating] inefficient incentives under limited liability is the shareholder's option to liquidate the corporation and distribute its assets before tort liability attaches. Since products and manufacturing processes often create long-term hazards that become visible only after many years, firms can—and often do—liquidate long before they can be sued by their tort victims."

1.2 The Scale and Scope of Unrecovered Environmental Costs

Nonrecoverable environmental obligations are more than a theoretical possibility. Over the past decades untold numbers of environmentally damaging operations have been abandoned or have avoided liability via bankruptcy. There is no central repository of statistics regarding the scale of unrecovered environmental obligations, but figures from a range of environmental programs illustrate the significance of these costs.

Underground storage tanks. Leaking underground storage tanks (USTs) pose a significant risk to the nation's groundwater supplies. There are currently an estimated 190,000 abandoned underground petroleum tanks in the United States.[12] According to EPA, "these USTs pose a challenge in that the owner is either disinclined or financially unable to comply, or is often difficult to locate." In addition, billions of dollars in public funds have been expended to clean up USTs that were not abandoned but whose owners and operators were unable to bear remediation costs themselves.[13]

Oil and gas wells. Unplugged oil and gas wells can pollute both ground and surface water. Many states have programs that have identified thousands of abandoned oil and gas wells. States have spent $70 million to plug approximately 13,000 orphan wells, but there remain an estimated 57,000 remaining orphan wells.[14] With an average plugging cost of $5,400, the cost to state agencies of plugging these orphan sites will be an additional $560 million.

Oil spills. Beginning with the 1972 Clean Water Act, and now under the Oil Pollution Act, the United States has maintained a public fund for the cleanup of oil spills associated with offshore accidents and onshore accidents contributing to surface water pollution. A goal of the fund is to recover public expenditures on oil spill response from responsible parties. According

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12 This includes 38,000 registered but abandoned tanks and 152,000 unregistered and abandoned tanks. U.S. EPA, Report to Congress on a Compliance Plan for the Underground Storage Tank Program. EPA 510-R-00-001, June 2000, at 11-12.

13 Congressional Research Service, Report for Congress, Leaking Underground Storage Tank Cleanup Issues, updated February 17, 1999. Beginning in 1987, the federal government began collection for the Leaking Underground Storage Tank (LUST) Fund. Before the taxing authority expired in December 1995, $1.6 billion had been collected. Congress reinstated the LUST tax in the Taxpayer Relief Act of 1997 (P.L. 105-34). As of December 31, 1998, the trust fund balance was $1.25 billion. In addition, 47 states established financial assurance funds. For 1997, the total balance of state funds was approximately $1.34 billion, annual revenues were $1.31 billion, and outstanding claims against the funds were $2.31 billion, Vermont Department of Environmental Conservation, Waste Management Division, Summary of State Fund Survey Results, June 1997.

14 See Thomas, supra note 14, at 2. Kentucky alone has 12,000 wells waiting to be plugged by the state.

to one study, however, the current fund has recovered only 19% of its expenditures from responsible parties.[15] Accordingly, the remaining percentage corresponds to costs externalized by polluters.

Landfills and other disposal facilities. A recent inventory by Texas located 4,200 abandoned landfills in that state alone.[16] A nationwide study of permitted, operating hazardous waste landfills in 1984 and 1985 identified 54 owned by bankrupt firms.[17] A more recent EPA study of medium-sized municipal solid waste disposal firms found that of 40 firms studied, 37 had estimated financial assurance obligations exceeding their net worth.[18] As recently as 1999, a Canadian company, exploiting exemptions in waste disposal regulations, was able to abandon a site in Tacoma, Washington, leaving $4.3 million in uncompensated cleanup costs.[19]

Hardrock mining. The Bureau of Land Management (BLM) has identified 900 environmentally hazardous abandoned mine sites on agency-managed lands.[20] A 1986 study by the U.S. General Accounting Office (GAO) found that of a sample of BLM mine sites surveyed, 39% had not been reclaimed.[21] One nongovernmental study estimates a total of 557,000 abandoned mine sites nationwide, with an estimated cleanup cost of $32 billion to $72 billion.[22] Sixty-seven abandoned mines are on EPA's Superfund National Priorities List, and the agency

15 The analysis was based on congressional documents and financial statements obtained from the Coast Guard under the Freedom of Information Act. See Brent Walth, "Spill Laws Fail to Halt Seepage of Public Cash," The Oregonian, February 27, 2000. Records show that the Oil Spill Liability Trust Fund has paid out $262 million for oil spills since 1990 and has been reimbursed $49 million, or about 19%. The Coast Guard claims a significantly higher recovery rate (60%) based on recoveries associated with closed cases.

16 www.tnrcc.state.tx.us/oprd/wasteplan/swinvent.html.

17 Docket materials in support of the April 10, 1998, Financial Assurance Mechanisms for Corporate Owners and Operators of Municipal Solid Waste Landfill Facilities; Final Rule, Issue Paper: Assessment of First Party Trust Funds, at 7 (citing ICF Incorporated, Preliminary Results of Case Studies of Bankrupt TSDFs, June 1985).

18 63 Federal Register 17706, 17731, April 10, 1998, Financial Assurance Mechanisms for Corporate Owners and Operators of Municipal Solid Waste Landfill Facilities. (Hereafter, "Federal Register 1998.")

19 Andrew Ballard, Financial Assurance, Closure Changes Urged by Washington State Regulator, Environment Reporter, April 27, 2001, at 807.

20 U.S. Department of the Interior, Bureau of Land Management, Abandoned Mine Land Inventory and Remediation: A Status Report to the Director, November 1996.

21 General Accounting Office, Public Lands: Interior Should Ensure against Abuses from Hardrock Mining, GAO/RCED-86-48, 1986, at 24.

22 Lyon, J.S., et al., 1993, Burden of Gilt, Mineral Policy Center.

estimates that it will cost approximately $20 billion to clean them up.[23] In terms of mine bankruptcies, a study of mining operations found 26 large-scale Western hardrock mines in bankruptcy as of 1999.[24] The Summitville mine in Colorado, abandoned in 1993, alone has an estimated cleanup cost of $150 million to $180 million.[25] A 1999 National Research Council report identified site abandonment and unfunded obligations as a significant regulatory issue for the industry.[26]

Coal mining. The federal government's Abandoned Mine Land (AML) program estimates $7.9 billion in high-priority coal-related AML problems, including health, safety, and environmental problems.[27] A study of coal mining sites in Pennsylvania found that mining bonds had been forfeited on more than 22,000 mining acres and that 67% of all acres covered by bond requirements had not been reclaimed.[28] A congressional hearing in 1986 identified poor reclamation rates in other states, including reclamation rates of only 7%, 19%, and 13% in Indiana, Kentucky, and Tennessee, respectively.[29] A recent actuarial study placed a lower bound of $1 billion on Pennsylvania's long-term mine drainage costs, associated primarily with abandoned mines.[30]

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23 Office of the Inspector General, Audit Report, EPA Can Do More to Help Minimize Hardrock Mining Liabilities, E1DMF6-08-0016-7100223, June 11, 1997, at 2.

24 The study defined large-scale mines as those with bond obligations greater than $250,000. James Kuipers, Hardrock Reclamation Bonding Practices in the Western United States, National Wildlife Federation, February 2000.

25 See www.epa.gov/unix0008/superfund/sites/sville.html.

26 National Research Council, Hardrock Mining on Federal Lands, National Academy Press, 1999. ("The Committee observed instances of recently abandoned but un-reclaimed exploration and mining sites that had not been covered by any financial assurance....The Committee also found that long-term water treatment and monitoring at mine sites generally does not carry financial assurance at either the state or federal level....Based on the Committee's findings, inadequate protection of the public and the environment caused by current financial assurance procedures is a gap in the regulatory programs," at 65.)

27 See Office of Surface Mining, Reclamation, and Enforcement 1999, http://www.osmre.gov/aml/remain/zintroun.htm.

28 Cited in U.S. Government Printing Office, Adequacy of Bonds to Ensure Reclamation of Surface Mines, Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, 99th Congress, June 26, 1986, at 4.

29 U.S. GPO, 1986, at 148.

30 Actuarial Study of the Pennsylvania Coal Mining Reclamation Bonding Program, Milliman & Robertson, Inc., July 16, 1993, at 13. As a concrete example of the inability to collect funds necessary for mine discharge treatment, consider Glacial Minerals, a mining company that went bankrupt in the early 1990s. The firm left 28 mine sites with postmining discharges in western Pennsylvania. Bond recoveries associated with the firm's sites have allowed for water treatment at only 3 sites. Testimony of John Hanger, Hearing on "Current and proposed Bonding

National Priorities List sites. Many Superfund sites were polluted by parties that no longer exist or are bankrupt.[31] EPA refers to these parties' contribution to contamination as "orphan shares." One EPA study estimated that the cost of orphan shares associated with sites on the National Priorities List (NPL) would range from $150 million to $420 million each year.[32] EPA's current orphan share compensation program has allocated $175 million in public funds for cleanup of 98 sites where responsible parties are willing to negotiate long-term cleanup settlements.[33] It should be noted that these expenditures represent only a lower bound on nonrecoverable NPL costs, since orphan share contributions are strictly limited to 25% of remedy and removal costs.[34] The lion's share of orphan shares is picked up by viable responsible parties under principles of joint and several liability. Also, these numbers are associated with orphan shares at the 1,300 NPL sites, which represent only a fraction of polluted sites nationwide.[35]

It should be emphasized that many of the unrecovered environmental obligations are due to the failure of past, rather than current regulatory programs. As described below, a variety of regulatory programs have been developed in recent years to minimize the environmental and financial problems created by bankrupt or unidentifiable polluters. The scale of problems indicated above suggests that these new programs will fill an important gap in environmental regulation. However, as will also be described below, current programs have by no means eliminated the externalization of significant environmental costs by polluters.

Requirements on Coal Mining," before the Pennsylvania Environmental Resources and Energy Committee, December 14, 1999. Also see Commonwealth of PA, DEQ Fact Sheet: Reed and Strattanville Mine Reclamation Projects, at http://www.dep.state.pa.us/dep/deputate/minres/BAMR/Strattanville/FS2386.pdf.

31 According to The Superfund Progress Report: 1980—1997, U.S. EPA 540-R-98-044 October 1998, "at almost every Superfund site, some parties responsible for contamination cannot be found, have gone out of business, or are no longer financially able to contribute to cleanup efforts."

32 U.S. EPA, OSWER, Mixed Funding Evaluation Report. The Potential Costs of Orphan Shares, September 1998.

33 Statement of Lois Schiffer, Assistant Attorney General, Environment and Natural Resources Division U.S. Department of Justice, before the Superfund, Waste Control, and Risk Assessment Subcommittee of the Environment and Public Works Committee, U.S. Senate, March 21, 2000.

34 Interim Guidance on Orphan Share Compensation for Settlors of Remedial Design/Remedial Action and Non-Time-Critical Removals, June 3, 1996.

35 Most states have developed cleanup programs to deal with an estimated 30,000 sites unable to qualify for the NPL program. Congressional Research Service, Report for Congress, Superfund and States: The State Role and Other Issues, October 16, 1997.

One conclusion to be drawn from the above statistics is that it is not only notorious catastrophes, such as oil tanker spills, that signal the need for financial responsibility. Smaller risks, such as unplugged wells and leaking tanks at filling stations, can in aggregate create even greater externalized costs because the number of operations is large and the pockets of firms responsible for them are shallow. Finally, it is important to realize that large companies, not only small ones, can externalize costs via bankruptcy. A current example is the chemical manufacturer W.R. Grace, which has recently filed for bankruptcy primarily because of asbestos-related liability claims. The effect of the firm's bankruptcy on its multimillion-dollar environmental cleanup liabilities remains to be seen.[36]

1.3 The Benefits of Assurance

Liability rules and reclamation obligations lead to polluter cost internalization only in theory. In practice, liability, many administrative requirements, and any other after-the-fact penalties or obligations suffer from an important weakness: Since the financial damages or obligations arise only after environmental damage has occurred, polluters can escape cost internalization via prior dissolution or bankruptcy. Financial assurance rules counter this weakness.

In concrete terms, financial responsibility ensures that the expected costs of environmental risks appear on a firm's balance sheets and in its business calculations. If new investments imply possible future environmental costs, financial responsibility increases the relevance of these costs to the firm's decisionmaking. When firms self-insure, they must possess demonstrable wealth and financial stability. Firms with fewer resources often cannot self-insure and must therefore acquire rights to financial assets from third parties, such as banks and insurers. Third-party assurance providers are obviously concerned that their capital will be consumed by their clients' future liabilities. As a result, they have a strong incentive to monitor the environmental safety of firms they underwrite. Capital providers can also base the cost of capital or premiums on observable attributes of the firms to which they provide assurance. For example, more favorable premiums can be offered to firms with meaningful risk management and safety programs. In the extreme, financial coverage may be denied altogether to firms that

36 The firm has cleanup liabilities in the tens of millions of dollars. "W.R. Grace Files for Bankruptcy Protection, Citing Huge Increases in Asbestos Litigation," Environment Reporter, April 6, 2001, at 640.

fail to demonstrate acceptable levels of safety. In these ways, the capital markets that arise to satisfy demand for financial responsibility generate incentives to reduce environmental risks.[37]

Financial assurance can also foster timely, relatively low-cost public access to compensation. This can be beneficial when a swift response helps minimize damages. When assurance is held by a public trustee, such as a state regulatory agency, it minimizes the public transaction costs associated with collecting compensation. Even when liability is firmly established, the possibility of appeal, delay, and uncertainties associated with penalty collection can complicate the actual transfer of funds from defendants to victims and resource trustees. Some financial assurance instruments, such as letters of credit, allow almost instant access by regulators to reserved funds. This shifts the burden of proof from the government to the plaintiff. Instead of the government's having to prove that compensation is due and seek the funds, the burden falls to the polluter to demonstrate that it is not liable.[38]

Assurance is a time-tested concept. Its application is neither new nor confined to environmental problems.[39] Mandatory automobile insurance and minimum capital requirements for banks share similar motivations: namely, the desire for victim compensation and the deterrence of inappropriate risk-taking.[40] Bail and construction bonds, like environmental bonds, guarantee performance of a future action by making a solvent third party liable for the costs of a performance failure. In terms of their environmental application, assurance has been advocated for decades as a complement to environmental law and regulation.[41] The academic literature on

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37 See generally Goran Skogh, Insurance and the Institutional Economics of Financial Intermediation, The Geneva Papers on Risk and Insurance, 1991 (describing the benefits from monitoring that come when intermediate financial guarantors expose their assets to the liability claims of the firms they underwrite).

38 The corollary, of course, is that the transaction costs borne by regulated firms will increase. Whether this improves overall welfare is a more complex issue.

39 Bond agreements can be found in the Old Testament, as in Genesis 43:9 ("I will be surety for him; of my hand you shall require him. If I do not bring him back to you and set him before you, then let me bear the blame for ever") and Proverbs 20:16 ("Take a man's garment when he has given surety for a stranger...").

40 For instance, the 1988 Basle Accord is an international agreement setting minimum capital requirements for banks to prevent bank failures. Bank insolvency creates a compensation problem because it means depositors cannot be paid. It creates a deterrence problem because the possibility of insolvency can create incentives for excessive risk taking, in this case excessive risk in the granting of loans. See Robert Merton, A Functional Perspective of Financial Intermediation, Financial Management 24, 1995, pp. 23–41 (identifying three ways for banks to reduce their risk exposures: hedging, insuring with others, and possession of an adequate capital cushion).

41 Peter Bohm and Clifford Russell, Comparative Analysis of Alternative Policy Instruments, in Allen V. Kneese and James L. Sweeney, eds., Handbook of Natural Resource and Energy Economics, Volume 1, Elsevier, 1985, and

tort law has long identified the defendant insolvency as a source of inefficiency associated with the use of liability rules.[42]

1.4 Alternatives to Assurance

Perhaps the strongest motivation for assurance requirements arises from contemplation of the alternatives. Since environmental costs never simply vanish on their own, someone must pay. The question is, who? Two principal alternatives exist: the externalization of costs to society and the extension of environmental costs to polluters' business partners. As argued above, the externalization of environmental costs to society is highly undesirable because it undermines deterrence and the ability to compensate victims. The extension of liability to business partners is a more complex case. But it, too, highlights the desirability of assurance.

The law routinely extends liability to the business partners of insolvent or absent defendants. Retailers and distributors can be liable for injuries due to defects in products they sold but did not manufacture, and employers can be liable for damages caused by independent contractors employed by them.[43] The motivation for extending liability is the same as that for assurance: Deterrence and compensation are served by an internalization of costs. Firms exposed to their business partners' liability will more closely monitor those partners' safety. Business partners also provide a source of compensation. In the environmental context, joint and several

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Peter Bohm, Deposit-Refund Systems: Theory and Applications to Environmental, Conservation, and Consumer Policy, Resources for the Future, by the Johns Hopkins University Press, 1981.

42 Because insolvency truncates the expected penalties borne by potential defendants, it also undermines the motivation to take precaution against risk. For analyses that explore or employ this reasoning, see Alan Schwartz, Products Liability, Corporate Structure, and Bankruptcy: Toxic Substances and the Remote-Risk Relationship, 14 J. Legal Stud. 689, 1985; Steven Shavell, The Judgment-Proof Problem, 6 Int'l Rev. L. & Econ., 45, 1986; William Landes and Richard Posner, The Economic Structure of Tort Law, 1987; Lewis Kornhauser and Richard Revesz, Apportioning Damages Among Potentially Insolvent Actors, 19 J. Legal Stud. 617, 1990; and James Boyd and Daniel Ingberman, Noncompensatory Damages and Potential Insolvency, 23 J. Legal Stud. 895, 1994.

43 For the liability of retailers and distributors, see Section 402A of the Restatement of Torts (Second) and Products Liability: Manufacturer and dealer or distributor as joint or concurrent tortfeasors, 97 ALR 2d 811. A recent case to this effect is Pepper v. Star Equipment, Ltd. 484 NW2d 156, CCH Prod. Liab. Rep. 13162, in which a defendant distributor in a products liability action was not allowed to seek contribution from a manufacturer in the midst of Chapter 7 bankruptcy.

For the liability of employers for injuries caused by independent contractors, see Sections 416 and 427 of the Restatement of Torts (Second), which states that when the contractor's activities are likely to entail significant or inherent risk, the employer of the contractor is liable for the contractor's failure to exercise reasonable precaution, even if the employer had required that precaution in the contract.

liability extends liability in this way and for these purposes. Under the Superfund law, an acquiring firm takes on the liabilities attached to property owned by the seller.[44] Liability is also extended from operators of disposal facilities to the original generators of waste.[45] And liability can be applied without reference to fault or the liable firm's proportional contribution to the damage.

Assurance is preferable to extended liability for a variety of reasons. First, the extension of liability does not guarantee cost internalization, since there may be no applicable business partners from which to seek compensation, or the partners may themselves be insolvent. Second, as the history of Superfund has shown, joint and several liability entails significant transaction costs associated with *ex ante* contracting between mutually liable firms and the resolution of *ex post* claims for contribution among jointly liable defendants.[46] Finally, extended liability can distort production decisions, such as investments in capital and the pattern of transactions between contracting parties.[47]

2. When Is Assurance Required?

Although some assurance rules have existed for decades under U.S. law, in the past decade their implementation has become much more widespread.[48] Assurance regulations are now associated with many of the nation's most important environmental laws. Financial assurance is required under the Oil Pollution Act (OPA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund), the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act, the Outer Continental Shelf Lands Act (OCSLA), the Federal Land Policy and Management Act (FLPMA), the Atomic Energy Act (AEA), Toxic Substances Control Act (TSCA), the Safe Drinking Water Act

44 See United States v. Kayser-Roth Corp., 910 F.2d 1032 (1st Cir. 1990).

45 42 U.S.C. § 9607 (1988).

46 For discussion of the transaction costs associated with joint and several liability under CERCLA, see Lloyd Dixon, The Transaction Costs Generated by Superfund's Liability Approach, in Richard Revesz and Richard Stewart, eds., Analyzing Superfund: Economics, Science, and the Law, Resources for the Future, 1995.

47 See James Boyd and Daniel Ingberman, The Search for Deep Pockets: Is Extended Liability Expensive Liability?, J. Law Econ. & Org., 1997; and James Boyd and Daniel Ingberman, The Extension of Liability Through Chains of Ownership, Contract, and Supply, in Anthony Heyes, ed., The Law and Economics of the Environment, forthcoming.

48 California required bonds for oil well plugging as early as 1931. See Thomas, supra note 14 at 2.

(SDWA), and the Surface Mining Control and Reclamation Act (SMCRA). Not all enterprises regulated under these laws are subject to assurance requirements, but financial assurance is required for vessels carrying oil or hazardous substances; underground petroleum storage tanks; solid and hazardous waste landfills; many types of industrial, oil, and gas wells; offshore oil-drilling facilities and pipelines; nuclear power plants and disposal facilities; and coal and mineral mining operations.

2.1 Federal Assurance Regulations

Assurance rules differ somewhat depending on their precise application but always feature descriptions of implementation schedules, types of facilities to which the rules apply, financial instruments with which compliance can be achieved, and enforcement procedures. This section provides a brief overview of the types of facilities and obligations governed by U.S. federal assurance rules. Section 3.4 describes the variety of financial mechanisms firms can use to demonstrate financial responsibility.

2.1.1 Vessels carrying oil and hazardous cargo

A financial assurance rule authorized by both OPA and CERCLA governs waterborne vessels that carry oil or hazardous substances.[49] Before the passage of OPA and CERCLA, financial responsibility was required for vessels carrying oil and hazardous cargo under the Federal Water Pollution Control Act.[50] The current rules apply to a wider range of vessels and facilities, cover a wider range of damages, and require higher levels of coverage.[51] Full implementation of these rules has occurred only recently.[52] Deadlines for compliance, which depended on the type and size of vessel, occurred between 1994 and 1997.[53] The vessel rule applies to tank vessels of any size, foreign-flag vessels of any size, and mobile offshore oil- and

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49 33 USC § 2702; 42 USC § 9607(a)(1). The rules are codified at 33 CFR, Part 138.

50 FWPCA, Section 311, 33 USC 1321 (1970).

51 For instance, the Clean Water Act § 311(f) limited liability to $150 per vessel ton. The corresponding limit under OPA is $1,200 per gross ton. Moreover, before OPA there were traditional admiralty shipowner liability protections that limited the application of liability to negligent parties and situations in which plaintiffs were “physically impacted or touched by the oil.”

52 The rule was finalized in 1996, Financial Responsibility for Water Pollution (Vessels), codified at 33 CFR 138; Final Rule, 61 FR 9274, March 7, 1996, and 61 FR 9263, March 7, 1996.

53 59 FR 34212-34213. 33 CFR 138.15.

gas-drilling units.[54] Some smaller commercial vessels, such as barges not carrying oil or hazardous substances, are excluded from the regulations. Mandatory assurance amounts are based on the type of cargo, type of vessel, and the vessel's tonnage. For a large vessel, assurance requirements can run into the tens of millions of dollars.

2.1.2 Offshore oil facilities

Another assurance rule authorized by OPA governs offshore facilities used for oil exploration, drilling, production, or transport.[55] Notice of the offshore facilities rule was given in 1997 and finalized in 1998.[56] Compliance for all regulated facilities had to be demonstrated by 1999. Prior to OPA, financial responsibility was required for offshore facilities under OCSLA, and for oil pipelines under the Trans-Alaska Pipeline Act.[57] The offshore facility rule applies to facilities "in, on, or under" navigable waters. Covered facilities include platforms, terminals, refineries, and pipelines used for oil exploration, drilling, and production.[58] Onshore oil facilities are not covered. Assurance amounts are based on calculations of "worst-case" discharge volumes from the facilities and can go as high as $150 million.[59]

2.1.3 Underground petroleum storage tanks

RCRA requires financial responsibility for the owners and operators of underground storage tanks, such as those used at gas stations.[60] The rules were codified in 1988, but compliance deadlines for certain operators extended until 1998. UST owners and operators must demonstrate the ability to perform corrective action to restore a contaminated site and compensate third parties for property damage or injury arising from a leaking tank. The amount

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54 33 CFR 138.12.

55 OPA § 1016. The offshore facility financial responsibility rules are codified at 30 CFR, Part 253.

56 62 FR 14052, March 25, 1997 (notice of proposed rulemaking); and the final rule, codified at 30 CFR, Part 253, Oil Spill Financial Responsibility for Offshore Facilities, 63 FR 42699, August 11, 1998.

57 See 30 CFR 250,251, 256, 281, 282 (mandatory bond coverage for Outer Continental Shelf lessees). The Outer Continental Shelf Lands Act had a $35 million FAR for certain oil and natural gas facilities. OPA increased the required amounts (to as much as $150 million) for some facilities.

58 30 CFR 253.3.

59 30 CFR 253.13.

60 RCRA's Subtitle I covers UST facilities. The UST financial responsibility rules are codified at 40 CFR 280, and see 53 FR 43370, October 26, 1988.

of financial assurance that must be demonstrated can be significant. For example, most gas stations are required to carry $1 million in insurance coverage.

2.1.4 Solid waste landfills and hazardous waste facilities

RCRA also requires financial assurance for solid waste (nonhazardous) landfills and hazardous waste treatment, storage, and disposal facilities (TSDFs).[61] The final municipal landfill compliance deadlines were in 1997. Facilities must provide financial guarantees designed to assure the internalization of costs associated with the closure of these facilities and their long-term maintenance.[62] Closure requirements include the capping of landfills and long-term monitoring of groundwater impacts. Hazardous facilities must also demonstrate liability coverage to compensate third parties suffering bodily injury or property damage resulting from an accident.[63] Coverage amounts for a typical site run into the millions of dollars.

2.1.5 Wells

To protect drinking water quality, the Safe Drinking Water Act of 1974 established rules for the regulation of underground injection control (UIC) wells. Operators of Class I, II, and III wells are required to demonstrate financial responsibility for their eventual plugging and abandonment.[64] Such wells are used to dispose of hazardous waste, to dispose of fluids associated with production of natural gas and oil, and to inject fluids for the extraction of minerals.[65] Unplugged wells can lead to migration of contaminants into aquifers, saltwater intrusion into a freshwater aquifer, and surface soil contamination. In addition to plugging, requirements can include revegetation, erosion control, and removal of tanks and lines. Bond

61 RCRA's Subtitles C and D govern hazardous and solid waste disposal facilities, respectively. The RCRA C financial responsibility rules are codified at 40 CFR 264 and 265 ("subpart H"). The RCRA D financial responsibility rules are codified at 40 CFR 258 ("subpart G").

62 For the Subtitle C requirements, see 40 CFR 264/265.144 and 264/265.145. For Subtitle D, see 40 CFR 258.72 and 258.73.

63 Coverage requirements may be for both "sudden" and "nonsudden" accidental occurrences. 40 CFR 264/265.147.

64 Codified at 40 CFR 144.28(d), 40 CFR 144.52(a)(7), and 40 CFR 144.60-144.70.

65 Injection wells are "bored, drilled or driven shafts or dug holes whose depth is greater than the largest surface dimension into which fluids...are emplaced. That is, any hole that is deeper than it is wide and through which fluids can enter the ground water is an injection well." 40 CFR 144.3.

amounts vary greatly depending on the well type.[66] There is no assurance required for third-party liability.

2.1.6 Coal and hardrock mines

Coal mining is regulated at the federal level by the Surface Coal Mining and Reclamation Act of 1977. SMCRA governs both surface effects, such as strip mine reclamation, and subsurface effects, such as damaged water quality from mine drainage.[67] Prior to the act's passage, states had regulatory authority and often required bonds, though these bond amounts were often inadequate.[68] SMCRA increased bond amounts for site reclamation, including revegetation, backfilling, grading, and mine drainage controls. Bond amounts are based on acreage and vary with the type of mining activity and site characteristics.[69]

Assurance is also required for hardrock mining operations. Hardrock mining continues to be regulated primarily by state law, and state bond policies vary.[70] However, federal law requires hardrock bonds when mining occurs on federal lands.[71] Mining on lands administered by the Bureau of Land Management and U.S. Forest Service is subject to those agencies' respective rules.[72] Like coal mine bonds, hardrock bonds are based on acreage and site characteristics.

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66 Oil and gas wells are typically regulated by individual states. Bond amounts vary from state –to state. For instance, a single well bond for a well 500 feet deep or less is $500 in Kentucky but $100,000 in Alaska. See Thomas, supra note 14, at 2.

67 30 CFR 800. For an overview, see James McElfish, Environmental Regulation of Coal Mining: SMCRA's Second Decade, Environmental Law Institute, 1990. The Mineral Leasing Act also requires bonds for compliance with approved mining and exploration plans on public lands. 43 CFR 3474.1.

68 Inadequate bond amounts were one reason for the act's passage. See McElfish, supra note 67 at 91, citing H. R. Rep No. 128, 95th Congress, 1st Session 57-58, reprinted in 1977 U.S. Code Cong. & Admin. News 595-96.

69 To illustrate, Pennsylvania requires minimum per-acre bond amounts that range from $1,000 to $5,000, depending upon site characteristics.
http://www.dep.state.pa.us/dep/deputate/minres/bmr/bonding/bondingrpt021000a.htm.

70 See generally, Kuipers supra note 24.

71 The Federal Land Policy and Management Act (FLPMA) directs the secretary of the Interior to prevent unnecessary or undue degradation of the public lands. Financial assurance is considered part of this charge. See 43 U.S.C.1732(b).

72 BLM mining rules are codified at 43 CFR 3809. USFS reclamation rules are codified at 36 CFR 228.

2.1.7 PCB storage facilities

Under the Toxic Substances Control Act, commercial PCB storage facilities must demonstrate financial assurance for costs associated with their closure, including final disposal, decontamination, and monitoring costs.[73]

2.1.8 Nuclear facilities

The Atomic Energy Act requires financial assurance for the costs associated with nuclear power plant decommissioning and for the closure of radioactive waste disposal facilities.[74] Minimum amounts for plant decommissioning are in excess of $100 million. Bonds are also required for the closure of uranium and thorium mill sites.[75] Assurance is also required for liabilities arising from nuclear accidents. The Price-Anderson Act, while limiting the industry's liability, also requires coverage for reactors, reprocessing facilities, and fuel enrichment facilities.[76] The private insurance requirement is currently $200 million for reactor units.[77]

2.2 The States' Role in Assurance Regulation

State laws sometimes complement and expand upon federal assurance regulations. States also often implement the assurance rules mandated by federal law. For these reasons, it is most appropriate to think of assurance regulations as emerging from a combination of state and federal rules and enforcement.

A comprehensive survey of state financial assurance requirements is beyond the scope of this paper. However, it is worth noting that individual states can have assurance requirements that in some cases exceed those under federal law. For example, California recently passed a law requiring oil-carrying vessels to demonstrate $1 billion in coverage for oil pollution damages.[78] The law also requires marine terminals, fueling facilities, and barges to demonstrate assurance

73 Codified at 40 CFR 761, Subpart D.

74 Plant decommissioning assurance rules are codified at 10 CFR 50.33(k) and 50.75; disposal assurance at 10 CFR 61.62.

75 10 CFR Part 40, Appendix A.

76 42 U.S.C. §2210.

77 See U.S. Nuclear Regulatory Commission, The Price-Anderson Act—Crossing the Bridge to the Next Century: A Report to Congress, 1998.

78 California Government Code § 8670.37.53. The law went into effect on January 1, 2000.

coverage. Alaska law mandates financial responsibility for oil terminals, pipelines, tank vessels, and barges with coverage levels higher than under federal law.[79] In addition, a new Alaska law extends financial responsibility to vessels other than tankers, including cruise ships, and railroad tank cars carrying oil.[80] Similarly, Washington State requires oil vessel coverage in excess of federal requirements and extends the requirements to a broader range of facilities.[81]

In other cases, states require assurance for operations or situations not required under federal law. Again, a comprehensive review is beyond the scope of this study, but Michigan, for example, requires holders of sand dune mining permits to provide assurance for the reclamation and revegetation of sand dune areas.[82] Several states require bonds to cover closure costs for scrap tire disposal facilities.[83] Texas requires transporters of medical waste to demonstrate insurance for automobile and pollution liability.[84] Several states require financial responsibility for the closure of agricultural operations producing animal waste.[85] And North Carolina established financial responsibility requirements for dry-cleaning operations.[86]

States are often responsible for the implementation of assurance regulations, even when assurance is required by federal law. This is true, for example, under RCRA. In general, UST, landfill, and TSDF assurance programs are operated by the states, subject to federal oversight and approval.[87] Under SDWA, the federal government regulates wells only if states do not

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79 Some oil terminals and pipelines must demonstrate $50 million in coverage. Tank vessels and barges must demonstrate up to $100 million. Alaska Stat. 46.04.040 (Supp. 1994).

80 Alaska Stat. 46.04.055, as of June 2000.

81 The coverage requirement for oil-carrying vessels is $500 million. Washington Rev. Code Ann. 88.40.020(2)(a). Coverage is also required for onshore facilities that could discharge oil to navigable waters or adjoining shorelines. Washington Rev. Code Ann. 88.40.025.

82 MCL 324.63712.

83 For example, Michigan, MCL 324.16903(1)(j); Ohio, OAC 3745-27-15(B)(1); and Texas, TAC, Title 30, Part 1, Chapter 37, Subchapter M.

84 TAC, Title 30, Part 1, Chapter 37, Subchapter U.

85 Kansas requires financial responsibility for large-scale swine facilities, K.A.R. 28-18a-23. Illinois requires financial responsibility for the closure of waste lagoons used in livestock production, 35 IAC § 506.601.

86 G.S. 143-215.104F (f). These rules have not been fully implemented. Facilities were required to obtain liability insurance of no less than $1 million or provide regulators with a surety bond or deposit of securities in the amount of $1 million. These requirements may be waived if the operation is unable to comply and is found to be uninsurable.

87 42 U.S.C. §6926(b), §6943, §6991(c). EPA delegates implementation via a state authorization process. Federal approval of state programs places a floor on standards and ensures consistency while allowingsome flexibility in program details. Individual states can implement stronger standards, 42 U.S.C. §6929.

administer their own programs.[88] For hardrock mining, states have their own mine bonding regulations but must come to agreement with the federal government over bonding criteria for mines on federal land.[89] Similarly, Under SMCRA, the Office of Surface Mining Reclamation and Enforcement (OSM) in the Department of the Interior enforces the rules until individual states achieve “primacy,” or independent enforcement authority approved by OSM.[90]

3. Demonstrating Financial Responsibility

Financial responsibility can be demonstrated in a variety of ways. All the assurance rules described above allow a choice of compliance mechanisms. This section describes the variety of mechanisms in more detail. First, it is useful to note some basic distinctions between insurance and performance bonds, and between self-assurance and assurance that is purchased from third parties.

3.1 “Assurance as Insurance” versus “Assurance as a Bond”

There are two basic types of environmental costs that require assurance: uncertain environmental liabilities (typically associated with remedial site cleanups, property damage, or health impacts) and more defined environmental obligations, such as site restoration, land reclamation, or long-term water treatment obligations.

The distinction is subtle but important. Assurance for uncertain environmental costs is best thought of as mandatory insurance. An important characteristic of insurance is that by forcing cost internalization, it creates an incentive to reduce uncertain environmental risks through improved technology or management. In contrast, when obligations are fully known *ex ante*, there is no need for insurance per se. Instead, what is needed is a guarantee that the known obligation will be performed. Typically, bonds are used to guarantee performance of a known, future obligation.

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88 “Direct implementation” states are those in which EPA administers the UIC program. As an example, Class II wells are federally administered in New York, Pennsylvania, Florida, Kentucky, Tennessee, Michigan, and Montana. www.epa.gov/r5water/uic/ffrdooc2.htm.

89 See Kuipers, supra note 24, at I-7.

90 http://ciir.cs.umass.edu/ua/October1995/priority/pfile-7.html.

Consider an example: landfill closures. Relatively certain obligations include the need to revegetate, cap, and monitor the site. These obligations tend to be guaranteed via bonds. Uncertain risks from the landfill include future groundwater contamination, health impacts, and damage to neighboring property. These uncertain liabilities tend to be assured via insurance coverage. To be clear, the motivation for assurance in the bonding context is nearly identical to the motivation for assurance in the insurance context. In both, assurance guarantees that funds will be available in the future to internalize costs.

The difference, though, has practical implications for the instruments used to demonstrate assurance. First, bond agreements typically assume that the principal bears ultimate responsibility for the loss. In other words, the bond provider pays only if the principal is unable to do so because of insolvency or abandonment.[91] Consequently, bond pricing is primarily a function of the principal's bankruptcy risk, and bonds tend to be priced as a simple percentage of their face value.[92] Insurance products are different because insurers typically pay the claims of both solvent and insolvent clients. This means that insurance is priced to reflect a greater likelihood and range of possible claims. Consequently, insurance is usually priced with much greater sensitivity to the risks presented by the insured.

A bright line between assurance as insurance and assurance as a bond should not always be drawn. Moreover, the distinction should not be applied to the suppliers of these forms of assurance, since surety bonds are often sold by insurance companies.

3.2 Self-Demonstrated versus Purchased Assurance

All assurance programs allow firms to purchase assurance from a third party. Insurance, bonds, bank certificates, and letters of credit can be purchased from private financial providers, including insurers, sureties, and lenders. Some programs allow firms to self-demonstrate assurance as an alternative to purchased assurance. Self-demonstration is essentially a

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91 Even in the absence of an express written indemnity agreement, common law indemnity would favor the surety against the principal. See Lawrence Moelmann and John Harris, eds., The Law of Performance Bonds, American Bar Association, 1999, at 6 (and also for more on the difference between performance bonds and insurance and a legal overview of performance bonds generally).

92 Moelmann and Harris, supra note 91, at 5 (referring to the relative simplicity of bond pricing, "this is a monumental difference from casualty underwriting, where the loss experience of the given insured can result in a premium that is several multiples of what an insured with a better record might pay").

demonstration of profitability and stability. In theory, wealthy, stable firms can be counted on to internalize their future costs, without the involvement of third-party capital providers.[93]

There are clear differences between purchased and self-demonstrated assurance. The most important difference is in the government's monitoring role. Self-demonstration requires the government to monitor the firm's financial condition over time. For instance, asset ratios, profitability indicators, and bond ratings may be used to pass a self-demonstration test. Accordingly, regulators must regularly audit these financial data to determine their accuracy and adequacy. Note, however, that corporate financial auditing is not a traditional strength of environmental regulators. In contrast, purchased assurance is relatively easy to monitor.[94] Two basic things must be verified: first, the existence of a valid assurance contract with a third-party provider, and second, the financial strength of that provider. The financial strength of capital providers is easy to monitor because oversight is usually already in place. The Securities and Exchange Commission, for example, keeps an up-to-date list of government-approved sureties. In contrast, self-demonstration requires verification of changeable, complex, and often subjective financial data.

Another difference is that purchased assurance inevitably directs the attention of private financial providers to the risks presented by the potential polluter. After all, it is in the commercial interest of private financial providers to accurately analyze and minimize the risks. This virtue is not harnessed when firms self-demonstrate assurance.

Some assurance mechanisms blur the distinction between purchased and self-demonstrated mechanisms. Trust funds, for example, are funded by the firm itself and thus are not technically purchased. However, when appropriately designed they involve an independent trustee and funds can be released only with the approval of the regulator. Accordingly, trust funds do not suffer from the weaknesses of self-demonstration. Another mechanism that blurs the distinction is captive insurance—that is, insurance provided by the firm itself or by a collection of similarly regulated firms. Like purchased insurance, captive insurance premiums are typically risk-sensitive. Because captive insurers are not independent firms, however, they present many of the same monitoring problems as self-demonstrated assurance.[95]

93 But see Section 6.6 infra.

94 Section 6.4 and 6.5 infra discuss the need to monitor purchased assurance.

95 See discussion in Section 6.4.6 infra.

3.3 Publicly Subsidized Assurance

In some instances environmental assurance is provided by public funds. For example, most states under RCRA's underground storage tank rules set up state guarantee funds to help owners comply with RCRA's financial responsibility provisions. Funds were financed via taxes on gasoline sales or retail deliveries, not by UST owner-operators themselves.[96] In a limited set of cases, publicly funded remediation is a defensible public policy.[97] In general, however, public financing of pollution costs is undesirable. Public funds are usually funded from taxes that do not reflect firms' safety records, technology, or ability to manage risks effectively. Since the coverage costs do not reflect risk, they fail to create an incentive for risk reduction. One particularly troubling aspect of publicly operated assurance funds is that they undermine private markets for assurance. Public assurance funds tend to be cheaper and easier to qualify for than privately purchased insurance. Private insurance is likely to be better monitored and more accurately priced, however, because private providers have incentives to minimize their own risks and collect premiums that will cover the costs they are insuring.[98] Most states have already phased out publicly financed UST guarantee funds, or are in the process of doing so.

3.4 Mechanisms

This section provides more specific descriptions of the financial products, mechanisms, or tests firms can use to demonstrate assurance. Assurance programs allow firms to choose from

96 Because retail gasoline is a highly competitive business, these taxes are simply passed along to the consumer. So although the industry is taxed, the tax liability falls primarily on consumers.

97 Subsidized assurance can be justified if it is used to finance so-called retroactive liabilities created by a change in regulation. During a period of legal transition, public financing promotes the timely remediation of existing pollution and compliance with the prospective, deterrent aims of the law. See James Boyd and Howard Kunreuther, Retroactive Liability or the Public Purse?, 11 Journal of Regulatory Economics 79, 1997.

98 See U.S. EPA, State Funds in Transition: Models for Underground Storage Tank Assurance Funds, Office of Underground Storage Tanks, 1996 (updated 1998), www.epa.gov/swerust1/states/statefnd.htm ("In 1996, commercial pollution liability insurance (which meets the federal financial responsibility requirements) is readily available and generally affordable, especially for 'good' tanks meeting all technical requirements. Growth of this insurance market has not been constrained by a lack of supply, but rather by a lack of demand due to competition from state assurance funds"), at 4. Also see Financial Responsibility Long Term Study, State of California, State Water Resources Control Board, January 1995, 94-2CWP. (The state UST fund "is a hindrance to insurance providers"), at 5. Available at http://www.swrcb.ca.gov/~cwphome/ustcf/resource/finrelts.htm.

a variety of the mechanisms, as described below.[99] The data suggests that firms exploit this flexibility by routinely combining mechanisms to meet their full assurance obligations.[100]

3.4.1 Insurance

Insurance policies are generally purchased from independent insurance providers. For a premium, the insurer promises to compensate the purchaser for claims covered in the insurance contract. Contracts are of two basic forms, "claims made" and "occurrence." Claims-made policies provide coverage for claims presented to the insured and reported to the insurer during the coverage period. Claims falling outside the coverage period, even if caused by acts during the coverage period, are not covered.[101] Accordingly, it is in the public interest that the use of claims-made policies be accompanied by additional safeguards to provide assurance over long time horizons. In contrast, occurrence policies cover claims arising even after the policy period has ended, providing the cause of the claim occurred during the policy period. Insurers like to avoid occurrence coverage, as a way to reduce the scale and enhance the predictability of their exposures. From the standpoint of public policy, however, occurrence coverage addresses the goals of assurance better than claims-made coverage.

Another concern associated with insurance is that the policy may feature "exclusions" that weaken coverage.[102] For this reason, regulators must carefully verify that policies fully cover the kinds of claims subject to assurance requirements.

3.4.2 Letters of credit and surety bonds

Letters of credit are purchased from banks.[103] They require the bank to pay a third party beneficiary, in this case the government, under certain specified circumstances, such as the

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99 Typically, different mechanisms can be used in combination, with the aggregate coverage equaling the liability limit. For example, self-insurance can be used to cover the deductible included in an insurance policy. 63 FR 42704, August 11, 1998.

100 For examples, see "Distribution of Subtitle C Facilities among Financial Assurance Mechanisms. Docket materials in support of the April 10, 1998, Financial Assurance Mechanisms for Corporate Owners and Operators of Municipal Solid Waste Landfill Facilities; Final Rule Issue Paper: Effects of the Financial Test on the Surety Industry, at 7 (TSDF assurance); Review of Hard Rock Mining Reclamation Bond Requirements, Legislative Request #98L-36, December 4, 1997, appendix (hardock mining bonds in Montana); U.S. Coast Guard data, available at http://www.cofr.npfc.gov (water-borne vessels).

101 See discussion, Section 6.4.4 infra.

102 See discussion, Section 6.4 infra.

failure of the purchaser to perform certain obligations. Banks may require collateral or deposits before providing a letter of credit, depending on the purchaser's financial health. Letters of credit are typically priced as a small fraction of their face value and are granted for annual terms. Typically, letters of credit are automatically extended after one year, subject to the purchaser's continued good credit and adherence to contract terms. The instrument can be altered only with the agreement of the purchaser, the provider, and the beneficiary. The credit provider does not generally pay out on claims. Rather, the purchaser indemnifies the bank, making the bank liable only if the purchaser defaults. Designed properly, beneficiaries can draw on the letter of credit if its term is not extended and if a replacement form of assurance is not put in place.

Surety bonds are similar to letters of credit, though usually purchased from an insurance company. Sureties usually pay out on claims only if the purchaser defaults.[104] Under most programs surety companies must be certified by the U.S. Treasury Department to qualify as an acceptable source of assurance.[105] Bonds, like letter of credit, cannot be cancelled unless prior notice is given to the regulator, and the government is the beneficiary of the bond in the event of default by the principal.

"Blanket bonds" are a special form of bond, allowable as assurance for oil and gas wells, where relatively large numbers of sites are covered by a single bond. With proof of past good behavior and passage of financial tests, well operators can bond a large number of wells for a relatively small fraction of the assurance they would have to demonstrate if they bonded the wells individually.[106] Since, almost by definition, the assurance amount is less than the firm's obligations, blanket bonds do not guarantee full cost recovery.

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103 Credit issuers must be those who operations are "regulated and examined by a Federal or State agency." 40 CFR 258.74(c).

104 Schmitt v. Insurance Co. of North America (1991) 230 Cal.App.3d 245, 257. Typically, though, either the principal or the surety may be sued on a bond, and the entire liability may be collected from either the principal or the surety. This characteristic of surety bonds is also tempered by FAR "direct action" requirements, described below.

105 See 30 CFR 253.31 (vessels); 33 CFR 138.80(b)(2) (offshore facilities); 43 CFR 3809.555(a) (hardrock mines); 40 CFR 258.74(b) (Subtitle D), 40 CFR 264.143(b)(1) (Subtitle C), 40 CFR 280.98(a) (Subtitle I). "The surety company issuing the bond must, at a minimum, be among those listed as acceptable sureties on Federal bonds in Circular 570 of the U.S. Department of the Treasury."

106 Federal Financial Responsibility Demonstrations for Owners and Operators of Class II Injection Wells, (EPA 570/9-84-007). Federal blanket bond coverage is accepted only if the operator (1) has a spotless past record of plugged and abandoned wells; (2) has at least one oil field or lease with an estimated remaining economic life exceeding five years; (3) has been in the oil business for more than five years; (4) is producing from more than one production field; (5) operates more than ten injection wells; and (6) can pass a financial test.

3.4.3 Cash accounts and certificates of deposit

Cash accounts and certificates of deposit are a particularly iron-clad form of assurance. They place cash or some other form of interest-bearing security into accounts that are made payable to or assigned to the regulatory authority.[107] In the event of default, the accounts may be liquidated by the regulator for the payment of covered obligations. There are several important safeguards for the use of these instruments: The public authority must be made the sole beneficiary, the accounts must be managed by independent financial institutions, and the terms can be changed only with the approval of regulators. Assets remaining after the fulfillment of obligations revert to the firm.

3.4.4 Trust funds

Trust funds are vehicles for the collection of monies dedicated to a specific purpose. So-called third-party trust funds are administered by an independent trustee who is in charge of collecting, investing, and disbursing funds.[108] Because money is typically paid in over some period of time, trust funds may not be fully funded at the time of a claim. Accordingly, shorter-term pay-in periods are preferable for assurance. The regulator should be the sole beneficiary of any such trust fund. The trust agreement, administered by the trustee, specifies the conditions under which trust monies are paid out. After obligations are fulfilled, trust assets are returned to the firm. It is essential that regulators monitor payments into the trust.

Less desirable are first-party trusts, in which trust funds remain in the custody of the principal. Because there is no independent trustee, first-party trusts should allow the regulator to make direct inquiry into the trust's status. Also, the principal's ability to alter the trust's terms or access its funds must be restricted.

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107 Under the hardrock mining assurance rules, cash must be deposited and placed in a federal depository account by BLM, 43 CFR 3809.555(b).

108 Only regulated trustees are acceptable. "The Trustee must be an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency." 40 CFR 258.74(a) (Subtitle D municipal landfill regulations); 40 CFR 264.143(a)(1) (Subtitle C), 40 CFR 280.102(a) (Subtitle I). A trustee may be required to "discharge his duties with respect to the trust fund solely in the interest of the beneficiaries and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity, and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims." 40 CFR 280.103(b).

3.4.5 Self-demonstration

Self-demonstration, or a "financial test," is a mechanism that allows companies with relatively deep pockets to satisfy coverage requirements by demonstrating sufficient financial strength.[109] For example, rules may require that the firm's working capital and net worth both be greater than the coverage requirement. Some require or allow a bond rating test. Usually, a combination of tests must be passed.[110] There may also be a domestic assets test to foster cost recovery. For example, working capital may be defined as the value of current assets in the United States minus current worldwide liabilities; and net worth may be defined as the value of all assets in the United States minus all worldwide liabilities.[111] Ideally, when using the financial test, firms must make annual reports that are independently audited according to generally accepted accounting practices and consistent with the numbers used in the firm's audited financial statements for Securities and Exchange Commission reporting.[112] Any changes in a firm's financial status should also be reported.

3.4.6 Corporate guarantee

A financial guaranty, or indemnity agreement, allows another firm, such as a parent corporation, to satisfy the coverage requirement. Financial guarantors must themselves pass the corporate financial test and agree to guarantee the liabilities of the firm seeking assurance. The requirements are identical to those for self-demonstrators, including the domestic assets requirement. Some programs require that the indemnity agreement be with a single firm that is either a corporate parent or an affiliate.[113]

109 USTs, 40 CFR 280.95; TSDFs 40 CFR 264.143(f); surface mines 30 CFR 800.23.

110 The Subtitle C assurance test involves passing one of two tests, each featuring a set of subtests. As an example, one of the tests requires the firm to pass a domestic assets test, a net worth test, a net working capital to closure cost ratio, and two of three tests relating to asset and liability ratios. 40 CFR 264.143(f)(1).

111 See the rules governing vessels carrying oil and hazardous substances, 33 CFR § 138.80(b)(3); 40 CFR 258.74(e).

112 As under offshore facilities assurance rules, 30 CFR § 253.21–.28. RCRA landfill rules allow discrepancies but only when accompanied by a special report providing explanation. 40 CFR 258.74(e)(2)(B). Audited reports are always required, 40 CFR 264.143(f)(3)(ii).

113 For landfills, see 40 CFR 258.74(g)(1); TSDFs 40 CFR 264.143(f)(10); and USTS 40 CFR280.96(a). In the case of offshore facilities rules, this restriction is the outgrowth of difficulties that arose in an earlier FAR program administered by the Department of the Interior. See 63 FR 42705, August 11, 1998 ("When the USCG first started operating the OCSLA OSFR program in the late 1970s, more than one indemnitor was allowed for any one OSFR demonstration. However, this proved to be unworkable because the failure of any one of the indemnitors could and

As financial responsibility instruments, self-demonstration and indemnity are popular with the regulated community because no third party must be involved and compensated. A common refrain in regulated industries is that the financial tests should be made less stringent, thus allowing a larger number of firms to qualify. However, these instruments are less desirable from a regulatory standpoint. They require more administrative oversight than insurance and sureties, and they provide less of a guarantee that costs will be recoverable in the future. Accordingly, some programs have resisted changes favoring the more widespread use of self-demonstration.[114]

4. The Politics and Cost of Assurance

The regulated community typically opposes new or strengthened assurance rules.[115] New assurance rules produce dire predictions of significantly higher insurance rates, the withdrawal of insurers and sureties from markets, and the demise of businesses unable to meet the assurance requirements.[116] The response to OPA vessel assurance rules is illustrative of the alarm with which some in the private sector received new assurance rules. The law was predicted to increase the cost of insurance by seven to nine times—if insurance was to be available at all. Even more dire predictions included the possibility of a total halt in maritime trade[117] and the collapse of worldwide vessel insurance markets.[118] RCRA's UST regulations were met with similar fear and opposition, one U.S. representative vowing that he would not "just sit around and watch the

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did cause the failure of the whole package of OSFR evidence," and "If the designated applicant and the indemnitor share non-OSFR business objectives, then the potential for disputes over who will pay a claim should be minimized. Likewise, the corporate affiliate requirement should maximize the potential for timely settlement").

114 See 61 FR 9270, 1996. "The Coast Guard does not consider self-insurance and financial guaranties to be ironclad methods of evidencing financial responsibility. Assets can be dissipated without the Coast Guard's knowledge, and continuous monitoring of a self-insured entity's asset base is not feasible…Accordingly, the Coast Guard believes that any amendment to the financial guarantor provision that reduces the protections afforded by that provision is inconsistent with the concept of financial responsibility."

115 Such as higher required bond levels.

116 See Jason Shogren, Joseph Herriges, and Ramu Govindasamy, Limits to Environmental Bonds, 8 Ecological Economics, 109–133, 1993, for a theoretical analysis suggesting that bonds and insurance may not be readily and cost-effectively supplied by financial markets.

117 See Deadline Near for Compliance with U.S. Oil Spill Liability Rules, Oil and Gas Journal, August 1, 1994, at 14.

118 Testimony of Chris Horrocks, International Chamber of Shipping, Hearing before the Subcommittee on Coast Guard and Maritime Transportation of the Committee on Transportation and Infrastructure, House of Representative, June 26, 1996 (hereafter, "1996 House Hearing"), at 44.

small businesses be legislated out of business by the Federal Government."[119] More recently, changes in hardrock mining rules have prompted opposition based on their impact on small mining operations.[120] Should these fears call into question assurance's social desirability?

First, it should be noted that much opposition can be attributed to an underlying fear of expanded liability, rather than fear of assurance requirements themselves. Over the last few decades the widespread adoption of assurance rules has occurred alongside a broad expansion of liability for environmental damages under U.S. law. For example, the adoption of strict, joint and several, and retroactive liability rules has vastly expanded the conditions under which polluters are liable. Second, federal enforcement is not a potential polluter's only concern. In addition to the federal government, private citizens, states, and localities can sue to recover environmental damages. A third source of concern to many is that OPA, CERCLA, and other statutes have expanded liability to include damages to natural resources, as distinct from damages to private property or human health.[121] Natural resource damages (NRDs) can be difficult to value, and methods used to calculate NRDs are controversial.[122] By definition, NRDs involve damages to ecosystem services or resources that are not "marketed" and for which there is no observable price. This means that NRDs are unpredictable and highly sensitive to the valuation methodologies employed by the government and courts.[123]

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119 Representative Richard Ray, November 18, 1987, Hearing before the House Committee on Small Business Subcommittee on Energy and Agriculture, Y4.Sm1/2:S.hrg.101-690. A front-page article in the New York Times fanned the flames with the headline "Fuel-Leak Rules May Hasten End of Mom and Pop Service Stations," that included an estimate by the American Petroleum Institute that the rules would force the closure of 25% of the nation's service stations. New York Times, June 19, 1989, at A1.

120 An economist for the Small Business Association concluded that "the regulated [hardrock] mining industries operate at the edge of profitability and that the rule would oust small businesses from the industry." Memorandum of Points and Authorities, National Mining Association v. Babbitt, U.S. District Court, D.C., No. 00-2998, January 3, 2001, at 29.

121 Section 107 of CERCLA establishes natural resource damage liability and authorizes federal trustees to recover damages for assessing and correcting natural resource injuries, 42 USC 9607(f)(1). OPA Section 1002 establishes liability for "injury to, destruction of, loss of, or loss of use of natural resources." 33 USC 2702(b)(2)(A).

122 See Testimony of Richard Hobbie, Water Quality Insurance Syndicate and American Institute of Marine Underwriters, 1996 House Hearing, supra note 118, at 41. "The major uncertainty to the continuation of the [financial responsibility] program is the natural resource damage assessment problem and those regulations, the lack of standards. Should our fears prove true, we may find that no insurers are going to be in a position to issue guarantees….The dangers posed by potentially excessive and arbitrary assessments present the most serious threat to our ability to continue to insure liabilities under these federal pollution statutes."

123 The contingent valuation method is particularly controversial, but its role in damage assessment has been overemphasized. See testimony of Douglas Hall, NOAA, Subcommittee on Water Resources and Environment, House of Representatives, July 11, 1995. "There have only been six contingent valuation studies completed to date,

All of those factors have generated fears in regulated industries of large, unpredictable, and uninsurable obligations. This is true even when liability is capped.[124] One way to oppose the expansion of liability is to oppose assurance, since for many firms assurance requirements are the way in which bottom-line liabilities are actually defined. There is an important corollary to this statement: Opposition to assurance can be reduced by reducing the uncertainty of liability standards and the methodologies used to value damages.

4.1 Cost Creation versus Cost Redistribution

Another way to explain opposition to assurance is to draw a distinction between created and redistributed regulatory costs. As with any regulation, assurance comes at a cost. And costs generate opposition. It is important, however, to distinguish between costs that are merely "redistributed" by assurance and new, "true" social costs. First consider the way in which assurance redistributes costs. Most obviously, assurance can raise a regulated firm's costs by forcing the internalization of otherwise avoided obligations—that being the very point of assurance. From the perspective of a regulated firm, newly internalized costs are very real and can be expected to reduce profitability. Accordingly, it is not surprising that assurance rules generate opposition. From the social perspective, however, costs newly internalized by polluters are redistributed, not new, costs. Without assurance society bears the cost. Assurance simply redistributes those costs to the polluter. Thus, from a social welfare standpoint, redistributed costs do not count as a true cost of assurance.

However, assurance can create real costs. For instance, assurance products must be purchased, contracts signed, paperwork administered, and compliance and coverage conflicts litigated. Also, regulators must monitor compliance and enforce the rules—tasks that create administrative costs. These costs are true social costs, since they are costs that would not be

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and only one in which the Federal Government was involved in litigation." Restoration or replacement, rather than monetized damage estimates, is the preferred damage calculation method for NRDs. See James Boyd, Financial Assurance Rules and Natural Resource Damage Liability: A Working Marriage? Resources for the Future, DP01-11, 2001.

124 OPA and CERCLA, for instance, limit liability for vessel spills, 33 CFR § 138.80 and offshore facilities 30 CFR 253.13. This is not enough to counter the fears of some potentially responsible firms. According to one shipping industry representative, "there is fundamental concern about the exposure under OPA 1990 to potentially unlimited liability. We know, of course, that the act retains the principle of limitation. We know that there is legal dispute about whether, in fact, legal limitation would be breached in real life." Testimony of Chris Horrocks, 1996 House Hearing, supra note 118, at 44.

present, absent assurance regulation. Note that a benefit-cost analysis of assurance should weigh only these true costs against the benefits of assurance.

In light of this distinction, political opposition to assurance should be placed in its proper perspective. As described in Section 2, environmental costs redistributed by assurance can be quite large, given the size of the obligations that many firms' would otherwise avoid. Society should embrace this redistribution, however, since it represents a fairer and more efficient allocation of financial responsibility for environmental harm. Of more appropriate concern are costs associated with administration and compliance. But the evidence suggests that these costs are relatively low. In environmental market after environmental market, assurance is readily available at reasonable rates. This is a strong indication that assurance's social costs are not overly significant.[125]

4.2 Availability and Affordability

The history of assurance implementation speaks for itself. Assurance does not bankrupt whole industries, and it does not mean the end of small business. In every regulatory context to date, private financial markets have developed to provide the insurance, bonds, and other financial instruments necessary to demonstrate assurance, and they provide these products at reasonable cost.[126] Consider the market for vessel assurance required by OPA. Despite fears, a host of financial assurance products are currently available at rates that have been easily absorbed by the maritime industry. None of the worst-case predictions—bankruptcies, failure of the insurance market—came to pass, and fears were exaggerated.[127] According to the Coast

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125 But see Section 6 infra, for a discussion of costs associated with the administration of assurance regulation.

126 There have been short-term shortages of assurance products in some industries. See 56 Federal Register 31602, Mining Claims under the General Mining Laws ("The traditional surety bond is no longer available. This lack of availability was clearly documented in the 1988 General Accounting Office Report, GAO/PEMD-88-17, Surface Mining: Cost and Availability of Reclamation Bonds....The report found that surety bonds were much harder to obtain than when the existing regulations were promulgated, because of tightening of requirements in the surety industry during the 1980's, and that even when obtainable they required large amounts of collateral. The report concluded that small and mid-sized coal operators face a liquidity crisis when forced to use high cost alternatives to surety bonds or to offer large amounts of collateral to obtain a surety bond"), at 31604.

127 Consider an illustrative exchange between Representative Sherwood Boehlert and Richard Hobbie, an insurance industry representative, during 1995 hearings relating to the fear of bankruptcies in the PRP vessel community (from 1995 House Hearing, note 171 supra): Rep. Boehlert: Do you have any examples of [firms] that have already gone out of business? Mr. Hobbie: The escalation of costs so far in OPA have been within a context that the maritime industry has been able to sustain. I would suggest that there used to be a larger number of small tow- and push-boat companies all throughout the south intracoastal waterways. Many of those are no longer with us. The larger

Guard, which administers the program, traditional vessel insurers “confirmed that [they] had no hard and fast information to support their testimony in July 1994 that the cost of commercial [assurance] would greatly exceed the cost of [prior]coverage” provided by the insurers.[128] New specialty providers have come into existence and are currently providing coverage at affordable rates.[129] To date, there have been no complaints regarding these new providers’ ability to offer coverage.[130]

The government has conducted its own analyses of financial assurance compliance costs under the vessel and offshore facility programs. According to the Coast Guard, combined annual premiums for vessel coverage were $70 million in 1996, two years after the program went into effect. This number is significantly lower than the preimplementation worst-case compliance cost estimate of $450 million per year.[131] Coverage rates vary by the type of vessel and the cargo carried, but at the low end, small, dry cargo vessels can get millions of dollars in coverage for a $1,000 annual premium.[132] As for the offshore facility program, administered by the Department

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operators have purchased many of them. If I may, we have had a number of companies who have ceased transporting black oil—that would be Ingram Barge Lines, Bouchard Transportation of New York, and Canal Barge Lines in New Orleans—because of the insurance costs and the liabilities, so I think there would be a direct example where OPA has caused people to change the business pattern. Rep. Boehlert: But no examples of anybody being forced out of business? I’m being intentional in my pursuit of this because so often we hear these horror stories up here and we are all alarmed and we can’t proceed with anything because the bottom is going to fall out, and then when we ask to see where the bottom has fallen out no one can quite show us where that bottom has fallen out…” Hearings before the Subcommittee on Water Resources and Environment of the Committee on Transportation and Infrastructure, House of Representatives, July 11, 1995.

128 Statement of Daniel Sheehan, Director, National Pollution Funds Center, USCG, 1996 House Hearing, supra note 118.

129 The traditional vessel insurance market is currently experiencing a period of health, at least on the loss side, which is translating into lower premiums. According to one insurance company document, “Excess oil pollution cover is again available from market underwriters for the 1999/2000 policy year. As a result of the excellent claims experience and the over capacity in the insurance market it has again been possible to achieve significant reductions in the rating structure.” See http://www.nepia.com/Circulars/excess_oil.htm (accessed July 28, 2000).

130 “Traditional providers of COFR guarantees declined to provide coverage under the OPA 90 regime, necessitating the emergence of new guarantors. However, since the regulatory program became effective in December 1994, there has not been a single incidence where a guarantor has not met the expectations of the program. The new mix of guarantors has been as reliable as the old mix.” Testimony of James Loy, USCG, Subcommittees on Coast Guard and Maritime Transportation and Water Resources and Environment, House of Representatives, March 24, 1999.

131 Statement of Daniel Sheehan, Director, National Pollution Funds Center, USCG, 1996 House Hearing, supra note 118.

132 According to one company’s advertisements, small dry cargo vessel operators can get up to $70 million in COFR coverage for $1,000 a year. See www.american-club.com/cir2-98.htm (accessed July 28, 2000).

of the Interior, the industry-wide annual cost of coverage is estimated at only $6.3 million.[133] Moreover, Interior does "not agree with the comment that the costs of complying with this regulation threaten the viability of many small businesses, because our estimated annual compliance cost is only $14,000 per business."[134]

Assurance under other programs is also readily available. According to a government study of hazardous waste facilities, "Every Subtitle C permit official interviewed, regardless of whether their state allowed the financial test, stated that no financially viable facility in the state was unable to obtain a valid financial assurance mechanism."[135] An estimate of assurance costs for nonhazardous waste landfills placed them at only 2% to 3% of total annual landfill costs.[136] According to GAO, mining bonds, too, are widely available.[137]

Assurance rates are a particularly good indicator of availability and affordability. The costs associated with specific assurance products are difficult to summarize. However, a 1994 government study of environmental bond prices revealed a price of approximately 1% to 1.5% of the bond's face value. More specifically, the 1994 rates for noncollateralized bonds covering environmental obligations were as listed in Table 4.[138]

Table 1. Environmental Bond Rates

Level or layer of coverage	*Bond rate*
First $100,000	$25 per $1,000 in coverage

133 63 FR 42709, August 11, 1998.

134 These figures are the agency's estimates for small facilities (those requiring only $10 million in annual coverage). The total includes $10,000 in estimated annual premium costs and $4,000 annual administrative costs. 63 FR 42708, August 11, 1998.

135 Docket materials in support of the April 10, 1998 Financial Assurance Mechanisms for Corporate Owners and Operators of Municipal Solid Waste Landfill Facilities; Final Rule Issue Paper: Market Effects of the Financial Test, at 7. The report also notes, "In some cases, firms have been unable to obtain financial assurance. However, in every case, the problem was not the availability of financial assurance mechanisms, but the financial strength of the company," at 7.

136 See Federal Register 1998, supra note 18, at 17722.

137 U.S. GAO, Federal Land Management: Financial Guarantees Encourage Reclamation of National Forest System Lands, GAO/RCED-87-157, August, 1987 ("We did not identify any cases where the costs associated with posting a financial guarantee prevented operators from mining"), at 1; ("Neither Forest Service officials nor representatives of mining associations that we spoke with could cite an instance where mine operators decided not to mine because of the cost of obtaining a financial guarantee"), at 6.

138 Office of Solid Waste, U.S. EPA, Subtitle C and D Corporate Financial Test Issue Paper: Performance of the Financial Test as a Predictor of Bankruptcy, April 30, 1996, at 5.

Next $100,000	$15 per $1,000 in coverage
Next $2,000,000	$10 per $1,000 in coverage
Next $2,500,000	$7.50 per $1,000 in coverage

The same report suggested that larger firms with good environmental records could obtain bonds at rates less than 1%.[139] Annual rates ranging from 1% to 3% of the coverage are reported by a range of sources.[140] Bonds used to guarantee safe nuclear facility closure exhibit a similar range of costs.[141] Offshore facility rates are even lower. According to the government, "90 percent of the 200 designated applicants will demonstrate an average of $35 million in financial responsibility using insurance or a surety that costs $35,000."[142] Annual premiums for $10 million in OSFR coverage average $10,000. These figures imply annual rates of only 0.1% of the coverage's face value. Finally, UST owners can insure a tank for $400 a year—less than it costs to insure a car.[143]

In conclusion, opposition to assurance, based on fears of mass disruption to business, are unwarranted. Opposition is best explained as a reaction to the redistribution of costs to responsible parties and as a lobbying tactic to reduce the stringency of regulatory requirements.

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139 Ibid., at 5.

140 Interviews with Michigan Department of Environmental Quality financial assurance program administrators. Also see ICF Memorandum to Betsy Tam, EPA Office of Solid Waste, January 25, 1988 (cited in Office of Solid Waste, U.S. EPA, Subtitle C and D Corporate Financial Test Analysis Issue Paper: Market Effects of the Financial Test, December 9, 1997, at 2), which reports an annual 1.5% of face value cost of environmental letters of credit and surety bonds. See also McElfish, supra note 67 (citing a representative of the Surety Association of America, placing the cost of surface mining reclamation bonds at 1.25%), at 86; Kuipers, supra note 24 (hardrock mining bonds costing 1 to 3.5% annually), at I-12; and C. George Miller, Use of Financial Surety for Environmental Purposes, paper prepared for the International Council on Metals and the Environment, 1998 (citing annual costs of mining letters of credit and surety bonds of .37% to 1.5% of face value), at 5. Available online at http://206.191.21.210/icme/finsurety.htm.

141 A Nuclear Regulatory Commission study of decommissioning bonds found rates from 3% to less than 1% of the bonds' face value. Cited in U.S. EPA, Issue Paper, Assessment of Trust Fund/Surety Combination, docket materials in support of Financial Assurance Mechanisms for Corporate Owners and Operators of Municipal Solid Waste Landfill Facilities; Final Rule, April 10, 1998, at 5.

142 Id. In addition, the government estimates that each regulated firm bears $4,000 in annual administrative costs associated with compliance.

143 U.S. EPA, State Funds in Transition: Models for Underground Storage Tank Assurance Funds, Office of Underground Storage Tanks, 1996 (updated 1998), www.epa.gov/swerust1/states/statefnd.htm, ("Premiums have also come down since 1989, when some of these commercial programs began. Then, the average premium was approximately $1000 per tank [for good tanks]. Today that average has been reduced to roughly $400 per tank. For a double-walled tank and piping system, the cost could drop to $200 per tank"), at 5.

Claims that assurance mechanisms will be unavailable and that insurance and bond markets will dry up should be viewed in the same context. In the words of one commentator, "frequently the assertion of bond unavailability has been used as an attempt to ratchet reclamation standards downward and to reduce periods of operator/surety responsibility. It has also led to the use of inadequate bond amounts in some states."[144]

4.3 An Important Exception: Assurance Availability and Retroactive Liability

In 1994, GAO issued a report on the availability of environmental insurance products. Principal findings were that "the majority of companies operating treatment, storage, and disposal facilities in 1991 that attempted to obtain pollution insurance found that it was difficult to obtain"[145] and that 44% of surveyed firms attempting to obtain insurance between 1982 and 1991 were denied coverage at least once.[146] These conclusions are clearly at odds with the argument that coverage is easily available and affordable. In large part, the discrepancy reflects short-term difficulties in the adjustment of insurance markets to assurance. Subsequent technological changes have improved the safety of facilities (a desirable consequence of assurance regulations), and the insurance industry today has an improved ability to predict exposures and tailor products to specific risks. Another explanation for the discrepancy is that the U.S. environmental insurance market in the 1980s and early 1990s was hobbled by uncertainties and costs arising from retroactive, unanticipated liabilities.

