Undermined Promise II

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Undermined Promise II

Undermined Promise II is a joint publication of the National Wildlife Federation, the Natural Resources Defense Council, and the Western Organization of Resource Councils.

NWF is a voice for wildlife, dedicated to protecting wildlife and habitat and inspiring the future generation of conservationists.

NRDC is one of the nation's most effective environmental action groups. It uses law, science and the support of its 1.4 million members and online activists to protect the planet's wildlife and wild places and to ensure a safe and healthy environment for all living things.

WORC is a regional network of eight grassroots community organizations with 12,000 members and 41 local chapters. WORC is committed to building sustainable environmental and economic growth with the health of people and stewardship of their land, water, and air resources.

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Introduction

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Undermined Promise II updates ***Undermined Promise: Reclamation and Enforcement of the Surface Mining Control and Reclamation Act 1977-2007,*** which analyzed the status of coal surface mine reclamation in five western states thirty years after passage of the federal Surface Mining Control and Reclamation Act (SMCRA). The 2007 report was produced by the Natural Resources Defense Council and the Western Organization of Resource Councils.

Undermined Promise II updates and amplifies the scope of the earlier work:

- It adds an overview of the impacts of coal mining and reclamation practices on wildlife and the plants on which they depend, prepared by Alexis Bonogofsky with the National Wildlife Federation. It includes a case study of issues around sage grouse habitat restoration on mined lands.

- It addresses the issue of mining and hydrology, of critical importance in an arid ecoregion. The hydrologic overview and recommendations are grounded in a paper written by geo-hydrologist Charles H. Norris, "Hydrologic Protections within the Federal Surface Mine Control and Reclamation Act" (September, 2014), published on-line as Appendix A with this report.

- It updates the original report's overview and analysis of reclamation, as measured by successful bond release. It calls special attention to the emerging public exposure to significant financial risk where regulators allow mine operators to self-bond.

- It updates key data on mine inspections and enforcement and regulatory oversight of surface mining in five western states.

- It updates and expands on recommendations made in 2007 with additional recommendations addressing hydrology, self-bonding, and wildlife habitat.

In the 1960s and 1970s, the devastating impacts of strip-mining in the East and the potential creation of "barren wastelands susceptible to continual erosion and disrupted groundwater systems" in the West led to congressional passage of the Surface Mining Control and Reclamation Act (SMCRA),[1] which was signed into law by President Jimmy Carter on August 3, 1977. In enacting SMCRA, Congress sought, among other purposes, to assure that "surface mining operations are not conducted where reclamation [...] is not feasible," "that surface coal mining operations are so conducted as to protect the environment," and "that adequate procedures are undertaken to reclaim surface areas as contemporaneously as possible with the surface coal mining operations."[2]

Today, eight years since our previous assessment of the implementation of SMCRA as reported in *Undermined Promise,* it is appropriate to again consider whether the on-the-ground implementation of the statute matches up to its text and the intentions of its authors. When SMCRA was enacted, lawmakers were concerned about the legacy of environmental harm that coal mining had already left in the East and the extensive damage that could result from the planned "expansion of coal surface mining [in the West] on a very large scale," given the demand at that time for coal. Today, coal demand is much higher than it was 38 years ago.

Since our last report eight years ago, however, major changes have occurred in the domestic coal mining industry. Monthly coal production has been trending downward since peak production in August, 2008.[3] There have been a string of bankruptcies, while other struggling companies are closing mines and shedding employees as they scale back production. Mining companies are pushing projects to export coal to South and East Asian economies in the face of declining domestic demand.

These factors signal the end of the line for some in the coal industry. Now, more than ever, we need a strong, vigorously enforced SMCRA to minimize the impacts of coal mining on the environment and the health and safety of local communities, and the avoidance of significant legacy costs that SMCRA was intended to prevent.

Since our last report eight years ago, however, major changes have occurred in the domestic coal mining industry. Monthly coal production has been trending downward since peak production in August, 2008.