Environmental laws passed in the 1970s and 1980s significantly strengthened regulatory requirements and expanded the scope of polluters' liability. CERCLA, for example, imposed liability on firms retroactively. In one stroke, firms were liable for damages due to preexisting conditions, conditions that may not have created liability prior to CERCLA's passage. It is important to emphasize that financial assurance rules foster prospective deterrence, but they do little to promote the cleanup of existing environmental problems. Firms with wealth adequate to absorb existing risks are already "financially responsible." Firms without adequate wealth have no incentive to demand—and capital providers have no incentive to supply—coverage for existing, known liabilities. For this reason, financial responsibility rules should not be applied to

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144 McElfish, supra note 67, at 90.

145 See General Accounting Office, Hazardous Waste: An Update on the Cost and Availability of Pollution Insurance, GAO/PEMD-94-16, April 1994, at 3.

146 Id., at 23.

retroactive liabilities.[147] In fact, the failure of regulation to account for the interaction between financial assurance rules and retroactive liability largely accounts for the insurance availability problems observed in the United States in the past decade. Insurance was unavailable or unaffordable because insurers were likely afraid of exposing their own assets to retroactive liability when underwriting future liabilities.

Consider the experience with UST assurance rules and liability. When RCRA mandated financial responsibility for UST owners, the law did not distinguish between financial responsibility for future risks and responsibility for the cleanup of existing contamination. Because many USTs had already leaked, the immediate effect of assurance requirements was to require insurance for environmental damages that already existed. Because many owners were small businesses unable to afford the cleanup of their sites, the UST requirements led to the publicly financed assurance funds described in Section 3.3. But as these funds are phased out, sites are remediated, and new technologies are installed, USTs are increasingly insurable by private markets.[148] EPA lists 13 major insurers and 97 agents and brokers as current providers of UST financial responsibility coverage.[149] The lesson to be drawn from the UST example is that public financing can be a desirable short-term financial mechanism for preexisting, retroactive liabilities. As long as they strictly limited in duration, public funds foster the transition to a workable and affordable system of prospective financial responsibility provided by third-party, private-sector providers.[150] Markets for financial assurance coverage may at first be problematic, but over time they adapt to new environmental technologies and risks, resulting in greater availability and lower prices.

147 See Boyd and Kunreuther, supra note 97. Public funds, by absolving firms of historic liabilities, allow for remediation of existing contamination without reducing firms' wealth. Firms left with greater wealth have a greater incentive to take efficient prospective risk reduction measures, assuming that they are prospectively liable and have to demonstrate privately provided financial responsibility.

148 See note 143 supra.

149 U.S. Environmental Protection Agency, List of Known Insurance Providers for Underground Storage Tanks, Office of Solid Waste and Emergency Response, EPA 510-B-00-004, January 2000.

150 As noted in Section 3.3, public financing is an undesirable form of prospective financial responsibility. By subsidizing private environmental costs, public assurance funds undermine deterrence.

4.4 The Politics of Small Business Regulation

A significant political barrier to assurance arises from its disproportionate impact on small businesses. This is unavoidable, of course, since small firms—by definition—are in particular need of financial responsibility regulation. In general, small firms are less wealthy and are thus more likely to become insolvent in the face of large environmental obligations. Small firms may also be monitored less effectively than larger firms. But clearly, it is harder and more costly for small firms to demonstrate financial assurance. For large firms, compliance with financial responsibility may involve little more than the preparation of audited financial statements. Small firms, by definition, cannot self-insure and so must pay for the involvement of a third-party insurance or capital provider. Also, small firms may be required to participate in risk assessments, paperwork, and transactions with which they are unfamiliar.

In general, regulating small business is not politically popular. Regulatory relief bills for small business are a common congressional offering.[151] A particular issue for agencies proposing assurance rules that apply to small businesses is the Regulatory Flexibility Act (RFA), which requires agencies to evaluate, offer flexible compliance alternatives, and minimize the impact of regulations on small business.[152] RFA can be thought of as a procedural safeguard to ensure that small firms are not overly burdened by regulation. It can also be viewed as warning to agencies targeting small firms for regulation. From a policy standpoint, and accepting the desirability of objective regulatory impact analysis, the "smallness" of firms should not be used as a barrier to assurance regulation. After all, small firms' size lies at the very root of the policy problem addressed by assurance.[153]

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151 See the Small Business Paperwork Reduction Act Amendments (HR 3310 & S. 1867), 1998, which would have prohibited federal agencies from fining small businesses for first-time violations or for not complying with paperwork requirements, as long as the company complied within six months of notice of the violation. See also the Small Business Liability Protection Act (H.R. 1831), 2001, a bill that provides Superfund liability relief for small businesses and other small contributors.

152 5 U.S.C. 601, et seq. See also the 1996 Small Business Regulatory Enforcement Fairness Act (which allows small businesses to challenge an agency in court for failure to comply with the RFA), 5 U.S.C. 801, et seq.

153 In at least one instance, an agency's assurance rules were overturned for failure to abide by RFA requirements. Revised hardrock mining bond rules were overturned in 1998 by as U.S. District Court, Northwest Mining Association v. Babbitt, F.Supp.2d 9, 1998 U.S. Dist.

5. Design and Implementation: The Scope of Assurance Rules

Assurance is a simple concept: Firms must provide a financial or contractual demonstration of their ability to meet environmental obligations. This simplicity obscures a set of important design issues, however. These issues can be grouped into two basic categories. First, what is the appropriate *scope* of assurance requirements? Second, how can the *security* of the assurance mechanism be guaranteed?

Issues of scope relate to the liabilities and obligations that are covered by assurance, and the dollar value of coverage or bonding that must be demonstrated. There is a tension between the desire to maximize deterrence and compensation by maximizing the scope of assurance, and the desire to minimize compliance costs by minimizing assurance requirements.[154] Issues of security relate to the collection of obligations in the future, given the financial mechanisms used to comply with the assurance rule. One way for responsible parties to reduce costs and their own financial risks is to reduce the security of the instruments they purchase or provide as assurance. A major challenge created by financial assurance rules is that they require regulators to monitor and ensure the mechanisms' security over long periods of time.

5.1 How Much Coverage Is Enough Coverage?

Assurance rules need to guarantee firms' ability to internalize the costs of future environmental obligations. So how high should coverage requirements be? The answer is, just high enough to guarantee the performance of the required obligation or internalization of future liabilities. Coverage requirements higher than these levels are wasteful, because they tie up capital (which always has an opportunity cost) but yield no additional social benefit. Coverage requirements lower than these levels are undesirable because they do not guarantee cost internalization and thus yield inadequate deterrence and compensation.

If it is known that a future restoration obligation will cost a firm *C*, then the appropriate level of assurance is *C*. Requiring less raises the possibility that the firm will fail to internalize

154 It is always in the interest of a regulated firm to minimize its assurance requirements. Lower levels of assurance imply less cost internalization in the future and lower assurance coverage costs in the present. As an example, see Office of Inspector General, Audit Report, EPA Can Do More to Help Minimize Hardrock Mining Liabilities, E1DMF6-08-0016-7100223, June 11, 1997, at 11 (citing instances of mine owners who converted land from federal land to private land to minimize bond requirements, where state bond requirements are less than federal requirements).

the full cost.[155] Usually, however, the prescription is less clear. For instance, a landfill may not leak, may leak a little, or may leak a lot. If a range of possible future costs can arise, what is the optimal level of assurance? If the possibilities range from zero to some higher-bound C^U, the appropriate level of assurance is the upper-bound C^U. Call this the "maximum realistic environmental cost." Unless there is assurance for the maximum realistic cost, firms may fail to fully compensate victims and, as a consequence, take insufficient care to avoid that cost.[156] In practice, assurance rules always mandate coverage up to some finite dollar value, even if there is no real upper limit to the possible damages arising from an operation.

5.2 How Are Required Assurance Levels Actually Determined?

In practice, firms and regulators rarely know with certainty what environmental costs will eventually be. Even the cost of a certain obligation, such as the capping, restoration, and monitoring of a landfill, can be difficult to estimate with precision over a period of decades. Will climate and biological variables allow for successful revegetation? Will the site's hydrology and geology prove stable? Will the site be subject to encroachment? As environmental conditions go, these are fairly predictable concerns. Even so, cost estimates are subject to error.

At the other extreme, liabilities associated with pollution events are even harder to predict. The environmental cost of a vessel grounding, for instance, may be very high or relatively low depending on the cargo, location, and weather conditions associated with the spill. In other words, while it may be clear that we should require coverage up to maximum realistic obligation C^U, how do we know what C^U is?

Given these uncertainties, the determination of required assurance amounts can be problematic. Various methods are used to determine coverage requirements. In some cases, coverage requirements are determined on a case-by-case basis, taking into account the specific risks posed by an operation. In others, greater procedural formality is imposed via established estimation methodologies. For example, some states require hazardous waste treatment, storage, and disposal facilities to prepare, based on a routine methodology, an estimate of costs required

155 For the moment, we set aside issues raised by the time value of money. Clearly, what is important is that the firm has reserved C for use at the future time it is required. This can mean that an amount less than C is set aside today, with knowledge that that amount will grow over time if invested properly.

156 Note that the firm need not set aside this full amount. All it need do is purchase insurance adequate to cover the full amount.

to close the facility.[157] This methodology typically involves the use of standard software and worksheets associated with specific cost categories. Even so, the characteristics of particular facilities, and hence closure cost estimates, can vary widely. To compound the challenge, it is common for cost estimates to change dramatically over time.[158] Bond amounts must be adjusted for cost inflation and changes in a site's environmental conditions.[159]

Accordingly, estimation of required coverage amounts places a significant burden on the regulator to audit the quality of the numbers and estimation methodology. Under some regulatory programs, a relatively fixed schedule of requirements is imposed across a whole industry. An example is the OPA and CERCLA coverage requirements for vessels carrying oil and hazardous cargo. Under these rules, coverage requirements are simply a function of the vessel's size, type, and cargo (oil versus hazardous substances) and can be easily calculated and verified.[160] As another example, offshore facility assurance requirements are based on the facility's location and the volume of a worst-case oil discharge.[161]

In general, however, agencies may have difficulty determining appropriate assurance levels.[162] Recent cases highlight the procedural challenge. For example, in *Leventis et al.* v. *South Carolina DHEC et al.*, the Sierra Club successfully argued that the state environmental agency failed to adequately determine and require adequate cleanup, closure, and restoration

157 See U.S. EPA, Region IV, Evaluating Cost Estimates for Closure and Post-Closure Care of RCRA Hazardous Waste Management Units, 1996.

158 Consider one example: bonds required for the Zortman-Landusky hardrock mine. Per-acre bond rates at the site increased from $750, to $8700, to $12,500, to $37,000 over a period from 1982 to 1998. See Kuipers, supra note 24.

159 Many assurance requirements have a fixed value over a period of decades. With the passage of time, fixed amounts may become significantly inadequate simply because of inflation. Some wells bonded in the 1940s and 1950s may still be operating under coverage amounts required 50 years ago. In some states, old well bonds are "grandfathered," meaning that wells with preexisting bonds do not have to post updated bond amounts. As a consequence, many wells may be significantly underprotected. (Conversation with Dave Davis, Michigan DEQ, August 1, 2000.)

160 See 33 CFR § 138.80(f)(3).

161 As a rule of thumb, the worst-case discharge is approximately equal to four times the estimated uncontrolled first-day discharge. 63 FR 42707, August 11, 1998. The only exempted facilities are those with an estimated worst-case oil discharge of 1,000 barrels or less. Depending on location and potential discharge volume, coverage requirements range from $10 million to $150 million for individual facilities.

162 See U.S. EPA, Office of the Inspector General, Audit Report, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001, at ii ("state officials have expressed concerns that the cost estimates are difficult to review").

assurance amounts for a hazardous waste disposal facility.[163] The case involved motion and countermotion to determine appropriate levels of financial assurance. In 1989, the South Carolina Department of Health and Environmental Control issued a draft determination requiring $30 million in third-party insurance coverage for property and bodily injury and a $114 million trust fund for cleanup, closure, and restoration costs. In 1992, those requirements were raised to $33 million and $132 million, respectively. A later administrative decision revised the requirements slightly downward. In turn, the Sierra Club appealed to the DHEC board. The board agreed in part, raising the trust fund component to $133 million, with part to be satisfied by a corporate guarantee. At that point, the landfill owner and Sierra Club both sought judicial review, challenging various aspects of the decision. Based on the state agency's failure to honor procedural safeguards relating to public comment, the court found in favor of the higher assurance amounts.[164]

One way in which an agency's assurance requirements—particularly for mining and forestry operations on federal lands—may be challenged is through the National Environmental Policy Act (NEPA). Primarily, a procedural statute, NEPA requires agencies to consider the full environmental consequences of allowing a project to proceed.[165] NEPA cannot be used to require assurance per se. But it can be used to force analysis and identification of restoration requirements that in turn would demand assurance.[166]

Also, federal and state agencies can be compelled to promulgate assurance requirements, as a matter of administrative law, if assurance is found to be short of legal requirements.[167] In

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163 340 S.C. 118, 530 SE2d 643, 2000 WL 502520 (S.C. App., refiled April 4, 2000).

164 "Sierra Club contends DHEC failed to issue proper notice and provide opportunity for adequate public comment. We agree."

165 42 U.S.C. 4321-4347.

166 See Interior Board of Land Appeals, IBLA 97-339, National Wildlife Federation et al., September 23, 1998. ("We believe the proper course of action at the time the ROD issued in March 1997 would have been for BLM, an agency operating under a mandate to protect the public lands from unnecessary or undue degradation, to require the posting of a sufficient bond to protect against the uncertainties relating to groundwater quality identified in the FEIS, with the possibility of reducing that bond if further studies clarified those uncertainties"), at 360; ("The lack of information and BLM's failure to require a bond in light of the uncertainties created by that lack of information is what convinced the Board to grant a partial stay in this case"), at 366.

167 See Pennsylvania Federation of Sportsmen's Clubs,et al. v. Com. of Pa. Dept. of Env. Resources 1868 C.D. 1981, which sought higher coal mine bonding rates. The petition resulted in a 1988 consent decree requiring modifications to the state's bonding program, including higher bond rates if indicated by forfeitures and incomplete reclamation.

general, the cost estimates that determine assurance requirements under many programs should be taken with a grain of salt and considered good candidates for regular review by both regulators and environmental advocates.

5.3 The Need to Audit Self-Estimated Assurance Requirements

Although regulators can perform cost estimation themselves, estimation is costly and time-consuming. In some cases, firms are asked to develop their own environmental cost estimates as a basis for their assurance obligations. Absent adequate oversight, these estimates may prove to be too low. After all, low-balling estimates of future environmental obligations is a good way for firms to minimize the costs of assurance. A low estimate translates into lower coverage requirements and, consequently, lower compliance costs. Accordingly, audits, ideally conducted by certified third parties, are imperative to ensure that adequate assurance is put in place. Note that a virtue of fixed assurance schedules is that they minimize this auditing burden.[168]

Absent a meaningful audit procedure, it is inadvisable to allow firms to estimate their own obligations.[169] In fact, there is evidence that firms routinely underestimate obligations in the course of complying with assurance regulations. One recent EPA study found that 89 of 100 facilities submitting landfill cost estimates underestimated their closure costs and thus posted inadequate levels of assurance. Moreover, the total amount of the underestimates was significant, estimated at $450 million just for those 89 sites.[170] Because the effectiveness of assurance rules hinges in large part on having enough assurance, and because the level of assurance is often based on cost estimates, verification of estimates should be an important regulatory priority.

See also Trustees for Alaska v Gorsuch, 835 P 2d 1239 (Alaska 1992), wherein Trustees for Alaska challenged a surface coal mining permit issued by the Alaska Department of Natural Resources, claiming that DNR violated Alaska's mining laws by approving a bond amount that inadequately reflected the costs of reclamation over the life of the permit. The court held that DNR should "recalculate" the bonds so that they would be "sufficient to assure the completion of the reclamation plan by [DNR] in the event of forfeiture," as under AS 27.21.160(a).

168 On the other hand, a weakness of fixed schedules is that they may fail to account for differences in the specific risks being assured.

169 See Kuipers, supra note 24, at 4, for a critique of Arizona and Nevada's hardrock mining regulations, in part on the basis of their willingness to allow companies to estimate their own reclamation costs.

170 Study cited in U.S. EPA, Office of the Inspector General, Audit Report, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001, at 46.

5.4 Are Coverage Levels Adequate?

Not always. The best test of whether coverage levels are adequate is the degree to which firms' environmental obligations are met over a span of decades. Because many assurance rules are relatively recent and cover obligations that arise over a period of decades, it is difficult to draw firm conclusions regarding the adequacy of coverage levels under, for example, RCRA waste disposal assurance rules. To be sure, isolated examples suggest that coverage amounts may be inadequate.[171] But longer-term, overall patterns of cost recovery have yet to be established.

Mining bond levels are an exception. Mining bonds have been required for decades, and there is ample evidence that mining bond levels have been, and in many cases remain, inadequate. The Surface Coal Mining and Reclamation Act of 1977 was enacted largely in response to the coal mining industry's poor record of surface mine reclamation. Over the past two and a half decades, SMCRA bonding requirements have improved, though not completely solved, the problem of unreclaimed coal mining sites and their associated environmental impacts. The adequacy of required bond levels has been an ongoing issue. A General Accounting Office study and congressional hearing in 1986 highlighted the problem. For example, as of 1986—nearly a decade after the passage of SMCRA—67% of all acres covered by bond requirements in Pennsylvania had not been reclaimed.[172] In West Virginia, 30% of disturbed lands had gone unreclaimed despite the presence of bonds.[173] The problem was due largely to the inadequacy of the bond amounts. For example, in Pennsylvania average per-acre reclamation costs were $6,200 over the period, yet average bond amounts were only $730.[174] GAO testimony suggested that

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171 For example, the first major post-OPA vessel oil spill created injuries valued at $90 million. The vessel was required to post only $10 million in assurance coverage, however. Brent Walth, Spill Laws Fail to Halt Seepage of Public Cash, The Oregonian, February 27, 2000. According to Walth, seven vessel spills since 1990 resulted in damages exceeding assurance requirements in seven vessel spills since 1990 (reporting on a statement from Daniel Sheehan, Director, National Pollution Funds Center, USCG). See also U.S. EPA Region V, UIC Permitting Guidance, Technical Support Document, Financial Responsibility for Class II Injection Wells, at http://www.epa.gov/r5water/uic/r5_02.htm, which suggests that coverage amounts for certain wells are not likely to be adequate ("The present coverage for blanket bonds in Michigan is $50,000 and in Indiana is $30,000. This is generally less than the Federal guideline of 10 times the cost to plug and abandon an injection well").

172 US Government Printing Office, 1986. Adequacy of Bonds to Ensure Reclamation of Surface Mines. Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, 99th Congress, 2nd Session, June 26, at 5.

173 Id.

174 Id. In West Virginia, the average reclamation cost was $2,500 per –acre, and the average bond was $1,100 per acre.

states were uncritically accepting reclamation cost estimates from mine operators, resulting in inadequate bond amounts.[175] More recent studies have also been critical of SMCRA bond implementation.[176] A study of Pennsylvania's coal bonding program suggests that the underbonding problem continues in that state,[177] and bonding programs have failed to adequately anticipate problems associated with long-term acid mine drainage.[178]

Bond levels for hardrock mining on Western lands are also inadequate in many cases.[179] A 1997 EPA Inspector General's report found "strong agreement" among agency officials that "financial assurance limits now in place at mines are, in large part, inadequate."[180] The report also found that only two of eight states studied required full bonding for the estimated costs of addressing toxic contamination."[181] A 1987 General Accounting Office study focused on bonds

175 "If you read OSM oversight reports, the comment that was made by OSM was that the State was accepting what the operator submitted as the estimated bond amount with no independent verification or mathematical calculations by the State regulatory authority...There isn't any written or formal criteria." Id., at 71.

176 McElfish, supra note 67 ("SMCRA's bonding provisions have not been effectively implemented in all states. Bond amounts are often set based on faulty assumptions or under systems that have not accurately projected the need for reclamation funds. Some forfeited mine sites still remain un-reclaimed or have been reclaimed to lower than statutory standards because their bonds were insufficient for full reclamation"), at 85.

177 Assessment of Pennsylvania's Bonding Program for Primacy Coal Mining Permits, Office of Mineral Resources Management, Bureau of Mining and Reclamation, February 2000. The analysis derives reclamation costs for sites that forfeited bonds ranging from $5,500 to $20,000 per acre, while bond rates range from only $1,000 to $5,000 per acre, at 5, and 20–23.

178 Actuarial Study of the Pennsylvania Coal Mining Reclamation Bonding Program, Milliman & Robertson, Inc., July 16, 1993. See also McElfish, supra note 67 ("...current bond-setting methodologies incorporate assumptions that do not consider all factors affecting reclamation costs, and thus result in bonds inadequate to cover all costs. For example, bond forfeiture sites frequently have water pollution problems, yet bond-setting methodologies overlook these costs"), at 92.

179 See Kuipers, supra note 24 ("the financial failure of numerous mining companies has exposed shortcomings in both bond methods and bond amounts. American taxpayers are faced with significant liability for mines left un-reclaimed, shifting the economic burden from the companies that profited from the mines and leaving environmental disasters behind for the public to clean up"), at 1. The bond amounts cited vary widely, depending on the state program (average per-acre bond amounts in Alaska $2,600 vs. $15,000 in Montana).

180 Office of the Inspector General, Audit Report, EPA Can Do More to Help Minimize Hardrock Mining Liabilities, E1DMF6-08-0016-7100223, June 11, 1997, at 8. ("Federal and state land management agencies' authorities to require environmental performance standards and financial assurances at hardrock mines varied, leaving critical gaps in bonding requirements. Unreasonably low bond ceilings did not allow adequate financial assurance coverage for hardrock mining on some state and private lands. As a result, EPA may become liable for the considerable costs of cleaning up mines abandoned by the companies that operated them"), at v.

181 Id., at 9.

for mining on Forest Service lands found federal bond procedures to be lacking.[182] The report cites Forest Service studies documenting poor management of bond programs. One finding is of particular significance: that reclamation standards, which determine bond amounts and the criteria for the release of bonds, were "not well documented" and are "generally subjective and difficult to measure."[183] This highlights the importance of standardized, audited reclamation cost estimates and performance standards. Other studies have emphasized the need for extending bonding requirements to even the smallest mine operations, some of which are exempt under current rules.[184]

Another concern relating to the adequacy of bond amounts arises from the use of trust funds as an assurance mechanism. If a trust fund is fully funded at its inception, then coverage will be adequate (if the required coverage amount is adequate). Some programs, however, allow firms to pay into a trust fund over time.[185] If a firm becomes insolvent before a trust is fully funded, the actual amount of available coverage will be inadequate. And in fact, incompletely funded trusts are relatively common.[186]

5.5 Does Assurance Lead to Confiscation?

Some have raised a concern that bonds and other forms of assurance may aid the government's ability to confiscate private property.[187] Put differently, if the government is the beneficiary of a bond, what is to guarantee that the bond will be released to a firm upon

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182 U.S. GAO, Federal Land Management: Financial Guarantees Encourage Reclamation of National Forest System Lands, GAO/RCED-87-157, August, 1987.

183 Id., at 5.

184 See National Research Council, Hardrock Mining on Federal Lands, National Academy Press, 1999 ("Financial assurance should be required for reclamation of disturbances to the environment caused by all mining activities beyond those classified as casual use, even if the area disturbed is less than 5 acres"), at 8. See also U.S. Department of the Interior, Office of the Inspector General, Hardrock Mining Site Reclamation, Bureau of Land Management (92-I-636), 1992 (recommending that all operators post financial guarantees, commensurate with the size and type of operation in question).

185 RCRA's hazardous waste disposal rules, for example, allow trust funds to be funded over the term of the facility operating permit, or the remaining life of the facility, whichever is shorter. 40 CFR 264.143(a)(3).

186 See U.S. EPA, Office of the Inspector General, Audit Report, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001 ("In our Subtitle C sample, there were a significant number of facilities that went out of business or into bankruptcy with partially funded trust funds"), at 21.

187 For a theoretical exploration of this concern, see Jason Shogren, Joseph Herriges, and Ramu Govindasamy, Limits to Environmental Bonds, 8 Ecological Economics, 109–133, 1993.

satisfaction of its obligations? Recall that bond agreements include a set of performance criteria. If those obligations are fulfilled, the bond is released—at least in theory.

Assuming a bond agreement is well specified *ex ante* and governments are subject to independent judicial oversight, there is little reason to fear confiscation. First, clear restoration criteria, and a firm's success in achieving those criteria, are interpretable by courts.[188] Second, liability for the environmental damage must be established before bond funds can be forfeited.[189]

Finally, bonds funds cannot be used to cover liabilities not specified in the bond agreement. A good example is *Long* v. City of Midway, a construction bond case, where tort claimants not explicitly covered by a bond sought construction bond funds as a source of compensation.[190] The plaintiffs' effort was rejected on the grounds that "if tort claimants are permitted to share in the amount of the bond equally with claimants for labor and material, such claimants can never be certain they will be paid, because a great many tort claims for personal injuries and injury to property would materially reduce or amount to perhaps, in some instances, more than the penalty of the bond."[191] Empirically, there is little evidence that environmental bonds are used for claims not specified in the bond.[192]

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188 United States v. Shumway, U.S. Court of Appeals for 9th Cir. (December 28, 1999), wherein the court rejected the U.S. Forest Service's attempt to increase required bond amounts for a hardrock mine operation. The court found the bond amount to have been raised arbitrarily. More specifically, the court cited evidence that environmental problems had not become more serious over time and that existing site conditions were acceptable, thus calling into question the need for increased bond levels ("Based on our review of the evidence before the trial court, there is an issue of fact as to whether or not the government properly increase the bond amount").

189 See C & K Coal Co. v. Commonwealth of Penn., Dept. of Environmental Resources, Docket No. 91-138-E (Consolidated), 1992 Pa Envirn LEXIS 128 (Pa EHB September 30, 1992), where the state was found to have improperly denied a bond release due to its failure to establish liability for damages ("...Since DER did not sustain its burden of proving there was a hydrogeologic connection between the discharge [emanating in the right-of-way of a public road and running along the boundary of the permitted area] and appellant's permitted area, DER's order to appellant directing it to treat the discharge was an abuse of DER's discretion. Likewise, as the only reason for DER's denial of the appellant's application for bond release was this discharge, DER's denial of bond release was an abuse of its discretion.")

190 311 S.E.2d 508 (Ga. Ct. App. 1983).

191 Id., citing John L. Roper Lumber Co. v. Lawson, 143 S.E. 847 (N.C. 1928). ("If actions for a tort like the present or personal injuries are contemplated, this should be fully and clearly provided for by the surety bond in reasonably clear language. The remedy of plaintiffs is against the contractors"), at 850.

192 See Moelmann and Harris, supra note 91, who reviewed surety contracts in the environmental field to assess whether bonds were reinterpreted to cover tort claimants ("In researching this field, previously thought to be a 'hot topic,' at no point was a performance bond surety castigated or found liable for any damages beyond those which are reasonably foreseeable or within the realm of a normal recovery under surety or contract law"), at 176.

However, it is important to note that many bonds are "penal bonds," which authorize the forfeiture of an entire bond amount for failure to perform as agreed. As a result, even though the performance failure may have a relatively small cost, a larger bond sum can be collected by the government.[193] This is by design, however, and is agreed upon mutually by the parties before the fact. Accordingly, penal bond collections represent less a worrisome form of confiscation, and more a penalty used to motivate compliance with performance standards.

5.6 Should Liability Be Limited to the Coverage Requirement?

Assurance requirements, even if based on sound estimation procedures, may be exceeded by the eventual costs of reclamation or liability. If so, is the firm's liability limited to the assured amount? In practice, it may be, since the firm may have no other funds available to cover environmental claims.[194] Legally, however, a firm's liability is not generally limited by the amount of required assurance.[195] That is, a firm is liable for any environmental damages it causes, irrespective of the amount of required assurance. There are exceptions, however. Under OPA and CERCLA, liability for oil and hazardous waste vessels and offshore facilities is capped at a statutory limit that is equal to the financial assurance requirements.[196] Nuclear facility liability is also limited, and equal to the amount of mandatory insurance coverage.[197]

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193 See American Druggists Ins. Co. v. Comm. of Kentucky Department of Natural Resources and Environmental Protection et al., No. 83-CA-807-MR, slip op. (Ky. Ct. App., November 11, 1983) (clarifying the nature of penal versus performance bonds and finding that failure to perform all reclamation requirements resulted in total bond forfeiture). See also Morcoal Co. v. Comm. of Pennsylvania, 459 A.2d 1303 (Pa Commw Ct 1983) (ruling that mining reclamation bonds are intended to be penal and that the state Department of Environmental Resources was not required to prove precise damages in order to forfeit the bonds).

194 The assured amount is a minimum, guaranteed amount of money available for compensation.

195 See Regulatory History 48 FR 32932 (July 19, 1983), Final Rule, Bond and Insurance Requirements, Discussion of Comments and Rules Adopted ("The operator does have the underlying obligation to fully reclaim disturbed lands. A regulatory authority, in having reclamation performed on which the operator has defaulted in his obligation, may incur costs in excess of the forfeited amount. To make clear that the regulatory authority may recover that excess amount from the operator, the suggested addition is made to Sec. 800.50 in paragraph (d)(1)").

196 There are limits to the liability limitation. Specifically, there is no liability limit if a release is determined to be caused by "gross negligence or willful misconduct of, or the violation of any applicable Federal safety, construction, or operating regulation by, the responsible party" or if the incident is not reported in a timely fashion. 33 USC § 2704(c)(1). But note that the liability of guarantors (the third parties guaranteeing coverage) is always strictly limited to amounts specified in the assurance contract, which in no case would be greater than the coverage requirement. 42 USC § 9608(d).

197 See section 2.1.8.

From a public policy standpoint, the choice of liability limits reflects a trade-off. On one hand, truncated damage awards reduce uncertainty. Reduced uncertainty can be expected to reduce the costs of assurance (above and beyond the cost reductions implied by the limitation itself) and thus may promote the development of markets for third-party assurance products. Also, from a regulated firm's standpoint, liability limits discipline the government's pursuit of claims the polluter may feel are unsubstantiated. Accordingly, liability limits may ameliorate political opposition to financial assurance requirements. On the other hand, these benefits to regulated industries must be weighed against the obvious drawback of capped liability: namely, that environmental costs above the cap will be uncompensated by responsible parties.

6. Design and Implementation: The Security of Assurance Mechanisms

Assurance rules must ultimately be judged on the basis of their ability to deliver compensation when environmental obligations come due. Thus, it is important to understand the ways in which the effectiveness, or security, of assurance can be thwarted. In some cases, firms may overtly fail to comply with coverage requirements. In other cases, third-party providers of assurance may themselves be unable to deliver on obligations because of their own insolvency. The financial mechanisms used to demonstrate compliance may be flawed, by design or lax regulatory oversight. In this regard, self-demonstrated financial assurance is a particularly problematic compliance mechanism. Finally, regulators may fail to administer assurance instruments effectively, allowing funds to be released prematurely.

6.1 Compliance Evasion

A virtue of financial assurance rules is that they create an incentive for third-party assurance providers to monitor the environmental safety and performance of the firms whose obligations they guarantee or underwrite. This can relieve some of the enforcement burden on regulatory agencies. An enforcement burden that is not relieved, however, is the need to ensure that firms comply with the assurance requirements themselves.[198] Like any regulation, assurance requirements require penalties and monitoring to promote compliance.[199]

Noncompliance has been defended with a variety of novel arguments, most of which fail. In *United States* v. *Ekco Housewares, Inc.,* for instance, Ekco failed to comply with RCRA hazardous waste financial assurance requirements and a consent order requiring assurance.[200] The firm argued, unsuccessfully, that it was excused from assurance requirements because the facility in question had accepted no new waste after 1984.[201] The defendant also filed a liability insurance policy as proof of assurance, knowing that it contained exclusions rendering it unacceptable as an assurance mechanism, and backdated the instrument in an attempt to conceal its failure to comply over a period of years. Finally, the firm argued that the $4,600,000 penalty imposed for these violations was unreasonably high.[202] The court of appeals ultimately reduced the penalty only a little, concluding that "the deterrence message sent by the district court's penalty was one sorely needed" given "Ekco's apparent view that financial responsibility requirements take a far-distant seat to its other RCRA obligations." Another example of noncompliance was a firm's argument that payments into a state UST trust fund constituted funds applicable to compliance with financial assurance requirements. In that case, the court held that the RCRA UST assurance rules required the firm to secure its own assurance.[203]

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198 According to EPA, 19% of hazardous waste facilities studied were not in compliance with financial assurance requirements. U.S. EPA, Office of Inspector General, Audit Report, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001, at 24.

199 For a set of cases involving penalties for failure to comply with financial assurance regulations see In the Matter of Marley Cooling Tower Co., No. RCRA-09-88-008, 1989 RCRA LEXIS 22 (November 30, 1989) ($7,000 penalty for failing to update financial assurances and failing to demonstrate financial responsibility for third-party claims); In the Matter of Landfill, Inc., Appeal No. 86-8, 1990 RCRA LEXIS 65 (November 30, 1990) (financial assurance penalty of $1,900); In re Frit Indus., No. RCRA-VI-415-H, 1985 RCRA LEXIS 4 (August 5, 1985) (financial assurance penalty of $1,200); In the Matter of Harmon Electronics, No. RCRA-VII-91-H-0037, 1994 RCRA LEXIS 52 (December 12, 1994) ($251,875 for four years of noncompliance); In the Matter of Standard Tank Cleaning Corp., No. II-RCRA-88-0110, 1991 RCRA LEXIS 47 (March 21, 1991) ($145,313 for six years of noncompliance), aff'd, Appeal No. 91-2 (July 19, 1991).

200 62 F.3d 806, 809, 812 (6th Cir. 1995).

201 The argument was based on a flawed reading of cases related to RCRA's "loss of interim status" (LOIS) amendment. The facility is in fact subject to assurance regulations until final closure is certified, even though it never obtained interim status by filing for a permit.

202 U.S. v. Ekco Housewares, Inc., 853 F. Supp 975 (N.D. Ohio 1994).

203 In the Matter of B&R Oil Company, Inc., Respondent, United States EPA, before the Administrator. Administrative Law Judge, issued September 4, 1997 ("payment into the state tank fund constitutes a legal obligation separate and apart from respondent's obligation to comply with the Federal regulations...").

Another case worthy of note, one testing the federal government's ability to "overfile" a state enforcement action, centered on Power Engineering Company's failure to provide financial assurance for a hazardous waste treatment facility.[204] The case history involved numerous RCRA violations associated with a metal refinishing plant and the defendant's failure to comply with several regulatory orders. The federal government initiated an action when Colorado failed to require financial assurance for the facility's closure. Assurance enforcement was urgent because as the court noted, the defendant had "recently engaged in a pattern of debt reduction and asset forfeiture...[and] threatened bankruptcy or abandonment of the facility if the federal or state government continues seeking the facility's compliance with applicable hazardous waste regulations."[205] Based on the federal government's motion, the district court required the defendant to provide $3.5 million in financial assurance.[206] The defendant subsequently appealed, arguing that the federal government did not have the authority to override a completed state enforcement action under RCRA. The firm's appeal was based in large part on another RCRA financial assurance case, *Harmon Industries, Inc.* v. *Browner*. In that case, the Eighth Circuit held that the federal government could initiate an enforcement action only if the state failed to initiate *any* enforcement action, or if the federal government completely withdrew the state's authorization to implement RCRA.[207] Power Engineering's appeal failed, however, upon the Tenth Circuit's refusal to decide the "overfile" issue and upon the Supreme Court's refusal to hear the case. Upon its return to district court, Power Engineering was required to comply with the financial assurance requirements originally imposed on it. The district court also explicitly rejected the Eighth Circuit's argument in *Harmon* limiting federal enforcement authority under RCRA.[208] The case is important because it affirms the federal government's ability to force compliance with assurance rules, and other RCRA provisions, despite preexisting and potentially inadequate state enforcement actions.

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204 United States v. Power Engineering Co., no. 97-B-1654 (D. Colo. November 24, 2000).

205 United States v. Power Engineering Co., no. 98-1273 (D. Colo., September 8, 1999), at 8. See also United States v. Power Engineering Co., 10 F.Supp2d 1145, 1165 (D. Colo. 1998) at 1157, 1163, and 1165.

206 United States v. Power Engineering Co., 10 F.Supp2d 1145, 1165 (D. Colo. 1998).

207 191 F.3d 894 (8th Cir. 1999).

208 United States v. Power Engineering Co., no. 97-B-1654 (D. Colo. November 24, 2000). ("With all due respect, I conclude that the Harmon decision incorrectly interprets the RCRA"), at 15.

6.2 Evasion via Bankruptcy?

Assurance rules reduce the risk that firms with environmental obligations will be insolvent when the obligations come due. In some cases, however, assurance is imposed, or greater amounts must be posted, while a firm is already in bankruptcy.[209] This creates a clash between assurance requirements and bankruptcy law. For instance, environmental cleanup costs, once a firm is in bankruptcy, may be a dischargeable "claim" under the bankruptcy code.[210] With the bankruptcy code as a shield, firms have attempted to evade assurance requirements by claiming that assurance-related expenditures are dischargeable obligations.

In general, however, courts have held that assurance costs, including the required posting of bonds or increased bond amounts to cover reclamation costs, are not "money judgments" under the bankruptcy code and fit within the "police and regulatory powers" exception to the automatic stay.[211] Consider the decision *In re Industrial Salvage, Inc.*, which involved cleanup and closure orders for landfills in Illinois.[212] As Industrial Salvage filed for bankruptcy, the Illinois Pollution Control Board required the facilities' closure, revoked the owner's development permit, and required it to post financial assurances for closure of the facilities. Industrial Salvage filed a petition for the discharge of debts, and in particular claimed that the facilities' closure and assurance costs should be discharged in bankruptcy. The company argued

209 Of the cases referenced in note 198 supra, "financial difficulties and bankruptcies were significant contributing factors to facility non-compliance," at 24.

210 See note 8 supra. For general guidance on the conditions that discharge environmental costs and penalties, see U.S. EPA, EPA Participation in Bankruptcy Cases, September 30, 1997, memorandum, available at http://es.epa.gov/oeca/osre/970930-1.pdf. An illustrative case exploring the issues is In Re Chateaugay Corp., 944 F 2d 997 (2nd Cir. 1991) (finding that an injunction encountered in an environmental case that does no more than impose an obligation entirely as an alternative to a payment right is dischargeable). But see also Ohio v. Kovacs 469 US 274, 105 S Ct 705 (1985) (Dischargeability is limited to situations where a cleanup order is converted into an obligation to pay money, and regulatory orders that demand performance and cannot be satisfied solely via a monetary payment are not dischargeable in bankruptcy). See also In re Commonwealth Oil Refining Co., 805 F.2d 1175 (5th Cir. 1986) (a RCRA compliance order is not stayed by bankruptcy code even though compliance involved expenditure of money).

211 See Commonwealth of PA, Dept. of Environ. Resources v. Peggs Run Coal Co., 55 PA Commw 312, 423 A 2d 765 (Pa Commw Ct 1980) (DER injunction, including bond requirement, was a "proceeding to enforce its police or regulatory power and as such is exempted from the stay provisions of Section 362 of the Bankruptcy Code").

212 196 Bankr. 784, 702 (Bankr. S.D. Ill. June 6, 1996). In the court's reasoning, the ability to collect on the bonds is not akin to a claim ("Environmental cleanup orders, in particular, often require an expenditure of money in order to clean up immediate and ongoing pollution, and the government may exercise its regulatory powers and force compliance with its laws even though a debtor must spend money to comply....an obligation does not become a 'claim' merely because it requires the expenditure of money"), at 5.

that the order to post financial assurances constituted a dischargeable claim because the state could collect on the bonds in the event of nonperformance. The court disagreed, however, finding that the "obligations under the Board's order for closure and post-closure care of the three landfills were not discharged as a claim in their Chapter 11 bankruptcy proceedings."[213]

Another decision supportive of assurance in the bankruptcy context is *Penn Terra, Ltd.* v. *Department of Environmental Resources.*[214] The bankrupt Penn Terra was asked to expend funds under Pennsylvania's SMCRA law to reclaim lands it had previously mined. The Third Circuit reversed a district court ruling that the reclamation request was a money judgment and thus dischargeable. In its ruling, the circuit court argued that the state environmental agency's attempt to remedy future harm, rather than past damages, did not constitute a money judgment but rather was an exercise of the state's police powers.[215] Accordingly, although the precise limits of the police and regulatory powers exception remain somewhat murky, closure and reclamation obligations, such as those associated with assurance, are not easily dischargeable in bankruptcy.

6.3 Insolvency of Assurance Providers

Insurers, banks issuing letters of credit, and sureties issuing bonds can themselves become insolvent, thus threatening the availability of assurance funds. Unfortunately, there is no insurance against an assuror's financial failure.[216] Regulations typically guard against the possibility of assuror insolvency by requiring U.S. Treasury certification of bond issuers, "secure" ratings for insurers, or at a minimum, some form of licensing for financial institutions providing assurance.[217] Nevertheless, provider bankruptcies are relatively common. Eight U.S.

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213 Id., at 4.

214 733 F.2d 267 (3rd Cir. 1984).

215 Id., at 278.

216 For example, the Federal Deposit Insurance Corporation (FDIC) does not insure letters of credit issued to governments, such as those that would be used as an environmental guarantee. Similarly, most states have an insurance guaranty fund to protect policyholders in the event of an insurer's insolvency. However, most enabling statutes include a "net worth exclusion" that eliminates governments as recipients of these funds. See Michigan, MCL 500.7925(3); and Illinois, 215 ILCS 5/534.3(b)(iv). Accordingly, government attempts to access such funds in environmental guarantee cases have not been successful. See Attorney General ex rel Department of Natural Resources v. Michigan Property and Casualty Guaranty Association, Court of Appeals of Michigan, 218 Mich. App. 342; 533 N.W.2d 700, 1996.

217 See notes 100, 103, and 106 supra. Trust funds can be vulnerable to the insolvency of a financial institution acting as trustee. Some regulations require trustees to be only those regulated or regularly examined by a federal or state agency, see 40 CFR 264.143.

insurance companies failed in 1998, 10 in 1999, and 16 in 2000.[218] Between 1982 and 1986, 10 to 15 sureties serving the surface mine bond reclamation market become insolvent, leaving a total of $36 million in bonds unfunded.[219] According to EPA, between 1984 and 1990 the average annual number of insolvencies among property and casualty insurers was 32 of 3,800, or an average annual failure rate of 0.85%.[220] Over the same period, the average annual failure rate for FDIC-insured banks was 1.14%, and U.S. Treasury-approved sureties were delisted at an annual rate of 0.95%.[221]

A particular concern when assurors fail is that their former customers must acquire assurance elsewhere on fairly short notice. For financially healthy customers this is not typically a problem. When firms in need of assurance are experiencing financial difficulties of their own, however, replacement can prove difficult. In some cases, new assurance may not be available. Recent problems with an important assurance provider, Frontier Insurance Company, are illustrative.[222] Because of financial weakness, the U.S. Treasury in 2000 removed Frontier's qualification to issue federal bonds. As a result, Frontier customers had to find providers to remain in compliance with their assurance requirements. Most were able to. But two large customers, landfill operator Safety-Kleen Corporation and mining company AEI Industries, have to date been unable to replace their environmental bonds.

When an assurance provider fails suddenly and a firm with assurance obligations is in financial distress, regulators face a dilemma.[223] Technically, noncompliance with assurance regulations is grounds for an injunctive action, including facility closure. This kind of penalty can be a powerful compliance motivator if a firm is financially healthy. When a firm is near

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218 See American Insurance: Bungee Jump, The Economist, September 16, 2000, at 84.

219 McElfish, supra note 67, at 89 (citing Office of Surface Mine Reclamation and Enforcement, Record of Surety Insolvencies, August 1988, unpublished).

220 U.S. EPA Issue Paper: Assessment of Financial Assurance Risk of Subtitles C and D Corporate Financial Test and Third-Party Financial Assurance Mechanisms, in docket materials in support of Financial Assurance Mechanisms for Corporate Owners and Operators of Municipal Solid Waste Landfill Facilities; Final Rule, April 10, 1998, at 7.

221 Id., at 6. Being delisted is not equivalent to being insolvent, though a surety's financial health is the main determinant of whether it is listed as an acceptable government bond provider.

222 Frontier was a major supplier of environmental bonds. For example, of 198 solid waste landfills in Michigan in 2000, 35, or 18% of the total, had closure bonds issued by Frontier.

223 According to an EPA official, "requiring the company to close its treatment, storage, and other services was not in the best interest of the environment." Quoted in Pat Phibbs, Safety-Kleen, EPA Agree on Deadline for Obtaining Insurance for Facilities, Environment Reporter, October 20, 2000, at 2200-1.

bankruptcy, however, facility closure yields no real environmental benefit, since closure starves the firm of cash flow that could be used to finance obligations, improve the firm's ability to find alternative bonds, and avoid insolvency.

In light of the dilemma, consider the difficulties faced by the states and EPA in motivating Safety-Kleen to replace its bonds. Safety-Kleen filed for bankruptcy in 2000, raising questions about a large number of closure obligations associated with its operations.[224] Safety-Kleen and EPA entered into a consent agreement requiring regular financial reports, reports on the firm's attempts to find alternative assurance, and independent environmental audits of sites formerly covered by Frontier bonds.[225] The agreement also specified a set of deadlines for bond replacement. Unfortunately, three deadlines have already passed without compliance, and according to Safety-Kleen itself, "there can be no assurance that the Company will be able to replace Frontier on a schedule acceptable to the EPA and the states."[226] Without any meaningful threat except facility closures, EPA's hand is weak. Compounding Safety-Kleen's problems, another its assurance providers, Reliance Group Holdings, Inc, filed for bankruptcy protection in June 2001.[227]

Frontier's weakness caused difficulty for at least one other large bond holder, AEI Resources, Inc.[228] AEI held $680 million worth of Frontier bonds and relied heavily on debt financing prior to Frontier's failure. In turn, the withdrawal of Frontier bonds led Moody's to downgrade the firm's debt to a Caa2 rating.[229] With such poorly rated debt and a lack of collateral, sureties have not been willing to supply AEI with replacement bonds.[230]

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224 In re Safety-Kleen Corp., Bankr. D. Del. No. 00-2303, October 17, 2000. Safety-Kleen and its subsidiaries operate approximately 30% of the waste management facilities in the United States. Approximately 50% of its financial assurance was provided by Frontier. It is important to note that Frontier bonds, while not acceptable because of Frontier's financial weakness, remain in place, with Safety-Kleen continuing to pay the premiums. See 10-Q Report for Safety-Kleen Corporation, SEC file 1-08368, February 28, 2001, at 9.

225 10-Q Report for Safety-Kleen Corporation, SEC file 1-08368, February 28, 2001, at 9-10. Safety-Kleen was in financial difficulty for a variety of reasons, most unrelated to the withdrawal of the Frontier bonds.

226 Id., at 9.

227 Wall Street Journal, Reliance Files for Chapter 11 Protection, June 13, 2001, at A3.

228 AEI is the fourth-largest producer of coal for energy production in the United States (corporate website).

229 Moody's Downgrades AEI Debt, Coal Outlook, July 31, 2000, at 1.

230 Ken Ward, Addingtons' Coal Company in Trouble, Downgrade of Reclamation Bond Provider Gets the Blame, Charleston Gazette, July 7, 2000.

Safety-Kleen and AEI Resources are large firms. Even so, the weakness of a single surety created a significant barrier to compliance for both firms and a financial crisis for AEI. Although assuror failures remain an infrequent occurrence, Frontier's failure underscores the importance of regulatory oversight and the screening and monitoring of assurance providers' financial health.

6.4 The Importance of Instrument Language

For assurance to be effective, the financial instruments used to demonstrate it should not contain defenses or exclusions that might hamper the government's ability to collect obligations. It is also important that the instruments not be easily withdrawn by providers if costly environmental problems develop. In most situations, insurers and insureds voluntarily agree on cancellation terms and coverage exclusions. For instance, nonpayment of premiums is typically grounds for cancellation. Exclusions may be included to reduce the insurer's risk exposure and, correspondingly, the customer's cost of coverage. These voluntary coverage limitations are inappropriate for the purposes of environmental assurance, however. Coverage limitations, though potentially desirable for the customer and insurance provider, undermine the ability to recover costs and ensure future environmental obligations.

6.4.1 Defenses

It is common for assurance rules to require that assurance instruments adhere to a format with terms established by regulation. As an example, consider the OPA and CERCLA rules for vessels and offshore facilities. Allowable assurance instruments must include an "acknowledgment of direct action."[231] This acknowledgment states that "the insurer [or surety] consents to be sued directly with respect to any claim."[232] The direct action provision is designed to foster resolution of claims and access to compensation. In practice, direct action allows cost recovery independent of a defendant's bankruptcy status.[233] The direct action requirement also eliminates a set of defenses that are typically available to insurers, such as fraud or

231 33 USC § 2716; 42 USC § 9608(c)(1–2).

232 Appendix B to 33 CFR, Part 138. Also see 30 CFR 253.41(a)(4).

233 The offshore facilities rule, for instance, allows direct action against guarantors as long as insolvency is simply "claimed" by the responsible party. In the government's reasoning, "Establishing a regulatory process that might require a lengthy insolvency determination procedure before compensation could begin would be totally inconsistent with [OPA objectives]." 63 FR 42707, August 11, 1998.

misrepresentations by the insured.[234] In a typical insurance agreement, fraud and misrepresentation are grounds for a denial of coverage.[235] OPA and CERCLA remove this possibility, as do some state laws.[236] All the third-party financial assurance mechanisms authorized under the statutes require an acknowledgment that the guarantor agrees to direct action.[237] The only defense available to a guarantor is that the loss was caused by the "willful misconduct" of the owner or operator.[238] The motivation for the direct action provisions is sound. Both cost recovery and deterrence are served by the limitation on policy defenses.[239]

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234 61 CFR 9270. "No standard marine liability insurance policy of which the Coast Guard is aware meets [the direct action] requirement."

235 For instance, there is an admiralty rule that any evidence of a material misrepresentation cancels insurance coverage. This rule is generally respected in U.S. jurisdictions. See Port Lynch, Inc. v. New England International Assurety, Inc., 754 F.Supp 816, 1992 AMC 225 (W.D. Wash. 1991), upholding the standard. In contrast, however, see Albany Insurance Co. v. Anh Thi Kieu, 927 F.2d 882, 1991 AMC 2211 (5th Cir.), at 890, holding that state law should govern the question of what voids coverage and that misrepresentations did not void coverage since the insured did not intend to deceive the insurer.

236 42 USC § 9608(c)(1). "The guarantor may invoke all rights and defenses which would be available to the owner or operator under this subchapter. The guarantor may also invoke the defense that the incident was caused by the willful misconduct of the owner or operator, but the guarantor may not invoke any other defense that the guarantor might have been entitled to invoke in a proceeding brought by the owner or operator against him." 61 FR 9268. "A guarantor agrees to waive all other defenses, including nonpayment of premium." For a state law example, see Alaska Statute 46.04.040(e).

237 33 CFR 138.80(d)(1). "Any evidence of financial responsibility submitted under this part must contain an acknowledgment by the insurer or other guarantor that an action in court by a claimant for costs and damage claims arising under the provisions of the Acts may be brought directly against the insurer or other guarantor."

238 30 CFR 253.41(a)(4); 33 CFR 138.80(d). "There is no evidence that fraud and misrepresentation have been a problem in the current OSFR program." 63 FR 42707, August 11, 1998. The meaning of the "willful misconduct" standard has been previously addressed by U.S. courts. See The Tug Ocean Prince, Inc. v. United States, 584 F.2d 1151, 1978 AMC 1787 (2nd. Cir 1978), cert. denied 440 U.S. 959 (1979): Willful misconduct or gross negligence being equivalent to the equally vague "egregious conduct making an accident likely to happen."

239 In the words of the Minerals Management Service, which administers the offshore facilities assurance program, "Allowing such a defense is inconsistent with two objectives of the OSFR program: Ensure that claims for oil-spill damages and cleanup costs are paid promptly; and make responsible parties or their guarantors pay claims rather than the Oil Spill Liability Trust Fund. Limiting the types of defenses guarantors may use to avoid payment of claims is consistent with and furthers the achievement of these objectives. Furthermore, there is no evidence that fraud and misrepresentation have been a problem in the current OSFR program," 63 FR 42707, August 11, 1998.

6.4.2 Exclusions

Not all assurance rules feature such a clearcut limitation on defenses available to an insurer.[240] Most programs, however, guard against the use of policy "exclusions"—features of an insurance contract designed to limit the exposure of an assurance provider to certain kinds of risks. Exclusions are problematic for an environmental assurance program.[241] Most obviously, they may directly exclude coverage for costs that are intended to be assured.[242] Even if an exclusion is not ultimately honored, exclusions complicate interpretation of the insurance contract, which can open the door to costly and time-consuming litigation.[243]

Because exclusions can so directly undermine the effectiveness of assurance, many state programs rely on the use of boilerplate endorsements that must accompany instruments used to demonstrate coverage.[244] These endorsements require the insurer to acknowledge the scope of coverages required by regulation and rule out any exclusions that would limit that coverage.[245]

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240 But note that, like the lack of insurer defenses under direct action provisions, case law denies sureties a defense based on malfeasance by the bond purchaser. In general, fraud by the principal does not discharge the surety's obligations unless the obligee (the party to whom performance is owed) was involved in the fraud. Rachman Bag Co. v. Liberty Mutual Insurance Co., 46 F.3d 230,237 (2nd Cir. 1995).

241 From an assurance standpoint, the most problematic of all exclusions would be one that relieves an insurer of its coverage obligations in the event of a customer's insolvency. Assurance rules tend to explicitly prohibit this specific exclusion. For example, 280.97(b)(2)(a).

242 See State of California, State Water Resources Control Board, Financial Responsibility Long Term Study, January 1995, 94-2CWP, describing difficulties associated with exclusions ("First, the products offered have many preinsurance requirements and numerous policy exclusions so that the coverage desired is often not the coverage offered. Second, the policy coverage offered often does not match necessarily the type of coverage legally required"), at 6.

243 "In spite of insurance certificates which provide a warrant that policies conform with regulations, policy terms and exclusions may make it difficult for states to obtain closure and post-closure funds from insurance policies without litigation," U.S. EPA, Office of the Inspector General, Audit Report, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001, at 18.

244 See Texas assurance regulations 30 TAC §37.641 (2)(e) and certification that "the wording of this [overage] endorsement is identical to the wording specified in 30 TAC §37.641."

245 For example, Michigan's hazardous waste management facility assurance program requires one of two endorsements. The first if for policies that are "preaccepted" as limiting exclusions. Insurers without preaccepted policies must sign an endorsement that includes the following declaration: "No condition, provision, stipulation, limitation, or exclusion contained in the Policy, or any other endorsement thereon, or any violation thereof, shall relieve the insurer from liability or from payment of any claim, within the stated limits of liability in this Endorsement, for bodily injury and property damage to a third party caused by a sudden and accidental occurrence." [The second endorsement ? If not relevant, change the first sentence to "For example, Michigan's...program requires an endorsement for policies that are 'preaccepted'..." ?]

In general, contract law offers protections against the use of exclusions that are not voluntarily agreed to by the insured or by the beneficiaries of assurance. Misrepresentations of an insurance contract by an insurer—for example, claiming coverage when coverage was in fact excluded—are not tolerated.[246] When bonds are issued to satisfy a customer's regulatory obligations, the coverage mandated by the regulations defines the bond provider's obligation. In cases where the regulatory requirement and the bond's language are in conflict, courts tend to favor the regulatory definition of coverage.[247] Courts also accord little credence to a surety's claim of misunderstanding a surety agreement.[248]

6.4.3 Cancellation

The cancellation of coverage prior to the satisfaction of claims and obligations is also a concern. Accordingly, assurance instruments, at a minimum, must carry cancellation clauses that require prior notification. Consider the RCRA rules for hazardous waste facility closure, which require advance notification of cancellation whether the instrument is a bond, letter of credit, or insurance policy.[249] Cancellation of an insurance policy is prohibited unless alternative coverage is acquired, or unless the insured fails to pay premiums.[250] Letters of credit must be automatically renewed, absent a cancellation notice.[251]

In the case of OPA and CERCLA rules for vessels and offshore facilities, the Coast Guard or Minerals Management Service must be notified at least 30 days prior to the cancellation of coverage. Moreover, the instruments must specify that "termination of the

246 See Advanced Environmental Technology Corp. v. Brown, 4th Cir., No. 99-2228, October 2, 2000 (insurance agent found liable for having "negligently misrepresented" coverage provided to a waste removal subcontractor, knowing an exclusion was for coverage sought by the insured).

247 A bond that is required by law but does not conform to the regulatory requirement is typically interpreted to provide the protections envisioned by regulation, 17 Am. Jur. 2d, Contractors' Bonds §8. See also Davis v. Moore, 7 Ill App 2d 519, 130 NE 2d 117 (Ill Ct App 1955), "[T]his court holds that the statutory requirements of an appeal bond are a part of such bond, whether fully recited therein or not, that it is not error for a court to decree a reformation of a bond to conform to the statute (although it may not be necessary), and that judgment may be entered on an appeal bond according to the provisions of the statute, regardless of any error in the form of the bond."

248 See U.S. v. Country Kettle, Inc., 738 F.Supp 1358, 1360 (D.Kan. 1990).

249 Bonds and letters of credit require at least 120 days' notice prior to cancellation. 40 CFR 264.143(b)(8), 40 CFR 264.143(c)(8), 40 CFR 264.143(d)(5).

250 40 CFR 264.143(e)(6),(8),(10). Failure to pay premiums is considered a violation of assurance regulations and accordingly can lead to monetary or injunctive penalties.

251 40 CFR 264.143(d)(5).

instrument will not affect the liability of the instrument issuer for claims arising from an incident…that occurred on or before the effective date of termination."[252] And with respect to litigation, guarantor liabilities survive well past coverage termination.[253] Because assurance can be difficult to purchase once environmental or financial difficulties arise, cancellation restrictions are an important component of any assurance program.[254]

6.4.4 Claims-made policies

Insurers can limit exposure to environmental risks by using "claims-made" policies. Under such policies, coverage is limited to claims made against the insured during the period of insurance. Claims made after the insurance expires or is withdrawn are not covered. In contrast, "occurrence" policies cover claims resulting from events during the coverage period, even if the claim is brought after coverage is withdrawn.[255] Claims-made policies can complicate cost recovery, since they place time pressure on regulators to discover pollution and initiate cost recovery actions.[256] For this reason, some assurance programs place restrictions on claims-made insurance policies. For example, regulations may require that the coverage period of a claims-made policy be extended beyond the policy's cancellation date.[257]

252 30 CFR 253.41(a)(2).

253 "OPA makes guarantors subject to liability for claims made up to 6 years after an oil-spill discharge occurs." 63 FR 42704, August 11, 1998.

254 See 44 FR 14902, March 13, 1979 ("This restriction [against cancellation of the bond] is based on the first principle of surety law, i.e., the surety undertakes the obligation to stand in the shoes of the principal, and his obligation may not be rescinded or terminated without the consent of the party to whom the duty is owed").

255 For more on the distinction between claims-made and occurrence coverage, see Chris Mattison and Edward Widmann, Environmental Insurance: An Introduction for the Environmental Attorney and Risk Manager, 30 ELR 10365, 2000.

256 Central Illinois Public Service Company v. American Empire Surplus Lines Insurance Company, 267 Ill. App. 3d 1043 (1994) (denying coverage on a claims-made policy because of the lack of a third-party demand necessary to constitute a valid "claim," even though pollution had been discovered and the regulator was notified of the occurrence).

257 See RCRA's UST assurance rules, 40 CFR 280.97(e). When a claims-made policy is used, the insurer must include an endorsement stating that "The insurance covers claims otherwise covered by the policy that are reported to the ["Insurer" or "Group"] within six months of the effective date of cancellation or non-renewal of the policy except where the new or renewed policy has the same retroactive date or a retroactive date earlier than that of the prior policy, and which arise out of any covered occurrence that commenced after the policy retroactive date, if applicable, and prior to such policy renewal or termination date." See also 40 CFR 258.74(d)(6), 40 CFR 264.143(e)(8).

6.4.5 Arrangements worthy of special attention

The regulator's administrative problems are multiplied when different mechanisms and providers are used in combination. This is typically allowed so long as the assorted coverages equal the aggregate requirements.[258] In some cases, however, there are restrictions on the number of providers. Under OPA-CERCLA vessel rule, for example, no more than four insurers or ten sureties can be used to satisfy a firm's coverage requirement.[259] The offshore facility rules place a limit on the number of insurers (either four or five, depending on the facility's location). Also, contribution percentages, in insurance parlance, must be "vertical," not "horizontal."[260] Vertical contributions associate a specific fraction of liability to a provider, irrespective of the dollar value of the claim. Horizontal contributions delineate provider liability as a function of the total dollar claim.[261] Horizontal layering of coverage by different providers is prohibited under the rules, apparently because of administrative difficulties associated with that type of contract.[262]

Increased attention should also be given to the use of "captive" insurance plans. A captive is an insurance company formed to insure the risks of a parent company or set of affiliated companies. Captives do not supply insurance to the general market. Although captives are entirely appropriate as a risk-reduction tool for firms, they are inappropriate as a demonstration of financial assurance because the captive insurer's financial strength is tied to that of the parent company. Thus, unlike a third-party insurer, a captive insurer's ability to

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Some states make further requirements. Texas, for example, require firms using claims-made policies to place in escrow funds sufficient to pay an additional year of premiums for renewal of a policy by the state on notice of the termination of coverage. Texas Code §37.6031(f).

258 For example, self-insurance can be used to cover the deductible included in an insurance policy. 63 FR 42704, August 11, 1998.

259 33 CFR 138.80(c)(1).

260 30 CFR 253.29(c)(4); 33 CFR § 138.80(c)(1)(j). The offshore facilities rule, however, establishes specific horizontal layers that can be served by different guarantors. Multiple guarantors cannot cover intermediate horizontal sublayers.

261 For example, insurer A is liable for claims up to $1 million, insurer B is liable for claims from $1 million to $2 million, etc.

262 Problems have been indicated by the Minerals Management Service: "The reason we placed a limit on the number of insurance certificates and the amounts in the [coverage] layers is that in the past we received insurance certificates that did not add up to the total amount of coverage indicated. We found that insurance certificate problems likely would increase with the number of certificates. Many times the problem was associated with 'horizontal' layering, which is the allocation of risk within an insurance sub-layer. Verifying that the total amount of the certificate was properly allocated among participating insurers is a burdensome process…" 63 FR 42704, August 11, 1998.

absorb claims is weakest when its strength is most needed—upon the insolvency of the parent.[263] Some, but not all, assurance programs prohibit the use of captives as an assurance instrument.[264] A problem for regulators is that identification of captive policies can be difficult because policies do not necessarily specify the insurer's structure.

6.5 Monitoring, Administration, and Record-Keeping

Assurance instruments must be monitored by regulators. First, the initial establishment of an approved mechanism must be verified, usually by inspection of the coverage contract from an approved assurance provider. The issues highlighted in Section 6.4 illustrate the need for regulatory oversight of the insurance, bond, and other instruments used to demonstrate assurance. But just as important, the ongoing validity of assurance contracts must be verified.

Regulatory rules themselves can help simplify the regulator's task. For example, requiring letters of credit to automatically renew relieves the regulator of one burden—the need to verify annual renewals. But sound bookkeeping and monitoring of instruments is crucial in order to ensure that the contracts will be valid and provide funds in the future. A particular problem is the release of assurance funds—letters of credit, certificates of deposit, and trust funds—by providers without regulatory approval.[265] Again, regulations can help address the problem, in this case by requiring the state agency be the sole beneficiary of a bond, letter of credit, certificate of deposit, or trust fund.[266] Changes in bank accounts or trust agreements can occur over time, providers themselves can merge or restructure, and computer records need to be

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263 U.S. EPA, Office of the Inspector General, Audit Report, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001 ("For example, a significant portion of the assets of one captive, established by a large waste management firm, was represented by a note receivable from the parent company"), at 12; ("captive insurance policies in our sample do not meet the intent or requirements of RCRA financial assurance regulations"), at 26.

264 A Virginia law, passed in 2000, prohibits reliance on captive insurers, approved surplus line insurers, and risk retention groups as a means of assuring closure and postclosure costs. HB1022, passed January 24, 2000.

265 U.S. EPA, Office of the Inspector General, Audit Report, RCRA Financial Assurance for Closure and Post-Closure, March 30, 2001 ("We were given examples during our audit where banks had released funds from trust funds to Subtitle C facility owners without the required approval"), at 21.

266 See Financial Responsibility Long Term Study, State of California, State Water Resources Control Board, January 1995, 94-2CWP ("The Fund has not directed owners or operators to send an original of these mechanisms to us even though the Fund is the designated payee....The Fund, as the payee, should obtain the original document designating the SWRCB as the payee"), at 10.

updated to reflect changes in the instruments.[267] At a minimum, regulatory rules and administrative procedures need to require basic record-keeping that facilitates the legal and financial maintenance of assurance instruments.[268] The fact that regulators are typically not accountants, insurance experts, or contract lawyers complicates the task.

Another potential pitfall for regulators is the decision to release assurance funds after a firm's reclamation, closure, postclosure, and other obligations are met. This requires scientific and engineering expertise, rather than financial acumen. But the administrative challenge is clear. The quality of restoration and site closure efforts can be difficult to assess.[269] Public involvement in these determinations can help but cannot be relied upon in all circumstances.[270] Firms also have the right to challenge an agency's determination not to release bonds. Litigation over these issues is common in some cases and adds to administrative costs.[271]

6.6 Problems with Self-Demonstration and Corporate Guarantees

Self-demonstrated assurance and corporate guarantees allow firms to pass accounting tests as a substitute for purchased assurance. When a firm self-demonstrates, its own financial

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267 Review of Hardrock Mining Reclamation Bond Requirements, Legislative Request #98L-36, Legislative Audit Division, State of Montana, December 4, 1997 ("During the course of our review, we identified several potential control weaknesses which affect the department's ability to effectively manage performance bonds....File documentation does not necessarily reconcile with computer system information. We noted instances of bonds without department signatures"); document available at leg.state.mt.us/audit/download/98L-36.pdf.

268 See testimony from the General Accounting Office on mining bond collection problems, Adequacy of Bonds to Ensure Reclamation of Surface Mines. Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, 99th Congress, 2nd Session, June 26, 1986. ("I spoke to the Director of the State regulatory authority. She indicated that the problem in Oklahoma was the 'paper' on which some of those bonds were written. In essence, the bond paper was bad. Once the bonds are written off on a legal technicality, you are not going to get any money"), and ("Some of these bonds—I think four of them, had letters of credit amounting to about $425,000 which were allowed to expire. Therefore the money is not going to be available to reclaim the sites"), at 70.

269 See Kuipers, supra note 24 ("The measurement of success can be highly subjective and is often dependent upon the interpretation of specialists hired by the mining company"), at I-16.

270 Review of Hardrock Mining Reclamation Bond Requirements, Legislative Request #98L-36, Legislative Audit Division, State of Montana, December 4, 1997 ("The department relies on public comment and scrutiny as a [bond release] control measure"), at 6.

271 Adequacy of Bonds to Ensure Reclamation of Surface Mines. Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, 99th Congress, 2nd Session, June 26, 1986 (discussing problems with inappropriate bond release and stating that 66% of mined Pennsylvania acres were appealed to an Environmental Hearing Board on the basis of conflicts over release. In all cases, the board eventually sided with state, but hearings took on average 16 months for resolution), at 4.

status is used to meet the standards. When a corporate guarantee is used, the corporate parent or affiliate's financial status is used. Almost all financial assurance programs allow self-demonstration and corporate guarantees as forms of compliance.[272] To the regulated community, self-demonstration is the cheapest and thus most desirable form of compliance, since no coverage need be purchased or dedicated funds set aside.[273] Accordingly, agencies and legislatures may be pressured to relax self-demonstration standards to allow more firms to comply in this nearly costless fashion.[274] Self-demonstration is desirable because it avoids the cost of purchased assurance.[275] Unfortunately, it can be surprisingly difficult to distinguish between wealthy, environmentally responsible, and financially stable firms—the firms for which self-demonstration is appropriate—and their less stable and scrupulous counterparts.

The problem with self-demonstration and guarantees, in a nutshell, is that there exists no financial instrument dedicated to environmental obligations.[276] In recognition of self-

272 Self-demonstration is allowed under the OPA/CERCLA vessel and offshore facility rules, all of the RCRA programs (Subtitles, C, D, and I), SMCRA, and many state hardrock mining programs.

273 Firms unable use self-demonstration are particularly aware of this advantage. According to the testimony of a firm unable to comply with the self-demonstration criteria, "The market is now divided into those who can self-insure and do not have to pay the additional premium cost, and those who cannot and must assume this enormous expense." The Federal Requirements for Vessels to Obtain Evidence of Financial Responsibility for Oil Spill Liability under the Oil Pollution Act of 1990, Hearing before the Subcommittee on Coast Guard and Maritime Transportation of the Committee on Transportation and Infrastructure, House of Representatives, 104th Congress, June 26, 1996, at 33.

274 As an example of the tendency to reduce the criteria necessary for self-demonstration, consider Michigan's UST assurance rules, which state, in part, that "the amount of the financial responsibility requirements required under the provisions of this subpart shall be reduced to the amount required by the federal government upon passage by the federal government of a reduction in the financial requirements of this part." R 29.2161(f), amending Section 280.90. See also Minerals Management Service Press Release, May 4, 1995, OCS Policy Committee Passes Recommendations on Oil Pollution Act Financial Responsibility Requirements (#50033), reporting on an advisory committee's approval of a resolution to seek "additional mechanisms for qualifying as a self-insurer" so that "the costs of demonstrating OSFR do not cause serious economic harm to responsible parties." Available at http://www.mms.gov/ooc/press/1995/50035.txt.

275 See Federal Register 1998, supra note 18 ("The financial test allows a company to avoid incurring the expenses associated with the existing financial assurance requirements which provide for demonstrating financial assurance through the use of third-party financial instruments, such as a trust fund, letter of credit, surety bond, or insurance policy"), at 17708. An EPA analysis of its self-demonstration rules for municipal landfills concluded that self-demonstration, by eliminating third-party assurance costs for qualifying firms, would save approximately $77 million annually. Id., at 17719.