Findings

Bond Release

- The review of reclamation progress in the years since 2007 confirms that bond release remains the only meaningful objective standard by which to assess whether reclamation is successful. The continued failure to achieve significant increases in Phase III (and Phase IV in Montana) bond release, eight years after WORC and NRDC's report, raises broad concerns about the long term prospects of reclamation in the harsh, brittle, and semi-arid ecosystems of Western states.

- Of 450 square miles of disturbed land in Montana, North Dakota and Wyoming, only 46 square miles have achieved Phase III bond release, demonstrating successful establishment of vegetation and soils to satisfy permit requirements for post mining land uses.

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Self-Bonding

- As the gap between acres disturbed by mining and the acres released from reclamation bond continues to grow, the outstanding bond liabilities of companies also continue to grow, which is especially troubling in light of the practice in some states of allowing coal operators to "self-bond" – that is, guarantee reclamation obligations without collateralized financial assurance.

- With substantial bonds riding on the financial health of coal operators or their corporate parent guarantors, regulators are placed in a challenging position when self-bonded operators face financial difficulties. In this situation, self-bonding can become a disincentive to regulators taking the initiative to protect the public's interest in full mine site reclamation due to concerns about coal operator solvency and fears that the agency might be saddled with the daunting, expensive task of reclaiming mined land if a coal operator becomes bankrupt.

- Peabody Energy and Arch Coal may be "double-pledging" their assets, which appear to be obligated to their creditors in addition to state regulatory authorities; these assets may also be overvalued.

- Neither Peabody Energy Corporation, Arch Coal, Inc., nor Alpha Natural Resources, Inc. appears to qualify as a self-bond guarantor under regulatory financial tests, though their subsidiaries may still qualify.

- Peabody Energy does not appear to be in compliance with regulatory limits on self-bonding.

- If no changes are made, regulators must rely on the future financial health of heavily indebted, loss-making coal operators to guarantee extensive mine site reclamation. This challenges

Bill Dvorak

the fundamental promise of SMCRA: that any lands mined for coal would be reclaimed for future land users.

Hydrology

- Characterization of the hydrologic balance in the permitting process is, too frequently, grossly inadequate. Baseline data collection is generally too limited geographically, geologically, in duration and in frequency. As a result, only a ghost of the hydrologic balance is drawn, without enough detail to protect it.

Wildlife

- SMCRA performance standards do not lead to sites that are equal to pre-mining sites in terms of habitat quality for native wildlife.

- Reclaimed lands may appear aesthetically pleasing, but plant communities essential to wildlife must undergo a long period of natural succession before they resemble the pre-mined communities of plants on the land.

- Reclaiming mined lands to sagebrush habitat critical to sage grouse survival may take decades (anywhere from 15 to 60 years) of natural succession to develop the characteristics of native shrub communities comparable to pre-mining conditions.

Inspection and Enforcement

- Since 2011 when annual state oversight reports started listing the number of complete and partial inspections required under SMCRA, of the state agencies analyzed in this report, only New Mexico's (in 2011) failed to complete the minimum required.

- Although the total number of inspectable units has declined since 2005, the total number of acres permitted and disturbed acres continues to increase, while the number of state regulatory employees has decreased. Between 2006 and 2013, the regulatory staff for the five states decreased by 13.8% while the permitted acreage expanded by 15%.

Part 1: Reclamation and Bonding

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Problems persist with low bond release numbers, lack of contemporaneous reclamation, and bond transfers without public hearing.

Eight years ago, *Undermined Promise* found that coal mining companies in five western states were not making the effort to apply for bond release, and regulatory authorities were not compelling them to do so. While the Office of Surface Mining Reclamation and Enforcement (OSM) field offices agreed that coal companies were not releasing enough acreage from bond obligations, OSM staff disagreed that this was a violation of the law given site specific circumstances of the companies. The report noted that OSM field offices were substituting acres that *could* be eligible for Phase III bond release for its measure of reclamation, rather than ensuring that the mines met OSM's national performance standards for acres reclaimed, to paint a rosier picture of performance under SMCRA. The 2007 report concluded that:

> *"Since final bond release is an objective and transparent measure of success, it should remain OSM's performance measure. Rather than adopt a new definition, the agency should move to prevent mine companies from indefinitely delaying application for release of their reclamation bonds."*

Assuring reclamation of mined lands to pre-mining conditions or to an approved post-mining beneficial use has always been one of SMCRA's most important objectives.[4] Successful reclamation of Western range and farmland requires both re-establishing vegetation on the surface and replacement and restoration of pre-mining water resources.[5] Western ranchers who have worked with OSM and state regulatory authorities report

what might be characterized as a policy of benign neglect towards enforcing the water protection, replacement and restoration requirements of SMCRA at Western mines.[6]

Performance bonds for permit areas are the principal means by which OSM enforces the statute's reclamation mandate.[7] The number of acres that meet bond release standards and for which bonds have finally been released is the agency's national measure of reclamation success.[8] While the bonds can be forfeited to the regulatory authorities to cover reclamation costs if the mining companies fail to reclaim properly, they are intended to encourage companies to do the reclamation work necessary to achieve Congress' reclamation goals themselves and thus get their bond monies back.

The performance of Western State programs and mines as measured by bond release remains dismal. For example: Wyoming, with 173,914 acres disturbed by mining at the end of EY2014, showed 10,607 acres released from Phase III (just over 6%); 24,806 acres released from Phase II (14%); and 63,320 acres released from Phase I (just over 36%).

For perspective, of almost 450 square miles of disturbed lands in Wyoming, Montana and North Dakota, only 46 square miles have achieved Phase III bond release.

Review of reclamation progress in the years since 2007 confirms that bond release remains the only meaningful, objective standard by which to assess whether reclamation is successful. The continued failure to achieve significant increases in Phase III bond release, eight years after WORC and NRDC's report, raises broad concerns about the long term prospects of reclamation in the harsh, brittle, and semi-arid ecosystem of Western states. *Undermined Promise* provided recommendations to address deficiencies in SMCRA oversight and enforcement at western mines. Here is an overview of those recommendations from 2007, and a brief update on the progress made by OSM since the publication of *Undermined Promise:*

Reclamation Phases:

Phases of reclamation success are unique to each state program. Wyoming's is typical:

Phase I – When the permittee completes the backfilling, regrading, topsoil replacement, recontouring and drainage control of a bonded area.

Phase II – When the permittee has established vegetation whose species composition is commensurate with that of the seed mix(es) of the approved reclamation plan.

Phase III – The remaining portion of the bond may be released after the permittee has successfully completed all surface coal mining and reclamation activities (vegetation success, hydrology supports post mining land use, etc.[11]

Phase IV – (only in Montana) – The remaining portion of the bond may be released after the permittee has successfully completed all surface coal mining and reclamation activities and all disturbed lands within any drainage basin have been reclaimed in accordance with the Phase I,II, and III requirements.

Table 1. Reclamation status as measured by bond release in three western states 2014.[9]

	Disturbed Acres	Phase I	Phase II	Phase III
Wyoming	173,914	63,320	24,806	10,607
Montana	39,953	19,497	13,377	3,870[10]
North Dakota	73,575	18,343	15,209	15,196
Total 3 States	287,442	102,143	53,382	29,673

- **Correct data problems by providing accurate, consistent and comprehensive information about implementation of SMCRA by federal and state agencies each year.** The report noted significant inconsistencies between OSM's national annual reports and the state reports from which they are supposed to be drawn. While some progress has been made in this vein, there remain significant differences among data provided in state annual evaluation reports.

- **Improve reclamation success by setting clear standards for reclamation benchmarks and penalizing mine operators who fail to reclaim mined land, in order to fulfill Congress's reclamation goal embodied in SMCRA.** Wyoming Department of Environmental Quality (DEQ) has initiated a working group to address bond release with OSM and industry, but progress is slow. No penalties or incentives to move forward on bond release have been established.