276 Disturbingly, and perhaps not coincidentally, Nevada's hardrock mining program, which as of 2000 had 13 mines in foreclosure or bankruptcy, also features a particularly high rate of self-bonding (approximately 50% of Nevada's hardrock mine reclamation bonds are in the form of self-bonds). Kuipers, supra note 24, at II-44.

demonstration's dangers, regulations feature a set of safeguards designed to ensure the firm's ability to absorb future costs. Under the RCRA hazardous waste facility rule, for example, firms must pass one of two tests: a bond rating test, or a set of financial ratio tests based on "total liabilities to net worth," "sum of net income plus depreciation, depletion, and amortization to total liabilities," and "current assets to current liabilities." In addition, there are a tangible net worth test, a domestic assets test, and a net working capital and "net working capital and tangible net worth to estimated closure and post-closure costs" ratio test.[277] This daunting set of accounting challenges means that many firms cannot self-demonstrate.[278]

The regulator's task is equally daunting. Interpretation, verification, and monitoring of the financial tests over time require either significant in-house accounting expertise or reliance on third-party audits. Regulations typically require independent accounting reports, but this is not an ironclad safeguard. Accounting fraud is relatively common, mostly among small firms and firms in financial distress—precisely the kind of firm and situation that can pose the most serious assurance problems.[279] Unfortunately, the occurrence of financial reporting fraud is not eliminated by independent audits, even those by the nationally prominent, "Big Six" firms.[280] Moreover, accounting standards for environmental liabilities and other obligations are not adequately standardized.[281] There tends to be great variability in the way environmental

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277 The financial tests are not arbitrary. Using retrospective analysis, EPA compared, the ability of different tests to predict future bankruptcy. For example, firms with less than $10 million in tangible net worth went bankrupt four times more frequently than firms with tangible net worth greater than $10 million. Federal Register, vol 59, no. 196, October 12, 1994, at 51524. See also Federal Register 1998, supra note 18 ("An analysis of bond ratings showed that bond ratings have been a good indicator of firm defaults, and that few firms with investment grade ratings have in fact gone bankrupt"), at 17709; justifying the use of debt-to-equity ratio profitability ratios as an alternative to bond ratings ("The Agency selected these two specific financial ratios with their associated thresholds based on their ability to differentiate between viable and bankrupt firms"), at 17709.

278 Self-demonstration tests differ slightly under the various programs. For example, see section 3.4.5 supra.

279 See Mark Beasley, Joseph Carcello, and Dana Hermanson, Fraudulent Financial Reporting: 1987–1997, An Analysis of U.S. Public Companies, Committee of Sponsoring Organizations of the Treadway Commission, 1999 ("Relative to public registrants, companies committing financial statement fraud were relatively small"), ("Pressures of financial strain or distress may have provided incentives for fraudulent activities for some fraud companies"), at 2.

280 Id., at 3. During the fraud period, 56% of the sample fraud companies were audited by a Big Eight/Six auditor, and 44% were audited by non-Big Eight/Six auditors.

281 See Federal Register 1998, supra note18, at 17717 ("The financial analysis of firms with net worth between $1 million and $10 million show that environmental obligations may not be universally recognized. When EPA examined the liabilities, net worth and estimated financial assurance amounts for forty firms with net worth between $1 and $10 million, it found that many of these firms had estimated financial assurance obligations that exceeded their net worth [thirty-seven] and their reported liabilities [thirty-five]. In the instances of firms with financial

obligations are recognized for accounting purposes.[282] Also, the degree to which a firm's assets are obligated to other liens or creditors may not be readily apparent.[283] From a bookkeeping standpoint alone, it is very difficult to assess all the environmental obligations attached to a single firm. Firms often operate multiple facilities with multiple obligations in multiple jurisdictions. Accordingly, adding up all these obligations and accounting for them properly is crucial for assessing a firm's ability to internalize costs years in the future.[284] In sum, environmental assurance accounting is a problem not only for regulators untrained in its subtleties, but for accountants themselves.

Another serious concern is that a firm's financial status can quickly deteriorate. When this happens, the regulator may not even be notified of the financial crisis for many months. Consider a firm that experiences a loss of revenue or an increase in costs, leaving it unable to pass the financial test criteria. RCRA hazardous waste rules require notification only "within 90 days after the end of the fiscal year for which the year-end financial data show that the owner or operator no longer meets the requirements."[285] The firm then has an additional 120 days in which to find alternative, third-party assurance. If financial conditions deteriorate early in a firm's fiscal year, notification may not occur until well into the following year.

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assurance obligations that exceed their liabilities, this strongly implies that they are not recognizing these obligations as liabilities, particularly because liabilities also include money owed to creditors such as banks. This inconsistent reporting of landfill closure obligations has been reported by the Financial Accounting Standards Board.")

282 For discussion of environmental obligation accounting standards, see Financial Accounting Standards Board, Exposure Draft, Proposed Statement of Financial Accounting Standards, Accounting for Certain Liabilities Related to Closure or Removal of Long-Lived Assets, No. 158-B, February 7, 1996. Given the subjectivity of standards, another concern is that audits may favor the interests of the audit's purchaser. See Comment Response Document for Financial Test and Corporate Guarantee for Private Owners or Operators of Municipal Solid Waste Landfill Facilities, October 12, 1994 Proposed Rule (59 FR 51523), ("Compliance with the proposed financial test relies on the opinion of an independent certified public accountant. The experience of [The Michigan Department of Natural Resources] is that even independent certifications are slanted to the benefit of the owner/operator to the maximum extent allowed by law"), at 111.

283 In a bankruptcy filing creditors compete to recover money owed to them. Environmental agencies are not typically guaranteed any priority in this competition. For this reason, some assurance rules require self-demonstrating firms to base asset calculations only on their unencumbered assets (those with no other claim attached to them). As under the offshore facilities rule, 30 CFR § 253.26; 63 FR 42703, August 11, 1998.

284 In theory, this problem is addressed by a requirement that all costs being assured are revealed. ("Requiring that the owner or operator include all of the costs it is assuring through a financial test when it calculates its obligations prevents an owner or operator from using the same assets to assure different obligations under different programs"), 63 Federal Register 1998, supra note18, at 17712.

285 40 CFR 264.143(f)(6).

As an example of both the rapidity with which a firm's financial fortunes can turn and the subjective and inappropriate use of accounting data and techniques, consider the case of Dow Corning. Between 1994 and 1995 Dow Corning went from an AA bond rating to bankruptcy, largely because of breast implant litigation costs.[286] As a result, the firm no longer qualified for self-demonstration for a hazardous waste disposal facility in Michigan. Nevertheless, the firm submitted a claim of self-demonstration based on dubious accounting techniques and unaudited data that were ultimately inconsistent with audited financial reports. In effect, the firm claimed that its balance sheet, for the purposes of assurance, improved as a result of its bankruptcy filing.[287] In that short period the firm went from compliance to noncompliance and left the site without an adequate assurance of its ability to provide closure, postclosure, and liability obligations. Any firm finding itself in this situation faces the challenge of finding alternative assurance at the very time—a bankruptcy filing—when providers will be most reluctant to offer it.[288]

Another problem with self-demonstration is that it involves no specific financial asset to which a regulator can lay claim in the event obligations are not performed.[289] Although, as discussed above, trust funds, insurance policies, letters of credit, bonds, and cash deposits may not always be easily converted into compensation, these instruments are reasonably likely to yield liquid sources of compensation.[290] This is particularly true if, as is ideal, the regulating

286 See "The People v. America Inc," The Economist, March 24, 2001, at 71.

287 See Correspondence, Waste Management Division, Michigan Department of Environmental Quality, to the Dow Corning Corporation, October 19, 1995 [on file with author] ("In making the demonstration, the company relied upon the bankruptcy filing as a basis to exclude certain liabilities, receivables, and special charges for the breast implant litigation. The MDEQ cannot accept the bankruptcy filing as a basis to exclude the amounts attributed to the breast implant litigation....The bankruptcy filing cannot be used as a basis to improve Dow Corning Corporation's ability to pass a financial test that it previously failed"). The data submitted to MDEQ was un-audited and in conflict with subsequent, audited data. According to MDEQ, "The August 2, 1995 letter from the independent accountant, Price Waterhouse LLP, noted many significant deviations from the un-audited financial statements."

288 See discussion in section 6.3 supra.

289 In the words of the Michigan Department of Natural Resources, commenting on the RCRA D financial test, "A financial test does no provide a state or the U.S. EPA access to funds to complete closure, post-closure, or corrective action should the financially responsible corporation refuse to take the needed actions....The only recourse to a state or the U.S. EPA would be a lengthy and costly lawsuit with the owner or operator." Comment Response Document for Financial Test and Corporate Guarantee for Private Owners or Operators of Municipal Solid Waste Landfill Facilities, October 12, 1994, Proposed Rule (59 FR 51523).

290 This distinction is acknowledged by EPA. Third-party mechanisms "provide easier access to funds to fulfill financial obligations. A State may, therefore, decide that it has facilities with poor compliance histories that do not make them a good candidate for the financial test in order to eliminate potential delays in obtaining closure, post-

agency is the sole beneficiary. Purchased coverage also tends to be viewed by courts as specifically dedicated to reclamation or liability obligations and thus is more likely to be recoverable for regulatory agencies.[291] The assets claimed by a self-demonstrating firm, on the other hand, are much more ephemeral. Such assets are not specifically dedicated to assurance in a legally binding way and must therefore be sought in competition with other creditors once obligations come due—if in fact they exist and have value at all.

7. Conclusion

Environmental obligations that are unfulfilled, whether due to abandonment or insolvency, are disturbingly common. Cost recovery, deterrence, and enforcement are improved directly by financial assurance requirements. Assurance is desirable in theory because it helps assign costs to the parties best able to plan for and reduce them—potential polluters themselves. Assurance is desirable in practice because it achieves its goals at relatively low cost and without significant commercial disruption, contrary to fearful rhetoric that typically accompanies the imposition of new assurance requirements. It is particularly desirable when viewed in relation to the alternatives: costs abandoned to the public or imposed after-the-fact on offending firms' commercial partners. Compared with these alternatives, assurance leads potential polluters to a transparent, in-advance appreciation of future environmental obligations. The value of assurance as a deterrent is enhanced further when firms must purchase assurance from third parties, since coverage rates and availability will be determined by the customer's environmental track record and expectations of future environmental performance. The breadth of operations and risks covered by current rules is an additional testament to assurance's practicality. Markets for assurance coverage provide a wide variety of financial instruments that can be tailored to the needs of individual firms, facilities, and regulatory needs.

If there is to be a criticism of assurance requirements, it may be that they do not go far enough. It is clear, for example, that many mining bonds have not been sufficient to ensure adequate reclamation. In other programs, more experience with cost recovery over longer periods is needed to judge whether the scope of assurance requirements is adequate. The security of

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closure or corrective action. Similarly, States may decide to forego altogether adoption of the financial tests." Federal Register 1998, supra note 18, at 17726.

291 See Section 6.4.2 supra.

particular assurance instruments is also worthy of ongoing scrutiny. Self-demonstrated assurance, claims-made insurance policies, captive insurance arrangements, and trust funds with lengthy pay-in periods may hamper cost recovery, particularly if costs arise only after decades. Also, state assurance programs could benefit from centralized administration and record-keeping and the creation of databases to foster intrastate comparison of firms' financial statements, aggregate environmental obligations, assurance coverages, and reclamation performance. As it stands, most state programs operate independently of one another, both within and across state boundaries.

Finally, it should be noted that many of the most significant environmental obligations guaranteed by assurance mechanisms have yet to come due. Long-tailed hazards associated with landfills, for example, will not reveal themselves for decades. Accordingly, the legal and financial security provided by current assurance rules will be tested in earnest only in the years to come. Ongoing analysis should be trained on the various mechanisms' ability to internalize costs over the long run. In turn, regulators should be prepared to respond to any weaknesses that are revealed, by eliminating weak mechanisms, mandating greater coverage amounts, improving auditing, and building assurance mechanisms with sturdier contractual foundations.

Phosphate Mine Reclamation Bond Preparation Guide

BLM Pocatello Field Office

September 19, 2018

1. Introduction

This document provides guidance for southeast Idaho phosphate mining companies involved in the calculation of a reclamation bond for the BLM and Forest Service. The methods and procedures in this guidance document are based on various information sources including the 2013 memo "Bond Requirements for Phosphate Mining Operations" from the Assistant Director, Mineral and Realty Management, BLM Washington Office. This guidance may be updated as new information becomes available.

2. Reclamation Bonding of Mines with Multiple Surface and Mineral Management and Authorities

Bonds for mines involving BLM, Forest Service, State and private surface and mineral management are typically calculated as if the reclamation of the entire mine would be performed as one project since this is typically how reclamation of non-performing mines are contracted. This also takes advantage of any efficiencies of scale, mobilizations and fixed costs to avoid duplicative fixed costs. For longer duration (multi-season) reclamation effort, additional mobilizations may be required due to normal work stoppages, such as winter conditions, and the need to return equipment for normal dealer preventative maintenance. The BLM, Forest Service and other surface owners will need to determine the portions of the total bond allocated between them. Where practical, bond calculation documents should be structured to allow the adequate breakout of each surface owner's portion. Typically the parties holding bonds for a single mine would include the BLM, Forest Service and Idaho department of Lands.

Bonding of mine facilities on non-federal lands outside of the lease would normally be held by the Idaho Department of Lands. In the past, memorandums of understanding between the BLM, Forest Service and State of Idaho allowed the entire bond amount to be held by one agency or split among multiple agencies, but those MOUs are currently expired, so currently, each agency holds their own bonds. Future MOUs could revise this approach.

Bond Calculation Standardization

Current BLM policy requires that mine reclamation bonds be fully reviewed and appropriately adjusted at least every 3 years. Bonds also need to be reviewed and potentially adjusted when mine modifications are approved that could substantially alter the reclamation bonding scenario resulting in increased reclamation cost. The 3 year bond review cycle keeps the agency's bond review process as efficient and timely as practical with the available personnel resources. Review efficiency is also greatly enhanced if bond calculation methodology is standardized. Standardization can be applied to unit costs, production factors, component descriptions, calculation methodologies, etc. unless factors unique to a mine dictate otherwise. In the past, each mine has taken a somewhat different tact in their calculations and used different unit costs, productivity and efficiency factors, etc. Those reclamation tasks that are similar between mines or typical to the industry should be standardized as should the methodologies, factors and unit costs. Standardization is also important to ensure the bonding process does not give one operator a competitive advantage as a result of utilizing more favorable unit costs, production factors, and etc.

Primary Goals of BLM Reclamation Bond Review

The bond support documents need to be organized and in enough detail to allow the BLM to ascertain that the calculations are accurate, appropriate, complete, fair and reasonable. The following components will be considered.

- Ensure that the bond covers an appropriate reclamation scenario that substantially meets environmental and resource performance requirements in the approved mine and reclamation plan. The scenario needs to be consistent with the lease stipulations, and ROD and mine authorization conditions of approval and approved mine modifications. The scenario also needs to meet current regulatory standards and performance requirements. The bond scenario needs to maintain the potential to economically recover the remaining mineral resource the extent practical. Most importantly, the bond needs to cover the maximum potential monetary exposure for reclamation cost during the prescribed period of the bond scenario.
- Ensure that the bond calculation basis including unit costs, production factors, take-off quantities, tasks and calculation methods are appropriately accurate for an “actual cost bond.” A plus or minus 20% estimate is typical.
- Ensure that the estimate is fair and equitable between companies, i.e. that one company does not gain an advantage by using different unit costs or methodologies.
- Ensure the bond covers all direct, indirect, administrative and overhead costs that would be incurred should the agencies need to hire government contractors to perform the reclamation.

Reclamation Scenario and Basis: To calculate an accurate bond, a “reclamation scenario” needs to be determined to base the cost estimation. Typically this step is performed before serious cost estimation is started although unit costs can often be addressed at this time. The scenario needs to reflect tasks required on the partially mined property that would fulfill the intent of the reclamation and environmental performance portion of the approved mine and reclamation plan and any approved mine plan modifications, should the operator default before mining and reclamation is completed. The scenario should represent that point in the mining sequence when the maximum cost liability would be incurred to reclaim the partially mined lease. The scenario also needs, to the extent practical, maintaining the viability of subsequent lessee to recover any remaining mineral resource to the extent that it does not violate environmental requirements.

A general process for determining a mine’s point of greatest reclamation cost liability is:

1. In coordination with the agencies (BLM, Forest Service and IDL as appropriate), review the approved mine and reclamation plans and any mine plan modifications to determine the overall reclamation and environmental performance goals. This would include identifying reclamation cover designs, pit backfill configurations (are there partially backfilled pits or pits not scheduled to be backfilled), water management objectives and goals such as managing seepage from waste areas, external dump locations and configurations, ground water and surface water mitigation objectives and designs, reclamation goals for haul roads, shops and other ancillary facilities, reclamation goals for ore processing facilities, etc.
2. Review the mining sequence, typically by mining panel or phase, to determine the most reclamation cost exposure within a chosen time window if mining was curtailed. The point of maximum reclamation costs is often when there is the greatest area of disturbance, greatest volume of materials needing to be handled to meet reclamation goals, or some other factor or combination of factors such as engineered cover construction, that maximizes the cost to reclaim, but could also be based on exposure of a particular feature that would require substantial effort to mitigate.
3. Using the scenario in Step 2 above, determine what work would be needed to maintain the mine in compliance with environmental standards and requirements such as surface and ground water quality and also what work would be needed to backfill, re-contour, stabilize and reclaim the disturbed areas to meet the resource restoration goals and post mining uses identified in Step 1 above. A narrative and relative schedule of the reclamation and short and long term monitoring scenario, methods of calculation, and scheduling of tasks should be submitted to the BLM for discussion and approval prior to calculating costs.
4. Once Step 3 is agreed on by the agencies, the mining company can prepare a bond calculation submittal that includes figures, drawings and a narrative describing the tasks and phases determined in Steps 1, 2 and 3 (some of this would be included in the submittal for Step 3), along with active live spreadsheets and documentation of the cost estimate to perform the reclamation work.

Additional details for the bond calculation submittals are provided in subsequent sections.

General Requirements

Bond Needs to be Calculated as if for a Government Contractor : Calculate costs as if the BLM or Forest Service contracted all work. The following indirect cost factors should be applied to the estimate.

A. Engineering, Design and Construction Plan	6% of Direct Costs
B. Insurance (On site Liability)	1.5% of Labor Costs
C. Performance and Payment Bonds (1.5% each)	3% of Direct Cost
D. Profit	10% of Direct Cost
E. Government Contract Administration	6% of Direct Costs
F. BLM Indirect Cost (21% of Contract Administration Cost)	1.26% of Direct Costs
G. Contractor Contract Administration Cost	6% of Direct Costs
H. Contingency	6% of Direct Costs
I. Interim Project Management	3% of Direct Costs

Interim Monitoring and Stabilization: Estimate cost of a contractor to perform all interim site maintenance (such as short term water management, short term slope stabilization, etc.) and environmental monitoring between the time the operator defaults and the time when the reclamation construction contractor mobilizes to the site. The interim contractor would be required to keep the area of operation in compliance with applicable safety and environmental requirements while the bond is being called and reclamation contracts are being developed, bid out and the contractor selected and mobilized. Experience has shown it would be at least a year before the reclamation contractor could be contracted and mobilized to the site.

Long Term Closure Costs: If any long term maintenance or closure costs that the operator will not be performing themselves should be included as an attachment with the bond estimate for inclusion in a trust fund. Typical costs are those required to construct, operate, maintain and reclaim any long-term treatment facilities or post-closure structures such as water management structures required by the approved mine plan or reclamation scenario.

Labor: Since the bond should be calculated as if it were a government contract, wages and fringe benefits for laborers and equipment operators need to be no lower than federally mandated labor rates given in the most current Davis-Bacon (D-B) Act Determination. This applies to prime contracts over $2,000.

If the reclamation is solely for the dismantling or removal of improvements (buildings, pipelines, etc.), use Service Contract Act wages. Labor to operate a water treatment plant, etc. should also use Service Contract Act wages, regardless of other types of work may require D-B Wages.

Calculating Wages

When calculating D-B wages, the Rate, Fringe benefits and Zone Pay values are added together to obtain the total hourly wage compensation. D-B Fringe benefits are paid in addition to the hourly rate. D-B fringe benefits are the costs or contributions incurred by the employer, not the employee. They do not include costs paid by the employer that are required by either Federal, State, or local law such as worker's compensation or unemployment insurance. The following are categories of costs that make up the D-B fringe benefit number.

Health & Welfare -- Medical or hospital care, or insurance to provide such care, life insurance, long-- or short--term disability, sickness, or accident insurance.

Pension (401K, etc.) -- Retirement/401K, defined contribution plans (including savings and thrift, deferred profit sharing and money purchase pension), annuity cost, or cost of insurance to provide such a benefit.

Apprentice Training -- Defrayment of the cost of apprenticeship or similar training programs.

Vacation & Holiday -- The payment of compensation for holidays and vacation.

Supervisor, Executive, Administrative, and Professional Wages: Employees who are bona fide executive, administrative, or professional employees as defined under the Fair Labor Standards Act at 29 CFR Part 541 are not covered by the Davis-Bacon Act. The wage rates for bona fide supervisory employees (foremen, superintendents, etc.) are also not regulated under D-B and related Acts because their duties are primarily administrative or executive in nature rather than those of laborers or mechanics (operators). However, such employees who devote more than 20 percent of their time during a workweek to mechanic (operator) or laborer duties are considered laborers and mechanics (operators) for the time so spent, and must be paid at least the appropriate wage rates specified in the D-B wage determination. Salaries and wages for supervisors, executives, administrators and professionals need to be based on prevailing wages and backed up with documentation.

Costs Requiring Consideration In Bond Calculations

Identify and calculate the relevant costs for the various tasks needed to complete the bonding scenario including, but not limited to:

- Equipment rental or acquisition costs.
- Equipment operation costs (fuel, oil, grease and maintenance [FOGM] and tires).

- Labor costs for manual labor, equipment operations, maintenance, monitoring, health and safety, technical, supervision and project management.
- Site maintenance including roads, infrastructure, power lines, fences, and monitoring facilities, etc.
- Reclamation materials costs (acquisition, shipping, etc.).
- Equipment mobilization and demobilization costs.
- Permits.
- Taxes (sales, property).

Equipment Productivity: There are several methods for calculating fleet and equipment production rates. They all utilize or assume factors such as material densities, operator efficiency, altitude corrections, fill factors, scheduled hours per year, rolling resistance, etc. To keep reclamation costs fair and consistent between mining companies, below is a list of reasonable values for these factors applicable throughout the phosphate patch. Keep in mind; these are factors that a third party government contractor would use in a bid, not necessarily the factors that a mining company has determined for their equipment and personnel from operating a mine at a specific site.

The following factors are based on the Cat Performance Handbook, experience and review of past and current phosphate mine reclamation bonds and other cost estimating references.

Standardized Performance Factors for BLM Reclamation Bonds

Factor	Value	Notes
Loose Density (lbs/cy)	3,000	Assumes 20% swell factor. Typical of values used in previous bond calculations.
Bank Density (lbs/cy)	3,700	Typical of values used in previous phosphate mine bond calculations and on in pit design densities.
Equipment Performance Altitude Correction Factor	Typically <1	Specific for each type of Equipment
Elevation for Altitude Correction Factor	7800 ft (2300 m) amsl	Typical elevation of mines in phosphate patch.
Upper equipment speed limit for material haulage	25 mph	Assumes medium haul distance. Adjust down for short hauls, up for long hauls over easy terrain.
Load Factor (L.F.)	83%	L.F.= (100%/(100%+20%swell)
Loader Fill Factor (%)	100%	Bucket loaders typically have a fill factor of at least 100%
Hauler Body Fill Factor (%)	95%	Typical of values used in previous bond calculations.
Operator Efficiency (%)	85%	Accounts for an experienced operator handling unfamiliar material in an unfamiliar location under varying conditions.
Scheduled Hours per Year for Operations	2,310 hours	One 10 hour shift per day, six days a week accounting for weather, holidays, equipment maintenance, mob and demob, misc. down time. Use if actual work days/hours and fleet availability are not used. (Source: USACE EP 1110-1-8, Vol 8)
Fleet Availability (%)	83%	Accounts for downtime for maintenance, etc. 50 min work hour (standard from many cost references)
Rolling Resistance (%)	5%	Dirt roadway, rutted or flexing under load, little maintenance, no water, 2 in. tire penetration. (Source: Cat Handbook)
Job Efficiency (day)	0.83	50 min/hr
Job Efficiency (night)	0.75	45 min/hr

Note: These factors are not necessarily mutually exclusive, additive nor multiplicative. It depends on the method used to calculate job performance.

Equipment Production Calculation Software: An application like FPC™, DozSim™, SRCE™, etc. can be used to obtain fleet production values. When these applications are used, provide printouts of the inputs and outputs and identify where the values are used in any outside calculations.

Caterpillar Performance Handbook™: If referencing the Caterpillar Performance Handbook, provide edition number and page number and a brief explanation of parameters used to obtain a particular value or select the methodology.

RS Means™: If using RS Means**™**, provide the book title, reference line number and any parameters, such as volume, haul distance, cycle time, etc. used to select the particular line. Provide printouts of estimates using the RS Means "Advanced" option. A copy of the page used is adequate if the book version is used.

EquipmentWatch™ Rental Blue Book or Green Book: If Blue Book or Green Book values are used, provide publication date (current date if using online version), and a copy or printout of the equipment rate pages showing rate adjustment for rate effective date, model year, region (Idaho), and ownership and operating factors. Avoid specifying equipment over five years old.

Other References: If other references are used, provide detail equivalent to that noted above so costs can be verified.

Standard Reclamation Cost Evaluator (SRCE) "The Nevada Method":

The Nevada Department of Environment Protection (NDEP), Nevada BLM, Forest Service and Nevada Mining Association have adopted a reclamation and closure cost estimator for Nevada that, in the words of the author, "standardizes user input requirements, productivity calculations, volume and area calculations in a consistent format to facilitate accuracy, completeness and consistency in the calculation of costs for mine site reclamation." The model was validated in the State of Nevada through an 18 month testing process. Although it has been used extensively in Nevada and worldwide by its developers, it has not been validated for general use in Idaho or the phosphate patch. The application depends on an extensive set of both standardized and site and region specific input data that includes labor rates, performance factors, unit operating rates, rental rates, material costs, etc. Nevada has a committee that periodically reviews and updates this standardized data set for Nevada.

No such standardized data set exists for southeast Idaho and it is expected that any dataset for Idaho would have significant differences from Nevada. Also, SRCE does not include every type of task or activity that could be required to fulfill the reclamation scenario, so additional cost estimating outside of SRCE is often needed. An example of a task that SRCE does not cover would be the installation of a GCLL, or store and release cover. That said, the application contains many of the calculations needed to handle reclamation and would be acceptable for phosphate reclamation bonding if standardized input values for southeast Idaho and approved by BLM were used and the application spreadsheets were submitted along with the bond documentation for approval by BLM.

Calculation Units:

Before actual cost bond calculations were required of phosphate mines, bonds were calculated using a standard costs per acre. At mine sites where no significant earthmoving tasks such as backfilling, recontouring or road prism reconstruction were required for reclamation, using cost per acre values to calculate bonds appeared to be adequate. Now that actual cost bonds are required, calculating and using cost per acre for reclamation is only appropriate for certain reclamation tasks. Below is a discussion of when costs based on volume (cubic yards, tons) of material and costs based on area (acres, sq-ft, etc.) are appropriate. Also, using assembly costs is addressed below.

Cubic Yards – Use cubic yards (cy) for costing all cut and fill tasks such as road recontouring or prism reconstruction; recontouring piles; excavation, loading, hauling, filling and spreading operations, etc.

Acres or square feet – Cost per unit area can be used for reclamation where large areas are reclaimed in a uniform fashion such as covers and revegetation, provided the component unit costs and methods used to calculate the cost per area are provided. For example, for revegetation, pounds of live seed per acre, fertilizer per acre, equipment type and production rates per acre, total time to accomplish etc. should be provided. For covers, equipment type, the thicknesses, volume and bulk densities of the materials used per unit area should be provided plus the location of source material so load/haul/dump or push distances and costs can be verified.

Assembly Costs: Assembly costs are costs for tasks or materials that can be lumped together to form a unit cost. Examples might be cost per foot to abandon a well, cost per cubic foot to demolish a building, cost per square foot to install synthetic liner, cost per gallons per minute for a package water treatment system, etc. Often, assembly costs are obtained from published price or rate sheets or by acquiring bids from outside contractors to perform a well-defined task, or manufacture a specific assembly (thus the term “assembly cost”). A bid from an analytical lab to perform a defined set of water analysis can be considered an assembly cost. Assembly costs can be used for specific tasks provided the underlying unit costs, or bid documentation is provided. For example, three “cost per acre” bids could be obtained for reseeding. The “request for bid” document should be provided to the agency along with the bond calculation so that it can be shown that the requirements of the reclamation scenario are satisfied. And be sure to inform the bidder that they are bidding as if it were a federal contract job since government jobs carry additional risk and expenditures that contracting for private industry typically does not.

Submittal Format

Reclamation Requirements

Scope of Area to be Reclaimed

Bonding Scenario Narrative

Phases of Reclamation Tasks

Equipment Fleet

Work Assumptions

Figures: Provide figure(s) and drawings showing (as appropriate):

- Map showing surface ownership within reclamation scenario.
- Total area covered by existing bond showing scenario mine features.
- Total area covered by Cost Estimate.
- Areas for which bonding has been released.
- Areas that have been fully reclaimed (recontoured, topsoiled, and reseeded) but that have not been released from bonding. Show when each area was last seeded.
- Detail maps, cross-sections and drawings showing mine scenario to which bond should be applied and time frame when this scenario should occur in the mining sequence. If slang location names are used in the text description of the scenario, show those locations on the figure and the area that these names pertain to (for example: at North Rasmussen Ridge Mine there is a Bowles Boulevard, Homer's Hump, Malfunction Junction, and Buck's Bank). It would be preferable to keep the use of slang place names to a minimum.
- Detail map showing final reclamation surfaces for selected scenario including surface preparation (Dinwoody cover, GCLL, topsoil thickness, cover type such as seeding or rock armoring, etc.).

Surface Land Ownership: Provide acreages of each surface owner within the reclamation bond scenario.

Survey Stations: If survey stations are used in the task descriptions (such as for road reclamation), provide a map showing the station locations in sufficient detail to follow the narrative and calculations.

Intermediate Stages of Reclamation: Show intermediate stages in the reclamation scenario that help to illustrate the techniques, equipment, push and haul distances, location of stockpiles, volumes and areas, etc.

Cross-sections: Provide longitudinal and lateral cross-sections in sufficient detail across cut and fill areas to allow verification of volumes, initial and final slopes, push and haul distances and grades. Provide cross-sections of roads and other cut of fill tasks showing the pre-reclamation and final reclamation profiles to allow a take-off of areas and volumes. Show area and quantities on each section.

Excel Spreadsheets: Provide live Excel spreadsheets showing all calculation cells including equations, unit values, production rates, volume calculations, mobilization, fleet costs, haulage, excavation, interim monitoring, long term management, etc. The BLM has examples of a spreadsheet that can be used as a template. If using SRCE, provide the application with the populated spreadsheets.

Direct Costs

The contract to perform the reclamation will be governed by the Federal Acquisition Regulations (FARs). The FARs define direct costs to mean any cost that is identified specifically with a particular final cost objective. Direct costs are not limited to items that are incorporated in the end product as material or labor. Costs identified specifically with a contract are direct costs of that contract. All costs identified specifically with other final cost objectives of the contractor are direct costs of those cost objectives (FAR Part 2 – Definitions).

The direct cost calculations should include the following items at a minimum.

Site Survey, Inventory and Design

Typically when an operator defaults, mining and reclamation stops quickly leaving the site in a state of partial closure and reclamation. The agency typically must hire a surveyor and engineering consultant to evaluate and document the condition of the site so a closure/reclamation plan and specification can be prepared.

Interim Operations and Maintenance

O&M of the site for the time period between company default and completion of the reclamation. This is essentially stabilizing the site and performing prescribed environmental monitoring while reclamation designs are prepared and contracts are let.

Site Reclamation

Full reclamation of the site based on the reclamation scenario.

Long-term Maintanence

Cost to monitor environmental sites such as ground water and surface water for a defined period of time and maintain site until water management structures are shown to be adequate and reclamation revegetation has stabilized.

Items to be Considered in Cost Calculation

- Hazardous Materials Handling and Disposal
- Demolition, Removal and Disposal of Structures, Equipment and Materials
- Fences
- Power lines, transformers
- Hard-surfaced roads
- Bridges
- Abandoned equipment
- Culverts
- Railroads
- Facility Buildings (shops, warehouses, offices, etc.) Provide total building volumes.
- Mineral handling facilities (truck dumps, conveyors, silos, scales, etc.)
- Support facilities (ready line, fuel tanks, water tanks, equipment yards, explosive storage sites, electrical substations)
- Earthwork
- Equipment types - Describe equipment, procedures and costs with reference to a quality, and current map of the project site. The map should show haul distances and grades.
- Location of stockpiles and load and dump areas.
- Topsoil/Growth Media: Show redistribution of topsoil or growth media on all disturbed areas that are to receive topsoil
- Revegetation
- Seedbed preparation
- Mulch
- Seed
- Fertilizer
- Post seeding maintenance (weed control, mowing, interseeding, rill repair) – suggest 10% of Revegetation costs

- Removal of monitoring structures (if structures need to be operational for a period after primary reclamation, include inflation for that period in costs)
- Ground water monitoring wells
- Other operator owned wells
- Surface water monitoring stations
- Experimental study sites
- Meteorological/air quality monitoring sites
- Environmental, Health & Safety Mitigation
- Long Term Operation and Maintenance (O&M)
- Surface Water Management Maintenance (sediment ponds, straw wattles, silt fencing other BMPs)
- Revegetation Monitoring and Maintenance
- Surface Water and Groundwater Quality Monitoring
- Environmental Monitoring (resources other than revegetation and water)
- Geotechnical Monitoring
- Water Treatment (if needed)
- Inflation for all tasks and long term O&M – Recommend 2.5%

Salvage: No salvage value can be credited for facilities, equipment, or other infrastructure. This is because salvage value is so volatile. It is not uncommon for the salvage value to be zero. For example, in 2004 the salvage value for steel was zero and currently the value of salvage is very low. It is also common for items of value to be removed from the site to pay company debts before bond money for on-site reclamation work can be realized.

Contract Assumptions:

- Assume work will be performed in the appropriate season.
- Assume work during the 3 months of winter will be limited. Since there is no profit motive to continue working during winter conditions, the added expense of working in the winter is typically not acceptable in a government contract.
- Assume work will be performed during daylight hours.
- Assume workers travel per diem is at local government rate.

Indirect Costs

Contractor's Costs

Performance and Payment Bonding and Insurance

Performance bond: Performance bonds are required for federal construction contracts over $150,000 (Federal Acquisition Regulations [FAR] 28.102). It covers bringing in another contractor in case the successful bidder can't complete the work and such items as repair of damaged structures or natural resources. The BLM and Forest Service consider a premium of 1.5% of the total contract (direct) cost to be fair and equitable.

*Payment bond***:** A payment bond is required for federal construction contracts (FAR 28.102). It pays subcontractors if the prime contractor defaults, and can be no less than the performance bond. The BLM and Forest Service consider a premium of 1.5% of the total contract (direct) cost to be fair and equitable.

Insurance: Insurance is required for government contracts (FAR 28.3) The BLM and Forest Service consider a premium of 1.5% of the total labor cost to be fair and equitable.

Profit

Profit is the contractor's profit calculated as a percentage of total direct costs that do not already contain a profit. The FAR considers 10% profit to be fair and equitable.

Taxes

Add sales tax to all materials and add sales and property tax to the cost of equipment purchased, rented, leased or used in a mine reclamation bond (IAC 35.01.02.082 "Idaho Tax Code Rule 82"). For Idaho, the sales tax is 6% and property tax is 2%.

Overhead and Per Diem (typically 15% of direct cost)

Corporate overhead, called G&A (General and Administrative) costs, need to be added to all direct costs, typically 15%. This value is ultimately a part of the winning bid of the successful contractor and is determined for each large government contractor by the DCAA, (Defense Contract Audit Agency). Although the DCAA is part of the Department of Defense, under interagency agreements they also do audits of contractors for other agencies such as the USDA and DOI.

Risk or Contingency (General Conditions) (typically 10% for reclamation projects))

Contingency costs are for errors that may exist in estimate resulting from the use of assumptions and conceptual information rather than actual measurement of work performed. **Contingency cost is not a way to estimate the cost of worst-case scenarios or reclamation failure.**

<u>Contract Administration</u> (6% of Direct Project Cost)

- Pays Mineral Administrator, Fiscal, Engineering and Other Specialists
- Pays Per Diem for inspections
- Pays Agency Contract Administration (Contracting Officer and staff, COR, Inspectors)

<u>Agency Indirect Costs</u> (21% of Contract Administration Cost)

- Pays for Washington office (payroll, etc), State office administration, District office costs.

<u>Inflation Factor</u> (total of the following) Assume 2.5% per year long term.

- Time until expected next bond update (3 years).
- Period of time until reclamation scenario.
- Time to actualize the bond, assume a year minimum.

  This is the time between actualizing bond (bond collection) and initiation of agency reclamation (time to prepare and let bid). Experience shows that this takes one year minimum.

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Washington, DC 20240
http://www.blm.gov

September 10, 2013

In Reply Refer To:
3504 (320) P

Memorandum

To: State Director, Idaho

From: Assistant Director, Minerals and Realty Management

Subject: Bond Requirements for Phosphate Mining Operations

The purpose of this memorandum is to implement the Department of the Interior (DOI), Bureau of Land Management (BLM) action in response to Recommendation 1 of Government Accountability Office (GAO) report GAO-12-505, "Phosphate Mining – Oversight Has Strengthened, but Financial Assurances and Coordination Still Need Improvement."

This memo documents and reaffirms the BLM's policy that reclamation bonds for phosphate mines operating on Federal leases are required, and encourages bonds that cover full estimated reclamation costs. The BLM relies on reclamation bonding in the event the lessee is unable to complete part or all of the reclamation work as the parties envisioned due to the lessee lacking funding at the time of reclamation. To calculate reclamation bond cost estimates for phosphate mining operations, BLM offices will follow the policy and procedural guidance in attachment 1 – Guidelines for Phosphate Mine Reclamation Cost Estimates, which closely follows Section 6.2 of H-3809-1, *Surface Management Handbook.*

This guidance is effective immediately to require reclamation bonds for phosphate mines operating on Federal leases in Idaho, and encourage bonds that cover full estimated reclamation costs as outlined in attachment 1 to this memo.

On May 4, 2012, the GAO completed a report entitled, "Phosphate Mining – Oversight Has Strengthened, but Financial Assurances and Coordination Still Need Improvement." The report made three recommendations. The first states, "Document the practice of requiring financial assurances to cover the estimated full cost of reclamation in BLM's official agency policy."

On August 2, 2012, the Acting Assistant Secretary, Land and Minerals Management transmitted to GAO a "Statement of Actions," which are actions the BLM will take in response to the GAO recommendations. The response to Recommendation 1 stated, "BLM will review the current reclamation and bonding practices used in Idaho phosphate mining and will develop written policy, through an Instruction Memorandum, to appropriately document and clarify that the BLM requires financial assurances that will cover the full estimated cost of reclamation."

Although the current BLM regulations do not require full cost bonding for phosphate mining, the applicable bonding regulations provide, "BLM will set permit and lease bond amounts for each lease or permit. We will consider the cost of complying with all permit and lease terms, including royalty and reclamation requirements, when setting bond amounts" (43 CFR 3504.50 (a)). Based on this regulation, the BLM must require bonding and should encourage full cost bonding whenever possible.

This memo transmits interim policy that the BLM will incorporate into MS-3504, *Bonds*, during the next revision.

If you have any questions concerning the content of this memo, please contact me at 202-208-4201, or your staff may contact Mitchell Leverette, Division Chief, Solid Minerals, at 202-912-7113 or mlevereret@blm.gov.

Attachment

Guidelines for Phosphate Mine Reclamation Cost Estimates

Introduction

When a new mine or exploration reclamation plan or a plan modification is approved, a new reclamation bond may be needed, or an existing bond adjusted to account for any additional potential reclamation requirements. In addition, a bond should be periodically reviewed to ensure it represents an accurate estimate of the current costs to perform the prescribed reclamation. The operator may also request an adjustment to a bond based on reclamation activities they have completed that review the bond's supporting documentation to determine if it identifies and incorporates all applicable reclamation and administrative costs, and meets the requirements of 43 CFR 3504.50(a). Besides reclamation, bonds should also include cost components related to complying with established requirements, such as royalty payments, maintaining compliance with the Clean Water Act and meeting requirements at 43 CFR 3591.1.

For a new exploration or mine plan, a reclamation bond is required after completion of the National Environmental Policy Act (NEPA) analysis and the Decision Record (DR) or Record of Decision (ROD) is signed and before any ground breaking activity can commence. For a mine or exploration plan modification proposed by the lessee or required by the BLM per 43 CFR 3592.1(d), the existing bond documentation needs to be reviewed to determine if the operator has identified and incorporated any new mine plan components or reclamation requirements into the bond. If the review warrants, the bond should be adjusted after completion of any required DR, ROD, or Determination of NEPA Adequacy (DNA) is signed, but before any ground-breaking activity associated with the modification is performed.

The following guidelines describe procedures to be followed and components to be considered when documenting the calculations for a bond to reclaim an exploration project or mine site, should the operator not complete reclamation as required in an approved reclamation plan. The guidelines are to ensure that the cost estimate:

- Covers an appropriate reclamation scenario that meets the requirements in the ROD or DR and approved reclamation plan or plan modification.
- Uses unit costs, production factors, quantity take-off, tasks and calculation methods that are reasonable and appropriately accurate for an "actual cost" estimate. Quantity take-off consists of using engineering drawings and figures to determine the quantity and types of materials that need to be handled or procured.
- Is equitable between operators, i.e., that one operator does not gain a competitive advantage by using more favorable, but unsupported unit costs, factors or methodologies to calculate their bond.

Reclamation Scenario and Basis

A "scope of work" should be developed to calculate a reclamation cost estimate (RCE), which should be used to perform quantity take-offs. In this guideline, this scope of work is called the reclamation "scenario." The scenario assumes mining stops at an intermediate point in the life of the mine when the cost to reclaim would be the highest. This intermediate point is typically not at the end of mine life, but could be. Also, the approved reclamation plan typically does not cover fully reclaiming the site at an intermediate point, so other than concurrent reclamation as mining proceeds, there is typically no interim final reclamation scenario described in an exploration or mine reclamation plan, and the RCE scenario needs to be prepared.

The scenario can be selected from the entire mine life for relatively short duration mines, or a part of the mine life for mines whose life is longer than can be reasonably and accurately determined. Whether for the entire mine life or a part, or "phase" of the mine life, the scenario needs to represent when the highest reclamation cost exposure might exist if mining were curtailed and reclamation stopped. The scenario should function like a scope of work in a construction bid and is used as a reference to perform quantity take-offs so that the cost of materials, equipment, and tasks can be determined for the RCE. The scenario needs to reflect reclamation tasks that would be needed to fulfill the intent of the reclamation portion of the approved exploration or mine reclamation plan, and account for any plan modifications.

The bases for the RCE are those unit costs, production factors, equipment types, and administrative costs and factors used to build the extended cost estimate. The basis should be consistent between the RCEs calculated for the different mines or exploration projects, taking into account normal fluctuations in unit costs, such as fuel, labor, etc.

Phased Scenario

For the purposes of the bond, a phase is defined as a time period shorter than the life-of-mine that consists of a logical phase of mining, such as one or more mine panels, an extension of the mine or main haul road, or the installation of a conveyor between panels. The intent of using a phased approach is to allow bonds for logical portions of the mining sequence as a unit and to allow bonds for a timely phase of the mining for those mines that have a long life-of-mine relative to the bond review period. It is also used to reduce the uncertainty that is inherent in determining the costs of activities in the distance future. A phased RCE and bond is typically not appropriate for a prospecting permit or exploration license since they are relatively short authorizations and expire in 2 years. The operator should prepare an RCE for the selected phase or phases, incorporating all applicable reclamation and administrative costs. The amount of the required bond for the mine should be based on the RCE for the phase of the operation plus any existing bonds for the mine, assuming the existing bond for the mine is satisfactory. If the existing bond needs adjustment, it should be reviewed and adjusted as part of the next scheduled periodic full review.

Preparing the Scenario and Basis

The following process should be used for determining the reclamation scenario and basis:

1. Review the ROD, DR, approved reclamation plans, and any plan modifications, in coordination with surface management agencies and the operator, to determine the overall reclamation goals. This includes identifying: 1) reclamation cover or cap designs and performance requirements, 2) pit backfill configurations (Are there partially backfilled pits or pits not scheduled to be backfilled in the reclamation plan?), 3) water management objectives and goals, 4) external dump locations and configurations, 5) ground water and surface water mitigation objectives and designs, 6) reclamation requirements for haul roads, shops and other ancillary facilities, 7) reclamation requirements for ore processing facilities, etc., 8) interim (before the bond can be

collected) site management and security needs, and 9) long-term monitoring and mitigation requirements, such as water treatment.

2. Review the mining sequence, typically by mining panel, phase or stage, as defined by the operator and usually identified in the mine and reclamation plan. Select a time period that the RCE will cover. During the selected time period, determine when the most reclamation cost exposure might exist if mining and reclamation stopped. Assume that the operator has performed the concurrent reclamation required by the mine and reclamation plan. Using the designs, goals, and performance requirements determined in step 1, determine the final reclaimed scenario to be achieved from the point mining stopped. The scenario should describe the conditions that are expected to exist when the mining stopped, and the conditions that need to be created through additional reclamation work. The difference between the two conditions is the work that needs to be performed and covered by the RCE and bond. The point of maximum reclamation costs is often when there is the greatest area of disturbance, greatest volume of materials needing to be handled to meet reclamation goals, or some other factor or combination of factors maximizing the cost to reclaim.

3. Using the scenario in step 2 above, determine the basis for the RCE. The basis is the work, tasks, and production factors and unit costs appropriate to bring the partially completed mine into compliance with any environmental standards and requirements, such as surface and groundwater quality standards, and also what work would be needed to backfill, contour, stabilize, cover, cap, and reclaim the disturbed areas to meet the resource restoration goals identified in step 1 above.

   Many of the phosphate mines in southeastern Idaho are located on U.S. Department of Agriculture, Forest Service-managed lands, and include mine facilities outside of the lease that would normally be reclaimed at the same time as the on-lease portions. To avoid duplicating fixed costs for mine reclamation inside and outside of the lease area, such as mobilization, laydown yards, ready lines, service vehicles, etc., it is recommended that all reclamation costs for the mine, both on- and off-lease, and irrespective of surface owner, be calculated as if performed at the same time, without duplicate costs. The costs should then be split for each bond holder through negotiation with the surface managers, typically based on surface area and reclamation effort.

   Often, an on-lease area needing filling or re-vegetation could require material from an off-lease area, or visa-versa. These aspects of the reclamation need to be explicit in the RCE. Keep in mind that the RCE will be used to prepare the actual scope of work by an engineering firm should the bond be forfeited, so the RCE needs to be explicit and detailed enough to provide guidance for that effort.

   Based on this information, the operator should submit a narrative to the field office, including drawings showing the reclamation tasks, short- and long-term monitoring scenarios, water treatment or similar long-term mitigation requirements if required, and the scheduling of tasks. Equipment types and fleet production factors should be discussed and agreed upon. For example, will a task require material be dozed, or will it be a load, haul, dump, and spread operation? What rolling resistance, equipment efficiency, operator efficiency, etc., will be used for the calculations? Be cautious about what factors are used since they can affect the calculated cost considerably, creating a biased estimate. To avoid this, require consistent regional factors between operators to avoid giving one operator a competitive advantage through the bond. Fuel can be up to 30 percent of the total cost of reclamation and is often the most time-volatile component of the cost estimate, so the current price for fuel should be used in the RCE.

Reclamation Cost Estimate Assumptions and Conditions

Once steps 1, 2 and 3 are completed, the field office should request the operator to prepare an RCE submittal based on the scenario and basis. The BLM should not prepare the RCE for the operator. The RCE should be based on the following assumptions and conditions:

- The estimate should cover all relevant operation, maintenance and administrative costs for all reclamation identified in the reclamation scenario.
- Costs should be estimated as if the BLM were hiring a third-party contractor to perform all required reclamation.
- Costs should include the use of offsite equipment as if the project area was vacated, and the estimate should include all associated mobilization and demobilization costs.
- The estimate should include, when applicable, all interim maintenance and security required to keep the area of operation in compliance with applicable safety and environmental requirements while reclamation contracts are developed and executed.
- The estimate should cover costs to construct and maintain any long-term treatment facilities or post-closure structures or tasks required in the approved plan.
- Reclamation by the operator is current as required by the approved mine or exploration reclamation plan up to the time that mining stopped.

Labor Costs – Where applicable, labor costs for laborers and operators should be based on federally mandated labor rates as required by the Davis-Bacon Act and the Federal Acquisition Regulations (FAR) for contracts over $2,000 (FAR 52.222-6). If the reclamation and cost estimate is solely for the dismantling, demolition, or removal of improvements, then contracting is under the Service Contract Act (FAR 52.222-41), and Davis-Bacon wage rates do not apply. Service Contract Act wages would also be applicable for operation and maintenance of a water treatment system, but not the construction. If construction, alteration, or repair of the improvements is contemplated, even if it is under a separate contract, the Davis-Bacon wages apply (http://www.wdol.gov/).

Inflation – Inflation can, over time, become a significant factor in the amount of the required bond. When calculating an RCE, inflate the cost over the review period, or over the time to the maximum disturbance reclamation scenario, whichever time period is less. To minimize the impact inflation can have, the field office should ensure RCEs are reviewed periodically.

Concurrent Reclamation Previously Performed and Accepted – Operators are expected to perform concurrent reclamation as exploration or mining progresses. Where concurrent reclamation has been accepted as complete by the BLM, the RCE and bond should be adjusted accordingly.

Reclamation, Closure, Mitigation and Monitoring Components

The reclamation costs reflect the direct construction and maintanence costs of a Government contract to reclaim the area as defined in the reclamation scenario. Reclamation and closure tasks that need to be considered include the following categories:

- Interim Operation & Maintanence (O&M) – If an operator abruptly ceases operations, immediate site operation and maintenance may be required by a third party to maintain the area of operation in compliance with applicable safety and environmental requirements. There is no preset time period for the care and maintenance of a site prior to the start of reclamation; much depends on the BLM's ability to access the bond, especially in bankruptcy cases, but experience has shown that it takes at least a year before full reclamation can commence. Much of this time is needed because field work is weather dependent and reclamation activities often cannot commence until late spring or early summer to avoid having snow incorporated into fill sections. It is a good rule-of-thumb to allow for a minimum of 1 year of interim O&M by a contractor. Large operations or project areas with limited seasonal access may warrant a longer time period.
- Hazardous Materials – This may include the cost of decontaminating, neutralizing, disposing, treating, or isolating hazardous materials used, produced, or stored on the site. The estimated cost for handling hazardous materials should assume, unless otherwise documented, that the material is properly stored and labeled. If, upon site inspection, it is determined the operator is using, producing, or storing material onsite that could be hazardous, e.g., unlabeled barrels, and the BLM is unsuccessful in getting the operator to properly manage those materials, the reclamation cost estimate should be updated to reflect the higher cost of disposing of such material. This distinction is important, as the disposal of properly managed hazardous materials may be a fraction of the disposal cost for materials that are not properly stored and identified.
- Water Treatment – If water treatment is prescribed in the reclamation plan and is included in the reclamation scenario, then all water treatment construction and maintenance costs needed to ensure that mine discharge or drainage will meet relevant standards should be included in the RCE. The cost of long-term, post-reclamation, operation, maintenance, and replacement requirements, if any, should be addressed in the bond.
- Mine Facilities – The cost to demolish, remove and dispose of all mine facilities, immobile equipment, and other materials from the project area should be accounted for in the RCE. Disposal costs for any facilities which have been approved in writing by the BLM for post-reclamation BLM use may be excluded from the RCE. No salvage value for structures, equipment, or materials is allowed in the RCE. Assume no mobile equipment, e.g., trucks, dozers, are left onsite, unless inspection of the site identifies equipment for which the operator is responsible but unwilling to remove.
- Earthwork – Earthwork includes, but is not limited to, the cost of hauling, placement, re-grading, and backfilling to reclaim mine disturbances, including roads that have not been specifically identified and approved to remain open. Some roads are approved to remain, but may still require work to reconfigure or reclaim to meet final reclamation requirements.

- Drill Hole Plugging – The cost of plugging, capping, and isolation of drill holes, including exploration, production, and monitoring holes should be addressed in the RCE. Specifically, care needs to be taken in determining plugging costs based upon whether drill holes are dry, encountered water, or found water under artesian pressure. Proposed plugging should meet all applicable Federal and State requirements. The RCE should include the estimated cost of plugging the maximum number of drill holes that may be open at one time, or the number of drill holes at a particular phase of the exploration program. It is recommended that the RCE never be less than the cost of plugging one drill hole for each drilling rig that will be working in the project area. When the approved plan calls for drill holes to be plugged without specifying that they be plugged before the drilling rig is moved from the drill pad, the RCE should include the plugging cost for all drill holes identified in the plan. For all drill holes and water monitoring and piezometer wells scheduled to be left open, the estimated plugging cost should be included in the RCE. When the approved plan proposes mining through an area where drilling is to occur and the cost of the post-mining reclamation is included in the RCE, the cost estimate for plugging those drill holes is not needed. If the BLM determines the State's plugging and bond requirements related to drill hole plugging accomplish the same level of protection as this policy, the Field Manager may base the estimated plugging costs on the State requirements.
- Re-vegetation – The RCE should include the cost of: 1) obtaining and applying the seed mix specified in the reclamation plan, 2) soil preparation, such as ripping and harrowing, 3) applying soil amendments, such as mulching or fertilizer, 4) controlling noxious weeds, and 5) placing tree and shrub seedlings, if required. The cost for hauling and placement of growth medium, if not addressed under earthwork, should be included.
- Mitigation – This may include avoiding, minimizing, rectifying, reducing, eliminating, or compensating for environmental impacts. This could include mitigation measures that were part of the mine and reclamation plan, such as engineered covers or caps on waste rock piles. The cost of any deferred mitigation the field office is requiring the operator to perform should be included in the RCE. For example, if the operator is required to develop 5 acres of wetlands to compensate for disturbance elsewhere on the project area, until that wetland development is completed, the RCE should include the cost of that mitigation.
- Post-Reclamation Costs – The costs of meeting long-term construction, operation, maintenance, or replacement requirements for any water treatment facilities and infrastructure should be included in the RCE.

In estimating the cost to perform the reclamation, closure, mitigation, and monitoring tasks, the operator's estimate should identify the current costs relating to performing the reclamation including:

- Equipment rental or acquisition costs. Do not forget to include State sales and property taxes on both rental equipment and equipment ownership;
- Equipment O&M costs;
- Cost of operating supplies;

- Labor costs for operations, maintenance and supervision. Supervision does not fall under Davis-Bacon or Service Contract Act wage determinations;
- Federal lodging and per diem rates for workers;
- Maintenance costs for roads, infrastructure, power lines, fences and monitoring facilities;
- Reclamation materials acquisition costs; and
- Mobilization and demobilization costs.

The line items listed are solely for the purpose of arriving at an acceptable RCE and are not to be considered spending constraints should a bond be forfeited. The actual reclamation needed if a bond is forfeited will likely be different than what is in the RCE reclamation scenario, since the actual point in the mining sequence when the forfeiture occurs is unknown. The total bond amount may be spent by the BLM as deemed necessary to implement reclamation. Care should be exercised to assure that bond amount decisions correctly reflect this policy.

Information sources which may be useful in developing and reviewing an RCE include: Handbook for Calculation of Reclamation Bond Amounts, Office of Surface Mining; BLM Solid Minerals Reclamation Handbook H-3042-1; Caterpillar Performance Handbook; CostMine, InfoMine USA, Inc.; R.S. Means Landscape Cost Data and Sitework Cost Data, Reed Construction Data; Rental Rate Blue Book and Green Book for Construction Equipment, EquipmentWatch; USACOE EP 1110-1-8, Vol 8 Construction Equipment Ownership and Operating Expense Schedule, Region VIII; and Skills & Knowledge of Cost Engineering; BLM Technical Note 441, Overview of Cost Estimating for Abandon Mine Lands and Hazardous Materials Cleanup Projects. Please be aware that owner/operator cost data does not reflect the BLM's contracting cost, which should be reflected in all RCEs.

Long-Term Obligation Funding

When funding is needed for long-term obligations, the operator should provide the field office with a scope of work, a cost estimate, and a schedule for the monitoring, construction, operation, maintenance, replacement, and other activities for the required facilities, treatment, or other needs documented in the plan. For reoccurring costs, such as maintenance of a water treatment facility, the frequency, timing, and duration of the obligation should be defined for each cost component. The operator's cost estimate for long-term obligations should be documented separately from the RCE. The long-term cost estimates should be reviewed by the Field Manager in the same manner and with the same degree of care that is used in estimating traditional bonds for reclamation obligations.

BLM Administrative Costs

The field office should ensure the cost of reclamation is estimated as if the BLM were hiring a contractor to perform all tasks. This may include costs incident to the Federal acqusition process the commercial operator does not normally encounter. This may include costs for risks that the Government passes down to a contractor that are not typically in a private construction contract. The BLM reviewer needs to pay particular attention to costing standards that are based on the Federal Acquisition Regulations (FAR), which can be found online at: http://farsite.hill.af.mil/vffara.htm. The responsible field office should coordinate with their state office procurement analyst concerning current labor wages, contracting requirements, and advice on various types of contracts, contract language, and administration.

This guidance contains administrative cost percentages that should be treated as rules-of-thumb. Percentages, other than those listed below, should be included in the calculation if explicitly addressed in a Federal-State agreement regarding the bond and/or are required by Federal or State law. Unless otherwise noted, the administrative cost categories identified below should be included in the RCE.

Engineering, Design and Construction (ED&C) Plan – An ED&C plan provides the details needed for contracting the reclamation construction work. Where appropriate, the RCE should reflect the costs to prepare such a plan. Should the operator fail to reclaim, the BLM may need to undertake a number of tasks including:

- Preparation of maps and plans to show the extent of required reclamation;
- Performing site surveys to determine amount of topsoil and growth medium stockpiles available;
- Surveying site elevations to provide a basis to determine take-off volumes and distances;
- Sampling and analysis of waste rock, tailings, heap material, surface and ground water, etc.;
- Sampling and analysis of topsoil, growth medium and waste piles to determine whether special handling or treatment is necessary;
- Evaluation of structures to determine requirements for demolition and removal;
- Evaluation of storm water facilities and process solutions or water impoundments to determine if treatment, clean out, or other improvements are necessary; and
- Preparation and execution of environmental or site studies before reclamation may commence.

Reported costs for preparation of ED&C plans have ranged from 2 to 20 percent of the estimated reclamation direct construction costs. The actual cost will depend to a great extent on the specifics, including reclamation complexities of the proposed operation. The amount or percentage applied should be based on available data within the State, but if specific local or State data is not available, the ED&C costs should be estimated as 4 to 8 percent of the estimated reclamation direct construction costs. However, inclusion of this line item may not be necessary for small operations such as an exploration license, where contracting and construction may be able to proceed without developing an ED&C plan.

Contingency – This allowance is for cost overruns that regularly occur but cannot be ascertained when a plan is being developed. Contingency costs generally reflect the level of detail and completeness of the cost estimate, as well as the level of uncertainty in the assumptions used for the RCE. With the development of an ED&C plan, many of the unforeseen circumstances and costs are identified. Contingency costs do not, however, include changes in the scope or unforeseeable or unanticipated events, such as the failure of reclamation or mitigation, earthquakes, labor strikes, or floods.

Federal and State agencies that routinely prepare construction cost estimates apply contingencies ranging from 3 to 45 percent of the direct construction costs. The amount or percentage required should be based on available reclamation or construction contract information within the State. Absent reliable local or State information, a contingency of 4 to 10 percent of the estimated reclamation direct construction costs should be used. Where State law specifies an amount, use that figure. When the proposed operation involves a relatively small uncomplicated reclamation effort, and development of an ED&C plan is not anticipated, there may not be a need to include a contingency line item. It is advisable to ensure a contingency is included for operations with estimated reclamation direct construction costs over $100,000.

Contractor Profit – Government contracts generally include prime contractor profit, which should be estimated as 10 percent of the estimated direct construction costs. When State or local contract information suggests a different amount or where State law specifies an amount, use that figure. Inclusion of a line item for prime contractor's profit may not be required if the operator incorporates it into the direct construction cost estimate, but the BLM field office should verify the profit percentage included in the direct construction cost.

Liability Insurance – The contractor's liability insurance premium should be included in the RCE, and should be set at 1.5 percent of the estimated labor costs for the project.

Payment and Performance Bonds – Premiums for both a performance bond and a payment bond, as required by the FAR for estimated contract costs over $150,000, should be included in the RCE. Three percent of the estimated direct construction costs should be used to calculate the cost of premiums for both bonds.

BLM Contract Administration – The BLM's direct labor and operations costs to administer a reclamation contract are estimated to be 6 to 10 percent of the estimated direct construction costs, depending on the size and complexity of the proposed operation. The actual cost will depend to a great extent on the specifics of the proposed operation, including reclamation complexities. Where data is available, the BLM state or field office should review their records to determine appropriate costs. Generally, the larger the bond amount, the lower the percentage needed for contract administration.

BLM Indirect Costs – The BLM's indirect costs should also be included in the RCE. The indirect cost rate for fiscal year 2013 is 19.8 percent of the estimated BLM contract administration costs, and may therefor range from 1.2 to 2 percent of direct construction costs (19.8 percent of the 6 to 10 percent contract administration costs).

If the BLM is required to administer a reclamation contract under a forfeited bond, these indirect cost funds should remain within the BLM state office where the reclamation work will be done. The funds will then be available to pay for within-State indirect costs (building rental, telephone, etc.) associated with the project, and any project support needed from other offices, such as the BLM National Operations Center.

Profit, Indirect and Overhead Costs Imbedded in Direct Construction Costs – When reviewing the operator's RCE, the field office may need to determine the administrative costs included in the direct construction costs, since the labor cost estimates may include base pay, payroll loading, overhead, and profit. To avoid overlooking or double counting any administrative costs, the operator should document the administrative costs which are included in their labor costs or other direct costs.

Reclamation Cost Estimating Tools

The state or field office may wish to develop their own tools to support the reclamation cost estimating process, and may make summary sheets, checklists, and/or cost models available to operators to assist in developing RCEs. Offices are encouraged, where appropriate, to develop processes based on standardized unit costs, schedules, spreadsheets, and models, which are useful tools that provide simplified, efficient, defensible, and consistent means of estimating costs. A process may be developed that uses local and/or regional standardized costs for typical reclamation activities for roads, drill pads, drill-holes, trenches, pits, and structures, or to perform site stabilization, revegetation, etc.

When a standardized reclamation cost estimating process is used, the amount of any bond should be sufficient to meet the "full cost" requirements. The assumptions used should also be consistent with this Instruction Memorandum and both State and Federal laws and regulations applicable to environmental and contracting requirements, such as the FAR.

Periodic Review

The BLM field office should periodically review supporting RCE documentation for each ongoing operation to ensure the amount of the bond continues to meet the reclamation and long-term obligation requirements in the mining and reclamation plan (MRP) and reclamation scenario and basis, to ensure continuing compliance with 43 CFR 3504.50(a). Additional bond amounts may be necessary to address unforeseen situations that have come to light from inspection and environmental monitoring programs. The BLM's RCE review should consist of a complete evaluation and update of the operator's RCE on file, unless the operator is proposing a modification to their plan, the existing RCE does not reflect authorized operations, or additional information is needed. Where the review finds that additional information is necessary, or a revised RCE is required, the Field Manager should direct the operator to provide that information.

RCEs for MRPs should be reviewed at least every 3 years, and for exploration plans, every 2 years. Since exploration licenses expire after 2 years and are not renewable, the initial RCE for the exploration plan should suffice for validation of the bond, unless a substantial modification to the exploration plan is approved, at which time the RCE should be reviewed. Reviews should also be conducted when exploration plans or MRPs are modified, focusing on how the modification affects the existing RCE and bond on file. The entire existing RCE does not need to be reviewed unless the proposed modification necessitates it; however, a modification review does not substitute for the suggested 2-year review for exploration plans or 3-year review for MRPs. More frequent reviews may be done at the discretion of the Field Manager.

The field office should conduct, at least every 3 years, a thorough review of the cost estimates and other assumptions used in determining the amount of funds needed for long-term funding obligations.

Although RCEs should be periodically reviewed as described above, BLM Manual Section 3504, *Bonds*, specifies that the BLM review non-energy bonds annually. Reviews of State bonds covering operations on Federal lands should be conducted in conformance with any State agreements, under 43 CFR 3504.50(b).

Review Results and Decisions

Acceptable Review Results – When the field office has reviewed and accepted a new RCE or an existing RCE for new activity, such as a mine expansion or modification, the Field Manager should provide a recommendation to the BLM Idaho State Office that includes a description of the RCE scenario, the new bond amount or any recommended change in existing bond amount, any production royalty amount required, the calculation method, and an RCE calculation summary. The state office should then make a determination as to the required bond amount and issue a decision which should state: 1) the current amount of any existing bond, 2) the amount of the bond to be provided, rounded up to the nearest $1,000, 3) the types of financial instruments acceptable to the BLM, and 4) that no activity is authorized under the lease until the BLM is provided with an acceptable bond that meets the requirements of 43 CFR 3504.50, and until the BLM has accepted and obligated the bond. The field office should be copied on the decision.

When the field office has reviewed and accepted an existing RCE, the Field Manager should provide a recommendation to the BLM state office that includes a description of the RCE scenario, the current bond amount, any recommended change in bond amount, any change in production royalty amount required and how this was calculated, and an RCE calculation summary. The review of an existing RCE could be due to changed conditions in the reclamation plan, and/or changed conditions as determined by an inspection or enforcement action, or upon an operator's request. The state office should then make a determination as to the required bond amount and issue a decision, which should state: 1) the current amount of any existing bond, 2) the amount of the bond to be provided, rounded up to the nearest $1,000, 3) the types of financial instruments acceptable to the BLM, 4) if the amount has increased, that the operator has 60 days from receipt of the decision to submit an acceptable bond, and that failure to provide an acceptable bond within the specified timeframe will result in an enforcement action, or 5) if the amount has decreased, that the operator may request the BLM state office to decrease the amount of the required bond. The field office should be copied on the decision

Unacceptable Review Results – The estimate should not be accepted if the field office determines that the operator: 1) has not provided information necessary to determine the adequacy of an existing RCE for an ongoing operation, 2) incorrectly calculated costs, 3) based the RCE on out-of-date cost data, 4) failed to incorporate contracting costs, 5) omitted other necessary items, or 6) used data inconsistent with preparing a "fair and reasonable" estimate. The FAR clearly establishes that a fair and reasonable price be determined before a Government contracting officer or ordering officer may award contracts or place orders.

The Field Manager should then notify the operator, in writing with a response due date, identifying the deficiencies or errors that lead to the conclusion that a revised RCE, with the correct information and calculations needs to be submitted. Failure to provide the required information within the specified timeframe may result in an enforcement action for failure to maintain an acceptable bond.

Appeal of Review Decisions – Decisions relating to the acceptability or unacceptability of a bond are subject to appeal under the provisions of 43 CFR 3501.30.

SECOND DRAFT RECOMMENDATIONS FOR COLUMN TESTING OF MINE ROCK IN THE SOUTHEAST IDAHO PHOSPHATE DISTRICT

Prepared for

U.S. Department of Interior
Bureau of Land Management
Idaho Falls District
Pocatello Field Office

And

U.S. Department of Agriculture
United States Forest Service
Caribou-Targhee National Forest
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1. INTRODUCTION

The following recommendations for column testing of phosphate mine rock have been prepared at the request of the United States Department of Interior Bureau of Land Management, Idaho Falls District Pocatello Field Office (BLM) and U.S. Department of Agriculture United States Forest Service Caribou-Targhee National Forest Soda Springs Ranger District (USFS). The intent of the document is three-fold:

1. To provide an overview of geochemical issues associated with mine rock seepage in the Southeast Idaho Phosphate District including:
    a. Identification of constituents of potential concern (COPCs).
    b. Compilation of regional water quality data for overburden springs and under drains.
    c. Identification of geochemical controls that affect the aqueous mobility of COPCs.
2. To provide an overview of the testing methods that have been used to predict seepage characteristics in the Southeast Idaho Phosphate District.
3. To provide recommendations and supporting analysis for a standard testing method to predict phosphate mine rock seepage characteristics.

2. GEOLOGY AND GEOCHEMICAL SETTING OF PHOSPHATE SEQUENCE ROCKS

The Phosphoria Formation has been the focus of numerous investigations by the United States Geological Survey (USGS) since 1909. In 2004, USGS prepared a series of geologic and geochemical studies to support land management decisions by federal and state agencies. The studies are published in *Lifecycle of the Phosphoria Formation: from Deposition to the Post-Mining Environment* (Hein, 2004) and concentrate on four main areas:

1) Delineation of phosphate resources and assessment of lands disturbed by mining.
2) Origin and diagenetic evolution of phosphate sequence rocks.
3) Lithologic and mineralogic characterization of the Phosphoria Formation.
4) Mineralogic residence and environmental mobility of selenium and other contaminants.

The USGS studies indicate that selenium, cadmium, nickel, and zinc are present at elevated concentrations in waste rock and ore from phosphate mines (Perkins and Foster, 2004; Hein et al., 2004a; Grauch et al., 2004; Herring and Grauch, 2004). The Meade Peak Phosphatic Shale Member of the Phosphoria Formation is identified as the primary geologic residence of the contaminants. The Rex Chert Member of the Phosphoria Formation may also contain selenium and other metals at levels of environmental concern (Hein et al., 2004b; Maxim, 2002a and 2005; Whetstone, 2010).

2.1 Stratigraphy

The stratigraphy of the Southeast Idaho Phosphate District is described by Mansfield (1927), McKelvey (1959), Armstrong (1969), Mabey and Oriel (1970), Armstrong et al. (1975), Rioux et al. (1975), Oriel and Platt (1980), Petrun (1999), and Murchey (2004). The phosphate mining sequence includes carbonate and clastic sedimentary rocks that may be overlain by younger unconsolidated deposits and volcanic rocks. A generalized stratigraphic section for the Southeast Idaho Phosphate District is presented in Figure 1. Lithologic descriptions of bedrock units typically produced during mining are described in Section 2.1.