- **Adopt a regulatory definition of "contemporaneous reclamation." Agency staff, the states, and the industry need a statutory or regulatory definition of this key term to provide a standard for evaluating and approving mine permit applications, for evaluating the effectiveness of the Act and its enforcement and to fulfill the premier goal of SMCRA – prompt and effective reclamation of mined land.** No definition has been adopted and, as a result, prompt, effective reclamation has not occurred. OSM updated its oversight guidance, REG-8, in January, 2011. REG-8 states that the information provided on Table 6 "Surface Coal Mining and Reclamation Activity" in state program Annual Evaluation Reports should be considered a source of information on contemporaneous reclamation. However, in the most recent Wyoming program oversight evaluation, OSM appears to substitute a different metric that ignores the Phase II standard for re-vegetation bond release.

- **Stop issuing permits for new mines or mine expansions in areas where strip-mined land remains unreclaimed after more than 10 years.** OSM continues to permit new mines and mine expansions where strip-mined land remains unreclaimed after more than 10 years. The agency has also not completed interim steps, such as compiling an inventory of such lands that may be eligible for bond release after the 10 year waiting period required by SMCRA for arid western lands.

Contemporaneous Reclamation

Undermined Promise put the spotlight on the low acreage meeting the standards established for Phase III bond release. By failing to craft a regulatory definition of "contemporaneous reclamation," OSM and state agencies are focusing instead on intermediate benchmarks that provide only a partial and deceptive picture of reclamation on the ground. For example, in the 2013 Evaluation Year report for the Wyoming State Program OSM suggests that "contemporaneous reclamation specifically refers to the timeliness that reclamation is occurring."[12] The agency then uses the acres that have been backfilled, graded, re-soiled and re-seeded as the "general measurement" for contemporaneous reclamation.[13] It also appears to count the same acre twice when measuring contemporaneous reclamation, once for backfilling and grading, and a second time for reseeding.

Over the last eight years, OSM field offices have devised alternative and hard to verify measures to determine contemporaneous reclamation and reduce the growing discrepancy between acres mined or disturbed and acres "reclaimed." By calculating a ratio to determine contemporaneous reclamation based on Phase II activities, but not

Colin Ruggiero

actual Phase II bond release, this measurement masks the fact that vast quantities of disturbed lands are decades past the waiting period for Phase III bond review. These measures conceal the growing problem of meeting the promise and standard set by Congress in the Surface Mining Control and Reclamation Act.

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In an April, 2012, letter to OSM Western Regional Office and the Casper Field Office, the Western Organization of Resource Councils objected to OSM's assertion that "[l]ands […] are considered permanently reclaimed when they are seeded with permanent vegetation consisting of species as prescribed in the reclamation plan of the approved permit." The letter pointed out that seeding hard-to-establish plant communities does not equate to a sustainable ecosystem in a harsh climate. At that time over 90% of disturbed lands in Montana and Wyoming had yet to be submitted for Phase III bond release, 30 years after passage of the law. In North Dakota the number was over 80%. In the three states, over 392 square miles had yet to be submitted for Phase III bond release. Numbers for earlier stages of bond release were "equally appalling," the letter asserted.[14]

Bond Release Progress Remains Slow

> *OSM will evaluate and report on the effectiveness of state programs in ensuring successful reclamation on lands affected by surface coal mining operations. Success will be determined based on the numbers of acres that meet the bond release standards and have been released by the state.*
>
> *Once the data collection system and verification procedures have been established, the acres released from bond will represent accomplishment of specific on-the-ground reclamation.*
>
> -OSM Directive REG-8 "Oversight of State Regulatory Programs"[15]

Performance bonds are typically released in three phases as reclamation proceeds.[16] Given the paramount role bonding plays in the Act's strategy for achieving reclamation, it is essential

that bond amounts for each phase be calculated so as to provide sufficient incentive for mining companies to reclaim, as well as to cover the cost of reclamation activities in the case of bond forfeiture.

The failure by most mining companies to request bond release highlighted in *Undermined Promise* has gotten the attention of regulators and industry, but eight years after the report pointed out the growing gap and failure to reclaim to the law's standards, progress remains slow. A working group was established by the Wyoming Department of Environmental Quality Land Quality Division (LQD), the mining industry, and other stakeholders, to meet regularly and address bond release issues. According to Wyoming's 2013 evaluation year report:

> *The main goal of the Coal Working Group is to clarify and streamline the guidelines for bond release, and develop transparent processes for reclamation evaluation and bond release in Wyoming. Monthly meetings and discussions are ongoing with the Coal Working Group, and significant progress has been made in revising and streamlining LQD [Land Quality Division] guidelines (guidelines 20, 21, 22, and 23) that address Phase I and Phase II bond release and the process and requirements for mine permittees to attain each of the phases.*
>
> *The Coal Working Group is also developing a new, yet to be named guideline that specifically addresses the Phase III bond release process and requirements.*[17]

The group, meeting monthly over the past two years, is only beginning to develop a Phase III guideline. And while state and federal regulators and coal industry representatives try to streamline the process and motivate companies to apply for bond release, OSM and state programs have largely failed to exercise their authority to compel mining companies to apply for bond release and demonstrate whether they have met the standards of SMCRA. OSM and DEQ could withhold approval

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of new permits and expansions where mines are sitting on large acreages of land that should be reviewed following the ten-year post-revegetation waiting period.

Public Role in Bond Release or Transfer

Federal law allows any interested party to submit written objections to an application for any phase of bond release and entitles them to a timely public hearing conducted by the regulatory authority before a decision on the application for bond release is reached.[18] In North Dakota, however, release and transfer of bonds is allowed without hearings or public comment, causing citizens and landowners frustration in their efforts to meaningfully participate in the decision. When a hearing was held by the North Dakota Public Service Commission (PSC) in January, 2012, on final—and first—bond release for 217.5 acres of the Falkirk mine in McLean County, residents and landowners were surprised to learn that the application from the operator did not entail any reduction in bond amount. As this was the only application for bond release ever submitted, it should have requested the release of the original amount of the bond in full. Evidently, there were no longer any financial guarantees bonding the tract in question because the remaining bonds had been transferred to another area. This suggests that the bonds had been effectively released without public notice, hearings or comment. Either way, the bond release process in North Dakota appears to be a paper exercise, rather than a

component of robust public oversight as required by SMCRA. If the undertaken reclamation activities prove insufficient, the PSC will be without any financial recourse to complete the work properly and the fundamental purpose of SMCRA will have been defeated.

Self-bonding

As the gap between acres disturbed by mining and the acres released from bond continues to grow, the outstanding bond liabilities of mining companies also continue to grow. This trend is especially troubling in light of the agency practice of allowing coal operators to "self-bond" because hundreds of millions of dollars in bond obligations are left without a surety. The current market conditions of the coal industry and the generally imperiled financial position of coal mining companies exacerbate these concerns and provide strong reasons to take a deeper look at self-bond programs to ensure the public is sufficiently protected in case a company defaults on its bond obligations.[19]

A. Background

The main advantage of self-bonds for operators is that they do not tie up property, cash, or credit capacity with regulatory authorities and financial institutions, or require the payment of surety bond premiums. As the expansive mine lands of the western region require reclamation bonds worth as much as hundreds of millions of dollars for the largest mines, self-bonding can free up large amounts of capital relative to collateral bonds;[24] the savings from replacing surety bonds with self-bonds were enticing enough for Cloud Peak Energy to initiate self-bonding in 2014, reportedly to save $2 million per year in surety premiums.[25]

According to results from a 2014 survey conducted by the Interstate Mining Compact Commission, the following states allow self-bonding or guarantees by a parent or non-parent corporation: Alabama, Arkansas, Colorado, Illinois, Indiana, Louisiana, Mississippi, New Mexico, North Dakota, Pennsylvania, Texas, Utah, Virginia, West Virginia, and Wyoming. The following states hold at least 50% of total reclamation bonds through any form of self-bonding: Colorado (57%), Indiana (56%), New Mexico (70%), North Dakota (69%), and Wyoming (63%).[26]

To qualify for self-bonding, guarantors must demonstrate that they meet the financial solvency requirements of one of three tests provided by SMCRA regulations:[27]

A. The applicant has a current rating for its most recent bond issuance of "A" or higher as issued by either Moody's Investor Service or Standard and Poor's Corporation;