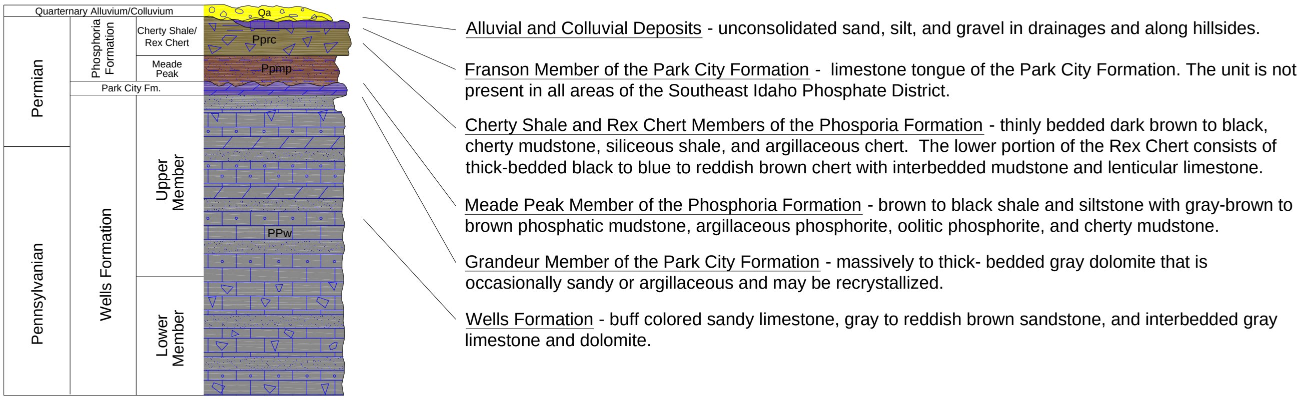

Figure 1. Generalized Stratigraphic Section for Project Area

2.1.1 Phosphoria Formation

The Phosphoria Formation is divided into three members in southeast Idaho. In descending order, the members include the Cherty Shale[1], Rex Chert, and Meade Peak Phosphatic Shale. The Meade Peak Phosphatic Shale is the host of ore-grade phosphate mineralization and lies unconformably over the Grandeur Member of the Park City Formation (Grandeur Tongue) or Wells Formation (McKelvey, 1959).

The Cherty Shale is at the top of the Phosphoria Formation and is composed of thin-bedded, dark brown to black, cherty mudstone, siliceous shale, and argillaceous chert. It has an average thickness of about 170 feet (Rioux et al., 1975). The Rex Chert lies below the Cherty Shale and consists of thick-bedded, black to bluish-white or reddish-brown chert with interbedded mudstone and lenticular limestones. The average thickness of the Rex Chert is about 80 feet (Rioux et al., 1975).

The Meade Peak Phosphatic Shale is at the base of the Phosphoria Formation and is informally divided into five mining units. The mining units include hanging wall mud (upper waste), upper ore, center waste, lower ore, and footwall mud (lower waste) in descending order. The hanging wall mud is 15 to 35 feet thick and is composed of mudstone, siltstone, and cherty phosphorite. Upper ore is 15 to 18 feet thick and is composed of gray-brown to brown phosphatic mudstone, argillaceous phosphorite, oolitic phosphorite, and cherty to calcareous mudstone. Center waste ranges from 80 to 110 feet thick and is composed of dark gray to black mudstone, siltstone, argillaceous carbonate, and thin-bedded oolitic phosphorite. The lower ore ranges from about 25 to 40 feet thick and is composed of gray to brown interbedded oolitic phosphorite, phosphatic mudstone, siltstone, limestone, and argillaceous phosphorite. The footwall mud is 3 to 5 feet thick and is a massively-bedded reddish brown siltstone with a thin layer of fossiliferous phosphatic siltstone at the base. The aggregate thickness of the Meade Peak is typically between 110 and 180 feet (Rioux et al., 1975).

2.1.2 Grandeur Member of the Park City Formation and Wells Formation

The Grandeur Tongue and the Upper Member of the Wells Formation lie below the Phosphoria Formation and are produced as waste rock by open pit mining operations. The Grandeur Tongue is approximately 80 feet thick and is composed of thick- to massively-bedded gray dolomite that is occasionally sandy or argillaceous and may be recrystallized. It may or may not be present in the stratigraphic section depending on location. The Upper Member of the Wells Formation is 1,350 and 1,450 feet thick and is composed of

[1] The Cherty Shale Member splits into the Tosi Chert Member (top) and the Retort Phosphatic Shale Member (bottom) toward the Permian craton in Montana and Wyoming. The Retort Phosphatic Shale Member is recognized at some locations in the Southeast Idaho Phosphate District.

buff-colored sandy limestone, gray to reddish brown sandstone, dolomitic limestone, and interbedded gray limestone and dolomite (Rioux et al., 1975).

2.2 Depositional Environment, Burial, and Thermal History of the Phosphoria Formation

The Permian-age Phosphoria Formation (265 to 269 mya) accumulated in a sediment-starved interior sag-basin off the western margin of Pangaea. The basin was bound to the north by the Milk River Uplift in western Montana; to the south by the Confusion Shelf and Front Range Uplift; and to the east by the Goose Egg Basin in Wyoming, Montana, North Dakota, and Nebraska (Perkins and Piper, 2004). Rocks of the Phosphoria Formation were deposited on a relatively flat carbonate ramp with a slope angle of less than 1° (Wardlaw and Collinson, 1986). The maximum depth of the Phosphoria Sea at the time of deposition was between 1,000 and 1,600 feet (Hein, 2004b).

The Phosphoria Sea was an area of moderate to intense upwelling caused by the equatorial surface current that directed flow along the continental margin (Hein, 2004b). Upwelling brought cold, nutrient-rich water to the surface, causing increased algal and plankton productivity, which resulted in steady deposition of organic debris on the seafloor. The resulting accumulation of carbon-rich sediments is the source of high-grade phosphorite deposits in southeast Idaho (Hein, 2004b; Piper and Link, 2002).

Phosphorite beds were deposited under cool water conditions during periods of intense upwelling and maximum transgression (Hein, 2004b). Inter-element ratios in the marine sediments imply that the bottom waters were denitrifying (dysoxic to anoxic), although temporary sulfate reducing conditions (anoxic to euxinic) may have occurred (Perkins and Piper, 2004). Chert deposition occurred during periods of moderate upwelling during which the bottom waters remained oxic (Hein et al., 2004a). The source of silica for chert beds was biogenic, consisting primarily of sponge spicules (Murchey, 2004). Major element-oxide ratios for siltstone and mudstone interbeds in the Meade Peak Member are similar to the world shale average indicating a terrigenous source (Medrano and Piper, 1995). Sorting, grain-size distribution, and sedimentary structures suggest that the clastic sediments were wind transported and settled from suspension (Carrol et al., 1998).

Following deposition, the Phosphoria Formation was buried and compacted by a thick sequence of Triassic and Jurassic overburden. The estimated depth of burial in the Southeast Idaho Phosphate District was about 2.6 miles (Edman and Surdam, 1984). Imbricate thrust faulting during the Cretaceous and Eocene placed the Putnam-Paris Plate over the Meade Plate and may have added an additional 5.6 to 7.4 miles of tectonic overburden above the Phosphoria Formation (Evans, 2004; DeCelles et al., 1993; Armstrong and Oriel, 1965). It also resulted in greenschist facies metamorphism of the overlying Dinwoody Formation by an inverted thermal gradient (Evans, 2004). The Phosphoria Formation may have been subjected to temperatures in excess of 300° C, but metamorphic mineral assemblages diagnostic of this temperature range are generally absent, possibly because of the short duration of tectonic burial (Evans, 2004).

2.3 Mineralogy and Elemental Distribution in the Meade Peak Member

2.3.1 Major Mineralogy and Framework Grains

The clastic framework assemblage of the Meade Peak Phosphatic Shale is dominated by silicate minerals including monocrystalline quartz, potassium feldspar, and plagioclase, with subordinate amounts of detrital phosphate, carbonate, and oxide minerals (Grauch et al., 2004; DePangher, 2007). Matrix minerals are a combination of detrital and authigenic clays including illite, chlorite, and kaolinite (Grauch et al., 2004; DePangher, 2007). Carbonate fluorapatite (CFA) is the primary phosphate mineral in both ore and waste rock lithologies. CFA is similar to common fluorapatite with extensive substitution of CO_3^{2-} for PO_4^{3-} (Knudsen and Gunter, 2004). Sulfate (SO_4^{2-}) also substitutes for PO_4^{3-} in the crystal matrix of CFA, but to a lesser extent than CO_3^{2-} (Knudsen and Gunter, 2004).

2.3.2 Minor Mineralogy

2.3.2.1 Sulfides

Fine-grained diagenetic pyrite (FeS_2) is widely distributed in the Meade Peak Phosphatic Shale. The earliest generation of pyrite occurs as disseminated framboids and inclusions in CFA pellets. Later generations of framboidal pyrite occur in veinlets and bitumen veins (Grauch et al., 2004). Euhedral to subhedral pyrite has been observed in bedding-parallel structures associated with clay (Grauch et al., 2004). Vaesite (NiS_2) is also common in solid-solution with pyrite (Grauch et al., 2004). Partial replacement of fossils by vaesite suggests that at least a portion of the nickel-rich pyrite formed prior to extensive sedimentary compaction. It is not known if there is significant compositional variation between different generations of pyrite and vaesite (Grauch et al., 2004).

Trace amounts of sphalerite (ZnS) are also distributed throughout the Meade Peak Phosphatic Shale. Three generations of sphalerite have been identified in the rocks: early diagenetic sphalerite, late diagenetic sphalerite, and supergene sphalerite (Grauch et al., 2004). Early diagenetic sphalerite may be coarse- or fine-grained and generally occurs as inclusions in CFA or as disseminated grains in the matrix. It is commonly associated with sulvanite (Cu_3VS_4), a copper vanadium sulfide mineral (Grauch et al., 2004). Late diagenetic sphalerite often replaces CFA. Supergene sphalerite has been observed as nano-scale botryoidal masses on dolomite. Grauch et al. (2004) suggests that the habit of the supergene sphalerite may be evidence of bacterial mediation. Cadmium sulfide (CdS) also occurs as an alteration product of sphalerite (Grauch et al., 2004).

2.3.2.2 Native Selenium

Native selenium has been observed as small acicular radiating clusters of crystals in pore spaces, fractures, and voids within the Meade Peak Phosphatic Shale (Grauch et al., 2004). It is associated with weathered pyrite, bitumen, and CFA. Textural relationships suggest that most, if not all, of the native selenium formed late in the diagenetic history of the Phosphoria Formation, probably in supergene or epigenetic environments (Grauch et al., 2004). Isotopic fractionation of the selenium indicates that it could have formed by either biotic or abiotic processes (Grauch et al., 2004).

2.3.2.3 Silicates, Carbonates, and Other Minerals

Glauconite pelloids have been observed in the hanging wall mud but are restricted to a fairly narrow horizon below the Rex Chert (Grauch et al., 2004). The pelloids are diagenetic and are believed to have formed in a reducing environment at the sediment-water interface shortly after deposition (Chafetz and Reed, 2000). Buddingtonite (ammonium feldspar) overgrowths on detrital orthoclase occur throughout the Meade Peak Phosphatic Shale but are especially concentrated in the center waste (Knudsen and Gunter, 2004). Degradation of organic matter during early digenesis was the probable source of ammonium for buddingtonite formation (Grauch et al., 2004). Roscoelite (vanadium illite) has been observed as coatings on bedding planes and as fillings in interstitial voids (Grauch et al., 2004). Carbonate cement (calcite and dolomite) and overgrowths on detrital carbonate grains are also common.

A variety of other minerals are also known to be present in the Meade Peak Member. Uraninite occurs as inclusions in CFA (Zielinski et al., 2004). Fluorite and barite occur in veinlets with quartz and calcite (Grauch et al., 2004). Bitumen, although not technically a mineral, is disseminated throughout the matrix and occurs in veins (Grauch et al., 2004). Apatite, zircon, and rutile are also known to be present in trace amounts (Grauch et al., 2004). A summary of minerals that have been identified in the Meade Peak Phosphatic Shale is presented in Table 1.

Table 1. Meade Peak Mineral Assemblages (after Grauch et al., 2004)

Mineral	Detrital	Authigenic/ Diagenetic	Supergene
Major (>3% by weight)			
Albite	Yes	Yes	
Apatite (F- and S-Bearing)	Possibly	Yes	
Buddingtonite K-Feldspar Solid Solution		Yes	
Calcite	Possibly	Yes	
Carbonate Fluorapatite	Yes	Yes	
Dolomite	Possibly	Yes	
Muscovite	Yes		
Orthoclase	Yes		
Quartz	Yes	Yes	
Minor to trace (<3% by weight)			
Apatite (Cl-Bearing)	Yes		
Barite			Possibly
Biotite	Yes		
Bitumen		Yes	Yes
Chlorite	Yes		
Ferrihydrite			Yes
Fluorite		Possibly	Yes
Glauconite		Yes	
Goslarite			Yes
Gypsum			Yes
Hematite		Yes	Yes
Iodargyrite			Yes
Illite	Yes	Yes	
Kaolinite	Possibly	Yes	
Microcline	Yes		
Monazite	Yes	Possibly	
Plagioclase	Yes		
Powellite		Yes	
Pyrite		Yes	Yes
Vasite-Pyrite Solid Solution		Yes	
Roscoelite		Yes	
Rutile (and/or Anatase)	Yes	Yes	
Native Selenium		Possibly	Yes
Sphalerite		Yes	Yes
Sulvanite		Yes	
Tourmaline	Yes		
Uraninite		Possibly	
Xenotime	Yes	Yes	
Zircon	Yes		

2.3.3 Elemental Distribution

A study by Perkins and Foster (2004) indicates that pyrite and sphalerite are the primary residences of selenium, cadmium, copper, and zinc in unweathered rocks of the Meade Peak Member. Nickel and vanadium are associated with sulfide mineralogy to a large extent as well. Fine-grained framboidal to subhedral pyrite is the principal host of selenium with observed concentrations of up to 20,000 ppm. Selenium concentrations in sphalerite and sulvanite may exceed 2,000 ppm and 5,000 ppm, respectively (Perkins and Foster, 2004). A small fraction of selenium in the Meade Peak Member is also present in elemental form. In weathered rocks, selenite (Se^{4+}) dominates over reduced forms and is associated with oxyhydroxides. It is assumed that selenite is derived from the oxidation of primary sulfide minerals (Perkins and Foster, 2004). Sphalerite and organic matter are the primary hosts of cadmium and zinc in unweathered rocks. Strong sorption to oxyhydroxides dominates cadmium and zinc occurrence in weathered rocks (Perkins and Foster, 2004).

Outside of the sulfide mineral reservoir, organic matter and oxyhydroxides generally contain the majority of selenium, cadmium, copper, zinc, nickel and vanadium that occur in the Meade Peak Member. Apatite is the primary host for uranium. Both apatite and organic matter host molybdenum. Chromium and a significant fraction of vanadium are contained in acid-insoluble phases (probably silicates and oxides). Chromium, uranium, and vanadium have minimal association with organic matter in unweathered rocks (Perkins and Foster, 2004).

2.4 Environmental Mobility of Selenium

Reduced forms of selenium, such as selenide (Se^{2-}) and elemental selenium (Se^0), are relatively insoluble in water and have low environmental mobility (Seed et al., 2000). Exposure to the atmosphere, however, can oxidize Se^{2-} and Se^0 into mobile forms such as selenite (Se^{4+}) and selenate (Se^{6+}), which can be transported in groundwater and surface water.

Selenium occurs as three principal species in oxygenated water: selenite (SeO_3^{2-}), biselenite ($HSeO_3^-$) and selenate (SeO_4^{2-}) (Hem, 1989; Masscheleyn et al., 1990). Geochemical controls that reduce or limit the solubility of selenium in water include sorption to mineral surfaces including oxyhydroxides of iron, manganese, and aluminum (Hayes et al., 1987; Balistrieri and Chao, 1990; Rajan, 1979). Clay and carbonate minerals also provide effective sorption surfaces for selenium (Bar-Yosef and Meek, 1987; Cowan et al., 1990). In general, selenate is less strongly sorbed to mineral surfaces than is selenite. Redox potential and pH both affect selenium solubility and sorption reactions. Sorption reactions for selenium are least efficient under oxidizing conditions at circum-neutral pH (Elrashidi et al., 1987).

Redox reaction rates for selenium can be rapid[2] (Pickering et al., 1995), with the aqueous species selenite (SeO_3^{2-}) and selenate (SeO_4^{2-}) being readily reduced to insoluble elemental selenium Se^0 (Hem, 1989). Likewise, elemental selenium (Se^0) and selenide (Se^{2-}) are easily oxidized to forms that are more mobile in the environment (Pickering et al., 1995). Microbial processes strongly affect the redox state of selenium. Selenate in solution (SeO_4^{2-}) is reduced to elemental selenium and precipitated by anaerobic bacteria in a wide range of sediments (Stolz et al., 2002). Oxidizing bacteria may also mobilize selenium in favorable environments. Bacterially mediated oxidation rates are generally three to four orders of magnitude less than the reductive part of the cycle (Stolz et al., 2002).

Regional studies indicate that only a fraction of the total elemental mass of selenium in the Meade Peak Member is readily soluble in water (Herring, 2004; Maxim, 2005; Tetra Tech, 2008; Whetstone, 2010). The soluble fraction is estimated to range from about 1 to 10 percent of the total contained mass with weathered rock having lower soluble percentages of selenium than unweathered rocks (Herring, 2004). Onxidative reactions involving sulfide minerals may release additional selenium into water from previously insoluble sources.

2.5 Other Constituents of Potential Concern

Aluminum, cadmium, antimony, iron, fluoride, sulfate, manganese, nickel, zinc, and total dissolved solids (TDS) have been identified as constituents of potential concern at phosphate mines in Southeast Idaho (Whetstone, 2010; Maxim, 2002a; Maxim, 2005). Waste rock from the Phosphoria Formation may also contain elevated concentrations of vanadium, chromium, molybdenum, and silver compared to other Paleozoic strata in the United States (Gulbrandsen, 1960).

The Meade Peak Member is a mixture of phosphorite and brown to black shale. The shales contain metals associated with sulfide minerals, and high concentrations of organic carbon reflecting deposition in a quiet marine setting where reducing conditions developed in the presence of organic matter (Maxim, 2002a). As a general rule, the potential for the release of trace metals is driven by the stability of the host mineral rather than by the total concentration of the element.

The weathering behavior of mineral components in shale formations with high organic-matter content has been evaluated by Clayton and King (1987), Clayton and Swetland (1978), and Littke et al. (1991). The general order of instability under conditions of subaerial weathering is:

sulfide minerals > organic matter > carbonates > apatite > chert > terrigenous debris

[2] Beauwens et al. (2005) suggests the reduction of selenate to elemental selenium in sediments is only rapid when bacterially mediated.

When sulfidic waste rock is exposed to oxygen and water in a waste dump or as backfill, oxidation occurs and trace metals may be released into soil or water. The weathering of pyrite (FeS_2) and sphalerite (ZnS) releases soluble iron, zinc, and sulfate, and possibly other metals that may occur as impurities in the crystal lattice. The oxidation of sulfide minerals also produces acidity and can result in the formation of acid rock drainage (ARD). Acidic drainage, however, has not been observed at phosphate mines in the district.

Metal mobility in water is typically a function of redox and pH conditions with most metals being more soluble and mobile under oxidizing conditions at low pH. At near neutral pH most metals have limited solubility and mobility in the environment. Similar to selenium, the mobility of trace metals and other COPCs may be affected by precipitation, sorption, complexation with organic or other compounds, and biologically mediated reduction or oxidation.

Studies by Herring (2004) indicate that about 10 percent of the total mass of molybdenum, nickel, and zinc contained in Meade Peak rocks is readily soluble in water, 1 to 10 percent of the total mass of cadmium and copper is soluble in water, and less than 0.1 percent of the total mass of arsenic, barium, chromium, uranium, and vanadium is readily soluble.

3. CHARACTERISTICS OF PHOSPHATE MINE ROCK SEEPAGE

Water quality data for seepage from phosphate mine rock have been compiled for 12 mining sites in Idaho (Appendix A). The data span 12 years (1997 through 2008) and include analyses for selenium, cadmium, nickel, zinc, iron, manganese, sulfate and total dissolved solids (TDS). A summary of selenium data for phosphate mine rock seepage is presented in Table 2. Additional COPCs are summarized in Table 3.

Table 2. Observed Selenium Concentrations in Seepage from Phosphate Mine Rock

Selenium Concentrations in Overburden Seeps and Springs	**Observed Range (mg/L)**	**References**
Ballard Mine	0.44 - 0.44	4
Champ Mine	0.0149 - 0.041	4
Conda Mine	0.0041 – 4.0	4, 7
Dry Valley Mine	0.0023 - 0.18	4, 13
Enoch Valley Mine	0.002 - 0.3	4
Henry Mine	0.001 - 0.001	4
Mountain Fuel Mine	0.0005 - 0.34	4
North Maybe Mine	0.0336 - 0.49	4
S. Rasmussen Ridge Mine	0.048 - 0.75	4, 8, 9, 10, 11
Smoky Canyon Mine	0.0003 - 13.3	4, 5, 6
Wooley Valley Mine	0.0028 - 1.4	4
Selenium Concentrations in Under Drains (mg/L)	**Observed Range (mg/L)**	**References**
Conda Mine	0.0098 - 0.35	1, 2, 3, 7
Henry Mine	0.00028 - 0.00065	4
Maybe Canyon Mine	0.64 - 1.5	4
Smoky Canyon Mine	0.07 - 2.35	4
Selenium Concentrations in Saturated Backfill or Overburden (mg/L)	**Observed Range (mg/L)**	**References**
Ballard Mine	0.03 - 1.94	14
Dry Valley Mine	0.0001 - 0.0567	13
Maybe Canyon Mine	0.0019 - 9.85	12
Smoky Canyon Mine	0.299 - 1.06	6

Notes: References are included with Table 3
Supporting data and statistics are presented in Table 3

Table 3. Observed Concentrations for Selected COPCs in Seepage from Phosphate Mine Rock

Parameter (mg/L)	Smoky Canyon Seeps	Conda Seeps	South Rasmussen Ridge Seeps	Dry Valley Seeps	Conda Under Drain	Henry Under Drain	Dry Valley Saturated Backfill	Ballard Saturated Fill	Smoky Canyon Saturated Fill
TDS	460 - 2130	560 - 1183	2.2 - 1900	5 – 2070	760 – 918	530 - 530	1070 - 2950	238 – 1480	2950 - 1070
Sulfate	24.7 - 1120	30 - 540	270 - 1200	220 – 3170	260 – 353	66- 76	526 - 957	27 – 905	957 - 526
Cadmium	0.0001 - 0.02	0.00006 - 0.01	0.0008 - 330	0.0001 - 0.08	0.00002 - 0.006	0.0004 - 0.003	0.003 - 0.62	0.0001 - 0.0003	0.62 - 0.003
Copper	0.001 - 0.01	0.0002 - 0.01	---	0.0005 - 0.03	---	---	---	0.001 - 0.001	---
Iron	0.004 - 0.03	0.05 - 0.05	---	0.0005 - 0.93	0.022 - 0.022	0.01 - 0.01	0.012 - 131	0.05 - 0.44	131 - 0.012
Manganese	0.005 - 2.4	0.005 - 0.04	---	0.002 - 4.8	0.05 - 0.07	0.027 - 1.5	0.34 - 2.4	0.006 - 1.98	2.41 - 0.34
Nickel	0.005 - 0.17	0.003 - 0.31	0.02 – 1.0	0.0005 – 4.0	0.01 - 0.05	0.005 - 0.04	0.07 - 2.2	0.02 - 0.02	2.2 - 0.07
Zinc	0.001 - 0.43	0.001 - 0.59	0.04 – 3.0	0.007 – 17	0.009 - 0.23	0.002 - 0.01	0.16 - 20	0.01 - 0.01	20 - 0.16
References	6	5, 7	8	13	1, 2, 3, 7	2, 3	13	14	6

Notes: Supporting data and statistics are presented in Appendix B

References for Table 2 and Table 3.

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A review of the data in Table 2 and Appendix A indicates that that selenium concentrations in phosphate mine rock seepage vary by more than 5 orders of magnitude regionally (<0.0001 to 13.3 mg/L). The average selenium concentration for available data (n= 278) including overburden seeps, under drains, and saturated backfill is 0.70 mg/L. The median value is 0.12 mg/L. The geometric mean of the data is 0.10 mg/L.

Seepage water quality data also indicate that selenium concentrations may vary by more than 2 orders of magnitude in individual seeps (Table 4). The variation has a seasonal component, with the highest average concentrations occurring in spring (Table 5). Seasonal (spring) concentration increases have also been noted for other COPCs (Whetstone, 2010).

Table 4. Range of Observed Variation in Selenium Concentrations in Individual Seeps and Under Drains

Site	Station	Description	Range (mg/L)
Conda Mine	DS023/NES-1	Dump Seep	0.023 – 0.23
	DS024/NES-2	Dump Seep	0.059 – 2.2
	DS019/NES-4-4	Dump Seep	0.0041 – 0.42
	DSO15/NES-5	Dump Seep	0.4 – 4
	FD001/FD1/DS021/44	Under Drain	0.0098 – 0.35
Dry Valley Mine	DS003	Dump Seep	0.0023 – 0.036
	NBD-1	Dump Seep	0.0025 – 0.122
	SP-2	Dump Seep	0.0044 – 0.18
Enoch Valley Mine	DSO26/EV14	Dump Seep	0.027 – 0.3
	DS025/EV10	Dump Seep	0.0020 – 0.008
South Rasmussen Ridge	SR-E7	Overburden Seep/Wetland	0.095 – 0.47
	SR-E8	Dump Toe Trench	0.21 – 0.75
	SR-E10	Dump Toe Trench / Wetland	0.048 – 0.47
Smoky Canyon	DS029/DS-7	Dump Seep	0.27 – 3.66
	ES-3	Dump Seep	0.0003 - 0.025
	ES-4	Dump Seep	3.13 – 13.3
	ES-5	Dump Seep	1.21 – 2.62
	E Panel Seep	Dump Seep	0.085 – 0.27
	Lower Pole Creek	Below Pole Canyon Dump	0.07 – 2.35
Wooley Valley Mine	DS010	Dump Seep	0.013 – 0.085
	DS011/42	Dump Seep	0.0065 – 0.065
	DS012	Dump Seep	0.0028 – 1.4
Maybe Canyon Mine	SW-2	Creek Below Cross Valley Fill	0.64 – 1.5

Table 5. Seasonal Variation of Selenium Concentration in Phosphate Mine Rock Seepage

Period	Number of Samples	Average	Median	Geometric mean
April-May	140	0.87 mg/L	0.30 mg/L	0.17 mg/L
April-June	170	0.74 mg/L	0.24 mg/L	0.13 mg/L
July-Dec	104	0.63 mg/L	0.05 mg/L	0.07 mg/L

4. SUMMARY OF COLUMN TESTING FOR THE SOUTHEAST IDAHO PHOSPHATE DISTRICT

Geochemical tests to evaluate the leaching characteristics of mine rock may be either static or kinetic. Static tests such as acid-base accounting (ABA) (EPA, 1978) are used to predict if mine rock will produce acidic leachates based on the chemical content of the solid material. Other tests such as the meteoric water mobility procedure (MWMP) (NDEP, 1990) or synthetic precipitation leaching procedure (SPLP) (EPA, 1994) are static in the sense that they predict seepage characteristics based on a single contact of a solution with the solid material. In contrast, kinetic tests use multiple leaching cycles to evaluate chemical release as a function of time and rate-limited reactions. The most commonly used kinetic tests for mine rock include humidity cell tests (ASTM, 1996 and ASTM, 2007) and column leaching tests. The methodology for humidity cell testing is well established and described in ASTM designations D5744-96 and D-5744-07. The primary applications of humidity cell tests are to: (1) determine whether a solid material will produce acidic, alkaline, or neutral leachate, (2) identify solutes in the leachates that represent dissolved weathering products, (3) determine the mass of solute release, and (4) determine reaction rates for sulfide minerals that contribute to acid rock drainage (ARD). In contrast, column testing methodologies are less well defined and procedures are adapted to evaluate specific chemical systems, weathering processes, or other issues of concern. In southeast Idaho, column tests have been used in place of humidity cell tests to evaluate seepage characteristics for phosphate mine rock.

As of April 1, 2012, column leaching studies have been prepared for 5 mining projects in the Southeast Idaho Phosphate District. The projects include:

1. Smoky Canyon Mine Expansion Panels B and C (BLM and USFS, 2002; Maxim, 2002b)
2. North Rasmussen Ridge Mine (BLM, 2003; Maxim, 2002a)
3. Dry Valley Mine South Extension[3] (BLM and USFS, 2000; Maxim, 2006)
4. Smoky Canyon Mine Expansion Panels F and G (BLM and USFS, 2007; Maxim, 2005)
5. Blackfoot Bridge Mine (BLM, 2011; Whetstone, 2010)

Operational parameters for the columns are summarized in Appendix B.

4.1 Column Testing for Smokey Canyon Panels B and C

A total of 9 columns were prepared for Smoky Canyon Mine Expansion Panels B and C[4]. The columns were 6 inches in diameter and contained 5 kg of waste rock. Eight of the columns contained a single rock type (i.e. monolithologic). One column contained a mixture of rock (i.e. run-of-mine [ROM]) that reflected the average material balance of the planned waste rock disposal facilities. The columns were operated for 10 cycles under unsaturated conditions and produced between 1,200 and 2,000 ml of effluent during each 4- to 8-day cycle. The columns were inoculated with bacteria and aerated for 1 to 2 days during each leaching cycle to promote oxidation of sulfide minerals. The application rate of the head solution varied from 30 to 100 ml/hr.

Time-concentration plots for major ions in column effluents displayed a characteristic washout curve with initial concentrations decreasing rapidly during the first 3 cycles and becoming asymptotic at lower concentrations during subsequent cycles. Releases during the initial cycles are interpreted to reflect dissolution of readily soluble salts, minerals, and weakly adsorbed compounds. Asymptotic concentrations during subsequent cycles are interpreted to reflect releases by rate-controlled weathering reactions (ie. sulfide mineral weathering and oxidation of organic carbon) and more strongly adsorbed compounds.

[3] Geochemical validation study prepared by maxim to meet requirements imposed by the Dry Valley Mine South Extension Environmental Impact Statement Record of Decision.

[4] Total excludes the control column, which contained silica sand.

Dissolved selenium concentrations in leachates from columns containing rocks of the Meade Peak Phosphatic Shale ranged from 0.109 to 0.951 mg/L during the first cycle. Dissolved selenium concentrations in second-cycle leachates from the same columns were lower and ranged from 0.047 to 0.459 mg/L. No trend of acidification of column leachates was observed during the tests.

4.2 Column Testing for North Rasmussen Ridge Mine

A total of 11 columns were prepared for the North Rasmussen Mine Expansion EIS[5]. The columns were 6 inches in diameter and contained 5 kg of waste rock. All of the columns contained a single rock type (i.e. monolithologic). The columns were operated for 10 cycles under unsaturated conditions and produced between 1,050 and 3,075 ml of effluent during each 4- to 6-day cycle. The columns were aerated for 1 to 2 days during each leaching cycle to promote oxidation of sulfide minerals and were not inoculated with bacteria. The application rate of the head solution was 30 ml/hr.

Time-concentration plots for major ions in column effluents generally displayed a characteristic washout curve with initial concentrations decreasing rapidly during the first 3 cycles and becoming asymptotic at lower concentrations during subsequent cycles. Releases during the initial cycles are interpreted to reflect dissolution of readily soluble salts, minerals, and weakly adsorbed compounds. Asymptotic concentrations during subsequent cycles are interpreted to reflect releases by rate-controlled weathering reactions (ie. sulfide mineral weathering and oxidation of organic carbon) and more strongly adsorbed compounds. Dissolved selenium concentrations in leachates from columns containing rocks of the Meade Peak Phosphatic Shale ranged from 0.870 to 7.13 mg/L during the first cycle. Dissolved selenium concentrations in second-cycle leachates from the same columns were reduced and ranged from 0.157 to 2.63 mg/L. No trend of acidification of column leachates was observed during the tests.

4.3 Column Testing for Dry Valley Mine South Extension Geochemical Validation Study

Two columns were prepared for the Dry Valley Mine South Extension Geochemical Validation Study. The columns were 6 inches in diameter. One column was operated under unsaturated conditions and contained 25 kg of ROM waste rock. The other column was operated under variably saturated conditions and contained 45 kg of ROM waste rock[6]. The unsaturated column was operated for 13 cycles. The variably saturated column was operated for 10 cycles. Neither column was aerated, sterilized, or inoculated with bacteria. The head solution was applied to the columns continuously at a rate of 15 ml/hr and the first leachates were collected at 0.2 pore volumes. Subsequent leachates were collected at even pore volume increments. Pore volumes were calculated to be 5,200 and 7,800 ml for the unsaturated and variably saturated columns, respectively. The length of a leaching cycle was reported to have been about 3 weeks for the unsaturated column and about 1 month for the variably saturated column.

Time-concentration plots for major ions in the unsaturated column effluent generally decreased with time but did not approach equilibrium release rates. The dissolved selenium concentration in the first partial pore volume was 9.32 mg/L, decreasing to 3.95 mg/L in the first full pore volume. Subsequent pore volumes had dissolved selenium concentrations between 1.84 and 0.345 mg/L.

Time concentration plots for the variably saturated column displayed an initial increase in concentrations for major ions between pore volumes 0.2 and 1.0. Dissolved selenium increased from 1.55 to 2.4 mg/L during the same period. Subsequent pore volumes had dissolved selenium concentrations between 0.017 and 0.122 mg/L.

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[5] Total excludes the control column, which contained silica sand.

[6] Operated as a single downward-flow column with a saturated lower portion and an unsaturated upper portion.

The results from the Dry Valley Mine column tests are interpreted to indicate that selenium and possibly other constituents are less mobile under saturated conditions than under unsaturated conditions. The reduced mobility is likely attributable to microbiological activity that favors selenium reduction in a saturated environment. It is also possible that lower redox conditions in the saturated column limited desorption and mobility of selenium by preventing oxidation of sorbed selenite (Se^{4+}) to selenate (Se^{6+}). No trend of acidification of column leachates was observed during the tests.

4.4 Column Testing for Smokey Canyon Panels F and G

A total of 25 columns were prepared for Smoky Canyon Mine Panels F and G[7]. Twenty-three of the columns were 4 inches in diameter and contained 5 kg of material. Two columns had a diameter of 6 inches and contained 21.8 kg of material. The columns included 21 monolithologic columns and 4 ROM columns. Testing conditions varied from unsaturated to partially saturated[8] and variably saturated[9]. All but 2 columns were inoculated with bacteria. The unsaturated columns were aerated for 2 to 3 days during the leaching cycle. Variably saturated and partially saturated columns did not include an aeration cycle. The application rate of the head solution varied from 15 to 22 ml/hr. Effluent volumes were variable but were generally 90 to 110 percent of the calculated pore volume. The durations of the leaching cycle were variable.

Results from the unsaturated columns were generally consistent with washout phenomena observed in column tests for other sites. Dissolved selenium concentrations in leachates from columns containing material from the Meade Peak Member ranged from 0.152 to 1.34 mg/L during the first cycle. Dissolved selenium concentrations in second-cycle leachates from the same columns were lower and ranged from 0.007 to 0.345 mg/L. Leachates from the variably saturated and partially saturated columns had lower dissolved selenium concentrations than leachates from the unsaturated columns. Dissolved selenium concentrations in first-cycle leachates from the variably saturated and partially saturated columns that contained material from the Meade Peak Phosphatic Shale ranged from 0.03 to 0.714 mg/L during the first cycle. Dissolved selenium concentrations in second-cycle leachates from the same columns were lower and ranged from 0.018 to 0.071 mg/L. No trend of acidification of column leachates was observed during the tests.

4.5 Column Testing for Blackfoot Bridge Mine

A total of 13 columns were prepared for The Blackfoot Bridge Mine[10]. The columns were 6-inches in diameter and contained 20 kg of ROM waste rock each. Nine of the columns were operated under unsaturated conditions. Four columns were operated under fully saturated conditions. Each leaching cycle had a duration of 19 days. The first leaching cycle generated between 1,062 and 2,547 ml of effluent. Subsequent leaching cycles generated approximately 5,000 of effluent. The unsaturated columns included a 3-day aeration cycle. Saturated columns were not aerated. The columns were not sterilized or inoculated with bacteria. The application rate of the head solution was 15 ml/hr.

Time-concentration plots for major ions in effluents from unsaturated columns displayed a characteristic washout curve with initial concentrations decreasing rapidly during the first 3 cycles and becoming asymptotic at lower concentrations during subsequent cycles. Saturated columns had lower initial releases

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[7] Total excludes the control column, which contained silica sand.

[8] 5 kg of material split into upper and lower columns. The upper column was leached under unsaturated conditions with the leachate flowing into the lower column that was leached under saturated conditions.

[9] Column packed with ROM waste rock on top of limestone. The top of the saturated zone was maintained in the limestone.

[10] Total excludes the control column, which contained silica sand.

that did not conform to a washout type curve. Both saturated and unsaturated columns approached equilibrium release rates after the first 3 or 4 cycles. Dissolved selenium concentrations in first-cycle leachates from unsaturated columns containing rocks of the Meade Peak Phosphatic Shale ranged from 0.74 to 3.11 mg/L. Dissolved selenium concentrations in the second-cycle leachates from the same columns were lower and ranged from 0.087 to 0.62 mg/L. Dissolved selenium concentrations in first-cycle leachates from saturated columns containing rocks of the Meade Peak Phosphatic Shale ranged from <0.001 to 0.008 mg/L. Dissolved selenium concentrations in second-cycle leachates from the same columns ranged from 0.001 to 0.002 mg/L. No trend of acidification of column leachates was observed during the tests.

5. RECOMMENDATIONS FOR STANDARDIZATION OF COLUMN TESTING PROCEDURES FOR PHOSPHATE MINE WASTE ROCK

5.1 Recommended Column Testing Method

Humidity cell and column tests are the most commonly used methods to develop kinetic leaching data for mine rock. The humidity cell procedure is well documented (ASTM, 1996 and 2007) and has been used extensively at hard rock mines in Nevada. The test is designed to accelerate sulfide mineral weathering and produce leachates on a weekly cycle. It uses a de-ionized water leaching solution, which is applied to a 1 kg solid sample at a water-to-rock ratio of either 1:1 or 0.5:1. The procedure specifies a 6-day aeration period (3 days dry air and 3 days humidified air) followed by a 1-hour solution contact period on the seventh day. The intended applications of the test are to identify soluble chemical constituents, determine if the material will produce acidic drainage, and determine reaction rates of sulfide minerals that contribute to ARD. The method is not intended to provide leachates that are in equilibrium with the solid sample or that are representative of seepage under field conditions (ASTM, 1996 and 2007).

In contrast to Nevada, column leaching tests have been used to provide site-specific leaching data in the Southeast Idaho Phosphate District. The testing methodology has varied from site to site and has evolved with increased understanding of the chemistry and issues associated with phosphate mine rock seepage. Common aspects of most column testing programs include water-to-rock ratios of less than 0.5:1 and longer solution contact periods than are used for humidity cell tests. The columns have also used larger sample masses (5 to 45 kg).

Despite variability associated with the column testing methods that have been used to date, effluents from the first 1 or 2 leaching cycles have generally provided reasonable models of the constituents and concentrations that are observed in seepage from field-scale facilities (Whetstone, 2010). Selenium is an element of primary concern in the region, and releases in first-cycle leachates from unsaturated columns containing Meade Peak rocks have ranged from 0.109 to 9.32 mg/L. This range is compared to observed seepage data for selenium (Appendix A) that range from <0.0001 to 13.3 mg/L and have average and median values of 0.698 and 0.12 mg/L respectively.

Although first-cycle leachates from unsaturated columns are a reasonable analog of seepage from field-scale facilities, the model is empirical in nature and many differences exist between column and field environments. For example, the hydrodynamics of field-scale systems exert dominant controls over seepage chemistry and no theoretical model exists to directly relate column leachate concentrations to field seepage concentrations. Infiltration rates for field-scale facilities vary seasonally and are typically several orders of magnitude less than for columns. This seasonal variation results in two flow regimes that control seepage movement; a low infiltration regime where water moves through fine-grained material by matrix suction and gravity drainage, and a high infiltration regime where water moves through courser material by gravity drainage. Various researchers suggest that only a fraction of the pore spaces within dump or backfill transmit seepage. Studies by Morin et al. (1991) and ElBoushi (1975) indicate that preferential flow paths develop within mine-rock piles and that only 5% to 20% of rock surfaces are regularly flushed by infiltrating meteoric water. Soluble salts and reaction products that accumulate in flow channels between infiltration events are regularly flushed by infiltrating water. The remaining 80% to 95% of the rock surfaces are infrequently flushed and can accumulate reaction products year after year. In contrast, water in columns moves under plug flow conditions dominated by gravity drainage and particles are evenly wetted and regularly flushed. Other factors that complicate theoretical comparisons of field-scale mine rock seepage with column leachates include variations in the lengths of the flow paths, the duration of solution contact, and the mass/surface area of the rock that is leached.

Notwithstanding theoretical limitations that complicate direct comparison of column leachates with seepage from mine facilities, it is recommended that a standardized column testing methodology be developed and used to provide site-specific leaching data for phosphate mine rock. Considerations that support this recommendation include:

- Concentrations in first-cycle column leachates are generally analogous to concentration in field-scale seepage and provide a predictive model that can be directly applied in numerical models of contaminant fate and transport.
- Columns use lower water-to-rock ratios and longer solution contact periods than humidity cells and are expected to generate leachates with higher concentrations. This aspect is more conservative from a regulatory perspective.
- Columns allow for testing of larger samples than humidity cells. All other factors being equal, larger samples are more likely to be representative of the average composition of the tested material than smaller samples.
- Column testing can be used to evaluate phosphate mine rock leaching characteristics under both saturated and unsaturated conditions.
- Columns testing has historic precedence in the Southeast Idaho Phosphate District.

5.2 Data Quality Objectives for Standardized Column Testing Methodology

Recommendations for standardization of column testing methods in the Southeast Idaho Phosphate District have 5 broad objectives:

1. To describe and document standardized testing procedures that can be used to provide quantitative geochemical data for prediction of seepage chemistry from phosphate mine rock.
2. To establish a standard testing method that can be used to generate comparable data at different mining sites within the Southeast Idaho Phosphate District and facilitate evaluation of regional impacts related to mine rock seepage.
3. To provide a standardized testing method that provides site-specific leaching data that can be used in agency decision-making.
4. To provide guidance for the selection and preparation of phosphate mine rock samples for column testing.
5. To provide a recommended list of analytes for column leachates that is applicable to baseline characterization studies prepared under NEPA.

Data quality objectives (DQOs) for column leaching tests are to:

1. Provide quantitative data to predict seepage characteristics of phosphate mine rock stored in:
    a) Saturated environments
    b) Unsaturated environments.
2. Produce analytical data of known and consistent quality with documented quality assurance/quality control (QA/QC) procedures.
3. Produce analytical data that are adequate to support NEPA impact analyses for phosphate mining projects in southeast Idaho.

Two column testing methods are presented in the following sections. Section 6 describes a standard column testing method to evaluate the seepage characteristics of phosphate mine rock stored in unsaturated environments above the water table. Section 7 describes a standard column testing procedure to evaluate the seepage characteristics of phosphate mine rock stored in saturated environments below the water table.

5.3 Recommendations for Sample Selection and Preparation

The column leaching protocols described in Sections 6 and 7 are intended to characterize materials that are produced by phosphate mining operations and stored in stockpiles, waste rock dumps, or pit backfills. Material types that are common to all open-pit phosphate mines in southeast Idaho include:

Rex Chert	Lower Ore
Hanging Wall Mud	Footwall Mud
Upper Ore	Grandeur Tongue/Wells Formation
Center Waste	

Other materials such as alluvium, basalt, Dinwoody Formation, or Franson Limestone may also be present.

Material types may be sub-divided for testing by lithology or other characteristics (e.g. color, weathering, stratigraphic position) that are distinguishable in the field and amenable to selective handling with standard mining equiment. For example, Rex Chert has significant lithologic and chemical variability at some locations and can be divided into two main types depending on whether the material is chert dominant (blond) or shale dominant (dark). Blond chert may contain minor shale beds that are too thin to be effectively segregated and selectively handled by mining equipment. Similarly, dark chert may be predominantly shaley, but can contain some cherty material that is sparry and light colored. The center waste can generally be divided into two sub-units based on weathering. Weathering is known to alter the distribution of selenium and other COPCs in center waste and is identified in the field by variations in color and hardness (Maxim, 2000, 2002a, 2005; Whetstone, 2010). Testing units for the center waste are generally not broken out by stratigraphic position because selenium is widely distributed across bedding, and regional studies have not identified a partitioning relationship that would allow the material to be subdivided and selectively handled to decrease environmental risk (Whetstone, 2010). Material types should be evaluated during initial inspection and logging of the samples to determine whether subdivision or consolidation of the units is appropriate.

EPA guidelines for mine rock characterization suggest that samples should be collected and tested for each significant rock type over the full vertical and areal extent of an ore deposit (EPA, 2003). A significant rock type is defined as a lithologically or geochemically distinct unit that represents one or two percent of the total mined volume. A literature review did not indicate consensus among researchers about the specific number of samples that are required to adequately characterize each rock type. Schafer (1993) recommends that 8 to 12 samples be analyzed for each significant rock type or that a minimum of one sample be analyzed for each one million tons of material. Alternatively, the Mine Environment Neutral Drainage Manual (MEND, 1994) recommends that sampling frequencies be calculated using the formula:

$$N = 0.026\ (M)^{0.5}$$

where: N is number of samples, and
M is mass of the geologic unit in tons ($M > 6{,}000$ tons).

Other rules of thumb have been proposed by Brady and Hornberger (1989); and Block et al. (2000), but determination of sampling adequacy is site-specific and largely a matter of professional judgment.

Solid samples for column leaching tests may include drill core, drill cuttings, and excavated rock or soil. The material should be air-dried and thoroughly characterized for lithology, mineralogy, weathering, elemental content, and grain size prior to being loaded into the columns. A rule of thumb is that the column inner diameter (ID) should be at least 4 times the diameter of the largest particle being leached to prevent adverse wall effects on solution flow (Potter, 1981; Cathles and Breen, 1983). The protocols included in Sections 6 and 7 specify a column ID 8 times greater than the largest particle size.

It is recommended that both monolithologic and ROM columns be prepared for baseline geochemical characterization studies that are intended to support NEPA analyses. ROM columns are packed with a mixture of rock types that are proportioned to represent the material balances of modeled mine facilities. They are considered to be the best laboratory analog of the complex geochemical reactions that control seepage chemistry in mine rock piles and address concerns that have been expressed by the Agencies and other reviewers about mathematically mixing leachates from monolithologic columns to represent heterogeneous disposal facilities. ROM columns have limitations, however, and cannot provide information about the seepage characteristics of individual rock types that may be selectively handled to improve project designs and environmental performance of mine facilities. Changes to mining plans that affect waste rock material balances are also problematic because previously prepared ROM columns may not reflect updated project designs. In this case, mathematic mixing models may be calibrated for improved confidence using results from ROM columns and equilibrium modeling techniques. It is therefore recommended that monolithologic columns also be prepared for each rock type that represents 5 percent or more of the planned material balance.

5.4 Idaho Water Quality Standards and Recommended Analyte Suite for Column Leaching Tests

The analyte list for column leaching studies should include major ions, COPCs, and other solution parameters that are needed to evaluate compliance with Idaho water quality standards. Idaho surface water and groundwater quality standards are described in Sections 5.4.1 and 5.4.2. The recommended analytical suite for column leaching studies that are prepared to support NEPA evaluations is presented in Section 5.4.3

5.4.1 Idaho Surface Water Standards

Water quality standards for surface water are contained in Idaho Administrative Procedures Act (IDAPA) 58.01.02 (IDAPA, 2011a). According to IDAPA 58.01.02, streams and lakes are classified by designated beneficial use. Designated beneficial uses may include: cold or warm water aquatic life; salmonid spawning; primary or secondary contact recreation; domestic, agricultural, or industrial water supply; wildlife habitat; or aesthetics. If more than one beneficial use is designated for a water body, the most stringent standard is applicable. Criteria for cold water aquatic life and primary or secondary contact recreation are applicable for undesignated water bodies. Federal drinking water standards are applicable for water bodies designated as domestic water supplies.

Water quality standards for cold water aquatic life are generally the most rigorous standards for surface water and can be divided into two broad categories based on either detrimental effects to aquatic biota or human exposure by consumption of water and aquatic organisms. Cold water biota standards are based on the duration of exposure and include acute and chronic criteria. The Criteria Maximum Concentration (CMC) is the highest concentration to which aquatic life can be exposed for a 1-hour period without deleterious effects. The Criteria Continuous Concentration (CCC) is the highest concentration to which aquatic life can be exposed for an extended period of time. Standards for human consumption are divided into criteria for the consumption of water and organisms, and consumption of organisms only.

Cold water aquatic life standards are based on dissolved concentrations, with the exceptions of criteria for selenium, ammonia, and turbidity. The standard for selenium is based on total recoverable concentration. Standards for ammonia and turbidity are based on total concentration. The standard for ammonia is temperature- and pH-dependent. Turbidity is measured in nephelometric turbidity units (NTU) and is not to exceed 50 NTU above background instantaneously or exceed 25 NTU for more than 10 days. Cadmium, chromium (III), copper, lead, nickel, silver, and zinc standards are hardness-dependent and are calculated according to the following equations:

$$CMC = WER \cdot e^{m_A \cdot \ln(H) + b_A} \cdot K_A$$

$$CCC = WER \cdot e^{m_C \cdot \ln(H) + b_C} \cdot K_C$$

where:
WER is the water effect ratio
m_A is a metal-specific constant for acute toxicity
m_C is a metal-specific constant for chronic toxicity
H is hardness (mg/L as $CaCO_3$)
b_A is a metal-specific constant for acute toxicity
b_C is a metal-specific constant for chronic toxicity, and
K is a freshwater conversion factor (K_A = acute, K_C = chronic).

Cold water aquatic life standards based on 100 milligrams per liter (mg/L) hardness and a WER of 1 are presented in Table 6. Metal-specific constants and conversion factors for the calculation of hardness-specific standards are presented in Table 7.

Table 6. Idaho Cold Water Aquatic Life Water Quality Standards and Federal Drinking Water Standards

Parameter (mg/L)	Surface Water Standards[1] (Aquatic Standards from IDAPA 58.01.02)				Federal Drinking Water Standards[2]	
	Cold Water Biota Based on 100 mg/L Total Hardness and WER of 1		Standards for Human Health Based on Consumption of:		Primary	Secondary
	CMC[3]	CCC[4]	Water and Organisms	Organisms Only		
Major Ions and Solution Parameters						
Chloride	—	—	—	—	—	250
Fluoride	—	—	—	—	4.0	2.0
Sulfate	—	—	—	—	—	250
TDS	—	—	—	—	—	500
Nutrients						
Ammonia as Nitrogen	—[5]	—[6 or 7]	—	—	—	—
Nitrate as Nitrogen	—	—	—	—	10	—
Nitrite as Nitrogen	—	—	—	—	1	—
Metals						
Aluminum	—	—	—	—	—	0.05
Antimony[8]	—	—	0.0056	0.64	0.006	—
Arsenic[9.10]	0.340	0.150	0.050	0.050	0.010	—
Barium	—	—	—	—	2	—
Beryllium	—	—	—	—	0.004	—
Cadmium[12]	0.0013	0.0006	—	—	0.005	—
Chromium	—	—	—	—	0.1	—
Chromium, VI[9]	0.016	0.011	—	—	—	—
Chromium III[12]	0.570	0.074	—	—	—	—
Copper[12]	0.017	0.011	—	—	1.3	1.0
Iron	—	—	—	—	—	0.3
Lead[12]	0.065	0.0025	—	—	0.015	—
Manganese	—	—	—	—	—	0.05
Mercury[11]	—	—	—	—	0.002	—
Nickel[12]	0.470	0.0520	0.610	4.6	—	—
Selenium[8]	0.02	0.005	0.17	4.2	0.05	—
Silver[12]	0.0034	—	—	—	—	0.10
Thallium[8]	—	—	0.00024	0.00047	0.002	—
Uranium	—	—	—	—	0.030	—
Zinc[12]	0.120	0.120	7.4	26	—	5
Field Parameters						
pH (s.u.)	6.5-9.0				—	6.5-8.5
Dissolved oxygen	>6 mg/L at all times				—	—
Temperature (ºC)	≤22 ºC (daily average 19)				—	—
Turbidity (NTU)	≤50 NTU above background (10 day consecutive ≤25)				—	—

Notes:
1. Water quality standards from Idaho Administrative Code, January 1, 2012. Aquatic standards are based on dissolved concentrations with the exception of selenium, which is based on total recoverable concentration, and ammonia and turbidity which are based on total concentration
2. Federal drinking water standards are based on total concentration
3. CMC is criterion maximum concentrations; acute
4. CCC is criterion continuous concentrations; chronic
5. Numeric criteria for ammonia CMC: the one hour average concentration of total ammonia nitrogen in mg N/L is not to exceed more than once every three years the value calculated by the following equation: $(0.275/(1+10^{7.204-pH}))+(39.0/(1+10^{pH-7.204}))$
6. Numeric criteria for ammonia CCC when fish early life stages are likely present: the 30-day average concentration of total ammonia nitrogen (mg N/L) is not to exceed more than once every three years the value calculated by the following equation: $(0.0577/(1+10^{7.688-pH}))+(2.487/(1+10^{pH-7.688}))*\min(2.85,1.45*(10^{0.028*(25-T)}))$; T = °C, min represents the smallest number in a set of values
7. Numeric criteria for ammonia CCC when fish early life stages are likely absent is: the 30-day average concentration of total ammonia nitrogen (mg N/L) is not to exceed more than once every three years the value calculated by the following equation: $(0.0577/(1+10^{7.688-pH}))+(2.487/(1+10^{pH-7.688}))*(1.45*(10^{0.028*(25-T)}))$; T =°C
8. Aquatic human health based standards for antimony, selenium and thallium, and aquatic standards for coldwater biota and human health are fixed numerical standards. Aquatic criteria for selenium are expressed as total recoverable (unfiltered) concentration.
9. Standards for CMC and CCC are the presented values multiplied by the WER
10. Standards for human health apply to inorganic arsenic only
11. Fish tissue criterion per implementation guidance document for Idaho mercury water quality criteria (IDEQ, 2005)
12. Hardness-dependent CMC and CCC standards

Table 7. Metal-Specific Constants and Conversion Factors for the Calculation of Cold Water Aquatic Life Water Quality Standards

Parameter	m_a[1]	b_a[2]	m_c[3]	b_c[4]	K_a[5]	K_c[6]
Arsenic	NA[7]	NA	NA	NA	1.0	1.0
Cadmium	0.8367	-3.560	0.6247	-3.344	0.944[8]	0.909[9]
Chromium (III)	0.819	3.7256	0.8190	0.6848	0.316	0.860
Chromium (VI)	NA	NA	NA	NA	0.982	0.962
Copper	0.9422	-1.464	0.8545	-1.465	0.960	0.960
Lead	1.273	-1.460	1.273	-4.705	0.791[10]	0.791[10]
Mercury	NA	NA	NA	NA	0.85	0.85
Nickel	0.846	2.255	0.8460—	0.0584	0.998	0.997
Silver	1.72	-6.52	—[11]	—[11]	0.85	—[11]
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

Notes:
1 m_A = Metal-specific constant for acute toxicity
2 b_A = Metal-specific constant for acute toxicity
3 m_C = Metal-specific constant for chronic toxicity
4 b_C = Metal-specific constant for chronic toxicity
5 K_a = Acute freshwater conversion factor
6 K_c = Chronic freshwater conversion factor
7 NA = Not applicable
8 No acute conversion factor is required for cadmium. The cadmium acute criterion equation was derived from dissolved metals toxicity data; The equation K_a = 1.136672-[(ln hardness)(0.041838)] may be used to back-calculate an equivalent total recoverable concentration
9 Cadmium K_c = 1.101672-[(ln hardness)(0.041838)]
10 Lead K_a and K_c = 1.46203-[(ln hardness)(0.145712)]
11 No chronic standards have been established for silver

5.4.2 Idaho Groundwater Standards

Idaho water quality standards for groundwater are contained in IDAPA 58.01.11 (IDAPA, 2011b). Aquifers in Idaho are classified as Sensitive Resources, General Resources, or Other Resources based on the vulnerability of the groundwater, existing and projected beneficial uses of the water, existing water quality, and social and economic considerations. Groundwater that is classified as a Sensitive Resource receives the highest degree of protection, and applicable water quality standards may be stricter than those listed in IDAPA 58.01.11.200. Currently, the Rathdrum Prairie Aquifer near Spokane is the only listed Sensitive Resource in the State of Idaho (IDAPA 58.01.11.300.1). All other aquifers are categorized according to IDAPA 58.01.11.300.02, which defines a General Resource as:

> *"All aquifers or portions of aquifers where there are activities with the potential to degrade groundwater quality of the aquifer, unless otherwise listed in subsection 300.01 or 300.03. Once an activity with the potential to degrade the groundwater quality of an uncategorized aquifer or portion of an aquifer is initiated, the uncategorized aquifer shall automatically become General Resource unless petitioned into the Sensitive Resource, or Other Resource category."*

No aquifers are currently listed as an Other Resource in the State of Idaho (IDAPA 58.01.11.300.03).

Based on the aquifer classification system described in the Idaho Administrative Code, groundwater in the Southeast Idaho Phosphate District is classified as a General Resource and is subject to numerical standards contained in section 58.01.11.200 and modified in subsection 200.03. Subsection 200.03 states:

> *"If the natural background level of a constituent exceeds the standard in this section, the natural background level shall be used as the standard."*

Background levels are determined using methods described in Statistical Guidance for Determining Background Ground Water Quality and Degradation (IDEQ, 2009). Applicable groundwater quality standards for inorganic constituents for the Southeast Idaho Phosphate District are presented in Table 8. Groundwater standards are based on total concentrations.

Table 8. Idaho Groundwater Standards

Parameter (mg/L)	Idaho Groundwater Standards[1]		Federal Drinking Water Standards	
	Primary	Secondary	Primary	Secondary
Major Ions and Laboratory Parameters				
pH, Laboratory	–	6.5–8.5	–	6.5–8.5
Chloride	–	250	–	250
Fluoride	4	–	4.0	–
Sulfate	–	250	–	250
TDS	–	500	–	500
Nutrients				
Nitrate as Nitrogen	10	–	10	–
Nitrite as Nitrogen	1		1	–
Nitrate/Nitrite as Nitrogen	10	–	–	–
Metals				
Aluminum	–	0.2	–	0.05
Antimony	0.006	–	0.006	–
Arsenic	0.05	–	0.010	–
Barium	2	–	2	–
Beryllium			0.004	–
Cadmium	0.005	–	0.005	–
Chromium	0.1	–	0.1	–
Copper	1.3	–	1.3	1.0
Iron	–	0.3	–	0.3
Lead	0.015	–	0.015	–
Manganese	–	0.05	–	0.05
Mercury	0.002	–	0.002	–
Selenium	0.05	–	0.05	–
Silver	–	0.1		0.10
Thallium	0.002	–	0.002	–
Uranium		–	0.030	–
Zinc	–	5	–	5

Notes: [1] Water quality standards from Idaho Administrative Code January 1, 2012. Groundwater standards are based on total concentrations

– Indicates parameter does not have associated standard

5.4.3 Recommended Analytical Suite for Column Tests.

The analytical suite presented in Table 9 is recommended for column leaching tests based on water quality standards contained in IDAPA 58.01.02 and 58.01.11.

Table 9. Recommended Analytical Suite for Column Leaching Tests

Parameter	Analytical Method	Method Detection Limit	Units
Major Ions and Solution Parameters			
pH	SM 4500H+B	0.1	°C
Alkalinity, Total as $CaCO_3$	SM 2320B	2	mg/L
Alkalinity, Carbonate as $CaCO_3$	SM 2320B	2	mg/L
Alkalinity, Bicarbonate as $CaCO_3$	SM 2320B	2	mg/L
Alkalinity, Hydroxide as $CaCO_3$	SM 2320B	2	mg/L
Hardness as $CaCO_3$	SM 2340B	1.5	Calculation
Calcium	EPA 6010B	0.2	mg/L
Magnesium	EPA 6010B	0.2	mg/L
Potassium	EPA 6010B	0.3	mg/L
Sodium	EPA 6010B	0.3	mg/L
Chloride	EPA 300.0	0.5	mg/L
Fluoride	EPA 300.0	0.1	mg/L
Bromide	EPA 300.0	0.01	mg/L
Sulfate	EPA 300.0	0.5	mg/L
Carbon, total organic (TOC)	SM 5310B	1	mg/L
Residue, Filterable (TDS) @180C	SM 2540C	10	mg/L
TDS, Calculated	Calculation	--	--
Residue, Non-Filter (TSS) @180C	SM 2540D	5	mg/L
Specific Conductance @25C	SM 2510B	1	umhos/cm
Anion-Cation Balance	Calculation	--	--
Nutrients			
Nitrate/Nitrite as N, dissolved	EPA 353.2	0.02	mg/L
Metals – Dissolved and Total			
Aluminum	EPA 6010B	0.03	mg/L
Antimony	EPA 6020A	0.0004	mg/L
Arsenic	EPA 6020A	0.0005	mg/L
Barium	EPA 6010B	0.003	mg/L
Beryllium	EPA 6010B	0.0001	mg/L
Boron	EPA 6010B	0.01	mg/L
Cadmium	EPA 6020A	0.0001	mg/L
Chromium	EPA 6020A	0.0005	mg/L
Copper	EPA 6020A	0.0005	mg/L
Iron	EPA 6010B	0.02	mg/L
Lead	EPA 6020A	0.0001	mg/L
Manganese	EPA 6010B	0.0005	mg/L
Mercury	EPA 7470A	0.0002	mg/L
Molybdenum	EPA 6010B	0.01	mg/L
Nickel	EPA 6010B	0.01	mg/L
Selenium[1]	EPA 6020A	0.0001	mg/L
Silver	EPA 6020A	0.00005	mg/L
Thallium	EPA 6010A	0.0001	mg/L
Uranium	EPA 6020A	0.0001	mg/L
Vanadium	EPA 6010B	0.0002	mg/L
Zinc	EPA 6010B	0.002	mg/L

Notes: [1] Idaho Surface water criterion for selenium are expressed as total recoverable (unfiltered) concentrations. The ground water quality standard for selenium is based on total concentration.

5.5 Recommended Quality Control for Column Leaching Tests

In addition to standard laboratory QA/QC procedures associated with the analytical methods listed in Table 9, it is recommended that column leaching studies incorporate replicate columns, control columns, equipment blanks, reagent blanks, and blind duplicate split samples.

5.5.1 Replicate Columns

Replicate columns provide QC for the evaluation of experimental precision and reproducibility. A replicate column is an exact duplicate of another column and is operated under identical conditions. Typically, one replicate column should be prepared for each type of leaching condition (i.e. saturated or unsaturated) that is included in the study. Leachates from replicate columns should be analyzed for the same suite of constituents as the other columns.

5.5.2 Control Columns

Control columns provide an overall and ongoing QC function to evaluate potential contamination that may occur at any point during column testing and analysis of leachates. Control columns are packed with inert materials that are used to construct the other columns (i.e. glass packing beads) and are operated under identical conditions. One control column should be prepared for each group of columns that are operated simultaneously. Leachates from the control column should be analyzed for the same suite of constituents as the other columns.

5.5.3 Equipment Blank Samples

Equipment blank samples are used to assess potential contamination from the testing apparatus and from the sample preparation and analytical procedures. Equipment blank samples should be prepared for each column prior to the start of testing. The recommended procedure is to scrub the column apparatus with a non-ionic surfactant detergent solution to remove gross contamination, followed by triple rinsing with a 10% solution of reagent-grade nitric acid and de-ionized water. After decontamination, the equipment blank sample should be prepared by adding 5,000 ml of reagent water to the column and allowing it to react for 24 hours before collection. The equipment blank sample should be analyzed for the same suite of constituents as the column leachates. If contamination issues are observed, the procedure should be repeated until an unaffected equipment blank is achieved.

5.5.4 Reagent Blank Samples

Reagent blank samples are used to assess potential contamination associated with the head solution. They also assess contamination that may be related to analytical procedures. A reagent blank consisting of a sample of the head solution should be submitted for analysis for each batch of head solution prepared for testing. The reagent blank should be analyzed for the same suite of constituents as the column leachates.

5.5.5 Blind Duplicate Samples

Blind duplicate samples are used to assess analytical precision and consistency of the sample preparation process. One blind duplicate sample should prepared for a randomly selected column during each leaching cycle and submitted for laboratory analysis. A blind duplicate sample is prepared by splitting a leachate into two or more aliquots prior to sample preparation. The samples are then carried through the preparation and analytical process. Blind duplicate samples should be submitted to the laboratory under an alias sample name and analyzed for the same suite of constituents as the original sample.

6. UNSATURATED COLUMN TESTING METHODOLOGY

The following unsaturated column testing methodology is recommended for use in the Southeast Idaho Phosphate District.

6.1 Scope and Applicability

i. This method is a standard column testing procedure for generating aqueous leachates from geologic materials associated with phosphate mining in the Southeast Idaho Phosphate District. It is applicable to waste rock, ore, and other naturally occurring geologic materials that will be stored in unsaturated environments (i.e. above the water table). These environments include, but may not be limited to, external dumps, backfill, and stockpiles. Application of the column testing procedure to materials that will be placed below the water table or to process wastes and tailings is outside of the scope of the method.

ii. Although microorganisms are known to mediate redox reactions involving sulfide minerals in waste rock and ore from phosphate mines (Maxim, 2002b and 2005), the following protocol specifies that the columns are not to be inoculated with bacteria or sterilized to eliminate bacteria that naturally exist in the solid sample material. This provision is in response to Agency concerns regarding the feasibility of collecting, identifying, and culturing representative populations of bacteria in the inoculant and column and of monitoring the constructed facilities to determine if the biologic communities reflect those modeled in the column. It is noted, however, that available data suggest that inoculated and un-inoculated columns will produce leachates with similar selenium concentrations (Maxim, 2005).

iii. This method is intended to provide site-specific leaching data that are needed to support impact analyses for mining under the NEPA.

iv. This method provides leachates that are suitable for analysis of nonvolatile compounds and solution parameters including major ions, metals, metalloids, nutrients, and total organic carbon.

v. Leachates produced by the test may not be in chemical equilibrium with the solid materials contained within the column.

vi. Analytical data from the column effluents provide information about the leaching characteristics of materials under the conditions used in the test and are not intended to be the sole basis for characterization of the materials, determination of environmental mobility of specific constituents, or engineering design of mine facilities.

6.2 Summary of Test Method

This column testing method is designed to evaluate the kinetic leaching characteristics of a 20-kg sample of waste rock or ore under unsaturated conditions in the presence of excess pore-space oxygen. The leaching solution is Type III de-ionized water (ASTM D1193). The testing method produces approximately 2,500 ml (±5%) of effluent during the first two cycles and 5,000 ml during each subsequent cycle. The effluent is suitable for analysis of solubilized nonvolatile constituents to determine the release characteristics of the solid material under the test conditions.

The test is performed in a 6-inch diameter cylindrical column. Multiple columns may be configured in parallel to permit simultaneous testing of several samples. The test procedure specifies repeated leaching cycles consisting of a solution application period followed by a drain-down period and an aeration period. The column is operated under downward flow conditions by applying the head solution to the top of the column and collecting the effluent from the bottom. A minimum test duration of 6 cycles (101 days) is recommended. Additional cycles may be required to evaluate the release of constituents controlled by kinetic processes (i.e. weathering reactions).

6.3 Apparatus

6.3.1 Column

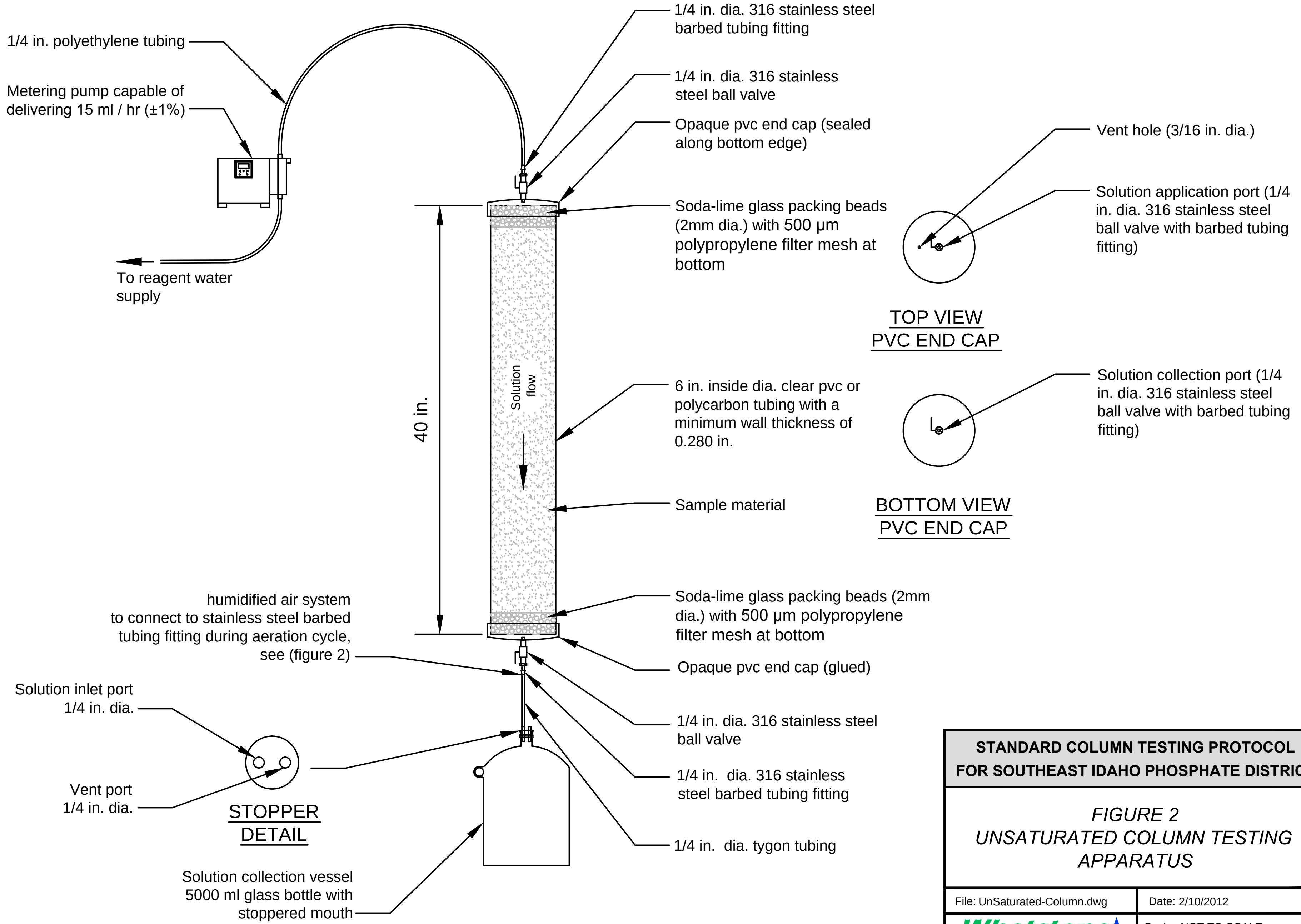
The column body should be constructed of clear polyvinyl chloride (PVC) or polycarbonate pipe, 40 inches in length, with an inside diameter of 6 inches and a minimum wall thickness of 0.280 inches (Figure 2). An opaque PVC end cap with centered sample port and 1/4-inch diameter 316 stainless steel ball valve should be fixed to the bottom of the column body using PVC cement or other sealant to ensure that the connection is watertight. Because PVC cement and other sealants have the potential to affect leachate chemistry, an equipment blank sample should be prepared and evaluated for the column prior to use. In many cases, contamination issues for total organic carbon (TOC) may be avoided if PVC cement and sealants are allowed sufficient time to cure and de-gas before the column is put into service. An opaque PVC end cap with centered solution application port and 1/4-inch diameter 316 stainless steel ball valve with barbed tubing fitting is installed at the top of the column body after the column has been loaded with the solid sample material. The top cap is not glued and should be vented with a 2-millimeter diameter hole located near the solution application port.

6.3.2 Metering Pump and Reagent Water Supply

A metering pump capable of accurately delivering 15 to 45 ml/hr (± 1%) is required to apply reagent water to the top of the column. When multiple columns are operated simultaneously, each column should have a separate metering pump connected to a common reagent water supply. Tubing from the reagent water supply may be configured in series or by manifold to supply multiple pumps. Tubing and vessels that are used to convey or store reagent water should be constructed of inert material such as glass, polyethylene, Teflon®, or Tygon®. Valves and other tubing fittings should be 316 stainless steel, polyethylene, or other inert material. All tapered threads on valve bodies and tubing connections should be sealed with Teflon® tape to prevent leakage.

6.3.3 Humidified Air Supply

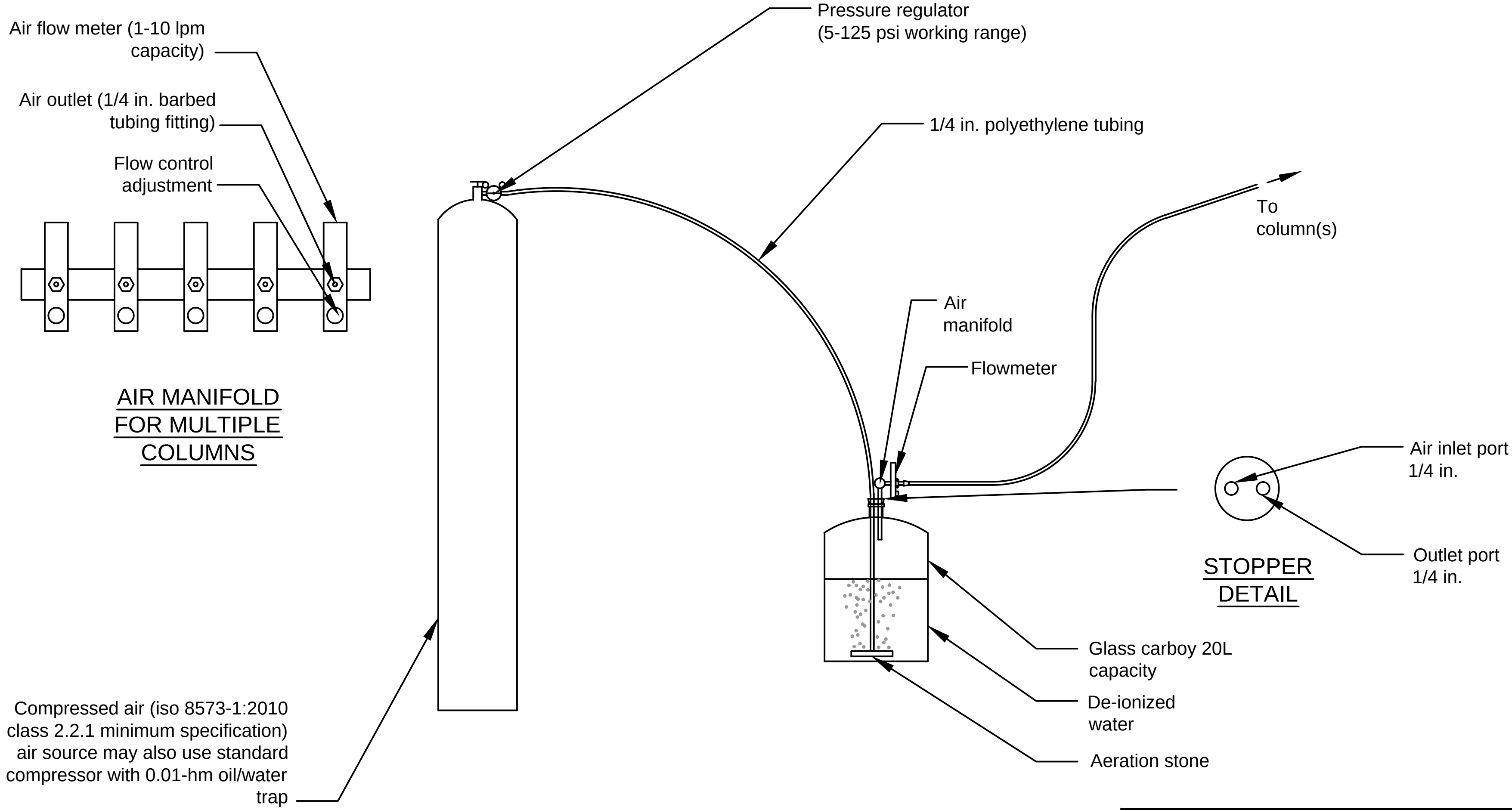
Compressed air for column aeration should conform to a minimum standard described in ISO 8573-1:2010 for Class 2.2.1 breathable air. Acceptable sources may include an air compressor with an 0.01-µm oil/water trap or commercially available high pressure cylinders. Dry air from the source should be pressure regulated and routed through a humidifier prior to circulation through the column. The humidifier should be a carboy or similar vessel with approximately 20 liters capacity that is partially filled with water. Dry air from the source should be passed through an aeration stone at the bottom of the carboy and bubbled upward through the water to exit through a stoppered port into a manifold (Figure 3). The manifold should be connected by polypropylene tubing (or other inert material) to the sample port at the bottom of the column to provide upward flow at a rate of 1 L/min (± 0.5 L/min) during the aeration cycle. Airlines for multiple columns should not be configured in series after the manifold to prevent uneven distribution of air. A flow meter and flow control valve should be installed on each airline after the manifold. Water in the humidifier should be maintained at room temperature (21˚C ± 3˚).



STANDARD COLUMN TESTING PROTOCOL FOR SOUTHEAST IDAHO PHOSPHATE DISTRICT

FIGURE 2
UNSATURATED COLUMN TESTING APPARATUS

File: UnSaturated-Column.dwg	Date: 2/10/2012
Whetstone Associates	Scale: NOT TO SCALE
	Drawn/Checked By: GS/SE



STANDARD COLUMN TESTING PROTOCOL FOR SOUTHEAST IDAHO PHOSPHATE DISTRICT	
FIGURE 3 *HUMIDIFIER CONFIGURATION*	
File: Humidified-Air-System.dwg	Date: 2/10/2012
Whetstone Associates	Scale: NOT TO SCALE
	Drawn/Checked By: GS/SE

6.4 Procedure

6.4.1 Column Decontamination and Preparation of Equipment Blank Sample

The column apparatus should be thoroughly decontaminated prior to sample placement. The recommended procedure is to scrub the column and associated fittings with a non-ionic surfactant detergent (Liquinox® or Alconox®) and tap water to remove gross contamination from surfaces, followed by triple rinsing of the column interior with a 10% solution of reagent-grade nitric acid and de-ionized water. The apparatus should be permitted to air dry. After decontamination, an equipment blank sample should be prepared for each column. An equipment blank sample consists of 5,000 ml of reagent water poured down the interior wall of the column to contact as much of the surface as possible. The sample should be allowed to stand in the column for 24 hours before collection and analysis of the parameters listed in Table 9.

6.4.2 Solid Sample Preparation

Rock and soil samples for column leaching tests should be air-dried as-received at room temperature (21˚C ± 3˚) to stable weight and logged for lithology, mineralogy, and weathering alteration. After drying, the entirety of each sample should be screened to pass a 0.75-inch wire mesh, with oversized material being reduced by hand breaking or jaw crushing to achieve a column diameter to maximum particle size ratio of 8:1. A representative split of the screened sample should be prepared using methodology described in ASTM 702-98 and set aside for standard particle size analysis using mesh sieves no. 5, 10, 18, 35, 60, 120, and 230 (ASTM D6913-04).

6.4.3 Column Packing

Sample and construction materials should be placed in the column in the following order:

1. A 6-inch diameter disk of polypropylene filter mesh with a pore opening of 500 µm should be placed in the bottom of the column to limit infiltration of fine-grained sample material into the column effluent.
2. A 4-inch thick layer of 2-mm diameter column packing beads (soda-lime glass) should be placed over the polypropylene filter mesh to elevate the sample above the opaque end cap. The packing beads should be thoroughly washed using tap water and a non-ionic surfactant detergent (Liquinox® or Alconox®), triple rinsed with a 10% solution of reagent-grade nitric acid and de-ionized water, and allowed to air dry prior to placement in the column.
3. The solid sample material (20 kg) should be placed above glass packing beads in random lifts of varying thickness. In multi-lithologic columns, random placement of the samples is preferred to blending to provide a more realistic simulation of the lithologic stratification that will be present in the field. Material in the columns should be compacted between lifts by gently tapping on the side of the column with a rubber mallet. The surface of each lift should be scarified (roughened) prior to the placement of the next lift to minimize the potential for preferential flow along the contact between lifts. Individual lifts should not have a thickness exceeding 3 inches.
4. A 6-inch diameter disk of polypropylene filter mesh with a pore opening of 500 µm should be placed on top of the sample material. The filter mesh disc separates the sample material from the overlying packing beads and helps to distribute the head solution evenly across the column.
5. A 2 to 4-inch thick of layer column packing beads (soda-lime glass) should be placed over the filter mesh disk to minimize evaporation of the reagent water and distribute water evenly across the top of the sample. The column packing beads should extend into the area covered by the opaque cap at the top of the column.

6.4.4 Column Operation

6.4.4.1 General

The reagent solution for column leaching tests is Type III de-ionized water (ASTM D1193) that has been allowed to equilibrate with the atmospheric oxygen and carbon dioxide. A common water supply reservoir should be used for multiple columns that are configured to permit simultaneous testing. A reagent blank for each batch of head solution used in the column leaching tests should be submitted for analysis of the parameters in Table 9. The columns should be maintained at room temperature (21˚C ± 3˚) during the testing period in a clean, dust-free, secure location and the laboratory kept dark except during leachate collection and column maintenance to minimize the potential for photo-oxidation of metallic constituents.

5,040 ml (± 1%) of reagent water is applied to the top of the columns during each leaching cycle with the exception of cycles 1 and 2. This volume provides a water-to-rock ratio of 0.25:1 by weight and approximates the volume of pore space in the sample assuming that porosity is equal to 40 percent and the average sample density is 1.6 g/cc (Maxim, 2002b and 2005; Whetstone, 2010). Cycles 1 and 2 are designed to generate 2,500 ml of effluent or about one half a pore volume each. The volume of effluent discharged from the column is typically 2 to 5 percent less than the applied volume because of evaporative losses during the aeration part of the cycle.

Additional reagent water in excess of the target effluent of2,500 ml is applied to the top of the column during the first leaching cycle to compensate for the volume of water that is retained by the column during wetting of the sample material. The required additional volume is variable between columns and depends on the characteristics of the sample. Experimental data indicates that columns containing fine-grained clastic rocks such as siltstone and shale may retain more than 3,800 ml of the solution applied during the first cycle (Whetstone, 2010). Columns with crystalline rocks such as chert and limestone are expected to retain between 2,500 and 3,000 ml.

The head solution should be applied with a metering pump at a rate of 15 ml/hr (± 1%) for all cycles after the initial solution application period. This rate is consistent with previous testing in the Southeast Idaho Phosphate District and is typically low enough to prevent ponding within the column (Maxim, 2002b and 2005; Whetstone, 2010). The column should be allowed to drain freely with leachates collected in a clean glass container that has been triple rinsed with a 10% solution of reagent-grade nitric acid and de-ionized water and allowed to dry. The column should be visually monitored daily for evidence of channelized flow, ponding, bacterial activity, and iron or manganese oxide formation. A written record of column maintenance, performance, and observations, should be kept in the laboratory record.

6.4.4.2 First Cycle Operation

The first leaching cycle is designed to produce approximately 2,500 ml (± 5%), or approximately one-half pore volume, of effluent and will require 13 days to complete. It includes a 4-day initial solution application period followed by a 2-day drain-down period, a second 2-day solution application period, a second 2-day drain-down period, and a 3-day aeration cycle.

6.4.4.2.1 Initial Solution Application Period

The length of the initial solution application period is 4 days (96 hours), during which, 4,320 ml of reagent water should be added to the top of the column at a rate of 45 ml/hr (±1%). The column should be allowed to drain freely and the progression of the wetting front should be observed daily for evidence of preferential flow or ponding. The wetting front should be photographed during progression: once while the front is in the top quarter of the column, once at approximately half way, and once in the bottom quarter. If preferential flow or ponding is observed, the application rate should be decreased until these conditions are corrected. The date and time of the first effluent from the column should also be noted and recorded in the experimental record.

6.4.4.2.2 First Drain-down Period

The first drain-down period starts immediately following cessation of the initial solution application period and has a duration of 2 days (48 hours). At the end of the drain-down period, gravity drainage from the column should be complete and no additional effluent should be flowing from the solution collection port. The date and time of the end of gravity drainage should be noted as closely as practical and recorded in the experimental record along with the volume of effluent. The drain-down period may be extended as needed in the event that column drainage is not complete at the end of 48 hours. The modified duration of the drainage period should be carried forward through subsequent leaching cycles to maintain procedural consistency throughout the test. If multiple columns are operated simultaneously, the modified drain-down period for the slowest draining column should be used for the group to keep the columns on the same schedule.

6.4.4.2.3 Second Solution Application Period

The duration of the second solution application period is 2 days (48 hours). The application rate should be determined based on the volume of effluent needed to complete the target effluent volume of 2,500 ml for the first leaching cycle. It is calculated by subtracting the volume of effluent at the end of the first drain-down period from 2,500 ml and dividing the difference by 48 hours:

$$r = \frac{2500 - V_1}{48}$$

Where: r is the application rate for the second application period in ml/hr, and
V_1 is the volume of effluent at the end of the first drain-down period

Reagent water should be applied to each column at the calculated application rate (±1%) to achieve the correct make up volume. The 48-hour solution application period allows for a maximum application rate of about 42 ml/hr for an assumed maximum make up volume of 2,000 ml of solution.

6.4.4.2.4 Second Drain-Down Period

The second drain-down period begins at the end of the second solution application period and has a duration of 2 days (48 hours). At the end of the drain-down period, gravity drainage from the column should be complete and no additional effluent should be flowing from the solution collection port. The date and time of the end of gravity drainage should be noted as closely as practical and recorded in the experimental record along with the volume of effluent. A sample of the composited effluent from the first and second drain-down period should be prepared and preserved as appropriate and submitted for the analyses listed in Table 9. The solution collection vessel should be emptied, decontaminated, and replaced in preparation for the second leaching cycle.

6.4.4.2.5 Aeration Period

Humidified air (1 L/min ± 0.5 L/min) should be circulated through the column for 3 three days (72 hours) at the end of the second drain-down period and prior to the start of the second leaching cycle. Air circulation should be up-flow, entering at the solution collection port at the base of the column and exiting through the vent hole at the top of the column. Column aeration should be monitored daily for plugging, excessive pressure, or drying of the sample material. Observations and adjustments to the airflow rate should be recorded in the experimental record.

6.4.4.3 Second Cycle Operation

The second leaching cycle is designed to produce approximately 2,500 ml (± 5%) of effluent, or approximately one-half pore volume, and will require approximately 12 days to complete. It includes a 7-day solution application period followed by a 2-day drain-down period and a 3-day aeration period.

6.4.4.3.1 Solution Application Period

The duration of the solution application period is 7 days (168 hours), during which 2,520 ml of reagent water should be added to the top of the column at a rate of 15 ml/hr (±1%). The column should be allowed to drain freely and be observed daily for evidence of preferential flow or ponding. Observations and adjustments to the solution application rate should be recorded in the experimental record.

6.4.4.3.2 Drain-Down Period

The drain-down period starts at the end of the solution application period and has a duration of 2 days (48 hours). At the end of the drain-down period, gravity drainage from the column should be complete and no additional effluent should be flowing from the solution collection port. The date and time of the end of gravity drainage should be noted as closely as practical and recorded in the experimental record along with the volume of effluent. A sample of the effluent should be prepared and preserved as appropriate and submitted for the analyses listed in Table 9. The solution collection vessel should be emptied, decontaminated, and replaced in preparation for the next leaching cycle.

6.4.4.3.3 Aeration Period

Humidified air (1 L/min ± 0.5 L/min) should be circulated through the column for 3 three days (72 hours) at the end of the drain-down period and prior to the start of the next leaching cycle. Air circulation should be up-flow, entering at the solution collection port at the base of the column and exiting through the vent hole at the top of the column. Column aeration should be monitored daily for plugging, excessive pressure, or drying of the sample material. Observations and adjustments to the airflow rate should be recorded in the experimental record.

6.4.4.4 Subsequent Cycle Operation

Each leaching cycle after the second cycle will require 19 days to complete and will include a solution application period (14 days), a drain-down period (2 days), and an aeration period (3 days).

6.4.4.4.1 Solution Application Period

The duration of the solution application period is 14 days (336 hours), during which 5,040 ml of reagent water should be added to the top of the column at a rate of 15 ml/hr (±1%). The column should be allowed to drain freely and be observed daily for evidence of preferential flow or ponding. Observations and adjustments to the solution application rate should be recorded in the experimental record.

6.4.4.4.2 Drain-Down Period

The drain-down period starts at the end of the solution application period and has a duration of 2 days (48 hours). At the end of the drain-down period, gravity drainage from the column should be complete and no additional effluent should be flowing from the solution collection port. The date and time of the end of gravity drainage should be noted as closely as practical and recorded in the experimental record along with the volume of effluent. A sample of the effluent should be prepared and preserved as appropriate and submitted for the analyses listed in Table 9. The solution collection vessel should be emptied, decontaminated, and replaced in preparation for the next leaching cycle.

6.4.4.4.3 Aeration Period

Humidified air (1 L/min ± 0.5 L/min) should be circulated through the column for 3 three days (72 hours) at the end of the drain-down period and prior to the start of the next leaching cycle. Air circulation should be up-flow, entering at the solution collection port at the base of the column and exiting through the vent hole at the top of the column. Column aeration should be monitored daily for plugging, excessive pressure, or drying of the sample material. Observations and adjustments to the airflow rate should be recorded in the experimental record.

6.4.5 Duration of Testing

Column tests should be performed for a minimum duration of 6 leaching cycles (101 days). In the event that steady-state release conditions have not been achieved at the end of 6 cycles, the columns should be continued until steady state release conditions are documented. Steady-state release conditions are typically considered to have been met when major ion and COPC concentrations do not show clear increasing or decreasing trends for three or more cycles and should be defined within the study plan for the column testing study.

7. SATURATED COLUMN TESTING METHODOLOGY

The following saturated column testing methodology is recommended for use in the Southeast Idaho Phosphate District.

7.1 Scope and Applicability

i. This method is a standard column testing procedure for generating aqueous leachates from geologic materials associated with phosphate mining in the Southeast Idaho Phosphate District. It is applicable to waste rock and other naturally occurring geologic materials that will be stored in saturated environments below the water table. These environments include, but may not be limited to, saturated pit backfills and flooded underground mine workings. Application of the column testing procedure to materials that will be placed above the water table or to process wastes and tailings is outside of the scope of the method.

ii. Although microorganisms are known to mediate redox reactions involving sulfide minerals in waste rock and ore from phosphate mines (Maxim, 2002b and 2005), the following protocol specifies that the columns are not to be inoculated with bacteria or sterilized to eliminate bacteria that naturally exist in the solid sample material. This provision is in response to Agency concerns regarding the feasibility of collecting, identifying, and culturing representative populations of bacteria in the inoculant and column and of monitoring the constructed facilities to determine if the biologic communities reflect those modeled in the column. It is noted, however, that available data suggest that inoculated and un-inoculated columns will produce leachates with similar selenium concentrations (Maxim, 2005).

iii. This method is intended to provide site-specific leaching data that are needed to support impact analyses for mining under the National Environmental Policy Act (NEPA).

iv. This method provides leachates that are suitable for analysis of nonvolatile compounds and solution parameters including major ions, metals, metalloids, nutrients, and total organic carbon.

v. Leachates produced by the test may not be in chemical equilibrium with the solid materials contained within the column.

vi. Analytical data from the column effluents provide information about the leaching characteristics of materials under the conditions used in the test and are not intended to be the sole basis for characterization of the materials, determination of environmental mobility of specific constituents, or engineering design of mine facilities.

7.2 Summary of Test Method

This column testing method is designed to evaluate the kinetic leaching characteristics of a 20-kg sample of waste rock or ore under saturated conditions. The leaching solution is Type III de-ionized water (ASTM D1193). The testing method produces approximately 2,500 ml (±5%) of effluent during the first two cycles and 5,000 ml during each subsequent cycle. The effluent is suitable for analysis of solubilized nonvolatile constituents to determine the release characteristics of the solid material under the test conditions.

The test is performed in a 6-inch diameter cylindrical column. Multiple columns may be configured in parallel to permit simultaneous testing of several samples. The test procedure specifies repeated leaching cycles consisting of a solution application period and areaction period. The column is operated under upward flow conditions by applying the head solution to the bottom of the column and collecting the effluent from the top. A minimum test duration of 6 cycles (approximately 107 days) is recommended. Additional cycles may be required to evaluate the release of constituents controlled by kinetic processes.

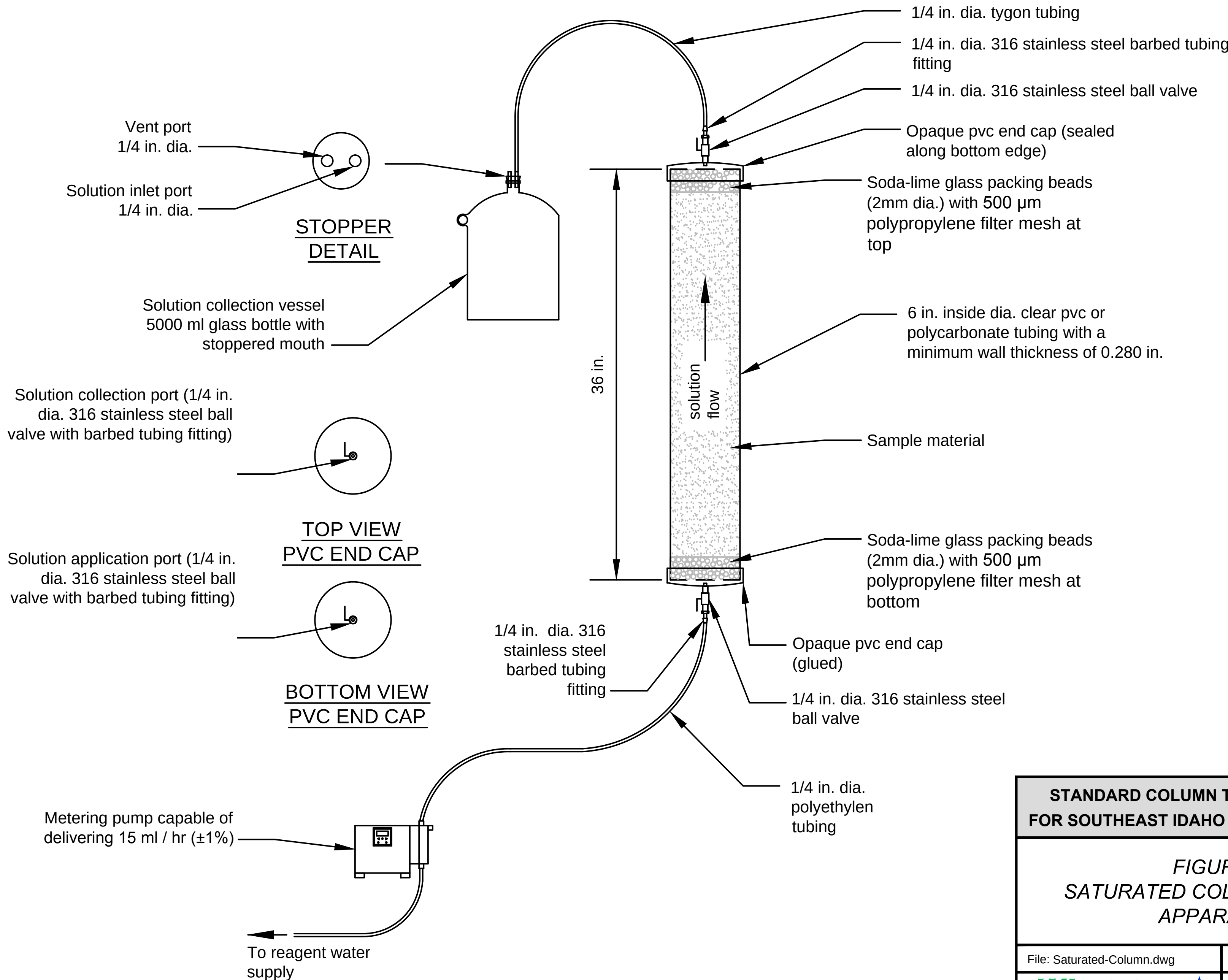
7.3 Apparatus

7.3.1 Column

The column body should be constructed of clear polyvinyl chloride (PVC) or polycarbonate pipe, 36 inches in length, with an inside diameter of 6 inches and a minimum wall thickness of 0.280 inches (Figure 4). An opaque PVC end cap with centered solution application port and 1/4-inch diameter 316 stainless steel ball valve should be fixed to the bottom of the column body using PVC cement or other sealant to ensure that the connection is watertight. Because PVC cement and other sealants have the potential to affect leachate chemistry, an equipment blank sample should be prepared and evaluated for the column prior to use. In many cases, contamination issues for total organic carbon (TOC) may be avoided if PVC cement and sealants are allowed sufficient time to cure and de-gas before the column is put into service. An opaque PVC end cap with centered sample collection port and 1/4-inch diameter 316 stainless steel ball valve with barbed tubing fitting is installed at the top of the column body after the column has been loaded with the solid sample material. The top cap should be sealed around the exterior bottom edge with silicone caulk to prevent leakage. PVC cement or other sealants applied to the interior of the cap should be avoided to minimize the risk of contamination of column leachates by volatile organic carbon (VOCs) vapors.

7.3.2 Metering Pump and Reagent Water Supply

A metering pump capable of accurately delivering 15 to 45 ml/hr (± 1%) is required to apply reagent water to the bottom of the column. When multiple columns are operated simultaneously, each column should have a separate metering pump connected to a common reagent water supply. Tubing from the reagent water supply may be configured in series or by manifold to supply multiple pumps. Tubing and vessels that are used to convey or store reagent water should be constructed of inert material such as glass, polyethylene, Teflon®, or Tygon®. Valves and other tubing fittings should be 316 stainless steel, polyethylene, or other inert material. All tapered threads on valve bodies and tubing connections should be sealed with Teflon® tape to prevent leakage.



STANDARD COLUMN TESTING PROTOCOL FOR SOUTHEAST IDAHO PHOSPHATE DISTRICT

FIGURE 4
SATURATED COLUMN TESTING APPARATUS

File: Saturated-Column.dwg	Date: 2/10/2012
Whetstone Associates	Scale: NOT TO SCALE
	Drawn/Checked By: GS/SE

7.4 Procedure

7.4.1 Column Decontamination and Preparation of Equipment Blank Sample

The column apparatus should be thoroughly decontaminated prior to sample placement. The recommended procedure is to scrub the column and associated fittings with a non-ionic surfactant detergent (Liquinox® or Alconox®) and tap water to remove gross contamination from surfaces, followed by triple rinsing of the column interior with a 10% solution of reagent-grade nitric acid and de-ionized water. The apparatus should be permitted to air dry. After decontamination, an equipment blank sample should be prepared for each column. An equipment blank sample consists of 5,000 ml of reagent water poured down the interior wall of the column to contact as much of the surface as possible. The sample should be allowed to stand in the column for 24 hours before collection and analysis of the parameters listed in Table 9.

7.4.2 Solid Sample Preparation

Rock and soil samples for column leaching tests should be air-dried as-received at room temperature (21˚C ± 3˚) to stable weight and logged for lithology, mineralogy, and weathering alteration. After drying, the entirety of each sample should be screened to pass a 0.75-inch wire mesh with oversized material being reduced by hand breaking or jaw crushing to achieve a column diameter to maximum particle size ratio of 8:1. A representative split of the screened sample should be prepared using methodology described in ASTM 702-98 and set aside for standard particle size analysis using mesh sieves no. 5, 10, 18, 35, 60, 120, and 230 (ASTM D6913-04).

7.4.3 Column Packing

Sample and construction materials should be placed in the column in the following order:

1. A 6-inch diameter disk of polypropylene filter mesh with a pore opening of 500 µm should be placed in the bottom of the column.
2. A 4-inch thick layer of 2-mm diameter column packing beads (soda-lime glass) should be placed over the polypropylene filter mesh to elevate the sample above the opaque end cap. The packing beads should be thoroughly washed using tap water and a non-ionic surfactant detergent (Liquinox® or Alconox®), triple rinsed with a 10% solution of reagent-grade nitric acid and de-ionized water, and allowed to air dry prior to placement in the column.
3. The solid sample material (20 kg) should be placed above the glass packing beads in random lifts of varying thickness. In multi-lithologic columns, random placement of the samples is preferred to blending to provide a more realistic simulation of the lithologic stratification that will be present in the field. Material in the columns should be compacted between lifts by gently tapping on the side of the column with a rubber mallet. The surface of each lift should be scarified (roughened) prior to the placement of the next lift to minimize the potential for preferential flow along the contact between lifts. Individual lifts should not have a thickness exceeding 3 inches.
4. The remaining volume of the column (typically 4- to 6-inches) should be filled with 2-mm diameter column packing beads (soda-lime glass).
5. A 6-inch diameter disk of polypropylene filter mesh with a pore opening of 500 µm should be placed over the top of the packing beads to limit solid sample loss in the effluent.

7.4.4 Column Operation

7.4.4.1 <u>General</u>

The reagent solution for column leaching tests is Type III de-ionized water (ASTM D1193) that has been allowed to equilibrate with the atmospheric oxygen and carbon dioxide. A common water supply reservoir should be used for multiple columns that are configured to permit simultaneous testing. A reagent blank for each batch of head solution used in the tests should be submitted for analysis of the parameters in Table 9. The columns should be maintained at room temperature (21˚C ± 3˚) during the testing period, and the laboratory kept dark except during leachate collection and column maintenance to minimize the potential for photo-oxidation of metallic constituents.

5,040 ml (± 1%) of reagent water is applied to the bottom of the columns during each leaching cycle with the exception of the cycles 1 and 2. This volume provides a water-to-rock ratio of 0.25:1 by weight and approximates the volume of pore space in the sample assuming that porosity is 40 percent and the average sample density is 1.6 g/cc (Maxim, 2002b and 2005; Whetstone, 2010). Cycles 1 and 2 are designed to generate 2,520 ml (± 1%) of effluent or about one half a pore volume each.

Additional reagent water in excess of the 2,520 ml target effluent volume is applied to the bottom of the column during the first leaching cycle to compensate for the volume of water that is retained by the column during saturation of the sample material and packing beads. The required additional volume is variable between columns and depends on the characteristics of the sample. Experimental data indicates that columns may retain between 7,000 and 8,000 ml of the solution applied during the first cycle (Whetstone, 2010).

After initial saturation of the column, the head solution should be applied with a metering pump at a rate of 15 ml/hr (± 1%). This rate is consistent with the unsaturated column testing protocol presented in Section 6 of this document and is low enough to ensure even saturation of the solid material (Whetstone, 2010). Column leachates should collected in a clean glass container that has been triple rinsed with a 10% solution of reagent-grade nitric acid and de-ionized water and allowed to dry. The column should be visually monitored daily for evidence of channelized flow, bacterial activity, and iron or manganese oxide formation. A written record of column maintenance, performance, and observations, should be kept in the laboratory record.

7.4.4.2 First Cycle Operation

The first leaching cycle is designed to produce 2,520 ml (± 5%), or approximately one-half pore volume, of effluent and will require approximately 19 days to complete. It includes an initial solution application period of approximately 7 days to saturate the column, a 5-day reaction period, and a 7-day solution application period to generate effluent for chemical analysis.

7.4.4.2.1 Initial Solution Application Period to Saturate the Column

The initial solution application period to saturate the column requires approximately 7 days (± 1 day) to complete. Water should be added to the column through the solution application port at a rate of 45 ml/hr (±1%). The column should be observed daily to track the saturation level as it rises, and the application period should be stopped as close as practical to the point when the first drop of effluent is released from the column into the solution collection vessel. The total volume of solution applied should be recorded in the experimental record along with the date and time of the first effluent and other observations made during column saturation.

7.4.4.2.2 Reaction Period

Following saturation, the column should be allowed to stand idle for 5 days (120 hrs) to permit the solution to react with the solid sample. The duration of the reaction period may be adjusted ± 24 hours to facilitate scheduling of multiple columns for the next phase of operation.

7.4.4.2.3 Solution Application Period to Generate Effluent

The duration of the solution application period to generate effluent for chemical analysis is 7 days (168 hours), during which 2,520 ml of reagent water should be added to the column through the solution application port at a rate of 15 ml/hr (±1%). The column should be observed daily for evidence of preferential flow, bacterial activity (biofilms) or mineral precipitates. Observations relevant to column operation and adjustments to the solution application rate should be recorded in the experimental record. A sample of the effluent should be prepared and preserved as appropriate and submitted for the analyses listed in Table 9. The solution collection vessel should be emptied, decontaminated, and replaced in preparation for the next leaching cycle.

7.4.4.3 Second Cycle Operation

The second leaching cycle is designed to produce 2,520 ml (± 5%), or approximately one-half pore volume, of effluent and will require approximately 12 days to complete. It includes a 5-day reaction period and a 7-day solution application period to generate effluent for chemical analysis.

7.4.4.3.1 Reaction Period

The column should be allowed to stand idle for 5 days (120 hrs) at the start of the second cycle to permit the solution to react with the solid sample.

7.4.4.3.2 Solution Application Period

The solution application period starts at the end of the reaction period and has a duration of 7 days (168 hours). The application rate should be 15 ml/hr (±1%) to add a total of 2,520 ml of reagent water to the column. The column should be observed daily for evidence of preferential flow, bacterial activity (biofilms) or mineral precipitates. Observations relevant to column operation and adjustments to the solution application rate should be recorded in the experimental record. A sample of the effluent should be prepared and preserved as appropriate and submitted for the analyses listed in Table 9. The solution collection vessel should be emptied, decontaminated, and replaced in preparation for the next leaching cycle.

7.4.4.4 Subsequent Cycle Operation

Each leaching cycle after the second cycle will require 19 days to complete and will include a reaction period (5 days) and a solution application period (14 days).

7.4.4.4.1 Reaction Period

The column should be allowed to stand idle for 5 days (120 hrs) at the start of each leaching cycle after the second cycle to permit the solution to react with the solid sample.

7.4.4.4.2 Solution Application Period

The solution application period starts at the end of the reaction period and has a duration of 14 days (336 hours). The application rate should be 15 ml/hr (±1%) to add a total of 5,040 ml of reagent water to the column during each leaching cycle. The column should be observed daily for evidence of preferential flow, bacterial activity (biofilms) or mineral precipitates. Observations relevant to column operation and adjustments to the solution application rate should be recorded in the experimental record. A sample of the effluent should be prepared and preserved as appropriate and submitted for the analyses listed in Table 9. The solution collection vessel should be emptied, decontaminated, and replaced in preparation for the next leaching cycle.

7.4.5 Duration of Testing

Column tests should be performed for a minimum duration of 6 leaching cycles (107 days approximate). In the event that steady-state release conditions have not been achieved at the end of 6 cycles, the columns should be continued until steady state release conditions are documented. Steady-state release conditions are typically considered to have been met when major ion and COPC concentrations do not show clear increasing or decreasing trends for three or more cycles and should be defined within the study plan for the column testing study.

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APPENDIX A

SUMMARY OF REGIONAL OVERBURDEN SEEPAGE DATA

Table A-1. Summary of Selenium Data for Overburden Seeps, Under Drains, and Backfill

Reference	Location	Site	Description	Sample Date	Selenium (mg/L)
Seeps					
JBR, 2007	Ballard Mine	DS027	Garden Hose Dump Seep	x/x/2001	0.44
JBR, 2007	Champ Mine	SW10	Goodheart Creek Headwater Spring Below Champ Mine Dumps	9/17/1997	0.0149
JBR, 2007	Champ Mine	DS006	Goodheart Creek Seep	x/x/2001	0.041
Newfields, 2007	Conda Mine	DS023/NES-1	Dump Seep #2, Northwestern most seep on the northeastern side of Woodall Mountain	5/x/2001	0.023
Newfields, 2007	Conda Mine	DS023/NES-1	Dump Seep #2, Northwestern most seep on the northeastern side of Woodall Mountain	5/8/2003	0.23
Newfields, 2007	Conda Mine	DS023/NES-1	Dump Seep #2, Northwestern most seep on the northeastern side of Woodall Mountain	5/13/2004	0.23
Newfields, 2007	Conda Mine	NES-1a	Seep area on the northeastern side of Woodall Mountain	5/8/2003	0.75
Newfields, 2007	Conda Mine	NES-1a	Seep area on the northeastern side of Woodall Mountain	5/13/2004	0.8
Newfields, 2007	Conda Mine	NES-1b	Seep on the northeastern side of Woodall Mountain	5/8/2003	2.1
Newfields, 2007	Conda Mine	NES-1b	Seep on the northeastern side of Woodall Mountain	5/13/2004	2.2
Newfields, 2007	Conda Mine	DS024/NES-2	Dump Seep #3 on the northeastern side of Woodall Mountain	5/x/2001	0.067
Newfields, 2007	Conda Mine	DS024/NES-2	Dump Seep #3 on the northeastern side of Woodall Mountain	5/8/2003	1.6
Newfields, 2007	Conda Mine	DS024/NES-2	Dump Seep #3 on the northeastern side of Woodall Mountain	5/13/2004	1.5
Newfields, 2007	Conda Mine	DS024/NES-2	Dump Seep #3 on the northeastern side of Woodall Mountain	10/x/2003	0.059
Newfields, 2007	Conda Mine	DS024/NES-2	Dump Seep #3 on the northeastern side of Woodall Mountain	5/1/2007	1.8
Newfields, 2007	Conda Mine	DS024/NES-2	Dump Seep #3 on the northeastern side of Woodall Mountain	5/10/2006	2.2
Newfields, 2007	Conda Mine	DS018/NES-3	Dump Seep #4	5/x/2001	2.2
Newfields, 2007	Conda Mine	DS019/NES-4	Dump Seep #7 on the northeastern side of Woodall Mountain	5/x/2001	0.42
Newfields, 2007	Conda Mine	DS019/NES-4	Dump Seep #7 on the northeastern side of Woodall Mountain	5/8/2003	0.01
Newfields, 2007	Conda Mine	DS019/NES-4	Dump Seep #7 on the northeastern side of Woodall Mountain	5/13/2004	0.0047
Newfields, 2007	Conda Mine	DS019/NES-4	Dump Seep #7 on the northeastern side of Woodall Mountain	10/x/2003	0.0041
JBR, 2007	Conda Mine	DS015/NES-5	West Limb Waste Dump Seep	7/x/1998	2.0
JBR, 2007	Conda Mine	DS015/NES-5	West Limb Waste Dump Seep	9/11/1998	1.3
JBR, 2007	Conda Mine	DS015/NES-5	West Limb Waste Dump Seep	9/9/1999	1.9
JBR, 2007	Conda Mine	DS015/NES-5	West Limb Waste Dump Seep	5/x/2001	1.7
JBR, 2007	Conda Mine	DS015/NES-5	West Limb Waste Dump Seep	5/22/2001	1.8
JBR, 2007	Conda Mine	DS015/NES-5	West Limb Waste Dump Seep	x/x/2001	1.9
Newfields, 2007	Conda Mine	DS015/NES-5	Conda Mine Waste Dump West Limb Seep	5/8/2003	3.1
Newfields, 2007	Conda Mine	DS015/NES-5	Conda Mine Waste Dump West Limb Seep	5/12/2004	4.0
Newfields, 2007	Conda Mine	DS015/NES-5	Conda Mine Waste Dump West Limb Seep	10/x/2003	0.4
Newfields, 2007	Conda Mine	DS015/NES-5	Conda Mine Waste Dump West Limb Seep	5/1/2007	2.4
JBR, 2007	Conda Mine	46/SWFD46/NES-6	SW3 Seep near Dredge Pond	9/22/1997	1.55
JBR, 2007	Conda Mine	DS017/SWS-3	Seep likely draining the underground workings at Adit No. 2	5/x/2001	0.0041
Newfields, 2007	Conda Mine	DS017/SWS-3	Seep likely draining the underground workings at Adit No. 2	5/11/2004	0.31
JBR, 2007	Dry Valley Mine	DS003	South B-Dump Seep	5/x/98	0.036
JBR, 2007	Dry Valley Mine	DS003	South B-Dump Seep	9/x/98	0.0069
JBR, 2007	Dry Valley Mine	DS003	South B-Dump Seep	9/11/1999	0.0023
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	5/28/1997	0.0067
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	5/27/1998	0.0025
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	11/17/1998	0.011
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	6/8/1999	0.0039
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	10/24/2000	0.037
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	6/3/2005	0.012
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	5/23/2006	0.0092
Whetstone, 2008a	Dry Valley Mine	NBD-1	Seep on south side of North B Pit Waste Dump	4/23/2007	0.122

Table A-1. Summary of Selenium Data for Overburden Seeps, Under Drains, and Backfill

Reference	Location	Site	Description	Sample Date	Selenium (mg/L)
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/27/1998	0.018
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	11/17/1998	0.0044
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	6/8/1999	0.03
JBR, 2007	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	4/26/1999	0.18
JBR, 2007	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/12/1999	0.047
JBR, 2007	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/31/2000	0.0083
JBR, 2007	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/24/2000	0.007
JBR, 2007	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/2/2001	0.012
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/25/2001	0.006
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/28/2002	0.033
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/8/2002	0.015
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/20/2003	0.039
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/6/2003	0.035
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	6/2/2004	0.0487
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/12/2004	0.0298
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/12/2004	0.0298
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	6/3/2005	0.067
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/11/2005	0.047
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/23/2006	0.0734
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	10/14/2006	0.0476
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	5/11/2007	0.0684
Whetstone, 2008a	Dry Valley Mine	SP-2/North B Dump	Seep on north side of North B Pit Waste Dump	9/28/2007	0.0449
JBR, 2007	Enoch Valley	DS026/EV 14	South Dump Seep	5/x/2001	0.049
JBR, 2007	Enoch Valley	DS026/EV 14	South Dump Seep	5/23/2002	0.3
JBR, 2007	Enoch Valley	DS026/EV 14	South Dump Seep	8/7/2002	0.027
JBR, 2007	Enoch Valley	DS026/EV 14	South Dump Seep	5/27/2003	0.3
JBR, 2007	Enoch Valley	DS026/EV 14	South Dump Seep	7/29/2003	0.075
JBR, 2007	Enoch Valley	DS025/EV 10	West Dump Seep	5/31/2000	0.008
JBR, 2007	Enoch Valley	DS025/EV 10	West Dump Seep	5/x/2001	0.0026
JBR, 2007	Enoch Valley	DS025/EV 10	West Dump Seep	5/20/2002	0.002
JBR, 2007	Enoch Valley	DS025/EV 10	West Dump Seep	7/29/2003	0.002
JBR, 2007	Henry Mine	SW29	Coarse Rock Fill Seep Below South Pit Overburden Dump	9/19/1997	0.00106
JBR, 2007	Mountain Fuel Mine	DS020/SW6	Spring #1 (Below South Dump)	9/16/1997	0.0431
JBR, 2007	Mountain Fuel Mine	DS020/SW6	Spring #1 (Below South Dump)	5/x/2001	0.34
JBR, 2007	Mountain Fuel Mine	SP004	Spring #2 (Below South Dump)	9/16/1997	0.0299
JBR, 2007	Mountain Fuel Mine	SP004	Spring #2 (Below South Dump)	5/x/2001	0.026
JBR, 2007	Mountain Fuel Mine	SP005	Spring #3 (Below South Dump)	9/16/1997	0.0034
JBR, 2007	Mountain Fuel Mine	SP005	Spring #3 (Below South Dump)	5/x/2001	0.0037
JBR, 2007	Mountain Fuel Mine	DS007/SW7	Mine Seep #1	5/x/2001	0.012
JBR, 2007	Mountain Fuel Mine	DS008/SW8	Mine Seep #2	5/x/2001	0.0005
JBR, 2007	North Maybe Mine	DS005/1	Below East Mill Dump Seep at FS station C-B&M-1	9/16/1997	0.0336
JBR, 2007	North Maybe Mine	DS005/1	East Mill Dump Seep	5/x/2001	0.49
JBR, 2007	S. Rasmussen Ridge	DS009	Unit I Overburden Dump Seep	5/x/2001	0.078
P4 Production, 2005	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	4/4/2005	0.21
P4 Production, 2005	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	4/18/2005	0.35
P4 Production, 2005	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	5/2/2005	0.29
P4 Production, 2005	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	5/17/2005	0.27

Table A-1. Summary of Selenium Data for Overburden Seeps, Under Drains, and Backfill

Reference	Location	Site	Description	Sample Date	Selenium (mg/L)
P4 Production, 2005	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	5/31/2005	0.26
P4 Production, 2006	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	5/3/2006	0.47
P4 Production, 2007a	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	4/16/2007	0.4
P4 Production, 2007a	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	5/2/2007	0.32
P4 Production, 2007a	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	5/15/2007	0.28
P4 Production, 2007a	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	5/30/2007	0.42
P4 Production, 2007a	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	6/12/2007	0.27
P4 Production, 2007a	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	6/25/2007	0.19
P4 Production, 2007b	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	7/24/2007	0.14
P4 Production, 2007b	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	8/28/2007	0.12
P4 Production, 2007b	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	9/19/2007	0.12
P4 Production, 2007b	S. Rasmussen Ridge	SR-E7	WS-B, natural wetland headwaters at edge of reclaimed area	10/15/2007	0.095
P4 Production, 2005	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	4/4/2005	0.21
P4 Production, 2005	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	4/18/2005	0.48
P4 Production, 2005	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	5/2/2005	0.75
P4 Production, 2005	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	5/17/2005	0.43
P4 Production, 2005	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	5/31/2005	0.32
P4 Production, 2006	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	5/3/2006	0.48
P4 Production, 2007a	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	4/16/2007	0.63
P4 Production, 2007a	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	5/2/2007	0.37
P4 Production, 2007a	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	5/15/2007	0.26
P4 Production, 2007a	S. Rasmussen Ridge	SR-E8	Horseshoe Toe Trench Discharge	6/12/2007	0.36
P4 Production, 2005	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	4/4/2005	0.22
P4 Production, 2005	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	4/18/2005	0.47
P4 Production, 2005	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	5/2/2005	0.33
P4 Production, 2005	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	5/17/2005	0.32
P4 Production, 2005	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	5/31/2005	0.28
P4 Production, 2006	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	5/3/2006	0.36
P4 Production, 2007a	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	4/16/2007	0.34
P4 Production, 2007a	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	5/2/2007	0.28
P4 Production, 2007a	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	5/15/2007	0.21
P4 Production, 2007a	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	5/30/2007	0.18
P4 Production, 2007a	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	6/12/2007	0.21
P4 Production, 2007a	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	6/25/2007	0.14
P4 Production, 2007b	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	7/24/2007	0.084
P4 Production, 2007b	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	8/28/2007	0.048
P4 Production, 2007b	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	9/19/2007	0.067
P4 Production, 2007b	S. Rasmussen Ridge	SR-E10	WS-B wetland, above Toe Trench Discharge	10/15/2007	0.054
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	5/x/2000	0.82
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	6/x/2000	0.95
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	9/x/2000	0.4
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	10/12/2000	0.29
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	12/13/2000	0.28
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	4/18/2001	1.98
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	5/22/2001	0.86
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	5/14/2002	2.4
JBR, 2007	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	10/18/2002	0.27

Table A-1. Summary of Selenium Data for Overburden Seeps, Under Drains, and Backfill

Reference	Location	Site	Description	Sample Date	Selenium (mg/L)
Newfields, 2005	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	5/25/2003	2.3
Newfields, 2005	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	10/29/2003	0.588
Newfields, 2005	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	5/18/2004	3.66
Newfields, 2005	Smoky Canyon	DS029/DS-7	Panel D Overburden seep on southeastern toe	7/22/2004	0.302
JBR, 2007	Smoky Canyon	DS028/DS-10	Panel D Overburden seep on west side of haul road	5/x/2001	0.53
Newfields, 2005	Smoky Canyon	DS028/DS-10	Panel D Overburden seep on west side of haul road	5/25/2003	1.09
Newfields, 2005	Smoky Canyon	AS-2	Panel A External Overburden Seep on northeastern toe	5/25/2003	3.15
Newfields, 2005	Smoky Canyon	AS-2	Panel A External Overburden Seep on northeastern toe	5/18/2004	3.78
JBR, 2007	Smoky Canyon	ES-3	North E Panel External Overburden Seep	5/14/2002	0.001
Newfields, 2005	Smoky Canyon	ES-3	North E Panel External Overburden Seep	10/17/2002	0.025
Newfields, 2005	Smoky Canyon	ES-3	North E Panel External Overburden Seep	5/21/2003	0.001
Newfields, 2005	Smoky Canyon	ES-3	North E Panel External Overburden Seep	5/18/2004	0.0003
Maxim, 2005	Smoky Canyon	ES-3	North E Panel External Overburden Seep	10/x/2005	0.001
JBR, 2007	Smoky Canyon	ES-4	Central E Panel External Overburden Seep	7/23/2004	0.0003
JBR, 2007	Smoky Canyon	ES-4	Central E Panel External Overburden Seep	10/17/2002	3.13
Newfields, 2005	Smoky Canyon	ES-4	Central E Panel External Overburden Seep	5/21/2003	12
Newfields, 2005	Smoky Canyon	ES-4	Central E Panel External Overburden Seep	10/29/2003	7.8
Newfields, 2005	Smoky Canyon	ES-4	Central E Panel External Overburden Seep	5/18/2004	13.3
Newfields, 2005	Smoky Canyon	ES-4	Central E Panel External Overburden Seep	7/23/2004	11.4
Maxim, 2005	Smoky Canyon	ES-4	Central E Panel External Overburden Seep	10/x/2005	10.6
JBR, 2007	Smoky Canyon	ES-5	South E Panel External Overburden Seep	5/14/2002	1.27
JBR, 2007	Smoky Canyon	ES-5	South E Panel External Overburden Seep	10/17/2002	1.21
Newfields, 2005	Smoky Canyon	ES-5	South E Panel External Overburden Seep	5/21/2003	1.51
Newfields, 2005	Smoky Canyon	ES-5	South E Panel External Overburden Seep	10/29/2003	1.67
Newfields, 2005	Smoky Canyon	ES-5	South E Panel External Overburden Seep	5/7/2004	1.61
Newfields, 2005	Smoky Canyon	ES-5	South E Panel External Overburden Seep	7/23/2004	2.62
Maxim, 2005	Smoky Canyon	ES-5	South E Panel External Overburden Seep	10/x/2005	1.62
JBR, 2007	Smoky Canyon	E Panel Seep	E Dump Seep	x/x/99	0.085
JBR, 2007	Smoky Canyon	E Panel Seep	E Dump Seep	7/17/2000	0.25
JBR, 2007	Smoky Canyon	Dump Seep	E Dump Seep	7/17/2000	0.27
JBR, 2007	Smoky Canyon	Dump Seep	E Dump Seep	10/12/2000	0.27
JBR, 2007	Smoky Canyon	E Ext Seep	E Dump Seep	12/14/2000	0.24
JBR, 2007	Smoky Canyon	E Panel Seep	E Dump Seep	4/18/2001	0.99
JBR, 2007	Wooley Valley Mine	DS010	Unit 1 Dump	5/x/2001	0.013
JBR, 2007	Wooley Valley Mine	DS010	Unit I Dump	5/x/98	0.085
JBR, 2007	Wooley Valley Mine	DS010	Unit I Dump	9/x/98	0.072
JBR, 2007	Wooley Valley Mine	DS010	Unit I Dump	9/9/1999	0.07
JBR, 2007	Wooley Valley Mine	DS011/42	Unit III Dump	9/19/1997	0.065
JBR, 2007	Wooley Valley Mine	DS011/42	Unit III Dump	5/x/98	0.037
JBR, 2007	Wooley Valley Mine	DS011/42	Unit III Dump	5/x/2001	0.0065
JBR, 2007	Wooley Valley Mine	DS012	Unit IV Dump	5/x/98	1.4
JBR, 2007	Wooley Valley Mine	DS012	Unit IV Dump	9/9/1999	0.091
JBR, 2007	Wooley Valley Mine	DS012	Univ IV Overburden Dump Seep	5/x/2001	0.0028
Under Drains					
IMA, 1998	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	9/20/1997	0.065
IMA, 1999	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	5/14/1998	0.24
IMA, 1999	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	9/10/1998	0.068

Table A-1. Summary of Selenium Data for Overburden Seeps, Under Drains, and Backfill

Reference	Location	Site	Description	Sample Date	Selenium (mg/L)
IMA, 2002	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	5/23/2001	0.088
Newfields, 2007	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	5/3/2007	0.041
Newfields, 2007	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	5/4/2007	0.041
Newfields, 2007	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	10/3/2007	0.0098
Newfields, 2007	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	5/7/2007	0.12
Newfields, 2007	Conda Mine	FD001/FD-1/DS021/44	Conda Mine French Drain	5/6/2007	0.35
JBR, 2007	Henry Mine	FD002	S. Pit Dump Limestone Drain	5/13/1998	0.0007
JBR, 2007	Henry Mine	FD002	S. Pit Dump Limestone Drain	9/13/1998	0.0003
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	5/22/1997	1.02
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	6/10/1997	0.71
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	6/17-19/97	0.64
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	7/29/1997	1.12
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	10/6/1997	1.5
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	10/27/1997	1.21
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	5/26/1998	1.43
JBR, 2007	Maybe Cyn.	SW-2	Maybe Creek Below Cross Valley Fill	10/12/1998	1.5
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	9/15/1997	0.583
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1991	0.07
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1992	0.125
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1993	0.17
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1994	0.262
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1995	0.5
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1996	0.21
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1997	0.33
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1998	0.22
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 1999	1.0
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 2000	0.71
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	Spring 2001	1.88
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	5/x/2000	0.66
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	6/x/2000	0.29
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	4/26/1999	2.35
JBR, 2007	Smoky Cyn	Lower Pole Creek	Pole Creek Below Pole Cyn. Dump	5/12/1999	1.4
Saturated Backfill					
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	11/x/1998	0.0081
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	6/9/1999	0.051
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	9/23/1999	0.043
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	9/23/1999	0.046
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	6/2/2000	0.043
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	11/7/2000	0.044
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	5/3/2001	0.033
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	10/30/2001	0.025
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	10/30/2001	0.024
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	5/20/2002	0.019
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	10/28/2002	0.018
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	6/3/2003	0.033
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	10/22/2003	0.026
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	6/8/2004	0.0243

Table A-1. Summary of Selenium Data for Overburden Seeps, Under Drains, and Backfill

Reference	Location	Site	Description	Sample Date	Selenium (mg/L)
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	6/8/2004	0.0291
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	10/7/2004	0.0172
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	6/17/2005	0.055
Whetstone, 2008a	Dry Valley	GW7D	B-pit backfill	10/19/2005	0.026
Whetstone, 2008a	Dry Valley	GW-7D	B-pit backfill	5/25/2006	0.0567
Whetstone, 2008a	Dry Valley	GW-7D	B-pit backfill	10/23/2006	0.027
Whetstone, 2008a	Dry Valley	GW-7D	B-pit backfill	6/12/2007	0.0269
Whetstone, 2008a	Dry Valley	GW-7D	B-pit backfill	10/4/2007	0.0214
Whetstone, 2008a	Dry Valley	GW-7D-2A	B-pit backfill	2/12/2003	0.009
Whetstone, 2008a	Dry Valley	GW-7D-2A	B-pit backfill	6/3/2003	0.027
Whetstone, 2008a	Dry Valley	GW-7D-2A	B-pit backfill	8/25/2003	0.017
Whetstone, 2008a	Dry Valley	GW-7D-2A	B-pit backfill	6/14/2004	0.0311
Whetstone, 2008a	Dry Valley	GW-7D-2A	B-pit backfill	6/15/2005	0.026
Whetstone, 2008a	Dry Valley	GW-7D-2A	B-pit backfill	8/18/2005	0.017
Whetstone, 2008a	Dry Valley	GW-7D-2A	B-pit backfill	5/25/2006	0.0167
Whetstone, 2008a	Dry Valley	GW-7D2A	B-pit backfill	10/25/2006	0.0102
Whetstone, 2008a	Dry Valley	GW-7D2A	B-pit backfill	6/14/2007	0.0213
Whetstone, 2008a	Dry Valley	GW-7D2A	B-pit backfill	10/4/2007	0.0144
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	2/12/2003	0.002
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	6/3/2003	0.022
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	8/25/2003	0.003
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	6/14/2004	0.0007
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	6/15/2005	0.001
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	6/18/2005	<0.001
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	5/25/2006	0.0002
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	6/12/2007	0.0001
Whetstone, 2008a	Dry Valley	GW-7D-2B	B-pit backfill	10/4/2007	<0.0001
Whetstone, 2008b	Ballard	MW-15A	Alluvium below waste dump	11/15/2006	0.59
Whetstone, 2008b	Ballard	MW-15A	Alluvium below waste dump	4/20/2007	0.8
Whetstone, 2008b	Ballard	MW-15A	Alluvium below waste dump	8/10/2007	1.94
Whetstone, 2008b	Ballard	MW-15A	Alluvium below waste dump	10/18/2007	1.77
Whetstone, 2008b	Ballard	MW-16A	Alluvium below waste dump	11/15/2006	0.056
Whetstone, 2008b	Ballard	MW-16A	Alluvium below waste dump	4/18/2007	0.11
Whetstone, 2008b	Ballard	MW-16A	Alluvium below waste dump	8/10/2007	0.05
Whetstone, 2008b	Ballard	MW-16A	Alluvium below waste dump	10/18/2007	0.03
TRC, 2007	Maybe Canyon	BH-1	Center Valley Fill	5/16/2006	0.577
TRC, 2007	Maybe Canyon	BH-1	Center Valley Fill	7/18/2006	0.103
TRC, 2007	Maybe Canyon	BH-2	Center Valley Fill	5/16/2006	9.85
TRC, 2007	Maybe Canyon	BH-3	Center Valley Fill	5/17/2006	0.003
TRC, 2007	Maybe Canyon	BH-3	Center Valley Fill	7/18/2006	0.0027
TRC, 2007	Maybe Canyon	BH-4	Center Valley Fill	5/17/2006	1.48
TRC, 2007	Maybe Canyon	BH-4	Center Valley Fill	7/18/2006	1.08
TRC, 2007	Maybe Canyon	BH-6	Center Valley Fill	5/17/2006	0.0019
TRC, 2007	Maybe Canyon	BH-6	Center Valley Fill	7/18/2006	0.0039
Newfields, 2005	Smoky Canyon	MW-11	A Panel backfill	10/30/2003	1.01
Newfields, 2005	Smoky Canyon	MW-11	A Panel backfill	5/9/2004	1.06
Newfields, 2005	Smoky Canyon	MW-11	A Panel backfill	7/25/2004	0.299

Table A-1. Summary of Selenium Data for Overburden Seeps, Under Drains, and Backfill

Reference	Location	Site	Description	Sample Date	Selenium (mg/L)
Statistics					
				Count	278
				Mean	0.698
				Median	0.12
				Minimum	<0.0001
				Maximum	13.3
				Geometric Mean	0.101

Table A-2. Summary of COPC Data for Overburden Seeps, Under Drains and Backfill

	Date	TDS mg/l	Sulfate mg/l	Cadmium mg/l	Copper mg/l	Iron mg/l	Manganese mg/l	Nickel mg/l	Zinc mg/l
Conda Mine Seeps, Maxim, 2005									
NES-3	10/x/2003	560	30	0.0001	---	---	0.005	---	---
NES-4	10/x/2003	1183	540	0.00064	---	---	0.04	---	---
NES-5	10/x/2003	854	298	0.0012	---	0.05	0.0399	---	---
Conda Mine Seeps, Newfields, 2007									
NES-1	5/x/2001	---	---	0.00019	0.0015	---	---	0.0045	0.017
NES-1	5/8/2003	---	---	0.0001	0.002	---	---	0.0043	0.02
NES-1	5/13/2004	---	---	0.0001	0.0021	---	---	0.0039	0.0038
NES-1a	5/8/2003	---	---	0.0014	0.0045	---	---	0.014	0.03
NES-1a	5/13/2004	---	---	0.00086	0.0021	---	---	0.015	0.042
NES-1b	5/8/2003	---	---	0.0001	0.0056	---	---	0.0064	0.01
NES-1b	5/13/2004	---	---	0.0001	0.0022	---	---	0.0032	0.0011
NES-2	5/x/2001	---	---	0.0033	0.0033	---	---	0.024	0.14
NES-2	5/8/2003	---	---	0.0082	0.0069	---	---	0.18	0.46
NES-2	10/x/2003	---	---	0.0046	0.0026	---	---	0.13	0.23
NES-2	5/13/2004	---	---	0.0059	0.0025	---	---	0.15	0.38
NES-2	5/10/2006	---	---	0.012	0.0002	---	---	0.22	0.59
NES-2	5/1/2007	---	---	0.0086	0.0058	---	---	0.16	0.41
NES-3	5/x/2001	---	---	0.0046	0.0033	---	---	0.31	0.56
NES-4	5/x/2001	---	---	0.0061	0.0021	---	---	0.12	0.35
NES-4	5/8/2003	---	---	0.0001	0.0053	---	---	0.011	0.01
NES-4	10/x/2003	---	---	0.00006	0.0026	---	---	0.0048	0.0018
NES-4	5/13/2004	---	---	0.0001	0.0021	---	---	0.0072	0.0018
NES-5	5/x/2001	---	---	0.0068	0.004	---	---	0.16	0.4
NES-5	5/8/2003	---	---	0.0067	0.01	---	---	0.17	0.26
NES-5	10/x/2003	---	---	0.0055	0.0026	---	---	0.26	0.46
NES-5	5/12/2004	---	---	0.0073	0.0036	---	---	0.21	0.32
NES-5	5/1/2007	---	---	0.0075	0.0058	---	---	0.19	0.32
SWS-3	5/11/2004	---	---	0.0041	0.0021	---	---	0.044	0.28
Smoky Canyon Mine Seeps, Newfields, 2005									
AS-2	5/25/2003	1500	820	0.0054	0.0036	0.02	0.007	0.054	0.15
AS-2	5/18/2004	1478	798	0.0042	0.0025	0.0124	0.0092	0.0402	0.103
DS-7	10/18/2002	2100	450	0.0007	0.009			0.024	0.03
DS-7	5/25/2003	2130	1120	0.0222	0.005	0.02	2.41	0.166	0.43
DS-7	10/29/2003	1794	862	0.00045	0.0018	0.027	1.53	0.151	0.316
DS-7	5/18/2004	2060	1040	0.0167	0.0022	0.0124	1.22	0.154	0.377
DS-7	7/22/2004	1790	962	0.0107	0.0014	0.011	1.26	0.14	0.311
DS-10	5/25/2003	920	150	0.0012	0.0024	0.02	0.032	0.0158	0.02
ES-3	10/17/2002	460	30	0.0015	0.009			0.0407	0.08
ES-3	5/21/2003	560	30	0.0001	0.0012	0.01	0.005	0.0061	0.01
ES-3	5/18/2004	676	24.7	0.00047	0.0021	0.0124	0.101	0.0056	0.0064
ES-3	7/23/2004	595	26.5	0.00039	0.0014	0.011	0.37	0.0054	0.0011
ES-4	10/17/2002	890	450	0.002	0.0098			0.0361	0.06
ES-4	5/21/2003	1560	830	0.0013	0.0051	0.02	0.016	0.039	0.03
ES-4	10/29/2003	1183	540	0.00064	0.0017	0.0035	0.04	0.0131	0.0239
ES-4	5/18/2004	1484	714	0.0012	0.0021	0.0124	0.0423	0.0212	0.0375
ES-4	6/7/2004								
ES-4	7/23/2004	1340	639	0.00026	0.0014	0.011	0.0932	0.0215	0.053
ES-5	10/17/2002	770	280	0.0024	0.0052			0.0346	0.09
ES-5	5/21/2003	870	310	0.0015	0.0025	0.01	0.024	0.0236	0.06
ES-5	10/29/2003	854	298	0.0012	0.0014	0.007	0.0399	0.0147	0.0372
ES-5	5/7/2004	871	376	0.00098	0.0026	0.0124	0.0161	0.017	0.0393
ES-5	7/23/2004	935	374	0.00056	0.0014	0.011	0.0713	0.0154	0.0347
South Rasmussen Ridge Seeps, P4 Production, 2005									
SR-E7	4/4/2005	470	270	0.0011	---	---	---	0.016	0.057
SR-E7	4/18/2005	3.9	380	0.004	---	---	---	0.025	0.097
SR-E7	5/2/2005	660	370	0.0011	---	---	---	0.025	0.074
SR-E7	5/17/2005	570	340	0.0015	---	---	---	0.028	0.086
SR-E7	5/31/2005	530	300	0.0011	---	---	---	0.023	0.038
SR-E7	5/3/2006	1300	910	330	---	---	---	0.35	1.2
SR-E7	4/16/2007	1600	1000	0.0086	---	---	---	0.51	1.9
SR-E7	5/2/2007	1400	910	0.0075	---	---	---	0.46	1.6
SR-E7	5/15/2007	1400	920	0.0068	---	---	---	0.36	1.4
SR-E7	5/30/2007	1400	840	0.0059	---	---	---	0.26	1.2

Table A-2. Summary of COPC Data for Overburden Seeps, Under Drains and Backfill

	Date	TDS mg/l	Sulfate mg/l	Cadmium mg/l	Copper mg/l	Iron mg/l	Manganese mg/l	Nickel mg/l	Zinc mg/l
SR-E7	6/12/2007	1300	810	0.0061	---	---	---	0.31	1.2
SR-E7	6/25/2007	1200	730	0.005	---	---	---	0.24	0.97
SR-E7	7/24/2007	1200	740	0.0012	---	---	---	0.19	0.72
SR-E7	8/28/2007	1200	690	0.0021	---	---	---	0.16	0.55
SR-E7	9/19/2007	1100	700	0.0015	---	---	---	0.24	0.66
SR-E7	10/15/2007	1100	640	0.0013	---	---	---	0.17	0.47
SR-E8	4/4/2005	540	320	0.0023	---	---	---	0.091	0.24
SR-E8	4/18/2005	7	580	0.0012	---	---	---	0.18	0.41
SR-E8	5/2/2005	1200	740	0.0065	---	---	---	0.3	0.78
SR-E8	5/17/2005	760	430	0.0048	---	---	---	0.28	0.59
SR-E8	5/31/2005	670	380	0.0039	---	---	---	0.26	0.54
SR-E8	5/3/2006	1300	930	280	---	---	---	1	2.6
SR-E8	4/16/2007	1900	1200	0.014	---	---	---	0.98	2.6
SR-E8	5/2/2007	1500	950	0.011	---	---	---	0.93	2.5
SR-E8	5/15/2007	1300	920	0.0097	---	---	---	0.85	2.4
SR-E8	6/12/2007	1400	900	0.0085	---	---	---	0.6	3
SR-E10	4/4/2005	550	320	0.00083	---	---	---	0.027	0.19
SR-E10	4/18/2005	2.2	470	0.0053	---	---	---	0.2	1.1
SR-E10	5/2/2005	660	380	0.003	---	---	---	0.12	0.62
SR-E10	5/17/2005	620	350	0.0029	---	---	---	0.094	0.49
SR-E10	5/31/2005	640	400	0.0018	---	---	---	0.049	0.22
SR-E10	5/3/2006	1200	740	260	---	---	---	0.34	1.3
SR-E10	4/16/2007	1500	960	0.0052	---	---	---	0.29	1.1
SR-E10	5/2/2007	1500	890	0.0041	---	---	---	0.25	0.96
SR-E10	5/15/2007	1300	920	0.0037	---	---	---	0.2	0.68
SR-E10	5/30/2007	1300	800	0.002	---	---	---	0.14	0.63
SR-E10	6/12/2007	1300	780	0.0025	---	---	---	0.2	0.64
SR-E10	6/25/2007	1200	710	0.0015	---	---	---	0.14	0.47
SR-E10	7/24/2007	1200	720	0.0015	---	---	---	0.11	0.27
SR-E10	8/28/2007	1100	680	0.0019	---	---	---	0.057	0.11
SR-E10	9/19/2007	1100	690	0.0014	---	---	---	0.092	0.18
SR-E10	10/15/2007	1100	620	0.0012	---	---	---	0.07	0.14
Dry Valley Seeps, Whetstone, 2008a									
SP-2	5/27/98	91	410	0.0009	<0.025	0.37	0.18	<0.04	0.043 B
SP-2	11/17/98	34	300	0.0065	0.012 B	0.6	0.69	0.031 B	0.19
SP-2	6/8/99	91	400	0.00096	<0.0031	0.20	0.29	<0.015	0.034 k
SP-2	5/31/00	<5.	220	0.0011	<0.0037	0.93	0.039	<0.0089	<0.014
SP-2	10/24/00	21.4	270	<0.0006	<0.0031	<0.05	0.0037	<0.015	<0.01
SP-2	5/2/01	26.1	300	<0.0006	<0.0031	0.06	0.0182	<0.015	<0.01
SP-2	10/25/01	21.4	300	<0.0006	<0.0031	<0.05	<0.0031	<0.015	<0.01
SP-2	5/28/02	40.6	330	<0.0006	<0.0031	<0.05	<0.0031	<0.015	<0.011
SP-2	10/8/02	29.2	290	<0.0006	<0.0031	<0.05	<0.0031	<0.015	<0.011
SP-2	5/20/2003	51.4	370	<0.0006	<0.0031	<0.05	<0.0031	<0.015	<0.011
SP-2	10/6/2003	40	330	<0.0006	<0.0031	<0.05	<0.0031	<0.015	<0.011
SP-2	6/2/04	71.2	340	<0.0005	<0.0005	<0.005	0.0053	0.0005	0.0073
SP-2 (1)	10/12/04	55.6	360	<0.0005	0.0011	<0.0005	0.0036	0.001	0.0136
SP-2 (2)	10/12/04	56.3	340	<0.0005	0.0007	<0.0005	0.0021	0.0005	0.011
SP-2	6/3/2005	70	390	<0.0001	<0.01	0.02	<0.005	<0.01	<0.01
SP-2	10/11/05	80	380	<0.0001	<0.01	<0.02	0.01	<0.01	<0.01
SP-2	5/23/06	90	390	<0.0001	<0.01	<0.02	<0.005	<0.01	<0.01
SP-2	10/14/06	70	350	<0.0001	<0.01	<0.02	0.009	<0.01	<0.01
SP-2	5/11/07	90	390	<0.0001	<0.01	<0.02	<0.005	<0.01	<0.01
SP-2	9/28/07	70	350	<0.0001	<0.01	<0.02	0.007	<0.01	<0.01
NBD-1	05/28/97	1900	3000	0.082 J	<0.025	0.11	1.7	NA	4.2
NBD-1	05/27/98	220	2800	0.0037	<0.025	0.18	0.27	0.28	1.4
NBD-1	11/17/98	240	510	0.012	<0.025	0.92	0.31	0.079	0.96
NBD-1	06/08/99	1600	2700	0.0037	<0.0031	0.20	1.0	0.67	3.9 k
NBD-1	10/24/00	705	1440	<0.0006	<0.0031	<0.05	0.354	0.072	0.02
NBD-1	06/03/05	2030	3110	0.0258	<0.02	<0.02	3.21	2.88	14.2
NBD-1	5/23/06	2070	3170	0.0289	<0.02	0.38	4.76	3.97	17.4
NBD-1	4/23/07	2070	3000	0.0258	<0.02	<0.04	2.44	3.1	14
Conda Mine Under Drain, Newfields, 2007									
FD-1	5/x/2001	---	---	0.00019	---	---	---	0.016	0.05
FD-1	5/x/2003	---	---	< 0.0001	---	---	---	0.023	0.03