B. The applicant has a tangible net worth of at least $10 million, a ratio of total liabilities to net worth of 2.5 times or less, and a ratio of current assets to current liabilities of 1.2 times or greater; or

C. The applicant's fixed assets[28] in the United States total at least $20 million, and the applicant has a ratio of total liabilities to net worth of 2.5 times or less, and a ratio of current assets to current liabilities of 1.2 times or greater.[29]

While the term "self-bond" is sometimes used to encompass all reclamation guarantees without separate surety, it is important to distinguish between the three entities who may qualify to guarantee a self-bond, and the terms used in each case:

This trend is especially troubling in light of the agency practice of allowing coal operators to "self-bond" because hundreds of millions of dollars in bond obligations are left without a surety.

Major Findings of this Report:

1. Parent corporations Peabody Energy Corporation and Arch Coal, Inc. do not guarantee self-bonds for their mines. Instead, the bonds are guaranteed by subsidiaries Peabody Investment Corp. and Arch Western Resources, LLC.[20]

2. Neither Peabody Energy Corporation, Arch Coal, Inc., nor Alpha Natural Resources, Inc. appears to meet the qualifying criteria to guarantee self-bonds, likely due to substantial long-term debt on their balance sheets. Peabody Investment Corp. (PIC) and Arch Western Resources, LLC (AWR) each qualify, likely because they do not report their parents' respective debts on their balance sheets. Financial information for these subsidiaries is not publicly disclosed through Securities and Exchange Commission (SEC) filings or state regulatory authorities, however.[21]

3. Assets of Peabody Energy Corporation and Arch Coal, Inc. that back reclamation self-bonds appear to be "double-pledged" to both state regulatory authorities and creditors of the parent corporations. While PIC and AWR likely do not report their parent corporations' long-term debt on their balance sheets, they appear to be pledged as collateral to that debt. Because AWR and PIC directly or indirectly control each company's respective operating subsidiaries, whose assets back self-bonds, these assets appear to be "double-pledged" to both state regulatory authorities and the creditors of the parent corporations.[22]

4. Peabody Energy Corporation appears to report aggregate self-bonding in excess of the regulatory threshold of 25% of tangible net worth. Self-bond guarantors may not guarantee reclamation obligations in excess of 25% of their tangible net worth. Regular financial disclosures via SEC filings reveal that Peabody Energy Corporation's affiliates appear to have done so frequently since data became available in 2003.[23]

- A "self-bond" is guaranteed by the mine operator, usually a subsidiary of a larger parent corporation.

- A "parent corporate guarantee" is guaranteed by the parent corporation of the mine operator, which is sometimes also a subsidiary of a larger parent corporation. For example, Peabody Investments Corp. guarantees the reclamation bond of the North Antelope Rochelle mine, which is operated by its subsidiary Peabody Powder River Mining, LLC.[30]

- A "non-parent corporate guarantee" is guaranteed by an entity that is neither the mine operator nor its direct parent. In this case, the guarantor may be within the same corporate family, or may be non-affiliated. For example, the self-bonds of mines associated with mine-mouth power plants are sometimes guaranteed by the associated electrical utility (e.g., Basin Electric Power Cooperative and Tri-State Generation and Transmission Association, Inc., jointly guarantee the self-bond of the Dry Fork mine in Wyoming;[31] Great Rivers Energy guarantees the reclamation bond of the Falkirk mine in North Dakota, which is operated by a subsidiary of NACCO Industries[32]).

In each case, the guarantor must meet the same financial solvency tests, whether self-bonded operator, parent guarantor, or non-parent guarantor.

As an example of which of the aforementioned tests have been used to qualify for self-bonding in Wyoming, a timeline has been reconstructed for the Black Thunder mine near Wright, Wyo., from documentation publicly available through the Wyoming Department of Environmental Quality (WDEQ).

August 26, 2004: Self-bond initiated at Black Thunder mine by Thunder Basin Coal Company, LLC (TBCC) as operator-guarantor (qualifying test unknown).

December 11, 2011: TBCC notified they continue to qualify for self-bonding under test B.[33] Black Thunder self-bond set at $168,187,911.