Table A-2. Summary of COPC Data for Overburden Seeps, Under Drains and Backfill

	Date	TDS mg/l	Sulfate mg/l	Cadmium mg/l	Copper mg/l	Iron mg/l	Manganese mg/l	Nickel mg/l	Zinc mg/l
FD-1	5/x/2004	---	---	< 0.0001	---	---	---	0.014	0.012
FD-1	10/x/2003	---	---	< 0.00006	---	---	---	0.025	0.033
FD-1	5/x/2007	---	---	0.00002	---	---	---	0.024	0.0086
FD-1	5/x/2006	---	---	0.00003	---	---	---	0.02	0.039
Conda Mine Under Drain, IMA 1997, 1998, 1999, 2002									
DS021/FD001/44	9/20/1997	918	---	---	---	---	---	---	---
DS021/FD001/45	9/20/1997	---	---	---	---	---	---	---	---
DS021/FD001/46	5/14/1998	---	353	0.0059	---	---	0.056	0.048	0.23
DS021/FD001/46	9/10/1998	---	260	0.0013	---	---	0.067	0.03	0.058
DS021/FD001/46	5/23/2001	760	290	0.0007	---	0.022	0.045	0.016	0.05
Henry Mine Under Drain, IMA 1997, 1998, 1999, 2002									
DS022/FD002	5/13/1998	---	66	0.003	---	---	1.3	0.039	0.0096
DS022/FD002	9/13/1998	---	74	0.0004	---	---	1.5	0.022	0.0023
DS022/FD002	5/15/2001	530	76	0.0007	---	0.01	0.027	0.0054	0.01
Dry Valley Saturated Backfill, Whetstone, 2008a									
GW7D	11/x/1998	1300	830	0.011	---	0.073	0.56	0.66	1.3
GW7D	6/9/1999	1200	600	0.017	---	0.31	0.39	0.42	1.4
GW7D	9/23/1999	1400	790	0.025	---	0.093	0.46	0.56	1.8
GW7D	9/23/1999	---	---	0.021	---	<0.065	0.41	0.50	1.5
GW7D	6/2/2000	---	---	0.023	---	<0.065	0.44	0.51	1.8
GW7D	6/2/2000	1300	660	---	---	---	---	---	---
GW7D	11/7/2000	1280	650	0.0243	---	<0.05	0.352	0.39	1.66
GW7D	5/3/2001	1210	576	0.022	---	<0.05	0.395	0.428	1.6
GW7D	10/30/2001	1230	583	0.0195	---	<0.05	0.382	0.421	1.46
GW7D	10/30/2001	1180	580	0.0181	---	<0.05	0.385	0.413	1.46
GW7D	5/20/2002	1120	526	0.0138	---	<0.05	0.439	0.387	1.4
GW7D	10/28/2002	1210	574	0.0153	---	<0.05	0.399	0.369	1.36
GW7D	6/3/2003	1150	526	0.0197	---	<0.05	0.400	0.325	1.23
GW7D	10/22/2003	1220	581	0.0306	---	2.88	0.417	0.394	1.62
GW7D	6/8/2004	1070	606	0.0228	---	0.014	0.4239	0.2584	1.1929
GW7D	6/8/2004	1100	567	0.0202	---	0.018	0.3389	0.2493	0.967
GW7D	10/7/2004	1200	615	0.0201	---	0.012	0.3716	0.2568	1.062
GW7D	6/17/2005	1220	610	0.0204	---	0.04	0.44	0.29	1.14
GW7D	10/19/2005	1250	650	0.0221	---	<0.02	0.424	0.32	1.38
GW-7D	5/25/2006	1340	680	0.0247	---	0.03	0.462	0.37	1.45
GW-7D	10/23/2006	1220	670	0.0217	---	<0.02	0.471	0.34	1.41
GW-7D	6/12/2007	1210	620	0.0223	---	<0.02	0.435	0.29	1.13
GW-7D	10/4/2007	1210	650	0.0192	---	<0.02	0.428	0.24	1.1
GW-7D-2A	10/30/2002	1340	689	0.0087	---	0.51	0.447	0.161	0.277
GW-7D-2A	2/12/2003	---	612	0.0251	---	14.9	1.28	0.191	1.02
GW-7D-2A	6/3/2003	1380	697	0.0127	---	0.66	0.514	0.182	0.317
GW-7D-2A	8/25/2003	---	661	0.0123	---	0.52	0.487	0.158	0.261
GW-7D-2A	12/2/2003	1250	553	0.0067	---	2.02	0.467	0.082	0.161
GW-7D-2A	6/14/2004	1360	749	0.0139	---	0.271	0.4269	0.1447	0.2845
GW-7D-2A	8/19/2004	1260	633	0.0134	---	0.199	0.3753	0.1447	0.2649
GW-7D-2A	6/15/2005	1270	740	0.0134	---	0.12	0.445	0.17	0.34
GW-7D-2A	8/18/2005	---	700	0.0133	---	0.2	0.417	0.15	0.27
GW-7D-2A	5/25/2006	1330	720	0.0151	---	0.11	0.448	0.16	0.28
GW-7D2A	10/25/2006	1240	690	0.0113	---	0.16	0.468	0.16	0.27
GW-7D2A	6/14/2007	1280	710	0.0139	---	0.22	0.47	0.15	0.28
GW-7D2A	10/4/2007	1300	710	0.0114	---	0.21	0.462	0.16	0.3
GW-7D-2B	10/30/2002	2950	813	0.0025	---	11.1	1.15	0.253	1.54
GW-7D-2B	2/12/2003	---	815	0.346	---	124	2.37	1.57	13.9
GW-7D-2B	6/3/2003	1650	957	0.617	---	131	2.41	2.24	20.1
GW-7D-2B	8/25/2003	---	815	0.055	---	15	1.21	0.514	3.95
GW-7D-2B	12/2/2003	1460	847	0.195	---	36.3	1.26	0.0652	5.04
GW-7D-2B	6/14/2004	1480	941	0.047	---	10.3	1.243	0.5104	4.16
GW-7D-2B	8/19/2004	1430	830	0.02	---	0.016	0.384	0.2306	0.9702
GW-7D-2B	6/15/2005	1440	940	0.0384	---	10.1	1.44	0.59	4.29
GW-7D-2B	6/18/2005	---	870	0.0309	---	8.86	1.28	0.46	3.43
GW-7D-2B	5/25/2006	1460	850	0.0125	---	7.33	1.09	0.33	1.98
GW-7D-2B	6/12/2007	1330	790	0.0072	---	6.29	0.967	0.24	1.51
GW-7D-2B	10/4/2007	1340	790	0.005	---	7.27	1.06	0.25	1.58
Ballard Saturated Fill, Whetstone, 2008b									

Table A-2. Summary of COPC Data for Overburden Seeps, Under Drains and Backfill

	Date	TDS mg/l	Sulfate mg/l	Cadmium mg/l	Copper mg/l	Iron mg/l	Manganese mg/l	Nickel mg/l	Zinc mg/l
MW-15A	11/15/2006	1270	673	< 0.0001	< 0.001	0.05	1.980	< 0.02	< 0.01
MW-15A	4/20/2007	612	295	0.0002	0.001	< 0.05	0.017	< 0.02	< 0.01
MW-15A	8/10/2007	1180	535	0.0003	< 0.001	0.07	0.008	0.02	< 0.01
MW-15A	10/18/2007	1240	613	< 0.0001	< 0.001	< 0.05	0.016	0.02	< 0.01
MW-16A	11/15/2006	238	27	< 0.0001	< 0.001	< 0.05	0.006	< 0.02	< 0.01
MW-16A	4/18/2007	1480	905	< 0.0001	0.001	0.29	1.700	< 0.02	< 0.01
MW-16A	8/10/2007	1450	769	< 0.0001	< 0.001	0.44	1.610	0.02	< 0.01
MW-16A	10/18/2007	1470	840	< 0.0001	< 0.001	0.09	1.660	0.02	< 0.01
Smoky Canyon Saturated Fill, Newfields, 2005									
GW-11	10/30/2003	2470	1666	0.0836	0.003	0.0045	0.0108	0.449	3.85
GW-11	5/9/2004	2546	1484	0.128	0.0021	0.0124	0.0068	0.816	4.32
GW-11	7/25/2004	---	---	0.172	0.0022	0.0124	0.0058	0.558	4.54
Statistics									
	Count	148	157	189	85	107	113	185	186
	Mean	1040	688	4.62	0.01	3.72	0.571	0.248	1.14
	Median	1200	639	0.0037	0.003	0.05	0.385	0.14	0.2823
	Minimum	2.2	24.7	0.00002	0.0002	0.0005	0.0021	0.0005	0.0011
	Maximum	2950	3170	330	0.03	131	4.76	3.97	20.1
	Geometric Mean	---	---	0.003162	0.003	0.09	0.1	0.08	0.19

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APPENDIX B
SUMMARY OF REGIONAL COLUMN TESTING DATA

Table B-1. Summary of Column Testing Data for the Southeast Idaho Phosphate District

Project	Column ID	Saturation	Material Type	Material Mass	Column Diameter	Packed Height	Pore Volume	Solution Application Rate	Aeration	Inoculation	Sterilization	Cycles Leached	Initial Water Retained		First Cycle Leachate				Second Cycle Leachate			
													Volume	Weight %	PV	Dis. Se (mg/L)	Dis. Cd (mg/L)	TDS (mg/L)	PV	Dis. Se (mg/L)	Dis. Cd (mg/L)	TDS (mg/L)
Dry Valley Mine Baseline Geochemistry Validation Study[1]	ASTC-140	Unsat.	Run of Mine Waste Rock	25 kg	6 in	80 in	5.2 L	15 ml/hr	No	No	No	13	[23]	[23]	0 to 0.2	9.32	0.0024	2,900	0.2 to 1	3.95	0.0166	3,980
	ASTC-180	Variable[14]	Run of Mine Waste Rock	45 kg	6 in	136 in	7.8 L	15 ml/hr	No	No	No	10	[23]	[23]	0 to 0.2	1.55	0.0006	1,400	0.2 to 1	2.4	0.0007	2,980
North Rasmussen Ridge Baseline Geochemistry Study[2]	ARC-1	Unsat.	Hanging Wall Mud	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1.4	7.13	0.0239	3,350	1.4 to 2.4	2.36	0.0094	1,990
	ARC-2	Unsat.	Control[19]	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1	0.003	< 0.0001	88	1 to 2	< 0.001	< 0.0001	46
	ARC-3	Unsat.	Footwall Mud	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1.1	0.870	0.0018	1,410	1.1 to 2.1	0.157	0.0015	404
	ARC-4	Unsat.	Aluvium	5 kg	6 in	[23]	1.4 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1.1	0.012	0.0004	517	1.1 to 2.1	0.003	< 0.0001	199
	ARC-5	Unsat.	Wells/Grandeur	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1.1	0.172	0.0001	797	1.1 to 2.1	0.079	< 0.0001	222
	ARC-6	Unsat.	Rex Chert	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1	0.860	0.0067	3,920	1 to 2	0.556	0.0196	2,730
	ARC-7	Unsat.	Center Waste (dark)	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1	0.964	0.0673	3,060	1 to 2	0.282	0.0746	1,880
	ARC-8[6]	Unsat.	Center Waste (dark)	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1.1	0.959	0.0747	3,290	1.1 to 2.1	0.222	0.0503	1,840
	ARC-9	Unsat.	Center Waste (light)	5 kg	6 in	[23]	1.4 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1.1	1.06	0.0003	335	1.1 to 2.1	0.306	0.0005	119
	ARC-10[7]	Unsat.	Center Waste (light)	5 kg	6 in	[23]	1.4 L	30 ml/hr	1 to 2 days	No	No	10	[23]	[23]	0 to 1.1	1.2	< 0.0001	363	1.1 to 2.1	0.369	< 0.0001	140
	ARC-11	Unsat.	Wells/Grandeur	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	5	[23]	[23]	0 to 1	0.0025	0.0003	--	1 to 2	0.0004	0.0004	--
	ARC-12	Unsat.	Wells/Grandeur	5 kg	6 in	[23]	1.2 L	30 ml/hr	1 to 2 days	No	No	5	[23]	[23]	0 to 1	0.0006	< 0.001	--	1 to 2	< 0.001	< 0.0001	--
Smoky Canyon Expansion EIS[3]	SCC-1	Unsat.	Hanging Wall Mud	5 kg	6 in	[23]	1.5 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.1	0.232	0.0008	816	1.1 to2.2	0.047	0.0004	448
	SCC-2	Unsat.	Control[19]	5 kg	6 in	[23]	1.7 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.0	0.002	0.0001	26	1.0 to 2.1	0.002	0.0001	23
	SCC-3	Unsat.	Hanging Wall Phosp. Shale[20]	5 kg	6 in	[23]	1.7 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.1	0.273	0.0035	1,270	1.1 to 2.2	0.101	0.0016	786
	SCC-4	Unsat.	Center Waste (light)	5 kg	6 in	[23]	1.8 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to1.1	0.205	0.0009	477	1.1 to 1.2	0.131	0.0007	488
	SCC-5[8]	Unsat.	Center Waste (light)	5 kg	6 in	[23]	1.7 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.1	0.404	0.0040	555	1.1 to 2.1	0.141	0.0014	332
	SCC-6	Unsat.	Center Waste (dark)	5 kg	6 in	[23]	1.7 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.1	0.117	0.0044	473	1.1 to 2.1	0.066	0.0055	569
	SCC-7[9]	Unsat.	Center Waste (dark)	5 kg	6 in	[23]	1.7 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.1	0.134	0.0048	755	1.1 to 2.1	0.126	0.0042	744
	SCC-8	Unsat.	Run of Mine Waste Rock	5 kg	6 in	[23]	1.5 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.1	0.951	0.0528	1,860	1.1 to 2.3	0.459	0.0153	1,060
	SCC-9	Unsat.	Rex Chert	5 kg	6 in	[23]	1.7 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.0	0.006	0.0005	270	0 to 1.1	0.003	0.0002	138
	SCC-10	Unsat.	Footwall Mud	5 kg	6 in	[23]	1.2 L	100 to 30 ml/hr	1 to 2 days	Yes	No	10	[23]	[23]	0 to 1.2	0.109	0.0081	666	1.2 to 2.4	0.062	0.0016	287
Smoky Canyon Panels F and G[4]	MSFG-1	Unsat.	Franson	5 kg	4 in	[23]	1.0 L	15 ml/hr	2 to 3 days	Yes	No	14	175 ml	3.5%	0 to 1.0	0.036	0.0011	3990 (SC)	1.0 to 2.1	0.027	< 0.0006	545 SC
	MSFG-2	Unsat.	Control[21]	5 kg	4 in	[23]	1.2 L	15 ml/hr	2 to 3 days	Yes	No	14	75 ml	1.5%	0 to 0.9	< 0.005	< 0.0006	817 (SC)	0.9 to 1.8	< 0.005	< 0.0006	97 SC
	MSFG-3	Unsat.	Rex Chert	5 kg	4 in	[23]	1.2 L	15 ml/hr	2 to 3 days	Yes	No	18	210 ml	4.2%	0 to 1.0	0.036	< 0.0006	3040 (SC)	1.0 to 2.0	0.018	< 0.0006	535 SC
	MSFG-4	Unsat.	Hanging Wall Mud	5 kg	4 in	[23]	1.5 L	15 ml/hr	2 to 3 days	Yes	No	9	800 ml	16.0%	0 to 1.1	0.225	0.0047	3760 (SC)	1.1 to 2.1	0.007	< 0.0006	936 SC
	MSFG-5	Unsat.	Center Waste (light)	5 kg	4 in	[23]	1.5 L	15 ml/hr	2 to 3 days	Yes	No	14	1110 ml	22.2%	0 to 1.1	0.273	0.074	2940 (SC)	1.1 to 2.1	0.062	0.002	539 SC
	MSFG-6	Unsat.	Center Waste (dark)	5 kg	4 in	[23]	1.5 L	15 ml/hr	2 to 3 days	Yes	No	20	625 ml	12.5%	0 to 1.0	2.25	0.221	4,050 SC	1.0 to 2.0	0.569	0.003	1,047 SC
	MSFG-7	Unsat.	Wells/Grandeur	5 kg	4 in	[23]	1.0 L	15 ml/hr	2 to 3 days	Yes	No	18	700 ml	14.0%	0 to 1.1	0.031	< 0.0006	3,130 SC	1.1 to 2.2	< 0.005	< 0.0006	392 SC
	DSFG-8	Unsat.	Rex Chert	5 kg	4 in	[23]	1.2 L	15 ml/hr	2 to 3 days	Yes	No	18	500 ml	10.0%	0 to 1.1	0.011	0.0366	3,470 SC	1.1 to 2.1	< 0.005	0.0008	378 SC
	DSFG-9	Unsat.	Hanging Wall Mud	5 kg	4 in	[23]	1.5 L	15 ml/hr	2 to 3 days	Yes	No	18	950 ml	19.0%	0 to 1.0	0.152	0.0025	3,480 SC	1.0 to 2.1	0.052	< 0.0006	676 SC
	DSFG-10	Unsat.	Center Waste	5 kg	4 in	[23]	1.5 L	15 ml/hr	2 to 3 days	Yes	No	20	900 ml	18.0%	0 to 1.1	1.34	0.133	4,610 SC	1.1 to 2.2	0.235	0.0067	1,496 SC
	DSFG-11	Unsat.	Footwall Mud	5 kg	4 in	[23]	1.5 L	15 ml/hr	2 to 3 days	Yes	No	14	710 ml	14.2%	0 to 1.1	0.189	0.0042	3,160 SC	1.1 to 2.0	0.151	< 0.0006	538 SC
	DSFG-12	Unsat.	Wells/GTD	5 kg	4 in	[23]	1.2 L	15 ml/hr	2 to 3 days	Yes	No	14	400 ml	8.0%	0 to 1.0	0.036	< 0.0006	3,190 SC	1.0 to 2.0	0.021	< 0.0006	462 SC
	ROM Inoc C1[10]	Unsat.	Run of Mine Waste Rock	5 kg	6 in	[23]	1.6 L	15 ml/hr	2 to 3 days	No	Yes	11	730 ml	14.6%	0 to 1.0	0.869 Tot	0.0084 Tot	2,210 SC	1.0 to 2.0	0.265 Tot	0.0013 Tot	1,088 SC
	ROM Inoc C2	Unsat.	Run of Mine Waste Rock	5 kg	6 in	[23]	1.6 L	15 ml/hr	2 to 3 days	Yes	Yes	11	1260 ml	25.2%	0 to 1.0	0.923 Tot	0.0247 Tot	3,800 SC	1.0 to 2.0	0.241 Tot	0.0028 Tot	1,377 SC
	CWS Inco C1[11]	Unsat.	Center Waste	5 kg	6 in	[23]	1.6 L	15 ml/hr	2 to 3 days	No	Yes	9	1225 ml	24.5%	0 to 1.0	1.1 Tot	0.0196 Tot	4,320 SC	1.0 to 2.1	0.291 Tot	0.0024 Tot	1,591 SC
	CWS Inco C2	Unsat.	Center Waste	5 kg	6 in	[23]	1.6 L	15 ml/hr	2 to 3 days	Yes	Yes	9	1250 ml	25.0%	0 to 1.0	1.18 Tot	0.0289 Tot	4,150 SC	1.0 to 2.0	0.345 Tot	0.003 Tot	1,625 SC
	MBFG-1	Variable[15]	Rex Chert	5 kg	4 in	[23]	1.2 L	15 ml/hr	No	Yes	No	20	250 ml	--	0 to 1.0	0.007	< 0.003	3,160 SC	1.0 to 2.0	0.018	< 0.003	1,106 SC
	MBFG-2	Variable[15]	Hanging Wall Mud	5 kg	4 in	[23]	1.3 L	15 ml/hr	No	Yes	No	13	400 ml	--	0 to 1.2	0.03	< 0.003	3,010 SC	1.2 to 2.2	0.018	0.003	751 SC
	MBFG-3	Variable[15]	Center Waste (light)	5 kg	4 in	[23]	1.6 L	15 ml/hr	No	Yes	No	20	550 ml	--	0 to 1.0	0.114	0.003	2,310 SC	1.0 to 2.0	0.037	< 0.003	1,011 SC
	MBFG-4	Variable[15]	Center Waste (dark)	5 kg	4 in	[23]	1.4 L	15 ml/hr	No	Yes	No	14	1050 ml	--	0 to 1.1	0.714	< 0.003	3,750 SC	1.1 to 2.1	0.053	< 0.003	1,249 SC
	DBFG-5	Variable[15]	Rex Chert	5 kg	4 in	[23]	1.2 L	15 ml/hr	No	Yes	No	14	800 ml	--	0 to 1.0	< 0.006	< 0.003	2,910 SC	1.0 to 2.0	< 0.005	< 0.003	1,231 SC
	DBFG-6	Variable[15]	Hanging Wall Mud	5 kg	4 in	[23]	1.6 L	15 ml/hr	No	Yes	No	20	1200 ml	--	0 to 1.0	0.029	0.011	2,780 SC	1.0 to 2.0	0.028	< 0.003	1,025 SC
	DBFG-7	Variable[15]	Center Waste	5 kg	4 in	[23]	1.6 L	15 ml/hr	No	Yes	No	20	1200 ml	--	0 to 1.0	0.287	< 0.003	3,710 SC	1.0 to 2.0	0.071	< 0.003	1,816 SC
	DBFG-8	Variable[15]	Footwall Mud	5 kg	4 in	[23]	1.3 L	15 ml/hr	No	Yes	No	14	1150 ml	--	0 to 1.0	0.182	0.006	3,080 SC	1.0 to 2.0	0.026	< 0.003	990 SC
	FT-1	Partial[16]	Run of Mine/Limestone	5kg/16.8kg[22]	6 in	[23]	5.4 L	22 ml/hr	No	Yes	No	5	425 ml	--	0 to 1.0	0.289	< 0.0006	2,740 SC	1.0 to 2.0	0.045	< 0.0006	1,062 SC
	FT-2	Partial[17]	Run of Mine/Limestone	5kg/16.8kg[22]	6 in	[23]	5.4 L	22 ml/hr	No	Yes	No	5	800 ml	--	0 to 1.0	0.056	< 0.0006	3,010 SC	1.0 to 2.0	0.018	< 0.0006	981 SC

Table B-1. Summary of Column Testing Data for the Southeast Idaho Phosphate District

Project	Column ID	Saturation	Material Type	Material Mass	Column Diameter	Packed Height	Pore Volume	Solution Application Rate	Aeration	Inoculation	Sterilization	Cycles Leached	Initial Water Retained		First Cycle Leachate				Second Cycle Leachate			
													Volume	Weight %	PV	Dis. Se (mg/L)	Dis. Cd (mg/L)	TDS (mg/L)	PV	Dis. Se (mg/L)	Dis. Cd (mg/L)	TDS (mg/L)
Blackfoot Bridge EIS[5]	NWOP-1	Unsat.	Select Handled Low Se	20 kg	6 in	26.89 in	4.9 L	15 ml/hr	3 days	No	No	11	2476 ml	49.5%	0 to 0.5	0.30	0.0025	1,120	0.5 to 1.5	0.055	0.0014	388
	EOP-1	Unsat.	Select Handled Low Se	20 kg	6 in	27.99 in	5.4 L	15 ml/hr	3 days	No	No	11	2774 ml	55.5%	0 to 0.4	0.31	0.0007	1060	0.4 to 1.2	0.041	0.0007	355
	EOP-2	Unsat.	Segregated Meade Peak	20 kg	6 in	30.75 in	6.7 L	15 ml/hr	3 days	No	No	19	3809 ml	76.2%	0 to 0.2	2.92	0.0076	2660	0.2 to 0.8	0.61	0.0026	843
	EOP-2R[12]	Unsat.	Segregated Meade Peak	20 kg	6 in	30.51 in	6.6 L	15 ml/hr	3 ml/hr	No	No	19	3708 ml	74.2%	0 to 0.2	3.110	0.0085	2790	0.2 to 0.9	0.620	0.0028	804
	NPBF-1	Unsat.	Run of Mine Waste Rock	20 kg	6 in	27.24 in	5.1 L	15 ml/hr	3 days	No	No	11	2915 ml	58.3%	0 to 0.4	0.74	0.0014	1340	0.4 to 1.3	0.087	0.0007	373
	MPBF-1	Unsat.	Run of Mine Waste Rock	20 kg	6 in	27.24 in	5.1 L	15 ml/hr	3 days	No	No	11	2488 ml	49.8%	0 to 0.5	0.90	0.0023	1380	0.5 to 1.5	0.090	0.0007	345
	SPBF-1	Unsat.	Run of Mine Waste Rock	20 kg	6 in	25.00 in	4.0 L	15 ml/hr	3 days	No	No	11	2453 ml	49.1%	0 to 0.6	2.50	0.0064	2150	0.6 to 1.8	0.23	0.0016	527
	NPBF-2S	Sat.[18]	Run of Mine Waste Rock	20 kg	6 in	27.76 in	5.3 L	15 ml/hr	No	No	No	11	3814 ml	76.3%	0 to 0.2	< 0.001	0.0042	560	0.2 to 0.8	0.002	0.0024	448
	NPBF-2RS[13]	Sat.[18]	Run of Mine Waste Rock	20 kg	6 in	27.76 in	5.3 L	15 ml/hr	No	No	No	11	3739 ml	74.8%	0 to 0.2	0.002	0.0043	621	0.2 to 0.8	0.002	0.0022	493
	MPBF-2S	Sat.[18]	Run of Mine Waste Rock	20 kg	6 in	27.52 in	5.2 L	15 ml/hr	No	No	No	11	3664 ml	73.3%	0 to 0.3	0.002	0.0015	630	0.3 to 0.8	0.002	0.0003	122
	SPBF-2S	Sat.[18]	Run of Mine Waste Rock	20 kg	6 in	25.00 in	4.0 L	15 ml/hr	No	No	No	11	3077 ml	61.5%	0 to 0.5	0.008	0.0030	1100	0.5 to 1.2	0.001	0.0002	734
	OS-1	Unsat.	Run of Mine Ore	20 kg	6 in	27.36 in	5.1 L	15 ml/hr	3 days	No	No	11	3416 ml	68.3%	0 to 0.3	0.27	0.0025	929	0.3 to 1.2	0.037	0.0056	358
	OS-2	Unsat.	Run of Mine Ore	20 kg	6 in	26.50 in	4.7 L	15 ml/hr	3 days	No	No	11	3796 ml	75.9%	0 to 0.3	0.59	0.010	1030	0.3 to 1.2	0.049	0.0040	376
	CONTROL	Unsat.	Control[19]	20 kg	6 in	37.99 in	6.6 L	15 ml/hr	3 days	No	No	11	3938 ml	78.8%	0 to 0.2	< 0.001	< 0.0001	< 20	0.2 to 0.7	< 0.001	< 0.0001	54

Notes:

1 Maxim Technologies, 2006. Agrium Dry Valley Mine Operational Geochemistry Baseline Validation Study. Prepared for Agrium Conda Phosphate Operations.
2 Maxim Technologies, 2002a. North Rasmussen Ridge Mine Expansion Final Environmental Geochemistry Study. Prepared for Agrium Conda Phosphate Operations.
3 Maxim Technologies, 2002b. Revised Final Simplot Smoky Canyon Expansion EIS Column Test Report. Prepared for J.R. Simplot Company.
4 Maxim Technologies, 2005. Final Baseline Technical Report on Environmental Geochemistry for Manning and Deer Creek Phosphate Lease Areas (Panels F and G) at Smoky Canyon Mine. Prepared for J.R. Simplot Company.
5 Whetstone Associates, 2010. Revised Final Baseline Geochemical Characterization Study for the Blackfoot Bridge Mine EIS. Prepared for U.S. Department of Interior, Bureau of Land Management, Idaho Falls District, Pocatello Field Office.
6 Replicate of column ARC-7.
7 Replicate of column ARC-9.
8 Replicate of column SCC-4.
9 Replicate of column SCC-6.
10 Replicate of column ROM Inoc C2 -this column was sterilized but not inoculated.
11 Replicate of column CWS Inoc C2 -this column was sterilized but not inoculated.
12 Replicate of column EOP-2.
13 Replicate of column NPBF-2S.
14 Operated as a down-flow single column with a saturated lower portion and an unsaturated upper portion.
15 5 kg of material split into upper and lower columns. The upper column was leached under unsaturated conditions with the leachate flowing into the lower column that was leached under saturated conditions. Leachates were collected under nitrogen head.
16 Column packed with run of mine waste rock on top of limestone. The top of the saturated zone was maintained in the limestone.
17 Column packed with run of mine waste rock on top of limestone. The top of the saturated zone was maintained in the waste rock.
18 Operated as up-flow column.
19 Silica sand.
20 Upper ore partings?
21 Glass wool.
22 5 kg of ROM waste rock and 16.8 kg of limestone.
23 Not given in reviewed document.

United States Government Accountability Office
Washington, DC 20548

December 12, 2011

The Honorable Doug Lamborn
Chairman
The Honorable Rush Holt
Ranking Member
Subcommittee on Energy and Mineral Resources
Committee on Natural Resources
House of Representatives

Subject: *Hardrock Mining: BLM Needs to Revise Its Systems for Assessing the Adequacy of Financial Assurances*

In a July 2011 testimony before your subcommittee, we summarized the key findings of our prior work on hardrock mining, including the adequacy of financial assurances.[1] At this hearing, we stated that the Department of the Interior's Bureau of Land Management (BLM) had taken actions to strengthen its processes, but the financial assurances that it had in place, when we last reported on this issue in 2008, were inadequate to cover estimated reclamation costs from hardrock mining operations, and the agency's Bond Review Fiscal Report (Bond Review Report) inaccurately calculated this shortfall. At the July 2011 hearing, the BLM witness testifying for the department stated that the agency had corrected these issues in response to the concerns we identified in the past.

As a result, you asked us to update our prior work assessing the hardrock mining financial assurances held by BLM and determine (1) the value and adequacy of financial assurances that operators use to guarantee reclamation costs for hardrock mining operations on BLM land and (2) the status of BLM's efforts to address issues we previously identified regarding the Bond Review Report and supporting documentation used to determine the adequacy of hardrock mining financial assurances.

To determine the value and adequacy of financial assurances for hardrock mining operations on BLM land, we obtained financial assurance data from BLM's Bond Review Report, which aggregates data from BLM's LR2000 database and includes data on bonds covering a single operation, as well as bonds covering all of an operator's mining operations within one state (known as statewide bonds) or all of its mining operations in the United States (known as nationwide bonds). Because LR2000 data is updated daily, we took steps to ensure that we only analyzed data on mining operations that had progressed past the preliminary stages of BLM's mine approval process by collecting data from LR2000 on those operations where the bond amount had been estimated, determined, or accepted as of December 1, 2010, or earlier. We chose December 1, 2010, as a cutoff date in consultation

[1] GAO, *Abandoned Mines: Information on the Number of Hardrock Mines, Cost of Cleanup, and Value of Financial Assurances,* GAO-11-834T (Washington, D.C.: July 14, 2011).

with BLM officials because they suggested this date would yield the most accurate data and would reflect corrections and revisions made by BLM state office and field office officials in response to guidance contained in various instructional memoranda (IM). We analyzed these data to summarize the number of hardrock mining operations, the total number and value of financial assurances, and the number of operations with inadequate financial assurances and the value of those financial assurances. Data for Alaska are not maintained in LR2000 and not reported in the Bond Review Report and are, therefore, not included in this analysis. To assess the reliability of LR2000 data and the Bond Review Report, we spoke with BLM information technology officials in Lakewood, Colorado, who are responsible for administering the system; BLM state and field office staff who enter information into the system; and BLM managers at its Washington, D.C., headquarters office who use information from the system. We discussed the structure and history of LR2000 and obtained a copy of BLM's Bond Review Report specifications that were used to create the Bond Review Report. We also conducted electronic testing of these data by, for example, counting records and looking for outliers in the data, to identify obvious errors in accuracy and completeness. We present data from LR2000 in this report and believe these data are sufficiently reliable for this update. To determine whether BLM addressed issues we previously identified regarding its bond adequacy reporting, we obtained the fiscal year 2010 state director certifications and the related corrective action plans for the 11 BLM states with hardrock mining operations—Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming. We analyzed the certifications to determine whether BLM's policies in IM 2009-153 were implemented. Specifically, we determined whether the states had submitted a certification that addressed whether financial assurances were reviewed within the specified time frames and whether financial assurances were adequate. We also analyzed the certifications to see if the BLM state offices had submitted a corrective action plan to address any deficiencies.

We conducted this performance audit from July 2011 to December 2011 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The General Mining Act of 1872 encouraged the development of the West by allowing individuals to stake claims and obtain exclusive rights to the gold, silver, copper, and other valuable hardrock mineral deposits on land belonging to the United States. Since then, thousands of operators have extracted billions of dollars worth of hardrock minerals from land managed by BLM.[2]

BLM issued regulations in 1981 requiring all operators of hardrock mines to reclaim the land disturbed by mining when operations cease.[3] BLM amended the regulations in 2001 to require all mining operators to provide bonds or other financial assurances before beginning exploration or mining operations on BLM land for both notice-level hardrock mining

[2]BLM and the U.S. Department of Agriculture's Forest Service are the two principal agencies responsible for managing the federal land open for hardrock mining.

[3]An operator is a person who conducts operations under the mining laws, including exploration, mining, and processing hardrock minerals.

operations—those disturbing 5 acres of land or less—and plan-level hardrock mining operations—those disturbing over 5 acres of land and those in certain designated areas, such as the national wild and scenic rivers system.[4] These financial assurances must cover, among other things, the estimated cost as if BLM were to contract with a third party to reclaim the operations according to the reclamation plan.[5] Having adequate financial assurances to pay reclamation costs for BLM land disturbed by hardrock operations is critical to ensuring that the land is reclaimed if the mining operators fail to do so.

In June 2005, we reported that some current hardrock operations on BLM land do not have adequate financial assurances in place, and some had no or outdated reclamation plans or cost estimates on which the financial assurances should have been based.[6] In that report, we concluded that BLM lacked a process and critical management information needed for ensuring that adequate financial assurances are actually in place, as required by federal regulations and BLM guidance. As a result, we recommended that BLM strengthen its management of financial assurances for hardrock operations on its land. At that time, BLM did not concur with our recommendations.

However, subsequently in June 2006, BLM took actions to respond to our recommendations by issuing IM 2006-172, which, among other things, provided guidance for generating the Bond Review Report in LR2000—an automated information system BLM uses to manage financial assurances.[7] BLM uses this report to determine if adequate financial assurances are in place for mining operations. IM 2006-172 also directed BLM state directors to annually review the Bond Review Report to determine if all reclamation cost estimates are adequate, take action to address inadequate cost estimates, and submit a certification to BLM's Washington, D.C., headquarters office that the financial assurances are adequate to cover reclamation costs.

In 2008, we again reviewed BLM's oversight of hardrock mining operations and found that the financial assurances that it had in place were inadequate to cover estimated reclamation costs by about $61 million and that the agency's Bond Review Report inaccurately calculated this shortfall.[8] Specifically, the Bond Review Report did not separately calculate the value of each inadequate financial assurance but instead calculated an aggregate value of all financial assurances across all operations (including those that were inadequate and those that were greater than required). Because a financial assurance that is greater than the amount required for an operation cannot be transferred to a different operation with inadequate financial assurances, the Bond Review Report incorrectly depicted the degree to which some financial assurances were inadequate. At that time, BLM officials agreed to take steps to modify LR2000.

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[4]43 C.F.R. Part 3809. Operators may also provide a single bond to cover all mining operations statewide or nationwide.

[5]When BLM identifies a need for it, the operator must also establish a trust fund or other funding mechanism to ensure the continuation of long-term treatment to achieve water quality standards and for other long-term, postmining maintenance requirements.

[6]GAO, *Hardrock Mining: BLM Needs to Better Manage Financial Assurances to Guarantee Coverage of Reclamation Costs*, GAO-05-377 (Washington, D.C.: June 20, 2005).

[7]BLM, *Bond Review Report—LR2000,* IM 2006-172 (Washington, D.C.: June 2006).

[8]GAO, *Hardrock Mining: Information on Abandoned Mines and Value and Coverage of Financial Assurances on BLM Land,* GAO-08-574T (Washington, D.C.: Mar. 12, 2008).

BLM's Financial Assurances for Some Hardrock Operations Continue to Be Inadequate

Based on the data we reviewed from BLM's Bond Review Report, mine operators had provided financial assurances valued at approximately $1.5 billion to guarantee reclamation costs for 1,365 hardrock operations on federal land managed by BLM. We determined that 57 hardrock operations had inadequate financial assurances—amounting to about $24 million less than needed to fully cover estimated reclamation costs. Nevada had the largest number of hardrock mining operations and the largest number of inadequate financial assurances. Table 1 shows the number and value of BLM-held financial assurances and the number and value of inadequate financial assurances, by state.

Table 1: The Number and Value of Hardrock Financial Assurances, and the Number and Value of Inadequate Financial Assurances, by State

State	Total operations[a]	Value of financial assurances	Operations with inadequate financial assurances	Total value of inadequate financial assurances
Arizona	140	$9,759,003	2	($755)
California	135	14,423,442	8	(98,142)
Colorado	84	2,572,706	1	(153,400)
Idaho	57	1,529,926	2	(22,500)
Montana	64	68,264,970	0	0
South Dakota	4	104,908	0	0
Nevada	491	1,152,432,561	24	(23,853,662)
New Mexico	27	1,109,596	0	0
Oregon	92	2,211,033	7	(36,775)
Washington	11	3,026,072	2	(35,300)
Utah	127	11,003,275	6	(11,953)
Wyoming	133	185,712,192	5	(89,613)
Total	**1,365**	**$1,452,149,685**	**57**	**($24,302,101)**

Source: GAO analysis of BLM's Bond Review Report.

Notes: These data include operations where the bond amount had been estimated, determined, or accepted as of December 1, 2010, or earlier. In addition, data for Alaska are not maintained in LR2000 and not reported in the Bond Review Report.

[a]Includes both plan- and notice-level operations.

BLM Has Not Fully Addressed Issues GAO Previously Identified

As we have reported, BLM has taken some steps to strengthen and improve its management of hardrock financial assurances but has not yet addressed the issues we identified in 2008 regarding how the Bond Review Report calculates the total value of those financial assurances that are inadequate.[9]

To improve its management of hardrock financial assurances, BLM in 2009 issued IM 2009-153, which, among other things, directs periodic review of reclamation cost estimates for all ongoing operations to ensure the current cost estimate and the amount of the required financial assurance continue to meet applicable regulatory requirements.[10] However, we

[9]GAO-11-834T.

[10]IM 2009-152, *Financial Guarantees for Notices and Plans of Operations.*

found that only two BLM state offices—Montana and Wyoming—fully implemented IM 2009-153 by conducting timely reviews of financial assurances and ensuring that financial assurances for hardrock operations under their purview were adequate. Although some BLM state offices reported that they had not always succeeded in conducting reviews of financial assurances in a timely manner, or had not always secured adequate financial assurances, they all had submitted a certification that included an action plan for addressing these deficiencies. In addition, in reviewing the Bond Review Report, we found that the implementation of IM 2009-153 has helped BLM reduce the amount of its inadequate financial assurances since 2008 by about $37 million. Table 2 summarizes the contents of the fiscal year 2010 state director certifications required by IM 2009-153.

Table 2: Summary of BLM Fiscal Year 2010 State Director Financial Assurance Certifications.

BLM state office	Notice-level financial assurances were reviewed every 2 years[a]	Plan-level financial assurances were reviewed every 3 years[a]	Notice-level financial assurances were adequate	Plan-level financial assurances were adequate	A corrective action plan was submitted, if necessary
Alaska	Yes	Yes	[b]	[b]	Yes
Arizona	No	No	Yes	Yes	Yes
California	No	No	Yes	Yes	Yes
Colorado	Yes	Yes	Yes	No	Yes
Idaho	No	No	Yes	Yes	Yes
Montana	Yes	Yes	Yes	Yes	Yes
Nevada	No	No	No	Yes	Yes
New Mexico	No	Yes	Yes	No	Yes
Oregon	No	No	Yes	No	Yes
Utah	No	No	No	No	Yes
Wyoming	Yes	Yes	Yes	Yes	Yes

Source: GAO analysis of BLM's Fiscal Year 2010 state directors' financial assurance certifications.

[a]Notice-level operations are those causing a surface disturbance of 5 acres or less; plan-level operations are those disturbing over 5 acres of land or those in certain designated areas.

[b]Data for Alaska are not maintained in LR2000 and not reported in its annual financial assurance certification.

Regarding the issue with the Bond Review Report that we identified in 2008, BLM has not modified LR2000 to correct how it calculates the value of inadequate financial assurances. Consequently, the Bond Review Report, as currently designed, provides inaccurate summary information by offsetting the shortfalls of some operations' financial assurances with surpluses from the financial assurances of other operations. For example, the Bond Review Report we examined estimated that the total financial assurances in place were about $7 million more than needed to fully guarantee estimated reclamation costs. However, we found that the report's estimated financial assurances were incorrect. By separately assessing the adequacy of financial assurances on an operation-by-operation basis, we determined that BLM's hardrock financial assurances, when aggregated, were about $24 million less than needed. As we have previously noted, higher-than-needed financial assurances for particular operations—which total $7 million by BLM's own calculation—cannot be used to offset the shortfall in other financial assurances for other operations. Hence, the Bond Review Report that we examined misrepresents the overall adequacy of the financial assurances by about $31 million.

Conclusions

Having adequate financial assurances to pay for reclamation costs for BLM land disturbed by hardrock operations is critical to ensuring that the land is reclaimed if operators fail to complete the reclamation as required. Since we first reported on these issues in 2005, BLM has taken important steps to improve its processes for ensuring that adequate financial assurances are actually in place by issuing two IMs that detail the steps BLM offices should take to ensure that hardrock financial assurances are adequate. However, the Bond Review Report—a key management tool supporting these processes—still provides misleading summary-level data on the overall adequacy of BLM-held financial assurances. Without separating the operation-specific calculations from summary-level data on adequate and inadequate financial assurances, Congress and the public cannot be assured that they have an accurate picture of BLM's efforts to ensure that enough funds are in place to fully cover estimated reclamation costs at each hardrock mining operation.

Recommendation for Executive Action

To ensure that BLM's Bond Review Report provides reliable and accurate data on the total value of inadequate financial assurances, we recommend that the Secretary of the Interior direct the Director of BLM to revise LR2000 and its Bond Review Report to calculate and report the value of inadequate hardrock financial assurances on an operation-by-operation basis in order to more accurately represent the adequacy of BLM's hardrock financial assurances.

Agency Comments

We provided a draft of this report to the Department of the Interior for review and comment. Interior did not provide written comments to include in this product. However, in an e-mail received November 28, 2011, the agency liaison stated that Interior concurs with the recommendation and is beginning to implement it. Interior also provided technical comments in its e-mail response, which we incorporated as appropriate.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the appropriate congressional committees, the Secretary of the Interior, and other interested parties. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or mittala@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report were Elizabeth Erdmann (Assistant Director), Andrea W. Brown, Casey L. Brown, and Jacqueline Wade.

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Director, Natural Resources
and Environment

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United States Government Accountability Office

GAO

Report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate

June 2005

HARDROCK MINING

BLM Needs to Better Manage Financial Assurances to Guarantee Coverage of Reclamation Costs

GAO

Accountability ★ Integrity ★ Reliability

GAO-05-377

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Accountability·Integrity·Reliability

Highlights

Highlights of GAO-05-377, a report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate

Why GAO Did This Study

Since the General Mining Act of 1872, billions of dollars in hardrock minerals, such as gold, have been extracted from federal land now managed by the Department of the Interior's Bureau of Land Management (BLM). For years, some mining operators did not reclaim land, creating environmental, health, and safety risks. Beginning in 1981, federal regulations required all operators to reclaim BLM land disturbed by these operations. In 2001, federal regulations began requiring operators to provide financial assurances before they began exploration or mining operations. GAO was asked to determine the (1) types, amount, and coverage of financial assurances operators currently use; (2) extent to which financial assurance providers and others have paid to reclaim land not reclaimed by the operator since BLM began requiring financial assurances; and (3) reliability and sufficiency of BLM's automated information system (LR2000) for managing financial assurances for hardrock operations.

What GAO Recommends

GAO recommends that BLM strengthen its management of financial assurances by requiring its state office directors to develop an action plan for ensuring operators have adequate financial assurances and improving the reliability and sufficiency of LR2000. Interior did not concur with the recommendations; GAO believes they are needed to ensure adequate financial assurances.

www.gao.gov/cgi-bin/getrpt?GAO-05-377.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Robin M. Nazzaro at (202) 512-3841 or nazzaror@gao.gov.

June 2005

HARDROCK MINING

BLM Needs to Better Manage Financial Assurances to Guarantee Coverage of Reclamation Costs

What GAO Found

According to GAO's survey of BLM state offices, as of July 2004, hardrock operators were using 11 types of financial assurances, valued at about $837 million, to guarantee reclamation costs for existing hardrock operations on BLM land. Surety bonds, letters of credit, and corporate guarantees accounted for most of the assurances' value. However, these financial assurances may not fully cover all future reclamation costs for these existing hardrock operations if operators do not complete required reclamation. BLM reported that, as of July 2004, some existing hardrock operations do not have financial assurances and some have no or outdated reclamation plans and/or cost estimates, on which financial assurances should be based.

BLM identified 48 hardrock operations on BLM land that had ceased and not been reclaimed by operators since it began requiring financial assurances. BLM reported that the most recent cost estimates for 43 of these operations totaled about $136 million, with no adjustment for inflation; it did not report reclamation cost estimates for the other 5 operations. However, as of July 2004, financial assurances had paid or guaranteed $69 million and federal agencies and others had provided $10.6 million to pay for reclamation, leaving $56.4 million in reclamation costs unfunded. Financial assurances were not adequate to pay all estimated costs for required reclamation for 25 of the 48 operations because (1) some operations did not have financial assurances, despite BLM efforts in some cases to make the operators provide them; (2) some operations' financial assurances were less than the most recent reclamation cost estimates; and (3) some financial assurance providers went bankrupt. Also, cost estimates may be understated for about half of the remaining 23 operations because the estimates may not have been updated to reflect inflation or other factors.

BLM's LR2000 is not reliable and sufficient for managing financial assurances for hardrock operations because BLM staff do not always update information and LR2000 is not currently designed to track certain critical information. Specifically, staff have not entered information on each operation, and for those operations that are included, the information is not always current. Also, LR2000 does not track some critical information—operations' basic status, some types of allowable assurances, and state- and county-held financial assurances. Given these limitations, BLM's reliance on LR2000 to manage financial assurances is mixed: headquarters does not always rely on it and BLM state offices' reliance varies. To compensate for LR2000's limitations, some BLM offices use informal record-keeping systems to help manage hardrock operations and financial assurances. BLM has taken some steps and identified others to improve LR2000 for managing financial assurances for hardrock operations.

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Abbreviations

ALIS	Alaska Land Information System
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act of 1980
LR2000	Legacy Rehost 2000
RAMS	Restoration of Abandoned Mine Sites

United States Government Accountability Office
Washington, D.C. 20548

June 20, 2005

The Honorable Joseph I. Lieberman
Ranking Minority Member
Committee on Homeland Security and Governmental Affairs
United States Senate

Dear Senator Lieberman:

The General Mining Act of 1872 encouraged development of the West by allowing individuals[1] to stake claims and obtain exclusive rights to gold, silver, copper, and other valuable hardrock mineral deposits on land belonging to the United States. Since then, thousands of operators[2] have extracted billions of dollars worth of hardrock minerals from land now managed by the Department of the Interior's Bureau of Land Management (BLM)—the agency that manages the largest amount of federal land.[3] However, some operators did not reclaim BLM land disturbed by hardrock operations related to exploration, mining, and mineral processing when their operations ceased. These operators left BLM with many thousands of acres of disturbed land, some of which posed environmental and health and safety risks.

The Federal Land Policy and Management Act of 1976 states that the Secretary of the Interior shall take any action required to prevent the "unnecessary or undue degradation" of public land and its resources. BLM has developed and revised regulations and issued policy under this provision. Specifically, BLM issued regulations, effective in 1981, that require all operators to reclaim BLM land disturbed by their hardrock operations. For plan-level operations—those disturbing over 5 acres of land or those in certain designated areas, such as the national wild and scenic rivers system—operators were to have a BLM-approved plan that

[1]Individuals include citizens and people declaring an intention to become citizens.

[2]For simplicity in this report, we refer to claimants and operators as operators. An operator is the person who conducts operations in connection with exploration, mining, and processing hardrock minerals on BLM land. Both the claimant and operator are responsible for reclamation.

[3]BLM manages about 261 million acres, most of which are located in 12 western states, including Alaska. Other federal agencies, such as the Department of Agriculture's Forest Service, also manage federal land available for hardrock operations. For simplicity in this report, we refer to BLM-managed land as BLM land.

documented all the anticipated hardrock activities and all required reclamation. For notice-level operations—those causing a surface disturbance of 5 acres or less—operators were to submit notices that informed BLM of the operators' intentions, but these notices did not require BLM's approval. Plans have to be approved and notices received by BLM before the operators begin exploration or mining operations. Also, to guarantee that reclamation costs are paid, these regulations stated that BLM could require plan-level operators to provide bonds or other financial assurances in an amount specified by BLM, taking into consideration the estimated cost of reasonable stabilization and reclamation of the disturbed land.[4] BLM also could require notice-level operators with a history of noncompliance with federal regulations to submit a plan of operation and thus notice-level operators could be required to provide financial assurances. Through a formal agreement, BLM can designate a state agency as responsible for managing some or all hardrock requirements, including financial assurances.[5] Operators have used a variety of types of financial assurances, ranging from funded assurances, such as cash and negotiable U.S. securities, to corporate guarantees, which are promises to complete reclamation that are backed only by the financial strength of the operator. Despite having the regulatory authority to do so, BLM rarely required operators to provide financial assurances throughout the 1980s.[6]

In August 1990, BLM issued a policy instructing BLM officials to require operators to provide financial assurances for all plan-level operations and for notice-level operations if the operators had a record of noncompliance with federal regulations.[7] BLM generally limited financial assurances to

[4]The regulations stated that in lieu of a bond, the operator (1) could deposit in a federal depository account of the United States, directed by BLM, cash or negotiable U.S. securities or (2) show evidence of an existing bond provided for the operation pursuant to state law or regulations.

[5]Financial assurances could have been payable to either BLM or the designated state agency, depending on the terms of the agreement between BLM and the state, which are to coordinate efforts and avoid duplication of financial assurances and other requirements. These agreements may establish joint federal-state program management and enforcement of hardrock operations on BLM land or assign primary responsibility for management to either BLM or the state.

[6]GAO, *Importance of Financial Guarantees for Ensuring Reclamation of Federal Lands*, GAO/T-RCED-89-13 (Washington, D.C.: Mar. 7, 1989).

[7]BLM Instruction Memorandum No. 90-582, *Modification of Bonding Policy for Plans of Operation Authorized by 43 CFR 3809* (Aug. 14, 1990).

$1,000 per acre for exploration and $2,000 per acre for mining operations. However, BLM required operators using leaching chemicals, such as cyanide and sulfuric acid, to extract minerals from ore and required operators with a record of noncompliance to provide financial assurances to cover all estimated reclamation costs for hardrock operations. For these operations, BLM was to estimate the cost of reclamation and add to it the reasonable administrative costs that would be incurred if reclamation were done under contract. However, BLM did not further specify the types of financial assurances that could or could not be used.

Concerns about the types of financial assurance and the lack of financial assurances requirements for all notice-level operations, among other things, prompted BLM to establish new regulations in 2001. The new regulations require operators to include reclamation plans and cost estimates in the notices and plans of operation that they submit to BLM for acceptance or approval. The new regulations require that before exploration or mining operations begin, operators must provide financial assurances to cover all estimated reclamation costs for both notice- and plan-level hardrock operations. In addition, BLM must periodically review the estimated cost of reclamation to determine if the cost estimates should be updated. The regulations also specify the types of acceptable financial assurances and prohibit new corporate guarantees and increases or transfers in the corporate guarantees used under BLM's previous policy. The financial assurance provisions of the new regulations applied immediately—on January 20, 2001, for new notice- and plan-level operations and on January 20, 2003, for extended notice-level operations, unless the notice was modified.[8] Plans of operations that were approved before January 20, 2001, were required to have financial assurances in place no later than November 20, 2001.

Under federal regulations, if an operator fails to complete required reclamation, BLM or the designated state agency may take steps to obtain funds from the financial assurance providers. Providers then have the option of (1) relinquishing the amount guaranteed by the financial assurance to BLM or the designated state agency, which would then use the funds for reclamation, or (2) completing the reclamation themselves. The regulations also give BLM the authority to take steps, such as issuing

[8]Before the 2001 regulations, notice-level operations did not have an expiration date. The 2001 regulations stated that all notices filed on or after January 20, 2001, would be extended only for 2 years, after which they would have to be renewed or would expire.

noncompliance and suspension orders, and revoking plans of operation, if operators do not comply with the financial assurance or other regulatory requirements.

BLM established an automated information system—the Legacy Rehost 2000 (LR2000)—in 1999 that combined into one system several existing systems that collect and store information on the programs and land BLM manages. LR2000 is composed of a number of subsystems, some of which contain information on hardrock operations and financial assurances.

You asked us to determine the (1) types, amount, and coverage of financial assurances operators currently use to guarantee reclamation costs, (2) amount that financial assurance providers and others have paid to reclaim operations that had ceased and not been reclaimed since BLM began requiring financial assurances and the estimated costs of completing reclamation for such operations, and (3) reliability and sufficiency of BLM's LR2000 for managing financial assurances for hardrock operations.

We did not rely on LR2000 information to address these objectives, but instead designed two surveys to obtain information from BLM's state and field offices because they maintain the case files and other specific information on hardrock operations. We asked the 12 BLM state offices that manage BLM programs across the United States to complete surveys for each state in their jurisdiction with hardrock operations.[9] We verified the information in the surveys through discussions with BLM officials in two state and four field offices and by reviewing case files and other documents. In the first survey, which focused on states' experiences with hardrock operations, we asked these 12 offices to provide information on (1) the number of existing hardrock operations for each state within their jurisdiction,[10] (2) the types and the amounts of financial assurances provided for existing hardrock operations in each state, (3) their views on

[9]Some of the 12 BLM state offices manage BLM programs in more than one state. For example, the BLM Montana state office manages BLM programs in Montana, North Dakota, and South Dakota, and the BLM Oregon state office manages BLM programs in Oregon and Washington.

[10]In our survey instructions, we defined existing operations to include those hardrock operations that (1) are pending BLM acceptance, (2) have been accepted but operations have not begun, (3) are ongoing, and (4) are temporarily inactive. While federal regulations require reclamation plans and cost estimates for all of these operations, they do not require financial assurances for those pending BLM acceptance or those that have been accepted but have not begun exploration or mining operations.

the effectiveness of the various types of financial assurances, (4) their views on the reliability and sufficiency of hardrock operation data contained in LR2000, and (5) their use of LR2000 for managing hardrock operations and financial assurances in their states. In the second survey, which focused on selected hardrock operations, we asked these 12 offices to provide detailed information on hardrock operations within their jurisdiction that met both of the following criteria: the operator (1) ceased operations after the requirement for financial assurances went into effect—August 1990 for plan-level operations, January 2001 for new notice-level operations, and January 2003 for existing notice-level operations and (2) failed to complete the required reclamation. We used information in this survey to determine the estimated reclamation costs and the adequacy of financial assurances for reclaiming each hardrock operation that BLM identified as meeting these criteria. We took steps to determine whether BLM officials identified all hardrock operations that met these criteria, such as comparing BLM's list of operations with operations identified by others. To the extent that BLM did not identify all hardrock operations that had ceased and not been reclaimed by the operator, the information it reported to us would be understated. In addition, we did not collect information on the thousands of ceased hardrock operations since 1872 that did not require financial assurances and therefore fell outside the scope of this review.

We also took steps to understand BLM's management and oversight of hardrock operations and the use of financial assurances to ensure reclamation. We reviewed BLM regulations, documents, and independent studies relevant to hardrock operations and financial assurances. We also discussed these issues with BLM officials at headquarters and in selected state and field offices. To understand the relationship between BLM and state agencies responsible for overseeing hardrock operations, we met with BLM state office and state agency officials in several states, and reviewed relevant memorandums of understanding and other agreements. To understand the reliability and sufficiency of LR2000, we spoke with BLM officials responsible for administering the system and staff in selected BLM state and field offices who enter information into the system and who use the system to manage hardrock operations and financial assurances. We also discussed relevant hardrock operation and financial assurance issues with experts and representatives from the mining industry, academia, and environmental groups. Finally, to better understand hardrock operations and reclamation requirements, we visited five mining operations in Nevada and Montana. Appendix I provides detailed information on our scope and methodology.

We conducted our review from October 2003 through May 2005 in accordance with generally accepted government auditing standards, which included an assessment of data reliability.

Results in Brief

As of July 2004, hardrock operators were using 11 different types of financial assurances, valued at approximately $837 million, to guarantee reclamation costs associated with approximately 2,500 existing hardrock operations on BLM land in 12 western states, according to our analysis of survey results. Surety bonds ($384 million), letters of credit ($238 million), and corporate guarantees ($204 million) accounted for almost all of the $837 million in financial assurances. However, these financial assurances may not fully cover all future reclamation costs for these existing hardrock operations if operators do not complete required reclamation. BLM reported that, as of July 2004, some existing hardrock operations do not have financial assurances, and some have no or outdated reclamation plans and/or cost estimates on which financial assurances should be based.

BLM identified 48 hardrock operations on its land that had ceased and not been reclaimed by operators since it began requiring financial assurances. BLM reported that the most recent cost estimates for reclamation required by applicable reclamation plans and federal regulations for 43 of the 48 operations totaled about $136 million, with no adjustment for inflation; it did not report reclamation cost estimates for the other 5 operations. However, as of July 2004, the BLM-required financial assurances had provided or were guaranteeing $69 million, and federal agencies and others had provided $10.6 million to pay the estimated costs for required reclamation for the 48 operations, leaving $56.4 million in unfunded reclamation costs. Financial assurances were not adequate to pay all estimated costs for required reclamation for 25 of the 48 ceased operations for several reasons. First, operators did not provide required financial assurances for 10 operations, despite BLM's efforts in some cases to make the operators provide them. Second, financial assurances that were provided were less than the most recent reclamation cost estimates for 13 operations. Third, financial assurance providers went bankrupt and did not have the funds to pay all reclamation costs for two other operations. In addition, cost estimates may be understated for about half of the remaining 23 operations because the cost estimates may not have been updated to reflect inflation or other factors that could increase reclamation costs. Furthermore, the $136 million cost estimate is understated to the extent that BLM did not identify or report information in response to our survey on all hardrock operations that had ceased and not been reclaimed by operators, as required. For example, Oregon's BLM state office estimated that 20 notice-level operations in Washington state had ceased and not been reclaimed, but neither the Oregon BLM state office nor its field offices completed our surveys for these operations. Clearly, the $136 million estimate would be higher if BLM's state or field offices had reported this information. Finally, according to BLM officials, required reclamation had been completed for only 5 of the 48 operations as of July 2004, but they believe it is likely that required reclamation will be completed on an additional 28 operations sometime in the future.

BLM's LR2000 is not reliable and sufficient for managing financial assurances that guarantee coverage of reclamation costs for BLM land disturbed by hardrock operations because staff do not always update information, and LR2000 is not currently designed to track certain critical information. Specifically, staff have not entered information on each hardrock operation and, for those hardrock operations included in LR2000, the information is not always current. Moreover, LR2000 does not track some information on hardrock operations and their associated financial assurances that we believe is critical for effectively managing financial assurances. This information includes the basic status of operations, such as whether they are ongoing or have ceased and should be reclaimed; some types of allowable financial assurances; and state- and county-held financial assurances. Given these limitations, it is not surprising that BLM's reliance on LR2000 to manage financial assurances is mixed. Specifically, BLM headquarters does not always rely on the system, and BLM state offices' reliance varies—in four states with hardrock operations, the state and field offices relied on the system to little or no extent; in eight states, to a moderate or some extent; and in one state, to a very great extent. In part to compensate for LR2000's limitations, some BLM state and field offices use informal record-keeping systems to help manage hardrock operations and financial assurances. BLM has taken some steps and identified others to improve LR2000 for managing financial assurances for hardrock operations.

To ensure that hardrock operators on BLM land have adequate financial assurances, we are making recommendations to the Secretary of the Interior to strengthen BLM's management of financial assurances for hardrock operations on its land by directing the Director of BLM to (1) require state office directors to develop an action plan for ensuring that operators have adequate financial assurances and (2) improve the reliability and sufficiency of BLM's automated information system.

In responding to a draft of this report, Interior stated that it appreciated the advice and critical assessment we provided on BLM's management of financial assurances required for hardrock operations. However, without acknowledging or addressing specific deficiencies identified in our report, Interior disagreed with our recommendations, stating that guidance already issued ensured that proper management attention was being provided. In the face of considerable evidence in this report to the contrary, Interior's assertions that all is well and that recently issued policy and guidance ensure that adequate financial assurances are in place seems hard to comprehend. Accordingly, we continue to believe that our recommendations are warranted to ensure that adequate financial assurances are in place. Interior's letter and our comments are included in appendix IV.

Background

BLM is responsible for managing approximately 261 million acres of public land, over 99 percent of which is located in 12 western states, including Alaska. Approximately 90 percent of this land is open to the public for hardrock mineral exploration and mining. Less than one-tenth of 1 percent of BLM land is affected by existing hardrock operations. Figure 1 shows the BLM land available for hardrock operations.

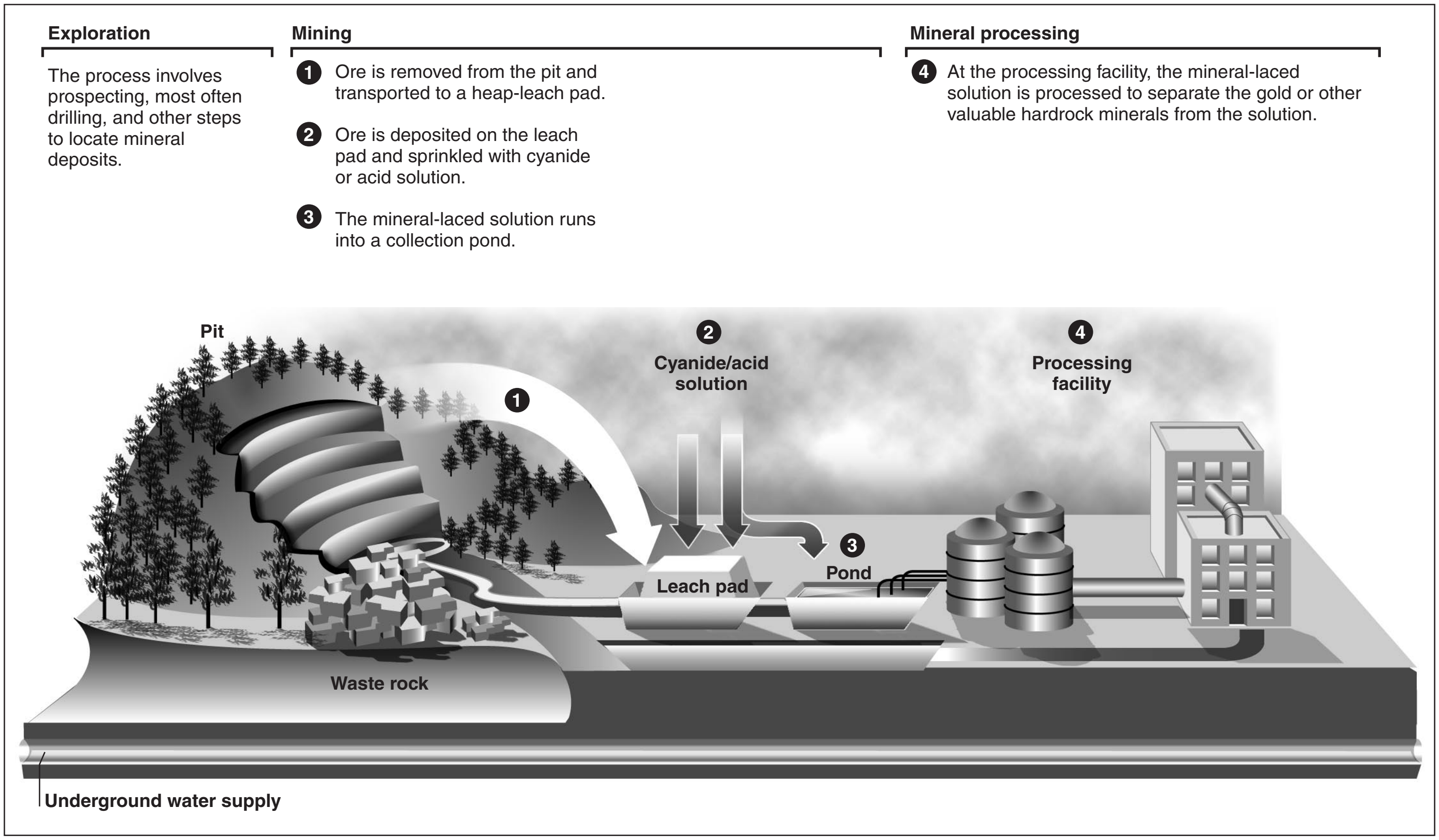
Figure 1: BLM-Managed Land

Source: BLM.

How Hardrock Operations Work and the Importance of Reclamation

Hardrock operations consist of three primary stages—exploration, mining, and mineral processing. Operators are responsible for reclaiming the land disturbed by such operations at the earliest economically and technically feasible time, if this land will not be further disturbed. Exploration involves prospecting and other steps to locate mineral deposits. Drilling is the most common exploration tool for identifying the extent, quantity, and quality of minerals within an area. The mining phase includes developing the mining infrastructure (water, power, buildings, and roads) and extracting the minerals. Mineral extraction generally entails drilling, blasting, and hauling ore from pit areas to processing areas. To process minerals, operators prepare the ore by crushing or grinding it to extract minerals. The material left after the minerals are extracted—tailings (a combination of fluid and rock particles)—is then disposed of, often in a nearby pile. In addition, some operators use a leaching process to recover microscopic hardrock minerals from heaps of crushed ore by percolating solvent (such as cyanide for gold and sulfuric acid for copper) through the heap of ore. Through this heap-leaching process, the minerals adhere to the solvent as it runs through the leach heap and into a collection pond. The mineral-laced solution is then taken from the collection pond to the processing facility, where the valuable minerals are separated from the solution for further refinement. Figure 2 provides an overview of the three stages of a hardrock operation using a heap-leaching process.

Figure 2: Overview of a Hardrock Operation Using a Heap-Leaching Process



Source: GAO analysis of information provided by BLM, the National Research Council, and others.

At the earliest feasible time, operators are required to reclaim BLM land that will not be further disturbed to prevent or control on-site or off-site damage. Reclamation practices vary by type of operation and by applicable federal, state, and local requirements. However, reclamation generally involves resloping pit walls to minimize erosion, removing or stabilizing buildings and other structures to reduce safety risks, removing mining roads to prevent damage from future traffic, and capping and revegetating leach heaps, tailings, and waste rock piles to control erosion and minimize the potential for contamination of groundwater from acid rock drainage and other potential water pollution problems.[11] Addressing potential water pollution problems may involve long-term monitoring and treatment. Reclamation costs for hardrock mining operations vary by type and size of operation. For example, the costs of plugging holes at an exploration site are usually minimal. Conversely, reclamation costs for large mining operations using leaching practices can be in the tens of millions of dollars.

Laws and Regulations for Hardrock Operations

Hardrock operations on BLM land are regulated by federal and state laws. Under the General Mining Act of 1872 (Mining Act),[12] an individual or corporation can establish a claim to any hardrock mineral on public land.[13] Upon recording a mining claim with BLM, the claimant must pay an initial $25 location fee and a $100 maintenance fee annually per claim;[14] the claimant is not required to pay royalties on any hardrock minerals extracted. The Mining Act was designed to encourage the settlement and development of the West; it was not designed to regulate the associated environmental effects of mining. The number of hardrock operations left abandoned throughout the West after operations ceased is not known but is estimated to be in the hundreds of thousands, many of which pose environmental, health, and safety risks. Until Congress passed the Federal Land Policy and Management Act of 1976 (FLPMA),[15] development of hardrock minerals on public land remained largely unregulated. FLPMA

[11]Acid drainage occurs when water and oxygen contact rock with sulfides and sulfates and form acids that can be released into the environment.

[12]30 U.S.C. § 22.

[13]Under U.S. mining laws, minerals are classified as locatable, leasable, or saleable. Locatable minerals—often referred to as hardrock minerals—include, for example, copper, lead, zinc, magnesium, gold, silver, and uranium. Only hardrock minerals continue to be "claimed" under the Mining Act. Leasable minerals include, for example, oil, gas, and coal. The Mineral Leasing Act of 1920, 41 Stat. 437 (codified at 30 U.S.C. § 181) created a leasing system for coal, gas, oil and other fuels, and chemical minerals. Saleable minerals include, for example, common sand, stone, and gravel. In 1955, the Multiple Use Mining Act of 1955, 69 Stat. 367 (codified at 30 U.S.C. § 601) removed common varieties of sand, stone, and gravel from development under the Mining Act.

[14] The location and maintenance fees were reduced from $30 and $125, respectively, by the Consolidated Appropriations Act, 2005, and will not be reinstated until, among other things, BLM establishes a nationwide system to track the length of time between submission and approval of a hardrock plan of operation.

[15]Pub. L. No. 94-579 (1976) (codified at 43 U.S.C. § 1701).

states that the Secretary of the Interior shall take any action necessary to prevent “unnecessary or undue degradation” of public land.[16]

Under FLPMA, BLM has developed and revised regulations and issued policies to prevent unnecessary or undue degradation of BLM land from hardrock operations. BLM issued regulations that took effect in 1981 on how these operations were to be conducted.[17] Named for their location in the *Code of Federal Regulations*, the “3809” regulations classify surface disturbance generated by hardrock operations into three categories: casual use, notice-level operations, and plan-level operations. For all three operation levels, the operator must prevent unnecessary and undue degradation and complete reclamation at the earliest feasible time. BLM issued the revised 3809 regulations, effective in part in January 2001 that, among other things, changed the definition of the types of operations, modified the reclamation requirements, and strengthened the financial assurance requirements. Table 1 describes each type of operation under both the old and new regulations.

[16]In addition, hardrock mining operations on BLM land may be subject to a variety of federal environmental laws, such as the National Environmental Policy Act, the Endangered Species Act, and the Clean Water Act. States can also pass their own laws for regulating hardrock operations in their state, including operations on BLM land.

[17]BLM’s Surface Management Program for hardrock operations began in 1981 with the issuance of these regulations (43 C.F.R. 3809), which apply only to hardrock operations.

Table 1: Description of Types of Hardrock Operations under 1981 and 2001 BLM Regulations

Type of operation	Description under 1981 regulations	Description under 2001 regulations
Casual use	• Activities ordinarily resulting in only negligible disturbance of public land and resources • Does not require the operator to notify BLM	• Activities ordinarily resulting in no or negligible disturbance of public land or resources • Does not require the operator to notify BLM
Notice-level operation	• Any operation that causes a surface disturbance of 5 acres or less • Operator must notify BLM 15 calendar days before commencing operations, but BLM does not approve the notice	• Exploration operations that disturb 5 acres or less of public land • Operator must notify BLM 15 calendar days in advance of causing surface disturbance, but BLM does not approve the notice
Plan-level operation	• Any operation that disturbs more than 5 acres or any operation, other than casual use, in BLM special status areas, such as the national wild and scenic river system • Plans of operations must be approved by BLM	• Any operation greater than casual use, except for notice-level operations, and operations causing surface disturbance greater than casual use in special status areas, such as designated wilderness areas and national monuments • Plans of operations must be approved by BLM[a]

Source: 1981 and 2001 federal regulations.

[a]Other plan-level operations include bulk sampling operations, in which 1,000 tons or more of presumed ore for testing will be removed.

While the performance standards for reclamation under the 1981 and 2001 regulations remain the same, the 2001 regulations specifically identified the components involved in reclamation. For standards under both regulations, the operator of a notice- or plan-level operation must reclaim the disturbed land at the earliest time that is economically and technically feasible, except to the extent necessary to preserve evidence of the presence of minerals, by taking reasonable measures to prevent or control on-site and off-site damage to federal land. Reclamation must include the following actions:

- saving topsoil to be applied after reshaping disturbed areas;
- taking measures to control erosion, landslides, and water runoff;
- taking measures to isolate, remove, or control toxic materials;
- reshaping the area disturbed, applying the topsoil, and revegetating disturbed areas, where reasonably practicable; and
- rehabilitating fisheries and wildlife habitat.

The 2001 regulations specified that, as applicable, reclamation components include:

- isolating, controlling, or removing acid-forming and deleterious substances;
- regrading and reshaping the disturbed land to conform with adjacent landforms, facilitating revegetation, controlling drainage, and minimizing erosion;
- placing growth medium and establishing self-sustaining vegetation;
- removing or stabilizing buildings, structures, or other support facilities;
- plugging drill holes and closing underground workings; and
- providing for post-mining monitoring, maintenance, or treatment.

The 2001 regulations also significantly strengthened the financial assurance requirements for hardrock mining operations. Under the 1981 regulations, BLM had the option of requiring an operator to obtain a bond or other financial assurances for plan-level hardrock operations and for notice-level operations where the operator had a record of noncompliance.[18] However, BLM rarely exercised this option.[19] In 1990, BLM instructed its officials to require operators of plan-level operations to provide (1) financial assurances of $1,000 per acre for exploration and $2,000 per acre for mining and (2) financial assurances for all estimated reclamation costs for operations that used leaching chemicals and for operators with a record of noncompliance. Under the 2001 regulations, BLM requires all notice- and plan-level hardrock operators to provide financial assurances that cover all estimated reclamation costs for all plan- and notice-level operations before exploration or mining operations begin. Casual-use operations do not have to provide financial assurances.

The 2001 regulations amended the types of financial assurances that can be used. The 1981 regulations identified three types of acceptable financial assurances—bonds, cash, and negotiable U.S. securities. BLM could also accept evidence of an existing bond pursuant to state law or regulations if BLM determined that the coverage would be equivalent to the amount that

[18]For notice-level operations with a history of noncompliance, BLM had to first require the operator to file a plan of operation.

[19]GAO/T-RCED-89-13.

would be required by BLM. Some operations used corporate guarantees, which were allowable under state laws and regulations. In contrast, the 2001 regulations prohibit the use of corporate guarantees for new operations and state that corporate guarantees currently in use under an approved BLM and state agreement cannot be increased or transferred. The 2001 regulations specify the following types of financial assurances as acceptable:

- surety bonds that meet the requirements of U.S. Treasury Circular 570;[20]
- cash in an amount equal to the required dollar amount of the financial assurance and maintained in a federal depository account of the U.S. Treasury by BLM;
- irrevocable letters of credit from a bank or other financial institution organized or authorized to transact business in the United States;
- certificates of deposit or savings accounts not in excess of the Federal Deposit Insurance Corporation's maximum insurable amount;
- negotiable U.S., state, and municipal securities or bonds with a market value of at least the required dollar amount of the financial assurance maintained in a Securities Investors Protection Corporation insured trust account by a licensed securities brokerage firm for the benefit of the Secretary of the Interior;[21]
- investment-grade securities that (1) have a Standard and Poor's rating of AAA or AA, or an equivalent rating from another nationally recognized securities rating service, (2) have a market value of at least the required dollar amount of the financial assurance, and (3) are maintained in a Securities Investors Protection Corporation insured trust account by a licensed securities brokerage firm for the benefit of the Secretary of the Interior;

[20]The Department of the Treasury reviews insurance companies to determine whether they qualify to underwrite insurance and annually publishes the list of qualified companies in Treasury Circular 570.

[21]The Securities Investors Protection Corporation is a nonprofit corporation created by Congress and funded by its member securities brokers and dealers to protect investors by returning cash, stock, and other securities if the brokerage firm goes bankrupt.

- certain types of insurance underwritten by a company having an A.M. Best rating of "superior" or an equivalent rating from another nationally recognized insurance rating service;

- evidence of an existing financial assurance under state law or regulations, as long as the financial assurance is held or approved by the state agency for the same operations covered by the notice or plan of operation, has a value equal to the required amount, and is redeemable by BLM. These financial assurances can include any of the above instruments. In addition, they can include state bond pools,[22] as well as corporate guarantees that existed on January 20, 2001, under an approved BLM and state agreement; or

- trust funds or other funding mechanisms available to BLM. The 2001 regulations require operators, when BLM identifies a need for it, to establish a trust fund or other funding mechanism to ensure continuation of long-term treatment to achieve water quality standards and for other long-term, post-mining maintenance requirements.

Finally, under the 2001 regulations, all notice- and plan-level operators must submit a reclamation plan and an associated cost estimate with its notice or plan of operation and any modifications or renewals. The financial assurance amount is based on the cost estimate. Furthermore, the associated cost estimate must reflect the cost to BLM as if the agency had to contract with a third party to complete reclamation. In addition, BLM issued guidance in February 2003, which was revised in March 2004, setting forth factors that should be considered in developing cost estimates. For example, estimates should include administrative and other indirect costs. The regulations require BLM to periodically review the estimates to determine if the estimate should be updated to reflect any necessary changes in the cost of reclaiming the operation.

BLM's Management and Oversight of Financial Assurances

BLM headquarters manages and oversees hardrock operations as well as its other programs, primarily through its headquarters, 12 state offices, and 157 field offices. Within headquarters, the Minerals, Realty, and Resource

[22] The state must agree that, upon BLM's request, it will use part of the bond pool to meet reclamation obligations on public land. In addition, the BLM state office director must determine that the bond pool provides the equivalent level of protection as otherwise required.

Protection group is responsible for administering the mining laws and establishing hardrock operations policies. This office is also responsible for evaluating the effectiveness of policy implementation at the state- and field-office levels. For example, in 2004, BLM conducted a survey of 18 of its 157 field offices to determine, among other things, whether operators had obtained financial assurances as required.

Each state office is headed by a state director who reports to the Director of BLM in headquarters. BLM state office delegations of responsibilities for financial assurances vary from state to state. For example, some state offices verify the authenticity of the financial assurance and confirm that financial assurances are payable to BLM. The state offices manage BLM programs and land in the geographic areas that generally conform to the boundary of one or more states. The state offices are Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Wyoming, and Eastern States. BLM has little land in the east and the Eastern state office is responsible for all of the states in the east. Figure 3 shows the boundaries of the 12 BLM state offices.

Figure 3: The Boundaries of the 12 BLM State Offices

Source: GAO analysis of BLM data.

The 157 BLM field offices, which are headed by field managers who report to the state directors, are responsible for implementing several BLM programs and policies, including many aspects of the hardrock mining program. The field offices maintain case files on each hardrock operation in their jurisdiction. Field office staffs are generally responsible for, among other things, (1) reviewing notices and plans of operations, along with associated reclamation plans and cost estimates; (2) determining the amount of financial assurances needed to pay reclamation costs; and (3) inspecting hardrock operations for compliance with regulations.

In addition, BLM has specialized centers, which are organizationally affiliated with headquarters, to carry out a variety of activities. One of these centers, near Denver, Colorado, administers BLM's LR2000, which is an automated information system used to collect and store information on BLM land and programs, including hardrock operations. LR2000 includes several subsystems that contain information on hardrock operations and the financial assurances provided by operators. Specifically, the Case Recordation System contains information on hardrock operations, such as the name and address of the operator; the location, type, and size of the operation; and inspection information. The other subsystem—the Bonding and Surety System—contains information on financial assurances, such as the types and amounts of financial assurances and the names of the providers. BLM state and field offices both enter data into LR2000 and thus are primarily responsible for the data's accuracy and completeness. In most instances, field offices are responsible for entering data about hardrock operations into the Case Recordation System, while BLM state offices are more often responsible for entering data about financial assurances into the Bonding and Surety System.

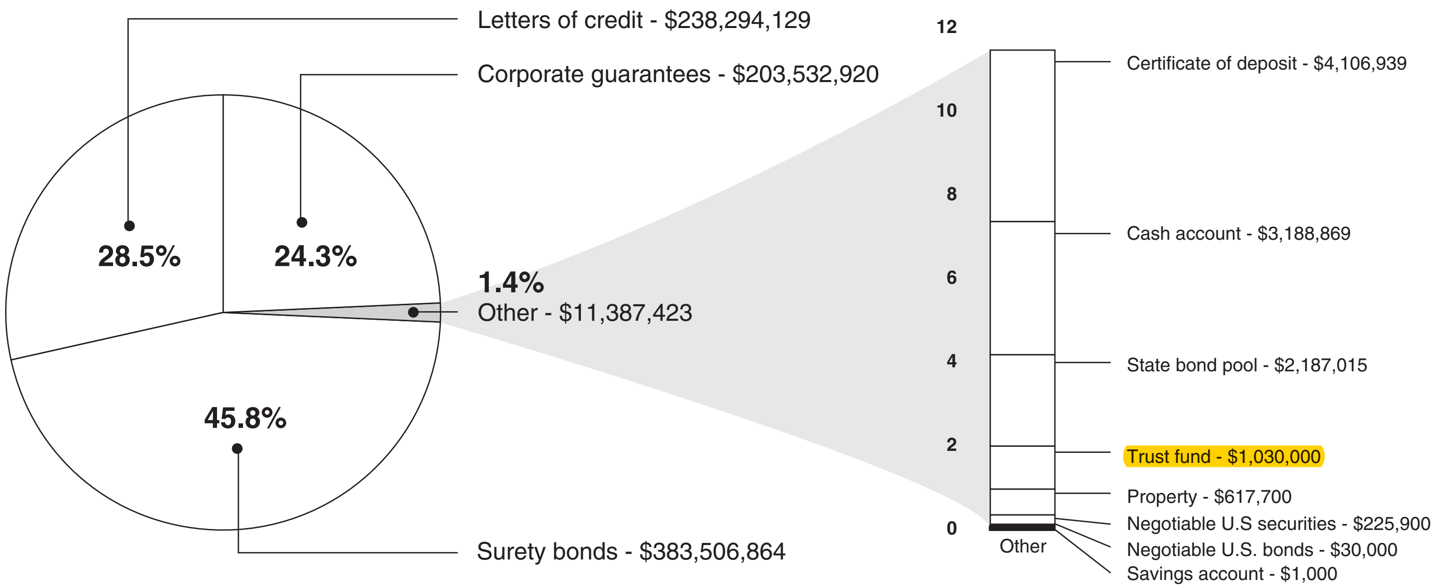
BLM Identified 11 Types of Financial Assurances Valued at Approximately $837 Million, but These Financial Assurances May Not Fully Cover Reclamation Costs

BLM reported that, as of July 2004, hardrock operators were using 11 types of financial assurances, valued at approximately $837 million, to cover reclamation costs on BLM land in 12 western states. Surety bonds, letters of credit, and corporate guarantees accounted for almost 99 percent of this $837 million. However, these financial assurances may not fully cover all future reclamation costs if operators fail to complete required reclamation. BLM reported that it had approximately 2,500 existing notice- and plan-level hardrock operations as of July 2004 and that some of these operations do not have financial assurances, and some have no or outdated reclamation plans and/or cost estimates on which financial assurances should be based. While BLM state office explanations indicated that financial assurances are not yet required for some operations, other explanations indicated that some operations may not be complying with BLM's requirements.

Surety Bonds, Letters of Credit, and Corporate Guarantees Are the Financial Assurances Currently Used to Cover Most of the Estimated Reclamation Costs

As of July 2004, operators were using 11 different types of financial assurances valued at approximately $837 million to guarantee reclamation costs for BLM land disturbed by hardrock operations, according to our analysis of survey results. Almost 99 percent of the $837 million in financial assurances is in the form of surety bonds, letters of credit, and corporate guarantees. Figure 4 shows the types of financial assurances used, their value, and the percentage of the total value accounted for by each type.

Figure 4: Types of Financial Assurances Used, Value, and Percentage of Total Value



Source: GAO analysis of BLM survey responses.

BLM reported that all of the current notice- and plan-level hardrock operations on BLM land—2,490 operations—are located in 12 western states.[23] Table 2 shows the states with existing hardrock operations and the types and amounts of financial assurances operators are currently using in each state.

[23]BLM reported a total of 1,704 notice-level operations and 786 plan-level hardrock operations in these 12 states. The BLM Montana state office, which also has jurisdiction over North Dakota and South Dakota, reported that South Dakota has only two hardrock operations and that both have ceased operating and are being reclaimed by the operators. For this reason, South Dakota was not included as a state with existing hardrock operations.

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Table 2: Type and Amount of Financial Assurances for 12 States with Existing Hardrock Operations, as of July 2004

State	Number of operations	Surety bonds	Letters of credit	Corporate guarantees
Alaska	240	$0	$0	$0
Arizona	185	3,802,763	571,907	0
California	303	3,986,000	737,000	0
Colorado	132	1,600,000	19,313	0
Idaho	55	242,340	305,050	0
Montana	180	103,831,894	3,996,803	0
New Mexico	35	3,307,406	921,293	0
Nevada	774	230,769,986	192,058,810	200,000,000
Oregon	175	34,000	0	0
Utah	216	1,719,343	365,699	122,000
Washington	139	[a]	[a]	[a]
Wyoming	56	34,213,132	39,318,254	3,410,920
Total	**2,490**	**$383,506,864**	**$238,294,129**	**$203,532,920**

Certificates of deposit	Cash accounts	State bond pools	Trust funds	Property	Negotiable U.S. securities	Negotiable U.S. bonds	Savings accounts	Total
$0	$0	$1,000,000	$0	$0	$0	$0	$0	**$1,000,000**
113,085	239,343	0	0	0	45,900	0	0	**4,772,998**
184,000	27,800	0	0	0	0	0	1,000	**4,935,800**
116,000	1,600	0	0	0	0	0	0	**1,736,913**
140,969	77,173	0	0	0	0	30,000	0	**795,532**
708,081	153,452	0	0	617,700	0	0	0	**109,307,930**
61,009	9,281	0	0	0	0	0	0	**4,308,289**
1,931,761	2,526,893	1,187,015	1,030,000	0	180,000	0	0	**629,684,465**
16,000	2,000	0	0	0	0	0	0	**52,000**
393,034	128,109	0	0	0	0	0	0	**2,728,185**
[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	**[a]**
443,000	23,218	0	0	0	0	0	0	**77,408,524**
$4,106,939	**$3,188,869**	**$2,187,015**	**$1,030,000**	**$617,700**	**$225,900**	**$30,000**	**$1,000**	**$836,721,336**

Source: GAO analysis of BLM survey responses.

[a]The BLM Oregon office did not provide information on the amount of financial assurances available to reclaim the existing hardrock operations it identified in Washington state on BLM land. The office reported no individual bonds are used for operations in Washington state, but that a statewide bond is held by the Washington state Department of Ecology.

The information below describes the types of financial assurances currently being used and BLM state offices' views of the effectiveness of these assurances in minimizing losses to the federal government if the operator does not complete reclamation.

Surety bonds. Surety bonds are a third party guarantee that an operator purchases from an insurance company. As a third party with possible financial responsibility for reclamation, the insurance company has a strong incentive to monitor the operator's environmental safety record and efforts to fulfill reclamation obligations. If the operator does not complete required reclamation once operations cease, the insurance company has the option of performing the reclamation work or paying the financial assurance value to BLM or the designated state agency for reclamation. According to industry representatives and experts, insurance companies are amenable to issuing surety bonds for hardrock operations for predictable reclamation activities that will occur in a defined time frame. As table 2 shows, operators in 10 of the 12 states with hardrock operations are using surety bonds. In 7 of these 10 states, BLM state offices rated surety bonds as “effective” or “very effective” for minimizing losses to the federal government; in the other three states, BLM state offices reported that they had no experience (that is, they had not taken steps to obtain funds from the financial assurance provider) in using this type of assurance in minimizing losses to the federal government.[24]

Letters of credit. Letters of credit, which hardrock operators typically purchase from a bank or other financial institution, require the institution to pay BLM or the designated state agency the value of the letter of credit if the purchaser does not complete the required reclamation. Depending on the financial condition of the operator, the financial institution may require a deposit or collateral. Letters of credit are used in nine states with hardrock operations. In seven of these states, BLM state offices rated letters of credit as “moderately effective” or “very effective” in minimizing losses to the federal government; in the other two states, the BLM state offices reported that they had no experience in using this type of assurance in minimizing losses to the federal government.

Corporate guarantees. Corporate guarantees are promises by operators, sometimes accompanied by a test of financial stability, to pay reclamation costs, but do not require that funds be set aside to pay such costs. Although BLM prohibits new corporate guarantees in its 2001 regulations, 3 of the 12 states had existing corporate guarantees that were to cover almost one fourth of the total estimated reclamation costs, as of July 2004. Most of these corporate guarantees—$200 million of the approximately $204 million—are for operations in Nevada. The Nevada BLM state office rated corporate guarantees as “not effective” for minimizing losses to the federal government. Operators in Utah and Wyoming are also using corporate guarantees, although in relatively smaller amounts of $122,000 and $3.4 million, respectively. The Utah BLM state office reported that it has no experience in using this type of financial assurance to minimize losses to the federal government and therefore did not rate the effectiveness of this type of assurance. The Wyoming BLM state office rated corporate guarantees as a “very effective” financial assurance, although the office

[24]We asked each of the 12 BLM state offices, for each state within their jurisdiction with hardrock operations, to rate the effectiveness of each type of financial assurance in minimizing losses to the federal government based on their experience. The rating categories were very effective, effective, moderately effective, somewhat effective, and not effective.

reported it had no experience with an operation that had this type of financial assurance and failed to reclaim the land.

State bond pools. Operators in two states—Alaska and Nevada—use state bond pools to cover reclamation costs. According to Alaska BLM state office officials, all hardrock operators on BLM land in Alaska participate in the state bond pool.[25] Operators in the Alaska bond pool do not develop individual cost estimates for reclaiming the land disturbed by their operations. The bond pool, administered by the Alaska Department of Natural Resources, had $1 million in reclamation funds as of July 2004.[26] According to Alaska BLM state office officials, if the bond pool funds are not sufficient to cover reclamation costs, the state of Alaska has agreed to cover any additional costs. The Alaska BLM state office rated the bond pool as “effective” in minimizing financial losses to the federal government. The office also reported that to date no requests or claims have been initiated to use bond pool funds for reclamation because either BLM has successfully negotiated with the operators to have the operations reclaimed, or the operations are pending further action.

The Nevada reclamation bond pool—which had about $1.2 million as of July 2004—is open to operators on BLM or private lands. The state’s Division of Minerals administers this pool that was designed to help smaller operations that may have difficulty securing other forms of financial assurances. The Nevada bond pool does not establish the amount of the assurance required for each operation; this is typically done by BLM for operations on BLM land. The maximum bond amount for a participant is

[25]The cost to an operator to participate in the Alaska state bond pool is calculated by multiplying the total number of acres to be disturbed by an operator by $150.00. The $150.00 includes a refundable reclamation deposit of $112.50 per acre and an annual nonrefundable administrative fee of $37.50 per acre. The fees for entry into the Alaska state bond pool were determined to be the average costs for reclamation per acre in the state for placer operations—those that involve extracting gold or other minerals from stream or beach sediment by gravity using water separation and typically do not use leaching chemicals. Operations using cyanide or other chemicals for leaching are not authorized to use the Alaska state bond pool and must secure another form of financial assurance.

[26]The Alaska bond pool covers all hardrock operations on federal, state, and private lands in the state.

$3 million.[27] The Nevada BLM state office rated the state's bond pool as "very effective" in minimizing financial losses but noted that the pool had not been used as of our July 2004 survey. Subsequently, the office told us that the bond pool was used for the first time in late 2004, when BLM requested funds from the pool to reclaim a hardrock operation.

Certificates of deposit and savings accounts. Certificates of deposit and savings accounts can be used to guarantee reclamation costs but must not exceed the maximum amount insured by the Federal Deposit Insurance Corporation. Operators use certificates of deposit in 10 of the 12 states with hardrock operations. BLM state offices in 7 of these 10 states rated these assurances as "effective" or "very effective" in minimizing losses to the federal government. Another state office rated this type of assurances as "moderately effective" and noted that care must be given to ensure that BLM is the beneficiary of the certificate. In the other two states, the BLM state offices reported that they had no experience with this type of assurance in minimizing losses to the federal government. Operators in one state are using savings accounts, and the BLM rated savings accounts as "very effective" for minimizing losses to the federal government.

Cash accounts. Operators provide cash to BLM to guarantee reclamation costs, and BLM must deposit and maintain this cash in a federal depository account of the U.S. Treasury. Operators in 10 of the 12 states with hardrock operations use cash accounts. BLM state offices in 8 of these 10 states rated cash as "very effective" for minimizing losses to the federal government. In the other two states, the offices reported that they had no experience with using this type of assurance to minimize losses to the federal government.

Trust funds. The 2001 regulations require operators, when BLM identifies a need for it, to establish a trust fund or other funding mechanism to ensure the continuation of long-term treatment to achieve water quality standards and other long-term, post-mining requirements. Funds are placed in an interest-bearing trust account by an operator with BLM as the beneficiary.

[27]For bonds under $10,000, the deposit is 100 percent of the bond amount, and the annual premium is 3 percent of the bond amount. For bonds of $10,000 and greater, the deposit is 50 percent of the bond amount, escalating linearly to 80 percent at the cap; and the annual premium is 10 percent of the bond amount, declining linearly to 5 percent at the cap. Interest earned remains in the pool's account, and the deposit is returned to the operator when the bond is released following successful reclamation. Premiums are not returned to the operator.

The trust account should accrue sufficient funds to be sustained in perpetuity. The Nevada BLM state office reported one trust fund with just over $1 million and said it did not have sufficient experience to determine the effectiveness of this type of assurance in minimizing losses to the federal government.

Property. The Montana BLM state office reported that one operator has used $617,000 in property—consisting of 17 mining claims on private land owned by the operator—as a financial assurance. According to BLM state office officials, the operator pledged these properties as collateral. The Montana BLM state office reported that it had no experience using property to minimize losses to the federal government. We note that the revised federal regulations do not identify property as an acceptable type of financial assurance.

Negotiable U.S. securities and bonds. Operators in two states—Arizona and Nevada—use negotiable U.S. securities. The Arizona BLM state office reported it had no experience in using this type of assurance to minimize losses to the federal government. The Nevada BLM state office rated this type of assurance as "effective." The Idaho BLM state office reported that operators in the state use U.S. bonds to guarantee reclamation costs and that the state has no experience using bonds to minimize losses to the federal government.

Although the $837 million in financial assurances that BLM reported is the most complete information available, we note that this total may not include all financial assurances for hardrock operations on BLM land. Some BLM state offices had difficulty determining the value of financial assurances for hardrock operations in their jurisdictions when designated state agencies hold these assurances. For example, the state offices reported the following:

- *Washington.* The Oregon BLM office did not provide the value of financial assurances for the 139 hardrock operations it identified in Washington state.

- *California.* The information the California BLM office provided may not be complete because some financial assurances may be held by California's 58 county agencies, and the state office did not contact each county agency to complete our survey.

- *Montana.* The Montana BLM office does not track state-held financial assurances for hardrock operations on BLM land. BLM obtained information on these assurances for our survey from the state and reported that this information was not all inclusive but appeared to be reasonably accurate.

See appendix II for the number of notice- and plan-level hardrock operations and associated financial assurances for each state identified by BLM state offices, as of July 2004.

Existing Financial Assurances May Not Fully Cover Future Reclamation Costs

Existing financial assurances for reclaiming BLM land disturbed by hardrock operations may not fully cover future reclamation costs for the approximately 2,500 hardrock operations that BLM reported if operators do not complete required reclamation. The costs may not be fully covered because BLM reported that some of these operations do not have financial assurances, and some have no or outdated reclamation plans and/or cost estimates. BLM's explanations for this lack of coverage indicate that some operators may not be complying with BLM requirements.

As of July 2004, BLM state offices reported that some notice- or plan-level operations in 9 of the 12 states with existing hardrock operations did not have financial assurances. For example, BLM state offices reported that in five states (Arizona, California, Idaho, New Mexico, and Utah) more than 5 percent of both notice- and plan-level operations did not have financial assurances. All of the operations in two other states—Colorado and Wyoming—had financial assurances, and the Oregon BLM state office reported that all plan-level operations in Washington state had financial assurances, but the office did not know the percentage of notice-level hardrock operations without financial assurances in Washington state. Table 3 shows the number of notice- and plan-level hardrock operations and the percentage of these operations without financial assurances for each of the 12 states with existing hardrock operations.

Table 3: Number of Notice- and Plan-Level Hardrock Operations and the Percentage of These Operations BLM Reported Had No Financial Assurances, by State, as of July 2004

State	Number of notice-level hardrock operations	Percentage of notice-level hardrock operations without financial assurances	Number of plan-level hardrock operations	Percentage of plan-level hardrock operations without financial assurances
Alaska	134	1-4	106	0
Arizona	130	50-74	55	25-49
California	205	5-14	98	15-24
Colorado	102	0	30	0
Idaho	32	5-14	23	5-14
Montana	150	1-4	30	0
Nevada	450	0	324	1-4
New Mexico	24	15-24	11	15-24
Oregon	165	1-4	10	0
Utah	167	50-74	49	15-24
Washington	127	Do not know	12	0
Wyoming	18	0	38	0

Source: GAO analysis of BLM survey responses.

Note: Based on our analysis of survey responses, we identified the range of percentages of hardrock operations that did not have financial assurances in each of the states with hardrock operations. Those percentage ranges were 0, 1-4, 5-14, 15-24, 25-49, 50-74, 75-99, and 100 percent.

For the states in which BLM state offices indicated that less than 100 percent of their hardrock operations had financial assurances, we asked them to provide an explanation. While some of the explanations indicated that financial assurances are not yet required for some operations, such as those that are pending BLM acceptance or have not yet begun exploration or mining, others indicated that the operations may not be complying with BLM's requirements. The following explanations provided by BLM state offices for the lack of financial assurances suggest that some operators may not be complying with applicable financial assurance requirements.

- *Alaska.* The operator failed to submit state bond pool fees on time.
- *California.* Some older operations may not have financial assurances.

- *Idaho.* The office could not find records of financial assurance for two plan-level operations.

- *Nevada.* Some operations have been terminated by the state bond pool, operators have gone bankrupt, or operations have been abandoned and the operator cannot be found.

BLM state offices also reported that, as of July 2004, some hardrock operations on BLM land have no or outdated reclamation plans and/or reclamation cost estimates. Specifically, BLM state offices reported that some existing hardrock operations in 9 of the 12 states did not have reclamation plans and/or cost estimates. For example, BLM state offices reported that in three states (Arizona, California, and Utah) both types of operations (notice- and plan-level operations) were missing some reclamation plans and cost estimates. In addition, according to BLM state office officials, all hardrock operators on BLM land in Alaska currently participate in the Alaska bond pool and do not develop cost estimates. All of the operations in two other states—New Mexico and Wyoming—had both reclamation plans and cost estimates, and the Oregon BLM office reported that in Washington state all plan-level operations have reclamation plans and cost estimates, but it did not know the percentage of notice-level hardrock operations without plans and estimates. Table 4 shows the percentage of BLM's notice- and plan-level hardrock operations without reclamation plans and cost estimates, as of July 2004.

Table 4: Reported Percentage of Notice- and Plan-Level Hardrock Operations without Reclamation Plans and Cost Estimates, by State, as of July 2004

	Percent of operations without reclamation plans		Percent of operations without cost estimates	
State	Notice-level	Plan-level	Notice-level	Plan-level
Alaska	1-4	0	100[a]	100[a]
Arizona	50-74	25-49	50-74	25-49
California	1-4	15-24	15-24	1-4
Colorado	5-14	0	0	0
Idaho	0	0	5-14	1-4
Montana	0	0	1-4	0
Nevada	0	0	0	1-4
New Mexico	0	0	0	0
Oregon	1-4	0	1-4	0
Utah	50-74	15-24	50-74	15-24
Washington	Do not know	0	Do not know	0
Wyoming	0	0	0	0

Source: GAO analysis of BLM survey responses.

Note: Based on our analysis of survey responses, we identified the ranges of the percentages of hardrock operations that did not have reclamation plans and cost estimates in each of the states with hardrock operations. Those ranges were 0, 1-4, 5-14, 15-24, 25-49, 50-74, 75-99, and 100 percent.

[a]All of the Alaska operations are covered by the Alaska state bond pool and do not develop cost estimates.

For the states in which BLM state offices reported that less than 100 percent of their operations had reclamation plans and/or cost estimates, we asked BLM to provide an explanation. All notice- and plan-level operations are required to have reclamation plans and cost estimates. The following explanations provided by BLM state offices for the lack of reclamation plans and/or cost estimates suggest that some operators may not be complying with financial assurance requirements.

- *Arizona.* Some of the older plan-level operations may still have financial assurances that were calculated on the basis of $2,000 per acre, which was the policy under previous federal regulations, rather than all of the estimated costs of reclamation as the 2001 regulations now require.

- *Colorado.* No reclamation plan was required when some of the notices were submitted.

- *Idaho.* A record of a cost estimate for two plans could not be found.

- *Oregon.* Not all of the notice-level operations have a reclamation plan because of a general backlog in updating reclamation plans, and reclamation cost estimates are still being developed in a few cases.

In addition, three state offices reported that some reclamation plans and cost estimates had not been updated. For example, the California BLM state office reported that some of the older reclamation plans for operations in that state have not been updated because of a workload backlog and staff vacancies. Consequently, these plans and estimates may not provide a sound basis for establishing financial assurances to cover all future reclamation costs.

Like our survey results, the results of the 2004 BLM survey of 18 of its 157 field offices showed that some hardrock mining operations under the jurisdiction of 7 field offices did not have financial assurances that met BLM's requirements in fiscal year 2003. For example, one field office reported that it did not have financial assurances that met BLM's requirements because none of the reclamation cost estimates for plan-level operations included indirect costs. Another field office had a backlog of nearly 80 plan-level operations that had not had their reclamation cost estimates updated because, among other things, the office did not have sufficiently trained staff to review updates. In yet another field office, higher priority work prevented timely updates of some reclamation cost estimates.

Financial Assurances Were Not Always Adequate to Pay All Estimated Costs for Required Reclamation for Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators

BLM identified 48 hardrock operations on BLM land that had ceased and not been reclaimed by operators since it began requiring financial assurances. BLM reported that the most recent cost estimates for reclamation required by applicable plans and federal regulations for 43 of these operations totaled about $136 million, with no adjustment for inflation; it did not report reclamation cost estimates for the other 5 operations.[28] However, as of July 2004, financial assurances had provided or were guaranteeing $69 million, and federal agencies and others had provided $10.6 million to pay estimated reclamation costs for the 48 operations, leaving $56.4 million of reclamation costs unfunded. In particular, financial assurances were not adequate to pay all estimated costs for required reclamation for 25 of the 48 operations because (1) some operations had no assurances, (2) some operations' assurances were less than the most recent reclamation cost estimates, and (3) some financial assurance providers declared bankruptcy and could not pay. In addition, for about half of the remaining 23 operations, cost estimates may be understated because the cost estimates may not have been updated to reflect inflation or other factors that could increase reclamation costs. Furthermore, the $136 million cost estimate is understated to the extent that BLM did not identify or report information on all hardrock operations that had ceased and not been reclaimed by operators as required. Finally, according to BLM officials, required reclamation had been completed for only 5 of the 48 operations as of July 2004, but they believe it is likely that required reclamation will be completed for 28 of the remaining 43 operations.

BLM Identified 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators Since It Began Requiring Financial Assurances and About $136 Million in Estimated Costs for Required Reclamation

BLM identified 48 hardrock operations in seven states that had ceased and not been reclaimed by operators, as required by applicable reclamation plans and federal regulations, since it began requiring financial assurances.[29] The number of operations BLM identified in each of the seven states, along with the primary minerals explored, mined, and/or processed, and the operating authority for the 48 operations are shown in table 5. Appendix III, table 14, contains additional information about these operations.

[28]BLM reported estimates before and/or after operations ceased. (See app. III, table 17 for details.) We used the most recent complete cost estimate to determine total estimated costs. (See app. I for detailed methodology.)

[29]For the other six states with hardrock operations—Colorado, New Mexico, Oregon, South Dakota, Utah, and Wyoming—BLM reported that no operations had ceased and not been reclaimed by operators since it began requiring financial assurances.

Table 5: Number and Selected Characteristics of 48 Hardrock Operations Reported by BLM as Ceased and Not Reclaimed by Operators Since BLM Began Requiring Financial Assurances, by State, as of July 2004

		Primary hardrock minerals being explored, mined, or processed			Authority	
States	Number of hardrock operations reported by BLM as ceased and not reclaimed by operators	Gold	Other minerals	Unidentified	Plan-level	Notice-level
Alaska	4	4	0	0	4	0
Arizona	6	6	0	0	5	1
California	2	2	0	0	2	0
Idaho	1	0	1[a]	0	1	0
Montana	3	3	0	0	2	1
Nevada	29	25	4[b]	0	26	3
Washington	3	1	0	2	3	0
Total	**48**	**41**	**5**	**2**	**43**	**5**

Source: GAO analysis of BLM survey responses.

[a]The primary mineral explored and mined at this operation was limestone.

[b]The primary mineral was different for each of these four operations: one mined copper, another silver, and a third zinc; the fourth was a mill site for platinum/gold.

According to BLM officials in each of the seven states, BLM had taken steps to compel operators of most of the 48 operations to reclaim BLM land. For example, it had sent notices of noncompliance (24 operations) and taken administrative, legal, or other actions (19 other operations), such as revoking plans of operations. BLM took no action to compel reclamation of the remaining five operations. However, none of the operators for these 48 operations completed reclamation, primarily because of bankruptcy (30 operations). Appendix III, table 16, details the actions BLM took to compel operators to complete reclamation and the reasons reclamation was not completed.

BLM reported reclamation cost estimates for 43 of the 48 operations that had ceased and not been reclaimed by the operators; it did not report estimates for the other 5 operations—2 in Alaska, 2 in Nevada, and 1 in Arizona. The most recent estimates as of July 2004 indicated that the total reclamation cost for the 43 operations was about $136 million.[30] Almost 99 percent of this estimated cost was associated with operations in Montana and Nevada—primarily for the Zortman and Landusky mining operation in Montana ($85 million) and the Paradise Peak operation ($21.2 million) and MacArthur Mine operation ($17 million) in Nevada. Clearly, the total cost estimate would be higher if the costs for the 5 operations with no estimates were included. The number of hardrock operations for which BLM reported cost estimates and the value of the most recent cost estimates, as of July 2004, for each of the seven states is shown in table 6. Appendix III, table 17, provides the reported estimates for each of the 43 operations.

Table 6: Cost Estimates for Required Reclamation of 43 Hardrock Operations with Cost Estimates Reported by BLM as Ceased and Not Reclaimed by Operators Since BLM Began Requiring Financial Assurances, by State, as of July 2004

State	Number of hardrock operations with cost estimates	Most recent BLM-reported reclamation cost estimates
Alaska	2	$639,000
Arizona	5	944,439
California	2	17,431
Idaho	1	12,000
Montana	3	85,502,013
Nevada	27	48,840,972
Washington	3	33,825
Total	**43**	**$135,989,680**

Source: GAO analysis of BLM survey responses.

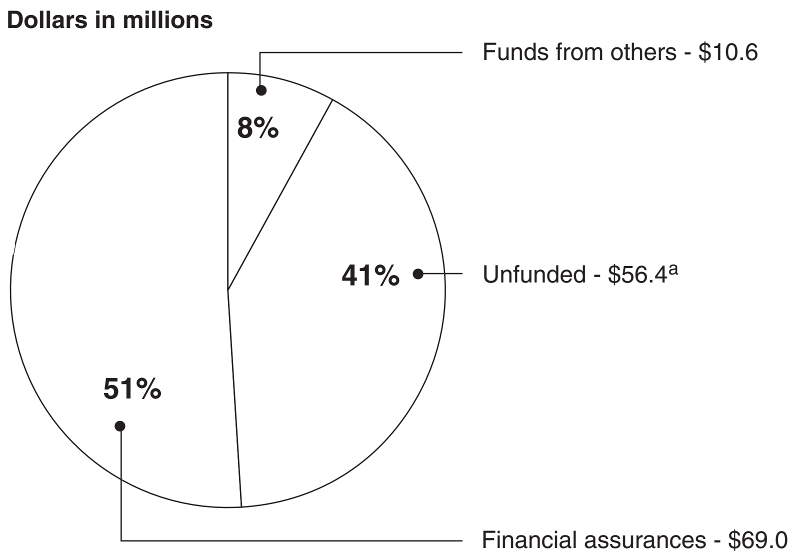
Financial Assurances and Funds Provided by Others Were Not Adequate to Pay All of the Estimated $136 Million in Costs for Required Reclamation

Financial assurances and funds provided by others were not adequate to pay all of the estimated $136 million needed to complete the required reclamation of the 43 operations for which BLM reported cost estimates. Surety bonds and other types of financial assurances had provided or were guaranteeing $69 million of the estimated costs for required reclamation that BLM reported for these operations, or about 51 percent. According to our analysis of information BLM officials provided in response to our survey, these funds were not adequate to pay all estimated costs for

[30]See appendix I for details on how the most recent cost estimates were identified.

required reclamation for 25 of the 48 operations. Moreover, cost estimates may be understated for 12 of the other 23 operations. In addition, funds provided by federal agencies and others paid only a fraction of the estimated reclamation costs. As a result, at least $56.4 million, or about 41 percent, of the estimated $136 million needed for required reclamation was unfunded, as shown in figure 5. Finally, the $136 million cost estimate for required reclamation is understated to the extent that BLM did not identify or report information on all hardrock operations that had ceased and not been reclaimed, as required.

Figure 5: Sources and Amount of Funds Provided or Guaranteed to Pay Estimated $136 Million in Costs for Required Reclamation for Operations that BLM Identified as Ceased and Not Reclaimed by Operators Since BLM Began Requiring Financial Assurances, as of July 2004



Source: GAO analysis of BLM survey responses.

[a]The $56.4 million of unfunded costs includes $4,233,465 in corporate guarantees that lost their value when the operator that guaranteed reclamation costs went bankrupt and had no funds to pay reclamation costs and $949,350 that was not relinquished by a financially-troubled surety bond provider. When the $56.4 million in unfunded costs is added to the $10.6 million from others, a total of $67 million, or about 49 percent of the total estimated cost, was not guaranteed by financial assurances.

Types of Financial Assurances Varied but Were Not Adequate to Pay About Half of the Estimated Costs Needed for Required Reclamation

Operators used a variety of types of financial assurances for 38 operations to pay or guarantee coverage of $74.2 million of the $136 million of estimated costs for required reclamation, as table 7 shows. (The remaining 10 operations had no financial assurances.) Operators used surety bonds, a trust fund, and corporate guarantees to guarantee almost 97 percent of these costs, with the rest guaranteed by state bond pools, letters of credit, certificates of deposit, cash, and a construction bond provided by an operator. However, as of July 2004, financial assurances had provided or were guaranteeing only $69 million, or almost 51 percent, of the reclamation costs. This amount decreased because $4.2 million in corporate guarantees had lost all their value when the operator that guaranteed the reclamation costs declared bankruptcy and had no funds to pay such costs, and $949,350 was not available from a surety bond because the financially-troubled financial assurance provider paid for reclamation instead of relinquishing the bond. See appendix III, table 18, for the types of financial assurances used for each hardrock operation.

Table 7: Type and Value of Financial Assurances Used by Operators to Guarantee Reclamation Costs for 38 Operations with Financial Assurances that BLM Identified as Ceased and Not Reclaimed by Operators Since BLM Began Requiring Financial Assurances, as of July 2004

Type of financial assurance	Number of operations with financial assurances[a]	Value of financial assurances
Surety bonds[b]	22	$55,294,010
Trust funds	1	12,300,000
Corporate guarantees[c]	3	4,233,465
Operator's construction bond	1	2,000,000
State bond pools[d]	8	340,573
Letters of credit	2	18,500
Certificates of deposit	3	17,431
Cash	3	7,076
Total[e]	**38[e]**	**$74,211,046**
Less financial assurances with no value	[b,c]	($5,182,815)
Total	**38[e]**	**$69,028,231**

Source: GAO analysis of BLM survey responses.

[a]Ten of the 48 operations had no financial assurances.

[b]As of July 2004, one security provider had financial problems and contracted for reclamation instead of relinquishing bond funds.

[c]As of July 2004, these three corporate guarantees had lost all their value because the operator that guaranteed the reclamation costs had gone bankrupt and had no funds to pay reclamation costs. However, these operations also had surety bonds that maintained their value.

[d]This is the value for six of the eight hardrock operations; BLM did not provide the value for the other two operations.

[e]Does not add because some operations had more than one type of financial assurance.

These 38 financial assurances provided or guaranteed funds for only about half of the estimated costs for required reclamation for the 48 hardrock operations. Specifically, these financial assurances were not adequate for 25 of the 48 operations because (1) operators did not provide financial assurances for 10 hardrock operations, (2) the financial assurances that were provided were less than the most recent cost estimates for 13 operations, and/or (3) the financial assurance providers declared bankruptcy and did not have the funds to pay all reclamation costs for two other operations. (Also, 2 of the 13 operations whose financial assurances were less than the most recent cost estimates went bankrupt.) Table 8 shows the reasons financial assurances were not adequate and the associated funding differential. Table 8 also shows that most of the difference between the value of the estimated reclamation costs and the value of the financial assurances occurred because the financial assurances were less than the most recent cost estimate.

Table 8: Reasons Financial Assurances Were Not Adequate to Pay Estimated Costs for Required Reclamation for 25 Hardrock Operations Identified by BLM as Ceased and Not Reclaimed by Operators Since BLM Began Requiring Financial Assurances, as of July 2004

Reason for inadequate financial assurances	Number of affected hardrock operations	Value of estimated reclamation costs	Value of financial assurances	Funding differential
Operations had no financial assurances	10[a]	$2,001,014	$0	($2,001,014)
Financial assurances less than most recent cost estimates	13	128,187,236	64,445,305	(63,741,931)
Bankrupt financial assurance providers	4[b]	1,688,006	2,638,017	950,011
Subtotal	**25[c]**	**$131,876,256**	**$67,083,322**	**($64,792,934)**
Less financial assurances with no value	[d]		(5,182,815)	(5,182,815)
Total	**25**	**$131,876,256**	**$61,900,507**	**($69,975,749)**

Source: GAO analysis of BLM survey responses.

[a]Includes one operation with no reported cost estimate.

[b]Four operations were affected by bankrupt financial assurances providers. The $1.7 million and $2.6 million are the values for estimated reclamation costs and associated financial assurances, respectively, for two of these operations—County Line and Olinghouse. For the other two operations—the MacArthur Mine and the Paradise Peak operations—the values for the estimated reclamation costs ($38.2 million) and the associated financial assurances ($4.8 million) are included with the 13 operations for which financial assurances were less than the most recent cost estimates.

[c]Does not add because two of these operations also had financial assurances that were less than the most recent cost estimate.

[d]As of July 2004, three of the four operations affected by bankruptcy used corporate guarantees that had lost all their value because the operator that guaranteed the reclamation costs was bankrupt and one surety bond provider did not relinquish bond funds because the provider went bankrupt.

No Financial Assurances

As table 8 shows, 10 hardrock operations had no financial assurances. These operations were located in Washington (2), Arizona (4), and Nevada (4). The most recent reclamation cost estimates for 9 of these 10 operations indicated that slightly over $2 million in reclamation costs was unfunded; BLM reported no cost estimate for the other operation. BLM officials provided the following explanations for why the 10 operations did not have the required financial assurances:

- *Two operations in Washington*. An official in Oregon's BLM state office, which manages BLM programs in Oregon and Washington, said that two operations in Washington did not have financial assurances, probably because the responsible BLM field office did not have adequate staff to enforce compliance with this requirement. The official also said that financial assurance training had been a problem and that staff turnover in one field office meant that financial assurances were overlooked for a period of time.

- *Four operations in Arizona*. According to BLM state office officials, the operators of two operations did not provide financial assurances, even though BLM told them that financial assurances were required. According to an official in the BLM state office, the heavy workloads associated with other BLM programs dissuaded staff from taking enforcement actions that could involve time-consuming activities, such as obtaining court orders. Furthermore, the official said that case files indicated the third operation had financial assurances sometime during the 1990s, but information on the type and amount of financial assurances after it ceased could not be found. No reason was given for the fourth operation.

- *Four operations in Nevada*. According to BLM state office officials, operators of three operations did not provide financial assurances, even though BLM notified the operators that financial assurances were required. At one of these operations, for example, BLM's field office issued a noncompliance order that, after the operator appealed it, was upheld by the BLM state office. BLM is currently working with the state of Nevada to reclaim this operation. BLM state office officials said that the operator of another operation, who eventually went bankrupt, was never able to provide a suitable financial assurance instrument. Regarding the fourth operation—Relief Canyon—officials in BLM's responsible field office told us that the operator refused to provide financial assurances despite the field office's enforcement steps. The field office issued a noncompliance order and took other enforcement actions, such as revoking the operator's plan of operation.

  The Relief Canyon gold mine is located in north-central Nevada on about 344 acres, including 295 acres of BLM land. According to BLM officials, the mine was being reclaimed when a new operator purchased it in 1995 and, at that time, the agency advised the new operator of the need for financial assurances for all required reclamation—including past and future disturbances. However, the operator never obtained the financial assurances. According to BLM, the mine's plan of operation was last updated in October 1996, and before the operation ceased, the operator estimated reclamation costs at about $889,000. BLM reported that, as of July 2004, 26 to 50 percent of the operation had been reclaimed. BLM officials told us that they had revoked the mine's plan of operation, operations had ceased, and the operator should complete reclamation, but the operator has appealed this revocation to Interior's Board of Land Appeals. The operator contends that he plans to either begin mining operations when he gets the funds or sell the operation. When we visited the operation in September 2004, we did not see any signs of ongoing mining activity and observed that buildings, collection pond liners, the security fence, and other structural facilities needed repair. As of June 2005, BLM was awaiting the board's decision.

Financial Assurances Were Less Than Recent Cost Estimates

As table 8 also shows, 13 operations had financial assurances that were less than the most recent cost estimates. These operations were located in Alaska (1), California (1), Montana (1), and Nevada (10). The most recent cost estimate for these 13 operations was $128.19 million, and the value of the associated financial assurances was $64.45 million, leaving $63.74 million of the estimated reclamation costs with no financial assurance coverage. Table 9 shows the most recent cost estimates, compared with the value of financial assurances for each of the 13 operations. Three mining operations—Zortman and Landusky, MacArthur Mine and Paradise Peak—accounted for about 95 percent of the amount that the cost estimates exceeded the financial assurances.

Table 9: Comparison of Most Recent Cost Estimate as of July 2004 with the Value of Financial Assurances for 13 Hardrock Operations with Cost Estimates That Exceeded Financial Assurances

Hardrock operation	Location	Most recent cost estimate	Value of financial assurances	Amount cost estimate exceeded financial assurance
Gold Hill Mining	Alaska	$500,000	$15,000	$485,000
Nina	California	15,000	5,000	10,000
Zortman and Landusky Mine	Montana	85,200,000	57,800,000	27,400,000
Wildhorse Canyon	Nevada	53,000	12,000	41,000
South Hy/Isabella	Nevada	169,700	22,000	147,700
Golden Butte	Nevada	1,397,000	328,942	1,068,058
Easy Jr	Nevada	668,936	365,917	303,019
Kinsley	Nevada	1,400,000	911,763	488,237
Phoenix Metals USA II Inc.	Nevada	100,000	45,904	54,096
American Canyon KOF	Nevada	21,600	5,314	16,286
16:1 Millsite	Nevada	458,000	124,017	333,983
MacArthur Mine[a]	Nevada	17,047,000	184,300	16,862,700
Paradise Peak[a]	Nevada	21,157,000	4,625,148	16,531,852
Total		**$128,187,236**	**$64,445,305**	**$63,741,931**

Source: GAO analysis of BLM survey responses.

[a]Part of these financial assurances were corporate guarantees that lost their value when the operator that guaranteed reclamation costs went bankrupt.

For these 13 hardrock operations, we identified several reasons why financial assurances were less than the most recent reclamation cost estimate. In particular:

- *Estimates at the time operations ceased for 6 of the 13 operations did not consider all costs.* BLM reported that some estimates excluded BLM administrative or indirect costs, interim maintenance costs, long-term maintenance and monitoring costs, costs for inflation, and/or other costs. For example, estimates for five operations did not include sufficient funds to cover BLM administrative or indirect costs, which can be high, especially if BLM gets involved with bankruptcy procedures. In its guidance on preparing cost estimates BLM states that estimates should include (1) costs for contract administration, which should be between 6 and 10 percent of estimated operations and maintenance costs, depending on the size of the operation, and (2) indirect costs, which should be 21 percent of the contract administration costs.

- *One operator intentionally understated reclamation costs for an operation to minimize the amount of financial assurances required*, according to BLM field office officials in Nevada. They said, for example, that the operator calculated the estimate as if very large equipment were going to be used, which would reduce costs; however, the operator did not have such equipment available in the state. The field office officials said that the BLM staff who reviewed the cost estimate were inexperienced and did not detect the understatement.

- *Reclamation plans and cost estimates sometimes were not updated to reflect all reclamation costs when the scope of the plan of operations changed and, as a result, the reclamation requirements changed.* For example, BLM reported that the amount of financial assurances for the Zortman and Landusky mining operation in Montana was significantly less than the cost estimate prepared after the operations ceased. The difference in costs was due in part to the failure to update the reclamation plan to address acid rock drainage found during an inspection in the early 1990s, despite efforts by the operator to update the plan. Specifically, the most recent cost estimate for water treatment is greater than the estimate prepared before operations ceased. In addition, the cost estimate increased because the revised reclamation plan required more extensive work on the heap-leach pad than in the earlier plan. Approval of the plan was delayed until 2002 by the review process and litigation over the effects of the proposed changes, and by that time the operator had declared bankruptcy.

  According to the Montana Department of Environmental Quality, which jointly manages the hardrock operation with BLM, the value of the financial assurances increased during this period. However, the most recent reclamation cost estimate was still greater than the associated financial assurances. An estimate of $85.2 million for reclamation costs was prepared after operations ceased and addressed water contamination and other reclamation activities, such as backfilling, regrading, and revegetating. This estimate included $36.3 million for earthworks, $22 million for water treatment through 2017, and $26.9 million for long-term water monitoring and treatment, according to BLM field office officials. This estimate was $27.4 million more than the $57.8 million in financial assurances provided for the reclamation. The financial assurances consisted of $29.6 million in surety bonds for earthworks, a $2 million construction assurance bond for water treatment facilities, $13.9 million in surety bonds for water treatment through 2017, and $12.3 million in a trust fund for long-term water treatment and monitoring. Part of the funding shortfall—about $8.7 million—was covered with funds from other sources.

Financial Assurance Providers Declared Bankruptcy

For four operations in Nevada, as table 8 shows, financial assurances were not adequate because financial assurance providers went bankrupt and could not pay all the reclamation costs they guaranteed. For three of these operations—Paradise Peak, County Line, and MacArthur Mine—an operator used corporate guarantees totaling $4.2 million to guarantee part of the estimated reclamation costs. However, these corporate guarantees lost all their value when the operator went bankrupt. Reclamation costs for the fourth operation were guaranteed with a surety bond underwritten by a company that went bankrupt and spent $850,650 for partial reclamation of the operation instead of relinquishing the $1.8 million surety bond. In particular:

- Paradise Peak, a mining operation in central Nevada, used heap leaching to extract gold from ore. When the operation ceased, it covered almost 1,000 acres, about half of which was on BLM land. The plan of operation was last updated in May 1996, and in November 1995, the operator estimated that reclamation costs would be $5,462,000. The operator, Arimetco Inc., provided financial assurances totaling $4,625,000—$1,157,000 in a surety bond and $3,468,000 in a corporate guarantee that lost all of its value when Arimetco went bankrupt. As of July 2004, the surety bond company had relinquished the $1,157,000, but none of the funds had been spent. BLM reported that estimated reclamation costs were $21,157,000—$20 million more than the funds the surety bond company relinquished. This estimated cost is significantly more than the original estimate, according to BLM state office officials, because the original estimate did not include all costs that it should have, such as costs for reclaiming collection ponds, and because the cost estimate was not updated to reflect changes in the reclamation plan. BLM reported that no reclamation had been done as of July 2004, but it was very likely that reclamation would be completed because a portion of the needed funding was obtained through bankruptcy procedures and BLM was working with the operator to perform reclamation.

- County Line Project, located on 130 acres of BLM land in western Nevada, used heap leaching to extract gold from ore. The plan of operation was last updated in January 1992, when the operator estimated that reclamation costs would be about $837,000. BLM reported no more recent reclamation cost estimates. Arimetco Inc., the operator, provided $838,000 in financial assurances—$210,000 in surety bonds and $628,000 in a corporate guarantee that lost all of its value after Arimetco went bankrupt. As of July 2004, the surety bond company had relinquished the $210,000, but none of the funds had been spent.[31] BLM reported that, as of July 2004, between 26 percent and 50 percent of the operation had been reclaimed. BLM also reported that it was very unlikely that reclamation would ever be completed because it was unlikely that the operator would remain viable after bankruptcy.[32]

- The MacArthur Mine covers about 550 acres, over three-quarters of which are on BLM land. The MacArthur Mine was purchased by Arimetco in 1988. This copper mine consisted of a pit, waste dump, and roads used to haul ore from the pit to three heap-leach pads that Arimetco constructed on the nearby Yerington Mine, which was also on BLM land, to extract copper from the MacArthur ore.[33] BLM reported that Arimetco began operating the MacArthur Mine in 1992 and ceased operations in 1997, after it filed for bankruptcy. BLM also reported that the plan of operation was last updated in 1995 and that Arimetco had no reclamation cost estimate before operations ceased. Further, BLM provided documents that showed the MacArthur reclamation plan covered not only the MacArthur land but also the heap-leach pads at the Yerington Mine. Although Arimetco had no cost estimate, it did have $184,300 in financial assurances—$47,000 in a surety bond and $137,300 in a corporate guarantee that had lost all of its value when Arimetco went bankrupt. BLM reported that, as of July 2004, the $47,000 in surety bond funds had been relinquished but not spent. BLM also reported that estimated reclamation costs would be $17,047,000—$17 million more than the funds relinquished by the surety bond company. This estimate, according to an official in a BLM Nevada field office, was prepared by

[31]BLM officials told us in February 2005 that, as of December 2004, some of the surety bond funds had been obligated to review and determine reclamation designs and costs.

[32]BLM officials told us in February 2005 that, as of December 2004, about 75 percent of the reclamation had been completed and that the heap-leach pad and process ponds were the remaining features to be reclaimed.

[33]The Yerington Mine, which is on BLM and private land, was mined by the Anaconda Copper Company from 1953 to 1978 (before BLM required reclamation or financial assurances) and was purchased by the Atlantic Richfield Company in 1977 and sold to a private entrepreneur in 1978. The entrepreneur sold the Yerington land to Arimetco in 1988.

the state of Nevada for bankruptcy procedures. BLM reported that, as of July 2004, no reclamation of the MacArthur operation had been undertaken or completed and that it was very unlikely reclamation of this operation would occur. However, in March 2005, the BLM official told us that the Yerington Mine, including the leach heaps built and used by Arimetco for the MacArthur operation, would be cleaned up under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA).[34] CERCLA governs cleanup of severely contaminated hazardous waste sites.[35]

- The Olinghouse Mine operation, a exploration and mining operation in northwest Nevada, used heap leaching to extract gold from ore on 502 acres, of which 447 acres were BLM land. The plan of operation was last updated in September 2002, and the operator estimated that reclamation costs would be about $851,000. BLM has not reported any more recent cost estimates. Alta Gold Company, the operator of the Olinghouse operation and eight other hardrock operations in Nevada, provided financial assurances to guarantee reclamation of all nine operations through a statewide surety bond underwritten by the Frontier Insurance Company (Frontier). In April 1999, Alta Gold Company filed for bankruptcy, and BLM gave Frontier the option of paying or performing reclamation. Subsequently, the insurance company filed for bankruptcy and was put into "rehabilitation"—a term for bankruptcy with the intent of making the company solvent. In October 2001, Frontier offered to reclaim the operation to a "satisfactory level." According to BLM, its options were to (1) wait upon the bankruptcy court, with no guarantee to obtain funds or (2) find an alternative solution to reclaim most of the land. BLM entered into an agreement with Frontier for it to perform reclamation using contractors, with BLM oversight. Frontier completed the agreed-upon reclamation by February 2003, and in December 2003, BLM released the company from future financial obligations for this operation. Frontier performed the reclamation for $850,650, which was significantly less than the $1.8 million surety bond that it would have

[34]42 U.S.C. §§ 9601-9675.

[35]BLM officials advised us that their most recent reclamation cost estimates for the MacArthur Mine pit and waste piles was $350,000 and for the haul road was $1.15 million. They also said that, assuming the estimate for the bankruptcy court was correct, over $15.5 million of the cleanup costs for the leach heaps on the Yerington Mine used to extract copper from the MacArthur pit will be included in the CERCLA cleanup costs. The officials said that the total reclamation costs for the Yerington Mine had not yet been estimated.

relinquished if Frontier had not performed the reclamation. BLM state and field office officials told us that this solution was satisfactory to all parties, even though all reclamation required by the reclamation plan was not completed. BLM reported that, as of July 2004, 86 to 95 percent of the reclamation had been completed, but it was very unlikely that the remaining reclamation would ever be completed. For example, BLM reported that all exploration roads were not reclaimed.

Financial Assurances for 12 Hardrock Operations May Not Be Adequate to Pay All Costs for Required Reclamation

Financial assurances may not be adequate to pay all costs for required reclamation for 12 of the other 23 operations—11 for operations where financial assurances were equal to the associated cost estimates and 1 where the financial assurance was greater than associated cost estimate.[36] The financial assurances may not be adequate because the cost estimates on which they were based were prepared before operations ceased—in some cases, as long as a decade ago—and likely do not reflect inflation or other factors that would cause reclamation costs to increase. Table 10 shows the value of the cost estimate prepared before the operations ceased and the number of months elapsed between that time and July 2004, when our surveys were completed.

[36]Of the remaining 11 operations, 3 had been reclaimed, 4 had no basis to assess the adequacy of the cost estimates because BLM reported no estimates, and the most recent cost estimates for 4 were prepared after operations ceased.

Table 10: Value of Cost Estimate Prepared before Hardrock Operations Ceased and the Number of Months Elapsed between Estimate Date and July 2004 for 12 Hardrock Operations Where Financial Assurances Were Equal to or Greater than Cost Estimate

Operation	Value of cost estimate prepared before hardrock operations ceased	Date of cost estimate	Number of months elapsed between cost estimate and July 2004
Pan Project	$5,670	Feb. 1993	137
Monte Exploration	7,395	April 1993	135
Ward Mine	141,500	Mar. 1993	136
Northern Crown Mines	3,897	Dec. 1991	151
Phil Claims Expl Proj	28,556	Oct. 1995	105
Diamond Peak Prospect Mtn	6,500	May 2001	38
Eldorado Pediment	8,200	Oct. 2001	33
Elder Creek	256,062	Feb. 1996	101
Gold Bar Resource Area	303,300	Dec. 1994	115
Gold Bar Mine	2,608,000	Oct. 1994	117
Atlas Exploration[a]	265,000[a]	June 1994	121
Snowbound Placer	$2,970	June 2003	13

Source: GAO analysis of BLM survey responses.

[a]The value of the financial assurance for this operation was $2,000 more than the value of the cost estimate.

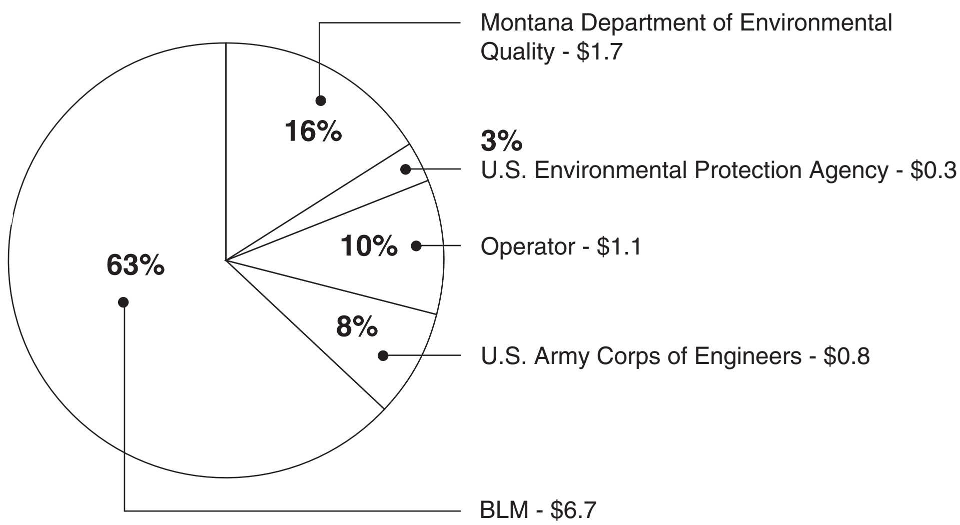
Because reclamation costs can be influenced by many factors, we did not attempt to project the amount that the cost estimates prepared before operations ceased were likely to be less than the amount currently needed to complete reclamation. However, BLM's past experience with reclamation costs indicates that cost estimates prepared after operations ceased likely will be higher than cost estimates prepared before operations ceased. Specifically, BLM updated cost estimates for 16 of the 43 operations for which cost estimates had been prepared before operations ceased, and those updated estimates were the same for 2, lower for 2, and higher for 12 operations. The increases in BLM's 12 higher estimates totaled about $35.5 million, or about a 47 percent increase over the estimates before operations ceased, and ranged from $690 to $16.7 million per hardrock operation, while the decreases in BLM's 2 lower estimates totaled $10,497, or about a 33 percent decrease, and were $6,000 and $4,497 for the two hardrock operations.

Federal Agencies and Others Provided Only a Fraction of the Funds Needed to Pay Estimated Costs for Required Reclamation

As of July 2004, BLM reported that federal agencies and others had provided about $10.6 million to help reclaim 11 operations. These funds accounted for about 8 percent of the estimated $136 million needed to pay for required reclamation for operations identified by BLM as ceased and not reclaimed by operators. The sources and amounts of funds provided by others are shown in figure 8. Appendix III, table 19, shows the other sources of funds for the 48 operations.

Figure 6: Sources of $10.6 Million Provided by Others to Pay the Cost of Required Reclamation for 11 Operations Identified by BLM as Ceased and Not Reclaimed by Operators, as of July 2004

Dollars in millions



Source: GAO analysis of BLM survey responses.

BLM headquarters provided over $6.7 million to reclaim 10 operations. Nearly all of this amount—$5,594,500—was for the Zortman and Landusky mining operation in Montana.[37] Officials in Montana's Lewistown field office told us that most of these funds came from BLM's Abandoned Mine Land Program and were used to remove leach pads and tailings, backfill

[37]Lewistown Montana BLM field office officials told us that BLM provided additional funds after July 2004.

pits, and treat water.[38] BLM headquarters officials told us that some of the funds used to reclaim the 10 operations were special funds that became available on a one-time basis as the result of a GAO report.[39] In March 2001, we reported that BLM had improperly used Mining Law Administration Program funds for purposes other than intended by that program and recommended that BLM correct the improper charges. BLM made the corrections and, according to BLM headquarters officials, used some of the funds for reclamation.

The U.S. Army Corps of Engineers (the Corps) provided about $0.8 million to reclaim two operations through its Restoration of Abandoned Mines Sites (RAMS) program, according to BLM. The RAMS program, created in 1999, allows the Secretary of the Army to provide assistance to federal and nonfederal entities for projects to address water quality problems caused by drainage and related activities from inactive and abandoned noncoal mines, such as hardrock operations. Specifically, BLM reported that the Corps provided $171,000 to reclaim the Easy Jr Mine located near Ely, Nevada. These funds were used for a site characterization study and for construction to close the operation, with the primary goal of recontouring and reclaiming a heap-leach pad. In addition, the Corps provided $600,000 to reclaim the Golden Butte Mine, which is also located near Ely, Nevada. This project included collecting and analyzing water data, characterizing the leach pad, and developing a closure plan. The Corps also partnered with BLM through the RAMS program on another operation that had ceased and not been reclaimed by the operator—the Elder Creek operation located near Battle Mountain, Nevada. BLM told us that, as of July 2004, the Corps had provided all of the funds to develop the engineering closure design for this project, but BLM did not identify the amount of funds provided.

Funds to reclaim the Zortman and Landusky mining operation also were provided from other sources, according to BLM. Through a bankruptcy procedure, the bankrupt operator provided $1,050,000 to help reclaim the

[38]The Abandoned Mine Land Reclamation Program is authorized by Title IV of the Surface Mining Control and Reclamation Act of 1977 and provides funds for reclamation and restoration of land mined and abandoned or left inadequately restored before August 13, 1977, and for which there is no continuous reclamation responsibility under state or other federal laws.

[39]GAO, *Bureau of Land Management: Improper Charges Made to Mining Law Administration Program*, GAO-01-356 (Washington, D.C.: Mar. 8, 2001).

operation. The Environmental Protection Agency provided $340,000 in grant funds, primarily to prepare a supplemental environmental impact statement. Finally, the Montana Department of Environmental Quality provided $1,697,000 for reclamation activities, such as studies, sampling, tailings removal, water treatment, and monitoring.[40] The status of reclamation in 1993 and 2004 for the Zortman and Landusky mining operations is shown below.

Description of Zortman and Landusky Mine

The Zortman and Landusky Mine is located in north-central Montana on about 1,200 acres, half of which are on BLM land. The operation, originally permitted in the 1970s, was the first large open-pit gold mine to use heap leaching in the United States. BLM reported that the operation began under a BLM-approved plan of operation in 1981 and ceased in 1999 after Pegasus Gold, the parent company, went bankrupt. BLM reported that, as of July 2004, over 85 percent of the required reclamation had been done and that complete reclamation is very likely.

Source: BLM and others.

[40]Most of this money came from Resource Indemnity Trust Grants, which are derived from taxes on coal mining in the state.

Figure 7: Zortman and Landusky Mining Operations at or Near Buildout in 1993 and Status of Reclamation in 2004

Zortman 1993
at full buildout

Landusky 1993
near full buildout

Source: BLM.

Zortman 2004
Reclamation near
completion

Landusky 2004
Reclamation near
completion

The $136 Million Estimate of Costs for Required Reclamation Is Understated to the Extent That BLM Did Not Identify or Report on All Hardrock Operations

The $136 million estimate of costs for required reclamation for hardrock operations that had ceased and not been reclaimed by the operators as required is understated to the extent that BLM did not identify or report information on all such operations. For example, officials in Oregon's BLM state office estimated that 20 notice-level operations in Washington state met these criteria, but neither the Oregon BLM state office nor its field offices completed our surveys for any of these operations. State office officials did not explain why surveys had not been completed for these notice-level operations. Clearly, the $136 million estimate would be higher if BLM's state or field offices had reported this information. Furthermore, some other BLM offices had difficulty identifying operations that met our criteria and may not have identified all such operations. For example, Nevada's BLM state office completed additional hardrock operation surveys after we questioned whether they had identified all the operations that met the criteria. For more detailed information on the difficulties in identifying hardrock operations that met our criteria, see our scope and methodology in appendix I.

Required Reclamation Has Been Completed for 5 of the 48 Hardrock Operations, and BLM Officials Believe That Reclamation Will Likely Be Completed for 28 Others

BLM reported that, as of July 2004, required reclamation had been completed for 5 of the 48 hardrock operations on BLM land that had ceased and not been reclaimed by operators since it began requiring financial assurances, and it expects to complete reclamation for most of the remaining operations. BLM reported that the reclamation status was in various stages or unknown for the 43 operations that had not completed reclamation. BLM officials' views on the likelihood of completing required reclamation for these operations varied, but they believed that 28 of the 43 operations are likely to be reclaimed, as shown in table 11. Appendix III, table 19, shows the status and likelihood of completing reclamation for the 48 operations.

Table 11: Reclamation Status and BLM Views on the Likelihood of Completing Reclamation of 43 Hardrock Operations for Which Required Reclamation Had Not Been Completed by Operators, as of July 2004

Reclamation status		BLM's views on the likelihood of completing reclamation			
Percent of reclamation completed	Number of hardrock operations	Somewhat or very likely	About as likely as unlikely	Somewhat or very unlikely	No answer
96-99	4	4	0	0	0
76–95	7	6	0	1	0
51–75	3	3	0	0	0
26–50	4	1	0	3	0
1–25	8	5	0	3	0
0	13	7	5	1	0
Do not know	4	2	0	1	1
Total	**43**	**28**	**5**	**9**	**1**

Source: GAO analysis of BLM survey responses.

Required reclamation of the five operations that were fully completed was accomplished with funds from several sources. For three of the five operations, financial assurances were sufficient to cover the costs to complete reclamation, including one for which the operator did some reclamation and negotiated with BLM to have BLM do the remaining reclamation. For the other two operations, BLM paid at least part of the reclamation costs. Specifically, BLM spent $92,000 to reclaim one operation that had no financial assurances, and spent $15,000 to reclaim another operation whose financial assurance was less than the most recent reclamation cost estimate. In the latter case, the operator agreed to abandon the claim if BLM did the reclamation; the operation was in a wild and scenic river canyon in California.

BLM officials generally believed that required reclamation would be completed for most of the 43 operations that had not been reclaimed by the operators as of July 2004. They reported that required reclamation was somewhat or very likely for 28, or almost two-thirds of the 43 operations. Some BLM officials believed reclamation would be completed because funds were available from financial assurances or other sources. For example, BLM reported that completion was very likely for the Zortman and Landusky mining operation in Montana, which was between 86 and 95 percent reclaimed as of July 2004, partly because funds for earthwork were available and work was under way. At the same time, BLM noted that more than $18 million in additional funds would be needed to maintain water treatment at the operation in perpetuity. In other cases, officials believed that operations may be taken over by new operators, or reopened by the existing operators, who will ultimately complete reclamation of the operations. For example, BLM reported that completing reclamation of an operation in Alaska that was less than 50 percent reclaimed was very likely because another operator agreed to reclaim the area in conjunction with taking over the operation from the bankrupt operator. Conversely, BLM reported that completing required reclamation was somewhat or very unlikely for nine operations, most of which had less than 50 percent of required reclamation completed as of July 2004. BLM said that the operators of several of these operations could not do the required reclamation, usually because they lacked funds.

BLM's LR2000 Is Not Reliable and Sufficient for Managing Financial Assurances for Hardrock Operations

BLM's LR2000 is not reliable and sufficient for managing financial assurances to cover reclamation costs for BLM land disturbed by hardrock operations because staff do not always update information, and LR2000 is not currently designed to track certain critical information. Specifically, staff have not entered information on every hardrock operation and, for those hardrock operations included in LR2000, information is not always current. In addition, the system does not track some information on hardrock operations and their associated financial assurances, which we believe is critical for effectively managing financial assurances. This information includes the basic status of operations, some types of allowable financial assurances, and state- and county-held financial assurances. Given these limitations, it is not surprising that BLM's reliance on LR2000 to manage financial assurances is mixed. In part to compensate for LR2000 limitations, some BLM offices use informal record-keeping systems to help manage financial assurances. BLM has taken some steps and identified others to improve LR2000 for managing financial assurances for hardrock operations.

Information in LR2000 Is Not Reliable and Sufficient

Information in LR2000 is not reliable and sufficient because staff do not always update the information, and the system is not currently designed to track critical information. Specifically, some hardrock operations are not in LR2000:

- In Nevada—the state with the largest number of hardrock operations—LR2000 does not contain information on all hardrock operations that a state BLM official's informal records show. When Nevada officials queried LR2000 during our visit, the system showed 248 plan-level operations in the state. However, according to a senior Nevada BLM state office official who keeps informal records of the hardrock operations, some of the operations are not in LR2000; his records contain 300 plan-level operations. According to BLM state and field office officials, some operations are not in the system because some data were lost during the conversion from an earlier information system to LR2000 in 1999. Officials in one Nevada field office told us that they have not had time to reenter some of the lost data but plan to do so in the future.

- Alaska—with 240 hardrock operations—does not use LR2000 to record information on these operations. Instead, BLM state office officials told us that they use the Alaska Land Information System (ALIS) because LR2000 cannot be used to meet the office's other needs. That is, LR2000 cannot process the conveyance of land from the federal government to the state of Alaska and to Native villages and corporations. In addition, the costs and staff time associated with incorporating the information in ALIS into LR2000 contributed to BLM's decision to continue to use ALIS.

- In BLM's March 2004 assessment of 18 of its 157 field offices' compliance with current hardrock regulations, 3 of the 18 offices reported that all hardrock operations were not recorded in LR2000. For example, one of these field offices reported that its office had only recently received training on LR2000.

Furthermore, for some operations that are in LR2000, information is not up to date. For example, in responding to our survey regarding the number of existing notice- and plan-level hardrock operations with financial assurances, the New Mexico state office explained that some of its existing operations without financial assurances may be inactive and should be closed in LR2000. BLM officials are to open a case in LR2000 when a notice or plan of operation is received, and they are to close the case in LR2000 when operations have ceased and reclamation is complete. However, BLM state and field office officials reported that data entry is not always timely. For example, some field office officials told us that they do not enter data until the winter, when it is more difficult to work in the field and they spend more time in the office. In addition, in BLM's March 2004 assessment, 11 of the 18 field offices reported that the results of compliance inspections were not entered in a timely manner.[41] These inspections are critical to ensuring

[41] In this survey, BLM defined timely as within 5 days.

that all hardrock operations are meeting federal requirements. The field offices explained that this problem occurred because of other office priorities, lack of staff trained to use LR2000, and staff workload. In addition, the BLM officials who administer LR2000 said the quality of the data currently in LR2000 varied in part because of the varied emphasis the field offices gave to data entry.

LR2000 also does not track some critical information on hardrock operations and their associated financial assurances. In particular, LR2000 does not track the following:

- *The status of hardrock operations, such as whether the operation is ongoing or has ceased and should be reclaimed.* LR2000 uses the term "open" to identify both operations that are ongoing and operations that have ceased and should be reclaimed. It uses the term "closed" to refer to those operations where reclamation has been completed. While field staff should know whether an operation is ongoing or has ceased because of first-hand knowledge or access to case files in their offices, BLM headquarters and state office officials do not have ready access to this basic information. For example, in response to our survey regarding the number of ongoing hardrock operations with financial assurances, the Arizona state office reported that only 32 of 55 plan-level operations had financial assurances. The office also reported that it was reviewing its case files to determine the status of the operations without financial assurances, such as whether any of these operations have ceased, been reclaimed, and should have been closed in LR2000. Also, in response to our survey, the California state office reported that LR2000 showed 639 "open" hardrock operations in the state, but officials estimated that only 303 of these operations were actually ongoing. Furthermore, for 9 of the 13 states with hardrock operations, BLM state offices reported that they did not track the status of reclamation where operators had failed to do required reclamation using LR2000 or other means.[42]

- *Information on all types of financial assurances allowed under federal regulations*. LR2000 has data entry fields for five of the allowed types of assurances—surety bonds, letters of credit, certificates of

[42]BLM state office officials completed state surveys for those states within their jurisdiction with hardrock operations—a total of 13 states. The BLM Montana state office said that one state within its jurisdiction—South Dakota—had only two hardrock operations, both of which had ceased operating and were being reclaimed by the operators.

deposit, cash, and treasury securities—as well as a "personal" field. However, some of the missing types of financial assurances, such as corporate guarantees, bond pools, and trust funds, are being used to guarantee reclamation costs. For example, corporate guarantees covered $204 million in reclamation costs, or 24 percent of the total value of financial assurances that BLM reported as of July 2004. To overcome this system limitation, the Nevada BLM state office uses the "personal" field to track information on both corporate guarantees and operations covered by the state bond pool. Without the capability to track all types of financial assurances, BLM cannot identify the total amount of reclamation costs that each type of financial assurance guarantees.

- *Information on financial assurances held by the state or county agencies.* Several BLM state offices reported that some financial assurances for hardrock operations on BLM land are held by state or county agencies and are not included in LR2000. For example, the Montana BLM state office contacted the Montana Department of Environmental Quality to obtain information on the types and amounts of financial assurances. The Idaho office reported that it relies on its own informal records to track state-held financial assurances and provided the information. In California, where county agencies can hold the financial assurances for hardrock operations on BLM land, the office reported that it does not have information on all financial assurances held by the counties and did not contact them to provide it. In commenting on a draft of this report, Interior stated that BLM issued an instruction memorandum in April 2005 to provide guidance and direction on data standards for LR2000.[43] The instruction memorandum states that BLM data entry staff must use a specific action code when financial assurances are filed and instructs the staff to use that action code when BLM receives documentation that a financial assurance is held by another agency.

BLM Makes Limited Use of LR2000

Given LR2000's limitations, it is not surprising that BLM's reliance on the system to manage financial assurances is mixed. At the headquarters level, BLM does not always rely on information in LR2000. Rather, to obtain information needed on hardrock operations and associated financial

[43]BLM Instruction Memorandum 2005-126, *Data Standard Changes for Surface Management Plans of Operations*, (Apr. 14, 2005).

assurances, BLM headquarters officials must contact their state and field offices. For example, because the information was not in LR2000, in March 2003, BLM headquarters requested information from its state and field offices on the number of notice-level operations that (1) did not meet the required deadline to request an extension, (2) requested an extension, and (3) were extended under the 2001 regulations. BLM needed this information to determine if all notice-level operations were in compliance with current regulations.[44]

Furthermore, BLM headquarters does not always rely on LR2000 to answer questions on financial assurances at a national or state level from the Congress, the public, and other interested parties. For example, BLM headquarters could not provide information on hardrock operations and financial assurances in response to our request for such information and told us we would have to get this information from the state and field offices. State offices told us that some of the critical information, such as the status of the hardrock operation and reclamation cost estimates needed to determine the adequacy of the financial assurances, is in paper case files located in the field offices. Others also have found that BLM does not systematically use LR2000 to track information on hardrock operations. For example, in its 1999 report on hardrock mining, the National Research Council found no systematic, easily available compilation and analysis of information about hardrock operations on BLM land.[45]

At the state- and field office-levels, BLM's reliance on LR2000 for managing financial assurances for hardrock operations varies. BLM state offices reported that in four states with hardrock operations LR2000 was relied on to little or no extent; in eight states, to a moderate or some extent; and in one state—Nevada—to a very great extent.[46] Of the four BLM state offices reporting little or no reliance on LR2000, two explained that there is no BLM state office oversight of the program; one defers program responsibility to the state agency; and one has few hardrock operations.

[44]BLM Instruction Memorandum 2003-118, *43 C.F.R. 3809 Notice-Workload Analysis* (Mar. 24, 2003).

[45]National Research Council, *Hardrock Mining on Federal Lands* (Washington, D.C.: 1999).

[46]We asked each of the BLM state offices with hardrock operations to what extent the state office or its field offices rely on information in BLM's LR2000 system for managing the financial assurance program for hardrock operations. The categories were: little or no extent, some extent, moderate extent, great extent, and very great extent. The Alaska BLM state office answered this question for ALIS.

The lack of reliance on LR2000 for managing financial assurances is due in part to state office concerns about the reliability and adequacy of information in the system. For example, as discussed earlier, some BLM state offices do not use LR2000 because it does not contain information on financial assurances held by state or county agencies. States' views on the reliability and adequacy of LR2000 are shown in table 12.

Table 12: States' Views on Reliability and Adequacy of LR2000 to Manage Financial Assurances

	BLM state offices' views					
Survey question: To what extent is the information in LR2000	**Did not use LR2000 to manage financial assurances**	**Very unreliable/ Inadequate**	**Unreliable/ Inadequate**	**Marginal or borderline reliability/ Adequacy**	**Generally reliable/ Adequate**	**Very reliable/ More than Adequate**
Reliable for managing financial assurances[a]	2	2	1	2	5	1
Adequate to manage financial assurances[b]	2	2	1	2	6	[c]

Source: GAO's analysis of BLM survey responses.

[a]We asked each of the BLM state offices with hardrock operations how reliable is the information in LR2000 for managing financial assurances. The categories were: very unreliable, unreliable, marginal or borderline reliability, generally reliable, very reliable, or do not use LR2000 for this purpose. The Alaska BLM state office answered this question for ALIS.

[b]We asked each of the BLM state offices with hardrock operations how adequate is the information in LR2000 for managing financial assurances. The categories were: very inadequate, inadequate, marginal or borderline adequacy, generally adequate, more than adequate, or do not use LR2000 for this purpose. The Alaska BLM state office answered this question for ALIS.

[c]None of the BLM state offices chose this response.

Some BLM offices reported using informal record-keeping systems or records to track information on hardrock operations and associated financial assurances within their jurisdiction. For example:

- In Alaska, the field offices use an Alaska state agency database to obtain information on the number of existing notice- and plan-level hardrock operations.
- The New Mexico BLM state office has an informal database that lists all financial assurances filed and approved to track financial assurance information in the state.
- The Nevada BLM state office uses field offices' logs and the Nevada state database to track information on hardrock operations.

- The Idaho BLM state office maintains informal records on state-held financial assurances.

According to agency officials, BLM has taken some steps to improve the information in LR2000 and is planning others. Specifically, BLM reported the following actions:

- *Developing revised data standards for LR2000, which have not been updated since the 1990s*. These standards set forth the type and format of information that must be entered into LR2000. Officials are considering expanding information on the status of hardrock operations in the system to show whether operations have been abandoned and the type of activity associated with the operation, such as mining and road construction. In commenting on a draft of this report, Interior stated that BLM's April 2005 instruction memorandum provided guidance on action codes to track the length of time between submission and approval of hardrock plans of operation.

- *Planning to add an additional report to LR2000 so that BLM officials can directly compare information on hardrock operations with their associated financial assurances*. The creation of this report was prompted by a request from the Nevada BLM state office for this information.

- *Reengineering LR2000 to better reflect the way BLM does business so that officials will have better management information*. Officials said that while progress has been made on this effort with some other BLM programs, such as oil and gas, reengineering BLM's data management for hardrock operations is planned for the future.

BLM state offices also identified some changes to LR2000 that could help them better manage financial assurances for hardrock operations. These changes included ensuring the codes in LR2000 match the on-the-ground conditions of operations; changing it to better identify critical information on financial assurances, such as those held by state and county agencies; and enhancing its capability to notify BLM officials when it is time to review financial assurance amounts. According to BLM officials responsible for administering LR2000, the system has the capacity to handle virtually any changes that the state and field offices request. In commenting on a draft of this report, Interior stated that BLM will continue to refine and enhance LR2000 data systems as needed to facilitate the hardrock mining program.

Conclusions

Having adequate financial assurances to pay reclamation costs for BLM land disturbed by hardrock operations is critical to ensuring that the land is reclaimed if operators fail to complete reclamation as required. Furthermore, financial assurances must be based on sound reclamation plans and current cost estimates so that BLM can be confident that financial assurances will fully cover reclamation costs. For years, BLM headquarters has relied on BLM state offices that, in turn, rely on BLM field offices and sometimes on state and county agencies to obtain adequate financial assurances. However, while federal regulations and BLM guidance set forth financial assurance requirements for notice- and plan-level hardrock mining operations, BLM does not have a process for ensuring that the regulations and guidance are effectively implemented to ensure that adequate financial assurances are actually in place, as required.

Moreover, BLM does not know whether all hardrock operations have adequate financial assurances because of limitations in the types of information collected in LR2000 and failure of staff to update information in a timely manner. Specifically, LR2000 does not track the status of hardrock operations, whether each existing operation that requires a financial assurance has the assurance, and whether the financial assurance is adequate to pay the cost of required reclamation.

Because BLM does not have an effective management process and critical management information, it has not ensured that some current and previous operators have adequate financial assurances, as required by federal regulations and/or BLM guidance. Furthermore, some operations either do not have any, or have outdated reclamation plans and/or cost estimates. When operators without any financial assurances, or with inadequate financial assurances, fail to reclaim BLM land disturbed by their hardrock operations, BLM is left with public land that requires tens of millions of dollars to reclaim and poses risks to the environment and public health and safety. Until BLM establishes monitoring and accountability mechanisms to ensure that all operations have required financial assurances—based on sound reclamation plans and current cost estimate—and improves the information it collects to effectively manage financial assurances, these problems will continue.

Recommendations for Executive Action

To ensure that hardrock operations on BLM land have adequate financial assurances, we recommend that the Secretary of the Interior direct the Director of BLM to take the following two actions:

- require the BLM state office directors to establish an action plan for ensuring that operators of hardrock operations have required financial assurances and that the financial assurances are based on sound reclamation plans and current cost estimates, so that they are adequate to pay all of the estimated costs of required reclamation if operators fail to complete the reclamation, and

- modify LR2000 to ensure that it tracks critical information on hardrock operations and associated financial assurances so that BLM headquarters and state offices can effectively manage financial assurances nationwide to ensure regulatory requirements are met.

Agency Comments and Our Evaluation

We received written comments on a draft of this report from the Department of the Interior. Interior stated that it appreciated the advice and critical assessment we provided on BLM's management of financial assurances required for hardrock operations. However, Interior did not acknowledge or address specific deficiencies identified in our report and did not concur with our recommendations or the conclusions upon which the recommendations were based.

In commenting on our recommendation to establish an action plan for ensuring that operators of hardrock operations have required financial assurances, Interior stated that existing procedures and policies ensure financial guarantees are in place to protect the public should an operator fail to reclaim. We disagree and believe that Interior's view is inconsistent with the evidence we developed based on information provided by BLM's own offices. While we agree that existing federal regulations and BLM guidance require financial assurances to cover all reclamation costs for notice- and plan-level hardrock operations, the evidence in our report shows that notices and plans of operation do not always have adequate financial assurances, as required. As we stated in this report, BLM state offices with existing hardrock operations informed us that, as of July 2004, some notice- and/or plan-level operations did not have adequate financial assurances. Furthermore, the evidence is clear that hardrock operations have ceased without operators having the adequate financial assurances required by regulations and BLM guidance. As a result, funds are not available to pay at least $56.4 million in reclamation costs for operations that had ceased and not been reclaimed since BLM began requiring financial assurances. We continue to believe that this evidence clearly calls for a plan of action that includes monitoring and accountability mechanisms to ensure that the requirements in the federal regulations and BLM guidance to have adequate financial assurances are met.

In commenting on our recommendation to modify LR2000 to ensure that it tracks critical information on hardrock operations and associated financial assurances, Interior stated that BLM does track all critical information on authorized operations in LR2000. Again, we disagree with BLM's opinion and find this view troubling when viewed in the context of clear evidence to the contrary presented in this report. As we reported, LR2000 does not track the critical information needed to effectively manage and oversee financial assurances, including the operation's basic status, such as whether the operation is ongoing or has ceased and should be reclaimed; some types of financial assurances being used, such as corporate guarantees, bond pools, and trust funds; and the adequacy of financial assurances to pay the cost of required reclamation. We are encouraged by BLM's April 2005 instruction memorandum to provide guidance and direction on data standards for LR2000 and the recent addition of codes and edits to LR2000 for plans of operations and financial guarantees, and we have added information to our report, as appropriate. We are also encouraged by BLM's willingness to refine and enhance LR2000. However, we continue to believe that until BLM timely enters, tracks, and uses this critical information it will not be able to effectively manage financial assurances to ensure that federal regulations and BLM guidance are followed.

Interior also suggested some technical changes that we have incorporated as appropriate. Interior's letter is included in appendix IV, along with our comments.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. We will then send copies to other appropriate congressional committees and to the Secretary of the Interior. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staff have any questions concerning this report, please contact me at (202) 512-3841 or Nazzaror@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix V.

Sincerely yours,

Robin M. Nazzaro

Robin M. Nazzaro
Director, Natural Resources and Environment

Objectives, Scope, and Methodology

This appendix details the methods we used to examine three aspects of financial assurances used to cover reclamation costs for the Department of the Interior's Bureau of Land Management (BLM) land disturbed by hardrock exploration, mining, and processing operations. Specifically, we were asked to determine the (1) types, amount, and coverage of financial assurances operators currently use to guarantee reclamation costs; (2) amount that financial assurance providers and others have paid to reclaim operations that had ceased and not been reclaimed since BLM began requiring financial assurances and the estimated costs of completing reclamation for such operations; and (3) reliability and sufficiency of BLM's automated LR2000 information system for managing financial assurances for hardrock operations.

To address these objectives, we designed two surveys to obtain information from BLM's state and field offices because they maintain the case files and other specific information on hardrock operations. We asked the 12 BLM state offices that manage BLM programs across the United States to complete surveys for each state in their jurisdiction with hardrock operations. The 12 BLM state offices were Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Wyoming, and Eastern States.[1]

We used the first survey, which focused on states' experiences with hardrock operations, to determine the types and amounts of financial assurances currently used to guarantee reclamation costs. Specifically, we asked the 12 BLM state offices to provide information on (1) the number of existing hardrock operations for each state within their jurisdiction, (2) the types and the amounts of financial assurances provided for existing hardrock operations in each state, (3) their views on the effectiveness of the various types of financial assurances, (4) their views on the reliability and sufficiency of hardrock operation data contained in the LR2000, and (5) their use of LR2000 for managing hardrock operations in their states.

We used the second survey, which focused on selected hardrock operations, to determine the amount of funds provided by financial assurances and others to reclaim hardrock operations that had ceased and

[1]Some of the 12 BLM state offices manage BLM programs in more than one state. For example, the BLM Montana state office manages BLM programs in Montana, North Dakota, and South Dakota, and the Oregon state office manages BLM programs in Oregon and Washington.

not been reclaimed by operators since BLM began requiring financial assurances and the estimated costs of completing reclamation of such operations. We asked the state offices to provide detailed information on each hardrock operation within their jurisdiction that met both of the following criteria: the operator (1) ceased operations after the requirement for financial assurances went into effect—August 1990 for plan-level operations, January 2001 for new notice-level operations, and January 2003 for existing notice-level operations—and (2) failed to complete the required reclamation. In most cases, BLM field office staff completed this survey because hardrock operation case files are maintained in these offices. Also, as necessary, we obtained information from BLM state and field staff to clarify responses to the survey. We used the information obtained to determine the estimated reclamation costs and the adequacy of financial assurances for reclaiming the hardrock operations that BLM identified as meeting our criteria.

To determine the adequacy of financial assurances, we compared the most recent complete reclamation cost estimate that BLM reported for each operation with the dollar value of the financial assurance that BLM reported for that operation. We then computed the difference between the most recent cost estimate and the value of the financial assurance to determine the total net excess or deficiency of the financial assurances. The total is the sum of the differences between the values of the financial assurances and the cost estimates that were made at different times over the past 15 years and were not adjusted for inflation. For each operation, we asked BLM to report the value of the (1) estimates that the operator had before operations ceased, (2) estimates that BLM prepared after operations ceased, (3) actual reclamation costs, (4) BLM's estimate of the shortfall in funds needed to complete reclamation in excess of funds relinquished by the financial assurance provider, and (5) BLM's estimates of funds needed to complete required reclamation. BLM reported one or more of these values for 43 operations, and no value for the other 5 operations. For 24 of these 43 operations, BLM reported only one value, and we used that value as the most recent reclamation cost estimate. For the other 19 operations, BLM reported two or more values. In determining which value to use for our analysis, we generally did not use the (1) actual costs for operations that were not fully reclaimed because the actual cost could not be known unless reclamation was complete and (2) estimated funds needed to complete reclamation for operations that were partly reclaimed because those estimates did not include funds that had already been spent. We used the following values as the most recent reclamation cost estimate for these 19 operations.

- For 12 operations, we used BLM's estimate prepared after operations ceased because those estimates were the most recent.

- For three operations that BLM reported as having no reclamation completed or not knowing the status of reclamation, we used BLM's reported estimate of funds needed to complete required reclamation.

- For one operation that BLM reported as being fully reclaimed, we used BLM's reported actual cost.

- For one operation, we used BLM's estimate of the shortfall of funds needed in excess of funds relinquished by the financial assurance provider because that estimate was the most recent and most accurate, according to BLM officials.

- For one operation, we used the estimate available before operations ceased because the only other value reported for the operation was BLM's estimate of funds needed to complete reclamation and reclamation was only partly completed.

- For one operation, we used the estimate available before operations ceased because the other values reported for the operation were BLM's estimate of funds needed to complete reclamation and the reported amount of actual costs, but reclamation was only partly completed.

We provided a copy of these two surveys to BLM headquarters and incorporated officials' comments as appropriate. We also pretested these surveys with state and field office staff in Nevada, Utah, and Arizona and made changes in the surveys' scope and content as appropriate. Further, after respondents submitted their answers, we (1) verified the information in the survey that focused on states' hardrock operations experience through discussions with BLM officials in two state offices with extensive financial assurance experience in hardrock operations—Nevada and Montana—and (2) verified information reported in four randomly selected hardrock operations surveys through discussions with officials and a review of case files in three Nevada field offices—Carson City, Elko, and Winnemucca—and one Montana field office—Lewistown. We checked the answers respondents had given to the questions against information contained in the case files. In many cases, staff provided answers based on their own knowledge and information in the case files.

Some BLM state offices had difficulty identifying hardrock operations that met our criteria. For example, some states completed our surveys for hardrock operations that did not appear to meet our criteria, and we contacted the respondents to clarify whether the operations did or did not meet the criteria. We eliminated 12 surveys that did not meet the criteria from our analysis.

Furthermore, we cannot know whether BLM reported to us all hardrock operations that met our criteria. To address this concern, we took additional steps to help ensure that BLM completed the selected hardrock operations survey for all operations that met our criteria. For example, in Nevada, we compared a list of bankrupt operations prepared by the Nevada Bonding Task Force with a list of BLM's completed surveys to identify potential omissions. In addition, we asked selected experts, interest groups, and others to identify instances when operators failed to complete required reclamation and the federal government or others paid such reclamation costs or the required reclamation was not fully completed. To the extent that BLM staff did not identify all of the operations that met our criteria or did not report information on those operations that did meet the criteria, the information the BLM staff reported is incomplete. Furthermore, we did not collect information on the thousands of ceased hardrock operations since 1872 that did not require financial assurances and, therefore, fell outside the scope of this review.

To determine the reliability and sufficiency of BLM's LR2000 system, we spoke with BLM information technology officials in the headquarters unit near Denver, Colorado, who are responsible for administering the system; BLM state and field office staff in two states who enter information into the system; and BLM managers at headquarters and in two states who use information from the system. In addition, we visited information technology officials near Denver to discuss the structure and history of LR2000 and to observe firsthand how data are entered into and processed by the two subsystems used to manage financial assurances—the Case Recordation System, which contains information about hardrock operations, and the Bond and Surety System, which contains information about financial assurances. Also, in our two surveys of BLM's 12 state offices, we asked questions to gather data on whether each respondent used LR2000 to respond to the survey. Specifically, we asked questions about whether the information used to respond came from LR2000 or from state office personnel's knowledge, field office personnel's knowledge, other databases, case files, or other sources. These questions helped us determine the extent to which BLM officials used and relied on the data in LR2000.

It is important to note that the practical difficulties of conducting any survey introduce various types of errors. Differences in how a particular question is interpreted and differences in the sources of information available to respondents can also be sources of survey response errors. We included steps in both the data collection and data analysis stages to minimize such errors. These steps included developing our survey questions with the aid of our survey specialists, conducting pretests of the questionnaires, and twice verifying the entry of survey data where applicable.

In addition to the surveys, we took several steps to understand BLM's management and oversight of hardrock operations and the use of financial assurances to ensure reclamation. We reviewed GAO reports, federal laws and regulations, BLM documents, and independent studies on hardrock operations and financial assurances. We also discussed these issues with BLM officials at headquarters and in selected state and field offices in Arizona, Montana, Nevada, and Utah. To understand the relationship between BLM and state agencies responsible for overseeing hardrock operations, we met with BLM and state agency officials in Colorado and Nevada, and we reviewed relevant memorandums of understanding and other documents for these and other states. We also discussed relevant hardrock operation and financial assurance issues with experts and representatives from the mining industry, academia, and environmental groups. Finally, to better understand hardrock operations and reclamation requirements, we visited five hardrock operations on BLM land in two states—the Florida Canyon, MacArthur Mine, Olinghouse, and Relief Canyon operations in Nevada and the Zortman and Landusky operation in Montana.

We conducted our review from October 2003 through May 2005 in accordance with generally accepted government auditing standards, including an assessment of data reliability.

Number of Notice- and Plan-Level Hardrock Operations and Value of Associated Financial Assurances

This appendix provides information on the number of notice- and plan-level operations and dollar value of associated financial assurances for the 12 states with existing hardrock operations as of July 2004, as reported by BLM.

Table 13: Number of Notice- and Plan-Level Hardrock Operations and Associated Financial Assurances, by State, as of July 2004

	Notice-level operations		Plan-level operations		Total for notice- and plan-level hardrock operations	
State	**Number of operations**	**Value of financial assurances**	**Number of operations**	**Value of financial assurances**	**Number of operations**	**Value of financial assurances**
Alaska	134	[a]	106	[a]	240	$1,000,000
Arizona	130	446,107	55	4,326,891	185	4,772,998
California[b]	205	116,800	98	4,819,000	303	4,935,800
Colorado	102	14,600	30	1,722,313	132	1,736,913
Idaho[c]	32	43,761	23	751,771	55	795,532
Montana	150	[d]	30	[d]	180	109,307,930
New Mexico	24	[e]	11	[e]	35	4,298,989
Nevada[f]	450	7,001,785	324	621,495,665	774	629,684,465
Oregon	165	21,000	10	31,000	175	52,000
Utah[g]	167	552,556	49	2,175,629	216	2,728,185
Washington	127	[h]	12	[h]	139	[h]
Wyoming[i]	18	51,000	38	77,357,524	56	77,408,524
Total	**1,704**	[j]	**786**	[j]	**2,490**	**$836,721,336**

Source: GAO analysis of BLM data.

[a]The Alaska state bond pool covers all hardrock operations in the state. The Alaska BLM office did not provide information on the value of financial assurances for each type of operation.

[b]The $4,935,800 in financial assurances includes those held by BLM, the state of California, and some county agencies in California. However, it may not include all financial assurances held by California counties to guarantee reclamation of hardrock operations on BLM public land.

[c]The $795,532 in financial assurances includes $512,590 held by the state of Idaho and $282,942 held by the BLM.

[d]Montana BLM holds $66,390 in financial assurances for hardrock operations in the state. The majority of financial assurances funds, $109,241,540, are held by the Montana Department of Environmental Quality. Neither the BLM nor the state agency provided information on the value of the financial assurances by type of operation.

[e]New Mexico BLM holds $975,191 in financial assurances—$71,898 for notice-level operations and $903,293 for plan-level operations. Additional financial assurances held by the New Mexico Mining and Minerals Division for hardrock operations on BLM land total $3,323,798. The New Mexico agency did not provide information on the value of these financial assurances by type of operation.

[f]The Nevada BLM reported that some operators in the state use statewide and nationwide financial assurances that the office could not separate by notice- and plan-level operation. The office estimated

that 10 percent of the statewide and nationwide financial assurances cover notice-level and 90 percent cover plan-level operations and allocated assurances accordingly. The $629,684,465 in financial assurances includes corporate guarantees held by the state of Nevada and one trust fund and the state bond pool, which are maintained by the State of Nevada.

[g]The $2,728,185 in financial assurances for Utah includes those held by both the BLM and the state of Utah.

[h]The Oregon BLM state office did not provide information on the amount of financial assurances available to reclaim the 139 existing hardrock operations it identified in the state of Washington on BLM public land. The office reported no individual bonds are used for operations in Washington state, but that a statewide bond is held by the Washington Department of Ecology.

[i]The state of Wyoming holds all financial assurances to guarantee reclamation of BLM public land.

[j]The total value of financial assurances for notice-level operations or the total value for plan-level operations is not available because BLM did not provide this information for some states.

Detailed Information on 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators

This appendix provides detailed information obtained from our survey on the 48 hardrock operations that BLM identified as ceased but not reclaimed by the operator since BLM began requiring financial assurances. Specifically, the appendix presents tables 14 through 19 showing: the basic characteristics of the 48 hardrock operations; key reclamation dates; BLM steps to compel operators to reclaim BLM land disturbed by hardrock operations and reasons operators did not reclaim the land; estimated reclamation costs; the types and amount of financial assurances and the amount of financial assurances relinquished and spent on reclamation; and sources of other funds and the status of reclamation.

Table 14: Basic Characteristics of 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators

State and operation	Authority	Type of operation	Primary hardrock mineral	Heap–leaching	BLM acres
Alaska					
Chapman Creek Mining	Plan	Mining; other (road construction)	Gold	No	5
R D Environmental Mining	Plan	Exploration; mining	Gold	No	2
Gold Hill Mining	Plan	Mining	Gold	No	30
Nixon Fork Mine	Plan	Exploration; mining	Gold	No	115
Arizona					
Tyro Mill	Plan	Other (gold milling)	Gold	No	20
Granite Property	Plan	Exploration	Gold	No	[a]
Herring Mine	Plan	Mining	Gold	No	2
SKOR	Plan	Mining	Gold	No	3
UFO	Plan	Mining	Gold	No	12
Ironwood Claim Group	New notice	Exploration	Gold	No	[a]
California					
Screech Owl	Plan	Exploration	Gold	No	2
Nina	Plan	Mining; other (placer gold wash plant)	Gold	No	4
Idaho					
West One Minerals	Plan	Exploration; mining	Limestone	No	7
Montana					
Snowbound Placer	New notice	Exploration	Gold	No	0
Zortman & Landusky Mine	Plan	Mining	Gold	Yes	684
Zortman Exploration Plans	Plan	Exploration	Gold	Yes	88
Nevada					
Adelaide Crown	Plan	Mining	Gold	Yes	69
Wildhorse Canyon	Plan	Exploration	Gold	No	12
South Hy/Isabella	Plan	Exploration	Gold	No	22
Hogum or Golden Eagle	Plan	Mining	Gold	No	10
Golden Butte	Plan	Mining	Gold	Yes	235
Pan Project	Plan	Exploration	Gold	No	30
Monte Exploration	Plan	Exploration	Gold	No	18
Ward Mine	Plan	Mining	Zinc	No	22
Easy Jr	Plan	Mining	Gold	Yes	247
MacArthur Mine	Plan	Mining	Copper	Yes	415
Northern Crown Mines	Plan	Exploration	Gold	No	4

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State and operation	Authority	Type of operation	Primary hardrock mineral	Heap–leaching	BLM acres
Maverick Springs	Plan	Exploration	Gold	No	13
Phil Claims Expl Proj	Plan	Exploration	Gold	No	23
Kinsley	Plan	Mining	Gold	Yes	350
County Line Project	Plan	Mining	Gold	Yes	130
Olinghouse Mine	Plan	Exploration; mining	Gold	Yes	447
Mina Mill	Plan	Other (custom mill)	Gold	No	20
Diamond Peak Prospect Mtn	New Notice	Exploration	Gold	No	1
Eldorado Pediment	New Notice	Exploration	Gold	No	1
Phoenix Metals USA II Inc.	Plan	Other (mill site)	Platinum group metals/gold	No	12
American Canyon KOF	New Notice	Exploration	Gold	No	1
Jumbo Mine	Plan	Mining	Gold	Yes	63
Relief Canyon Mine	Plan	Mining	Gold	Yes	295
Elder Creek	Plan	Mining	Gold	Yes	102
Gold Bar Resource Area	Plan	Exploration; mining	Gold	Yes	154
Atlas Exploration	Plan	Exploration	Gold	No	149
16: 1 Millsite	Plan	Mining	Silver	Yes	40
Gold Bar Mine	Plan	Exploration; mining	Gold	Yes	1,175
Paradise Peak	Plan	Mining	Gold	Yes	470
Washington					
Raven Hill Mining	Plan	Mining	Rare Earth Elements	No	10
Empire Creek Project	Plan	Exploration	Unknown	No	5
Lamefoot	Plan	Mining	Gold	No	5

Source: BLM survey responses.

[a]No acreage given.

Table 15: Key Dates for 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators

State	Operation began	Last plan of operation update	Last reclamation plan update	Last cost estimate update	Operation ceased	BLM cost estimate
Alaska						
Chapman Creek Mining	7/1996	7/1996	Not applicable	No answer	1/1998	No answer
R D Environmental Mining	1/1992	7/1995	7/1995	No answer	1/1995	6/2003
Gold Hill Mining	2/1999	5/2000	No answer	No answer	5/2002	No answer
Nixon Fork Mine	1/1991	5/1999	No answer	No answer	1/1999	No answer
Arizona						
Tyro Mill	1/1980	2/2000	2/2000	2/2000	7/2002	No answer
Granite Property	1/1990	5/1990	5/1990	No answer	11/1990	No answer
Herring Mine	1/2002	6/2002	6/2002	6/2002	1/2002	No answer
SKOR	1/1984	3/1985	Not applicable	No answer	1/1991	6/2003
UFO	1/1982	5/1991	Not applicable	No answer	1/1991	3/2004
Ironwood Claim Group	1/1983	1/2003	No answer	No answer	1/2003	No answer
California						
Screech Owl	7/1981	8/1995	8/1995	No answer	8/1996	No answer
Nina	1/1988	5/1995	4/1988	4/1988	1/2001	9/2003
Idaho						
West One Minerals	3/1990	1/1991	No answer	No answer	4/1991	No answer
Montana						
Snowbound Placer	1/2003	6/2003	9/2003	6/2003	1/2003	No answer
Zortman & Landusky Mine	1/1981	2/1994	2/1994	6/1998	1/1999	8/2004
Zortman Exploration Plans	1/1981	1/1996	1/1996	8/1999	1/1998	8/1999
Nevada						
Adelaide Crown	6/1988	6/1991	3/1988	No answer	10/1991	No answer
Wildhorse Canyon	10/1989	3/1995	3/1995	3/1995	7/1999	6/2003
South Hy/Isabella	5/1988	5/1995	5/1995	5/1995	7/1999	6/2003
Hogum or Golden Eagle	1/1997	2/1989	2/1989	No answer	1/1999	No answer
Golden Butte	1/1986	9/1995	4/1993	4/1993	1/1999	8/2004

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State	Operation began	Last plan of operation update	Last reclamation plan update	Last cost estimate update	Operation ceased	BLM cost estimate
Pan Project	1/1989	9/1989	No answer	No answer	1/1999	No answer
Monte Exploration	1/1987	4/1993	4/1993	4/1993	1/1999	No answer
Ward Mine	1/1989	3/1993	11/1994	No answer	1/1999	No answer
Easy Jr	1/1987	5/1999	5/1999	5/1999	1/1999	8/2003
MacArthur Mine	9/1992	9/1995	5/1998	No answer	11/1997	No answer
Northern Crown Mines	12/1991	3/1993	Not applicable	12/1991	12/1993	No answer
Maverick Springs	7/1990	12/1990	Not applicable	No answer	7/1991	9/1993
Phil Claims Expl Proj	1/1982	10/1995	10/1995	10/1995	1/1998	No answer
Kinsley	1/1994	3/1997	1/1996	1/1996	1/2000	No answer
County Line Project	5/1991	1/1992	12/1994	1/1992	12/1995	No answer
Olinghouse Mine	5/1998	9/2002	9/2002	9/2002	5/1999	No answer
Mina Mill	11/1985	11/1994	11/1994	11/1994	6/1996	No answer
Diamond Peak Prospect Mtn	6/2001	8/2002	5/2001	5/2001	1/2003	No answer
Eldorado Pediment	8/2001	10/2001	10/2001	10/2001	10/2003	No answer
Phoenix Metals USA II Inc.	1/1997	12/2001	2/1999	9/1997	12/2001	11/2001
American Canyon KOF	1/2002	5/2002	Not applicable	5/2002	1/2002	No answer
Jumbo Mine	1/1983	6/1986	4/1986	No answer	1/1997	1/1998
Relief Canyon Mine	1/1995	5/1997	5/1994	5/1997	1/2001	No answer
Elder Creek	1/1989	10/2000	12/1995	2/1996	1/2000	No answer
Gold Bar Resource Area	12/1986	8/2004	9/2004	12/1994	12/1994	No answer
Atlas Exploration	1/1984	12/1994	9/2004	6/1994	1/1994	No answer
16: 1 Millsite	4/1981	3/1991	No answer	7/1991	6/1992	7/1992
Gold Bar Mine	1/1984	8/2004	9/2004	10/1994	1/1994	No answer
Paradise Peak	12/1995	5/1996	5/1996	11/1995	8/2003	No answer
Washington						
Raven Hill Mining	1/1995	6/1995	No answer	No answer	1/1996	No answer
Empire Creek Project	4/1997	4/1997	No answer	4/1997	Unknown	No answer
Lamefoot	1/1992	11/1991	No answer	No answer	1/2001	No answer

Source: BLM survey responses.

Table 16: BLM Steps to Compel Operators to Reclaim BLM Land Disturbed by 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators and the Reasons Operators Did Not Reclaim the Land

State and operation	BLM steps to compel reclamation	Operator did some reclamation	Reasons operators did not complete reclamation
Alaska			
Chapman Creek Mining	Notice of noncompliance; other (sent letters)	No	Recently ceased; other (operator tried unsuccessfully to sell)
R D Environmental Mining	Notice of noncompliance	Some reclamation	Other (claimant had health problems)
Gold Hill Mining	Notice of noncompliance; other (issued enforcement order)	No	Bankruptcy
Nixon Fork Mine	Other (worked with solicitor re: bankruptcy)	Some reclamation	Bankruptcy
Arizona			
Tyro Mill	Other (issued orders)	No	Other (operator in violation of two orders)
Granite Property	No action	No	Unknown
Herring Mine	Notice of noncompliance; other (revoked plan)	Some reclamation	Bankruptcy
SKOR	No action	No	Bankruptcy
UFO	Other (tried to locate operator)	Some reclamation	Bankruptcy; other (operator failed to submit bond)
Ironwood Claim Group	Other (asked friends to do reclamation)	Some reclamation	Other (claimant died)
California			
Screech Owl	Notice of noncompliance	Some reclamation	Other (claimant had BLM reclaim using financial assurance funds)
Nina	Other (negotiated bond release & claim relinquishment)	Some reclamation	Bankruptcy; other (BLM reclaimed in exchange for forfeiture of claim)
Idaho			
West One Minerals	Notice of noncompliance; other (attached bond)	No	Bankruptcy
Montana			
Snowbound Placer	Notice of noncompliance; other (sent letters)	Some reclamation	Recently ceased; other (operator was busy but promised to reclaim)
Zortman & Landusky Mine	Other (filed bankruptcy claim & worked with state re: bond)	Some reclamation	Bankruptcy
Zortman Exploration Plans	Other (unsuccessfully tried to have financial assurance provider do work)	Some reclamation	Bankruptcy
Nevada			
Adelaide Crown	Notice of noncompliance	No	Bankruptcy
Wildhorse Canyon	Notice of noncompliance	No	Bankruptcy

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State and operation	BLM steps to compel reclamation	Operator did some reclamation	Reasons operators did not complete reclamation
South Hy/Isabella	Notice of noncompliance	No	Bankruptcy
Hogum or Golden Eagle	Other (legal procedures to obtain bond)	Some reclamation	Bankruptcy
Golden Butte	Other (legal procedures to obtain bond)	Some reclamation	Bankruptcy
Pan Project	Other (legal procedures to obtain bond)	Some reclamation	Bankruptcy
Monte Exploration	Other (legal procedures to obtain bond)	Some reclamation	Bankruptcy
Ward Mine	Other (legal procedures to obtain bond)	Some reclamation	Bankruptcy
Easy Jr	Other (legal procedures to obtain bond)	Some reclamation	Bankruptcy
MacArthur Mine	Notice of noncompliance	No	Bankruptcy; other (operator believes reclamation will affect sale)
Northern Crown Mines	Notice of noncompliance	No	Other (ceased operations in 1993; no BLM action since)
Maverick Springs	Other (sent letters)	Some reclamation	Other (civil action)
Phil Claims Expl Proj	Notice of noncompliance; other (sent letters & made phone calls)	Some reclamation	Other (operator would like to continue work, but has no funds)
Kinsley	No action	Some reclamation	Bankruptcy
County Line Project	Notice of noncompliance	No	Bankruptcy
Olinghouse Mine	Notice of noncompliance	No	Bankruptcy; other (financial assurance provider went bankrupt, but did some work)
Mina Mill	Notice of noncompliance	No	Other (operator died & spouse has no funds for reclamation)
Diamond Peak Prospect Mtn	Other (sent notice of expiration)	No answer	Unknown
Eldorado Pediment	Other (sent expiration letter)	No	Recently ceased operation
Phoenix Metals USA II Inc.	Other (civil action & obtained court order to seize property)	No	Other (operator died)
American Canyon KOF	Notice of noncompliance	No	Other (operator fled)
Jumbo Mine	Notice of noncompliance	Some reclamation	Bankruptcy
Relief Canyon Mine	Notice of noncompliance; other (revoked plan)	No	Other (another operator assumed responsibility)
Elder Creek	Other (sent letters)	No	Bankruptcy
Gold Bar Resource Area	Notice of noncompliance	No	Bankruptcy
Atlas Exploration	Notice of noncompliance	Some reclamation	Bankruptcy
16: 1 Millsite	No action	Some reclamation	Bankruptcy
Gold Bar Mine	Notice of noncompliance	No	Bankruptcy
Paradise Peak	Notice of noncompliance	No	Bankruptcy

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State and operation	BLM steps to compel reclamation	Operator did some reclamation	Reasons operators did not complete reclamation
Washington			
Raven Hill Mining	Notice of noncompliance	Some reclamation	Bankruptcy
Empire Creek Project	No action	Some reclamation	Bankruptcy; other (project languished and was never completed)
Lamefoot	Other (awaiting operator decision re: closure)	Some reclamation	No answer

Source: BLM survey responses.

Table 17: Estimated Reclamation Costs for 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators

State and operation	Operators cost estimate before operation ceased	BLM cost estimate after operations ceased	Actual cost or estimate of shortfall or funds needed to complete reclamation	Most recent reclamation cost estimate as of July 2004
Alaska				
Chapman Creek Mining	No answer	No answer	No estimate	$0
R D Environmental Mining	No answer	$139,000	No estimate	$139,000
Gold Hill Mining	No answer	No answer	$500,000 needed to complete reclamation	$500,000
Nixon Fork Mine	No answer	No answer	No estimate	$0
Arizona				
Tyro Mill	$47,023	$800,000	$300,000 needed to complete reclamation and $800,000 actual	$800,000
Granite Property	No answer	No answer	No estimate	$0
Herring Mine	$1,800	No answer	$34,000 needed to complete and $34,000 actual	$34,000
SKOR	No answer	$88,240	$92,239 actual cost	$92,239
UFO	$24,000	$18,000	No estimate	$18,000
Ironwood Claim Group	$200	No answer	No estimate	$200
California				
Screech Owl	No answer	No answer	$2,431 actual cost	$2,431
Nina	$5,000	$15,000	No estimate	$15,000
Idaho				
West One Minerals	$12,000	No answer	No estimate	$12,000
Montana				
Snowbound Placer	$2,970	No answer	$2,970 needed to complete and $2,970 actual	$2,970
Zortman & Landusky Mine	$68,500,000	$85,200,000	$18,500,000 needed to complete and $25,200,000 shortfall	$85,200,000
Zortman Exploration Plans	$299,043	$299,043	No estimate	$299,043
Nevada				
Adelaide Crown	No answer	No answer	No estimate	$0

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State and operation	Operators cost estimate before operation ceased	BLM cost estimate after operations ceased	Actual cost or estimate of shortfall or funds needed to complete reclamation	Most recent reclamation cost estimate as of July 2004
Wildhorse Canyon	$52,310	$53,006	$53,000 needed to complete	$53,000
South Hy/Isabella	$122,369	$169,593	$169,700 needed to complete	$169,700
Hogum or Golden Eagle	No answer	No answer	No estimate	$0
Golden Butte	$328,942	$1,397,000	$400,000 needed to complete and $1,068,000 shortfall	$1,397,000
Pan Project	$5,670	No answer	No estimate	$5,670
Monte Exploration	$7,395	No answer	No estimate	$7,395
Ward Mine	$141,500	No answer	No estimate	$141,500
Easy Jr	$365,917	$668,936	$100,000 needed to complete and $400,000 shortfall	$668,936
MacArthur Mine	No Answer	No answer	$17,000,000 shortfall over $47,000 funds relinquished	$17,047,000
Northern Crown Mines	$3,897	No answer	No estimate	$3,897
Maverick Springs	No Answer	$7,999	$37,846 needed to complete	$37,846
Phil Claims Expl Proj	$28,556	No answer	No estimate	$28,556
Kinsley	$911,763	$1,400,000	$550,000 needed to complete and $500,000 shortfall	$1,400,000
County Line Project	$837,356	No answer	No estimate	$837,356
Olinghouse Mine	$850,650	No answer	No estimate	$850,650
Mina Mill	$116,408	No answer	No estimate	$116,408
Diamond Peak Prospect Mtn	$6,500	No answer	No estimate	$6,500
Eldorado Pediment	$8,200	No answer	No estimate	$8,200
Phoenix Metals USA II Inc.	$45,904	$100,000	$30,000 needed to complete	$100,000
American Canyon KOF	$21,600	No answer	No estimate	$21,600
Jumbo Mine	$8,197	$3,700	$2,500 needed to complete	$3,700

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State and operation	Operators cost estimate before operation ceased	BLM cost estimate after operations ceased	Actual cost or estimate of shortfall or funds needed to complete reclamation	Most recent reclamation cost estimate as of July 2004
Relief Canyon Mine	$888,696	No answer	$463,500 needed to complete	$888,696
Elder Creek	$256,062	No answer	No estimate	$256,062
Gold Bar Resource Area	$303,300	No answer	No estimate	$303,300
Atlas Exploration	$265,000	No answer	No estimate	$265,000
16: 1 Millsite	$124,017	$458,000	No estimate	$458,000
Gold Bar Mine	$2,608,000	No answer	No estimate	$2,608,000
Paradise Peak	$5,461,537	No answer	$20,000,000 shortfall over $1,157,000 funds relinquished	$21,157,000
Washington				
Raven Hill Mining	$6,700	No answer	No estimate	$6,700
Empire Creek Project	$7,125	No answer	No estimate	$7,125
Lamefoot	No answer	$20,000	No estimate	$20,000

Source: BLM survey responses.

Table 18: Types and Amount of Financial Assurances and the Amount of Financial Assurances Relinquished and Spent on Reclamation of 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators

State and operation	Financial assurance	Types and amount of financial assurances	Types and amount relinquished	Types and amount spent
Alaska				
Chapman Creek Mining	Yes	Bond pool - no value reported	None relinquished	Not applicable
R D Environmental Mining	Yes	Bond pool - $139,000	None relinquished	Not applicable
Gold Hill Mining	Yes	Bond pool - $15,000	None relinquished	Not applicable
Nixon Fork Mine	Yes	Bond pool - no value reported	None relinquished	Not applicable
Arizona				
Tyro Mill	No	No financial assurances	Not applicable	Not applicable
Granite Property	Yes	Surety bond - $2,000	None relinquished	Not applicable
Herring Mine	No	No financial assurances	Not applicable	Not applicable
SKOR	No	No financial assurances	Not applicable	Not applicable
UFO	No	No financial assurances	Not applicable	Not applicable
Ironwood Claim Group	Yes	Cash - $200	Cash - $200	Cash - $200
California				
Screech Owl	Yes	Certificate of deposit - $2,431	Certificate of deposit - $2,431	Certificate of deposit - $2,431
Nina	Yes	Certificate of deposit - $5,000	None relinquished	Not applicable
Idaho				
West One Minerals	Yes	Letter of credit - $12,000	Letter of credit - $12,000	Letter of credit - $12,000
Montana				
Snowbound Placer	Yes	Cash - $2,970	None relinquished	Not applicable
Zortman & Landusky Mine	Yes	Surety bond - $43,500,000; other - $14,300,000	Surety bond - $31,200,000 other - $2,000,000	Surety bond - $31,200,000 other - $1,800,000
Zortman Exploration Plans	Yes	Surety bond - $299,043	None relinquished	Not applicable
Nevada				
Adelaide Crown	No	No financial assurances	Not applicable	Not applicable
Wildhorse Canyon	Yes	Bond pool - $12,000	None relinquished	Not applicable
South Hy/Isabella	Yes	Bond pool - $22,000	None relinquished	Not applicable

(Continued From Previous Page)

State and operation	Financial assurance	Types and amount of financial assurances	Types and amount relinquished	Types and amount spent
Hogum or Golden Eagle	Yes	Surety bond - $24,000	Surety bond - $24,000	Surety bond - none
Golden Butte	Yes	Surety bond - $328,942	Surety bond - $328,942	Surety bond - none
Pan Project	Yes	Surety bond - $5,670	Surety bond - $5,670	Surety bond - none
Monte Exploration	Yes	Surety bond - $7,395	Surety bond - $7,395	Surety bond - none
Ward Mine	Yes	Surety bond - $141,500	Surety bond - $141,500	Surety bond - none
Easy Jr	Yes	Surety bond - $365,917	Surety bond - $365,917	Surety bond - none
MacArthur Mine	Yes	Surety bond - $47,000; corporate guarantee - $137,300	Surety bond - $47,000; corporate guarantee - none	Surety bond-none; corporate guarantee-not applicable
Northern Crown Mines	Yes	Cash - $3,897	None relinquished	Not applicable
Maverick Springs	No	No financial assurances	Not applicable	Not applicable
Phil Claims Expl Proj	Yes	Bond pool - $28,556	None relinquished	Not applicable
Kinsley	Yes	Surety bond - $911,763	Surety bond - $911,763	Surety bond - $561,763
County Line Project	Yes	Surety bond - $210,000; corporate guarantee - $628,017	Surety bond - $210,000; corporate guarantee – none relinquished	Surety bond-none[a] Corporate guarantee-not applicable
Olinghouse Mine	Yes	Surety bond - $1,800,000	None relinquished	Not applicable
Mina Mill	No	No financial assurances	Not applicable	Not applicable
Diamond Peak Prospect Mtn	Yes	Letter of credit - $6,500	None relinquished	Not applicable
Eldorado Pediment	Yes	Surety bond - $8,200	None relinquished	Not applicable
Phoenix Metals USA II Inc.	Yes	Surety bond - $45,904	None relinquished	Not applicable
American Canyon KOF	Yes	Surety bond - $5,314	None relinquished	Not applicable
Jumbo Mine	Yes	Certificate of deposit - $10,000	Certificate of deposit - $4,323	Certificate of deposit - $1,800
Relief Canyon Mine	No	No financial assurances	Not applicable	Not applicable
Elder Creek	Yes	Surety bond - $256,062	Surety bond - $256,062	Surety bond - none
Gold Bar Resource Area	Yes	Surety bond - $303,300	None relinquished	Not applicable
Atlas Exploration	Yes	Surety bond - $267,000	None relinquished	Not applicable
16: 1 Millsite	Yes	Bond pool - $124,017	None relinquished	Not applicable
Gold Bar Mine	Yes	Surety bond - $2,608,000	None relinquished	Not applicable

(Continued From Previous Page)

State and operation	Financial assurance	Types and amount of financial assurances	Types and amount relinquished	Types and amount spent
Paradise Peak	Yes	Surety bond - $1,157,000; corporate guarantee - $3,468,148	Surety bond - $1,157,000; corporate guarantee-none relinquished	Surety bond-none; corporate guarantee-not applicable
Washington				
Raven Hill Mining	No	No financial assurances	Not applicable	Not applicable
Empire Creek Project	No	No financial assurances	Not applicable	Not applicable
Lamefoot	Yes	Surety bond - $3,000,000	None relinquished	Not applicable

Source: BLM survey responses.

[a]BLM told us in February 2005 that, as of December 2004, some of the surety bond funds had been obligated to review and determine reclamation design and costs.

Table 19: Sources of Other Funds and the Status of Reclamation of 48 Hardrock Operations That Had Ceased and Not Been Reclaimed by Operators

State and operation	Sources and amount of funds received from others	BLM made arrangements for the financial assurance provider to do the reclamation	Percent of reclamation complete	Likelihood reclamation will be completed
Alaska				
Chapman Creek Mining	None	No answer	96-99%	Very likely
R D Environmental Mining	BLM - $65,000	No answer	86-95%	Very likely
Gold Hill Mining	None	No answer	None	Somewhat likely
Nixon Fork Mine	None	No answer	26-50%	Very likely
Arizona				
Tyro Mill	BLM - $517,088	No answer	76-85%	Very likely
Granite Property	None	No answer	None	About as likely as unlikely
Herring Mine	BLM - $34,000	No answer	None	Very likely
SKOR	BLM - $92,000	No answer	100%	Not applicable-reclamation complete
UFO	BLM - $35,110	No answer	76-85%	Somewhat likely
Ironwood Claim Group	None	Yes	100%	Not applicable - reclamation complete
California				
Screech Owl	None	No	100%	Not applicable - reclamation complete
Nina	BLM - $15,000	No answer	100%	Not applicable - reclamation complete
Idaho				
West One Minerals	None	No	100%	Not applicable - reclamation complete
Montana				
Snowbound Placer	None	No	1-25%	Somewhat unlikely
Zortman & Landusky Mine	BLM - $5,594,500;[a] operator - $1,050,000; EPA - $340,000; MT DEQ - $1,697,000	No	86-95%	Very likely
Zortman Exploration Plans	None	Yes	76-85%	Very likely
Nevada				
Adelaide Crown	None	No answer	1-25%	Very unlikely

(Continued From Previous Page)

State and operation	Sources and amount of funds received from others	BLM made arrangements for the financial assurance provider to do the reclamation	Percent of reclamation complete	Likelihood reclamation will be completed
Wildhorse Canyon	None	No answer	None	About as likely as unlikely
South Hy/Isabella	None	No answer	None	About as likely as unlikely
Hogum or Golden Eagle	None	No	1-25%	Very likely
Golden Butte	U.S. Army Corps of Engineers - $600,000	No	51-5%	Very likely
Pan Project	None	No	96-99%	Very likely
Monte Exploration	None	No	96-99%	Very likely
Ward Mine	None	No	1-25%	Very likely
Easy Jr	BLM - $300,000; U.S. Army Corps of Engineers - $171,000	No	51-75%	Very likely
MacArthur Mine	None	No	None	Very unlikely
Northern Crown Mines	None	No Answer	Do not know	Very unlikely
Maverick Springs	None	No Answer	Do not know	Somewhat likely
Phil Claims Expl Proj	None	Yes	None	Very likely
Kinsley	None	No	51-75%	Very likely
County Line Project	None	No	26-50%	Very unlikely
Olinghouse Mine	None	Yes	86-95%	Very unlikely
Mina Mill	None	No answer	None	About as likely as unlikely
Diamond Peak Prospect Mtn	None	No answer	Do not know	Very likely
Eldorado Pediment	None	No	None	Very likely
Phoenix Metals USA II Inc.	BLM - $50,000	No answer	76-85%	Very likely
American Canyon KOF	None	No answer	None	About as likely as unlikely
Jumbo Mine	None	No	96-99%	Very likely
Relief Canyon Mine	None	No answer	26-50%	Somewhat unlikely
Elder Creek	None	Yes	1-25%	Very likely

(Continued From Previous Page)

State and operation	Sources and amount of funds received from others	BLM made arrangements for the financial assurance provider to do the reclamation	Percent of reclamation complete	Likelihood reclamation will be completed
Gold Bar Resource Area	None	Yes	None	Somewhat likely
Atlas Exploration	None	Yes	1-25%	Somewhat likely
16: 1 Millsite	None	No answer	1-25%	Somewhat unlikely
Gold Bar Mine	None	Yes	None	Somewhat likely
Paradise Peak	None	No	None	Very likely
Washington				
Raven Hill Mining	BLM - $2,500	No answer	26-50%	Very unlikely
Empire Creek Project	None	No answer	Do not know	No answer
Lamefoot	None	No answer	1-25%	Very likely

Source: BLM survey responses.

[a]Lewistown Montana BLM field office officials told us that BLM provided an additional $550,000 after July 2004 and before September 2004.

Comments from the Department of the Interior

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

In Reply Refer To:
1245 (830)

JUN 8 2005

Ms. Robin M. Nazzaro
Director, Natural Resources and Environment
Government Accountability Office
441 G Street, NW
Washington, DC 20548-0001

Dear Ms. Nazzaro:

Thank you for the opportunity to respond to the U.S. Government Accountability Office (GAO) Draft Report, *Hardrock Mining - BLM Needs to Better Manage Financial Assurances to Guarantee Coverage of Reclamation Costs* (GAO-05-377).

The draft report captures many of the demands facing the Mining Law Administration, Surface Management Program of the Bureau of Land Management (BLM) related to managing financial guarantees required for operations authorized under the General Mining Law of 1872, as amended (Mining Law). Following are our responses to the recommendations and some suggested changes within the report.

Responses to the Recommendations:

See comment 1.

Recommendation #1: *We recommend that the Secretary of the Interior direct the Director of BLM to require the BLM state office directors to establish an action plan for ensuring that operators of hardrock operations have required financial assurances, and that the financial assurances are based on sound reclamation plans and current cost estimates so they are adequate to pay all of the estimated costs of required reclamation if operators fail to complete the reclamation.*

Existing procedures and policies ensure financial guarantees are in place to protect the public should an operator fail to reclaim. The regulations at 43 CFR 3809 require the operator to provide a financial guarantee that covers the full reclamation cost for the operation. The regulations also require the BLM to conduct a periodic review of the reclamation cost estimate and the financial guarantee. BLM issued guidance on February 5, 2003 (IM 2003-082) on the review and acceptance of financial guarantee cost estimates for Notices and Plans of Operations under the 43 CFR 3809 Surface Management regulations. This guidance was updated on March 1, 2004 (IM 2003-082, Change 1). The guidance provides specific timeframes within which reclamation cost estimates must be reviewed for adequacy. The guidance requires: cost estimates for Notices are to be reviewed at time of extension (every two years); reclamation cost estimates for Plans of Operations are to be reviewed at least every three years; financial guarantees for part of an operation are to have the cost estimate reviewed annually; anytime an operation is modified, the cost estimate for the entire operation is to be reviewed; and if there is an agreement with the State dealing with financial guarantees and the State has review timeframes more stringent than the BLM's, the State's more stringent timeframe must be met.

Ensuring that the financial guarantees for operations authorized under the Mining Law meet the requirements of the regulations are a priority of the BLM's Surface Management Program. The importance of having adequate financial guarantees in place for all operations is stressed through the budget process and in directives issued by the BLM-Washington Office and State Offices.

In summary, we do not concur with this recommendation because the BLM has recently updated and implemented national policy and field guidance to ensure bond adequacy.

See comment 2.

Recommendation #2: *We recommend that the Secretary of the Interior direct the Director of BLM to modify LR2000 to ensure that it tracks critical information on hardrock operations and associated financial assurances so that BLM headquarters and state offices can effectively manage financial assurances nationwide to ensure regulatory requirements are met.*

The BLM tracks all critical information on authorized operations in LR2000, which include case recordation and the bond and surety systems. BLM issued Instruction Memorandum No. 2005-126 on April 29, 2005 to provide guidance and direction on data standards for LR2000. Recently, the BLM added codes and edits to LR2000 for Plans of Operations, environmental analyses, financial guarantees and appeals. The BLM will continue to refine and enhance LR2000 data systems as needed to facilitate the surface management program.

Suggested changes within the report:

See comment 3.

Report title: Consider changing the report title to *BLM Needs to Better Manage Financial Assurances "that" Guarantee Coverage of Reclamation Costs.*

See comment 4.

Page 3, 2nd paragraph, after last sentence add: Plans of Operations that were approved on or before January 20, 2001, were required to have financial guarantees in place that met the requirements of the regulations on November 20, 2001.

See comment 5.

Now on pp. 3 and 4.

Page 4, 1st paragraph, revise sentence from "…give BLM authority to take steps, such as issuing notices of noncompliance and revoking plans of operations" to "….give BLM authority to take steps, such as issuing noncompliance and suspension orders, and revoking plans of operations…" We suggest this because the previous regulations (43 CFR 3809,October 1, 2000) used the term "notice of noncompliance." The current regulations use the term "noncompliance and suspension orders."

See comment 6.

Page 5, 1st paragraph, 2nd sentence "…with operations identified by others": If possible, identify GAO's "others."

See comment 7.

Page 11, Figure 2 footnote: If possible, identify "others."

See comment 8.

Page 11, Figure 2: Remove Step 5. The reason we suggest removal of the step is the operation described in the figure is employing a heap-leaching process. However, the described operation includes a tailings pile. There are no tailings in heap-leaching operations. Tailings piles are associated with operations that employ milling and flotation.

See comment 9.

Page 12, 2nd paragraph, 2nd sentence, change to read: Upon recording a mining claim with BLM, the claimant must pay, per claim, an initial location fee, and a maintenance fee that is required annually; the claimant is not required to pay royalties on any hardrock minerals extracted.

See comment 10.

Page 20, 1st paragraph: To clarify this paragraph please include the following: Approved operations on notices and plans of operations are subject to the claimant or operator filing and obtaining approval of the financial guarantee instrument from BLM in accordance with regulations and policy.

See comment 11.

Page 21, paragraph: For consistency with information on page 20, add "notice- and plan-level" before "…hardrock operations…."

See comment 12.

Now on page 65.

See comment 13.

Page 63, Conclusions: We disagree with the 4th sentence that reads "BLM has no process in place to ensure that operators obtain adequate financial assurance." As stated under Recommendation #1, the BLM process as mandated in regulations and guidance adequately addresses the financial obligations of an operator for notice-level and plan-level hardrock mining operations. In addition, we do not agree with the sentence "Specifically, LR2000 does not track the status of hardrock operations…." As noted under our response to Recommendation 2, BLM tracks all critical information on authorized operations in the LR2000 database.

We appreciate the advice and critical assessment the GAO has given to BLM's Mining Law Administration, Surface Management Program. If you have any questions, please contact Ted Murphy, Chief, Division of Solid Minerals, at 202-452-0351, or Andrea Nygren, BLM Audit Liaison Officer, at 202-452-5153.

Sincerely,

for

Rebecca W. Watson
Assistant Secretary
Land and Minerals Management

The following are GAO's comments on the Department of the Interior's letter dated June 8, 2005.

GAO Comments

1. See agency comments and our evaluation section of this report.

2. See agency comments and our evaluation section of this report.

3. We did not change the title of the report because doing so would indicate that adequate financial assurances are in place to guarantee reclamation costs. As we report, this is not the case.

4. We added a sentence to state that plans of operations that were approved before January 20, 2001, were required to have financial assurances in place no later than November 20, 2001.

5. We changed the language to state that BLM has the authority to take steps, such as issuing noncompliance and suspension orders or revoking plans of operations, if operators do not comply with financial assurance or other regulatory requirements.

6. The "other" sources of information on hardrock operations that had ceased and not been reclaimed, as required, are identified in appendix I.

7. We added the National Research Council as one of the other sources used to develop figure 2.

8. We removed step 5, which described leftover material known as tailings, from figure 2.

9. We changed the language to clarify that upon recording a mining claim with BLM, the claimant must pay the fees discussed in our report, and that the location fee is not paid annually.

10. We did not add this language to this section of the report because we explain in the background section of the report that BLM requires all notice- and plan-level hardrock operations to have financial assurances before exploration or mining operations begin.

11. We clarified the language by adding "notice- and plan-level" before hardrock operations.

12. We clarified this sentence in our conclusion to state that “However, while federal regulations and BLM guidance set forth financial assurance requirements for notice- and plan-level hardrock mining operations, BLM has no process for ensuring that the regulations and guidance are effectively implemented to ensure that adequate financial assurances are in place, as required.” Our report shows that BLM state offices with hardrock operations reported that, as of July 2004, some hardrock operations did not have adequate financial assurances. Furthermore, past experience has shown that some hardrock operations have ceased without operators having the adequate financial assurances required by regulations and BLM guidance. We continue to believe that until BLM establishes monitoring and accountability mechanisms to ensure that all hardrock operations have required financial assurances based on sound plans and current cost estimates, these problems will continue.

13. We did not change this sentence in our conclusion because evidence in our report shows that LR2000 does not track the critical information BLM needs to effectively manage financial assurances on hardrock operations. Specifically, we reported that LR2000 does not track some critical information, including the operation’s basic status, such as whether the operation is ongoing or has ceased and should be reclaimed; some types of financial assurances being used, such as corporate guarantees, bond pools, and trust funds; and the adequacy of financial assurances to pay the cost of required reclamation.

GAO Contact and Staff Acknowledgments

GAO Contact

Robin M. Nazzaro (202) 512-3841

Acknowledgments

In addition to the contact named above, Andrea Wamstad Brown, Byron S. Galloway, Heather Holsinger, Carol Herrnstadt Shulman, Walter Vance, and Amy Webbink made key contributions to this report.

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