March, 2012: Arch Western Resources, LLC (AWR), parent of TBCC, applied to WDEQ as parent-guarantor for all Arch Coal mines in Wyoming, including Black Thunder. Applied to qualify under test C.[34]

July 19, 2012: North Rochelle mine and Jacobs Ranch mine self-bonds consolidated under Black Thunder self-bond. New total self-bond amount: $298,550,000.

August 20, 2012: AWR accepted as parent-guarantor of self-bond for consolidated Black Thunder mine.

May 28, 2013: Black Thunder parent guarantee increased to $329,317,000.

November 28, 2014: Black Thunder parent guarantee increased to $374,215,000.[35]

With such substantial bonds riding on the financial health of coal operators or their corporate guarantors, self-bonding programs impose important administrative challenges. For one, considerable regulatory oversight is required to interpret and track companies' finances.[36,37] More importantly, perhaps, regulators are placed in a challenging position when self-bonded coal operators face financial difficulties. On the one hand, regulators can insist on the replacement of self-bonds with alternative financial assurances to protect the public interest and meet their statutory obligation to ensure mine site reclamation, but thereby add further financial stress to the guarantor. On the other hand, regulators can choose not to pursue alternative financial assurance to avoid precipitating additional financial strain, but thereby tolerate inadequate bonds.[38] Thus, in situations of sustained financial difficulties, self-bonding presents regulatory authorities with a classic Catch-22.[39]

B. Financial Headwinds

The coal mining industry is currently facing some of the toughest market conditions it has seen in its recent history. Following large acquisitions financed heavily with debt leading up to 2011, cheap natural gas undercut domestic thermal coal markets. As coal production costs continue to rise due to economic and geologic factors[40] while global markets and domestic competition for electricity generation push coal prices down, the pressures on coal producers show no sign of relenting. Accordingly, major coal operators have earned low marks from credit ratings agencies:

Moody's Investor Service:

October 7, 2013: Arch Coal "Corporate Family Rating" downgraded to B3 from B2, outlook negative.[41]

May 13, 2014: Alpha Natural Resources "Corporate Family Rating" downgraded to B3 from B2, outlook stable.[42]

July 23, 2014: Peabody Energy "Corporate Family Rating" downgraded to Ba3 from Ba2, outlook negative.[43]

Fitch:

May 8, 2014: Arch Coal "Issuer Default Rating" downgraded to CCC from B-.[44]

October 28, 2014: Peabody Energy "Issuer Default Rating" downgraded to BB- from BB, outlook negative.[45]

Standard & Poors:

August, 2014: Arch Coal rating outlook downgraded to "negative" from "stable."[46]

January 23, 2015: Peabody Energy rating outlook downgraded to "negative" from "stable." BB- corporate credit rating affirmed.[47]

Professional financial analysts' opinions reveal serious concern over the financial health of U.S. mining companies. For example, UBS Securities LLC coal equities analyst Kuni Chen notes that major bankruptcies may only be a few years off:

> Since 2012, we have seen [Appalachian operators] Patriot Coal and James River file for bankruptcy protection. There continues to be signs of mounting financial distress in the coal sector [...] While there does not appear to be any imminent bankruptcy risk, we want to discuss the potential event path to a next potential liquidity crisis looking ahead 2-3 years.[48]

Other analysts see a nearer-term bankruptcy risk, especially for Arch Coal:

> Evan Mann, an analyst with bond research firm Gimme Credit LLC, told SNL Energy that because the company is so heavily leveraged, he predicted "Arch will be the first" to go under among the leading U.S. coal producers. By late 2015 or 2016, "the stockpile of money is going to run out," Mann said. The company had about $5.12 billion in long-term debt at June 30[, 2014].[49]

Concern around Arch Coal is underlined by its dismal market valuation: the company's share price crossed below the $1.00 mark for the first time in the company's history on January 28, 2015.

Trade press coverage sums up the coal mining industry's present condition well:

> Persistently weak coal markets have forced domestic producers to take drastic action from closing mines and hoarding cash to selling assets and lately cutting dividends to stay afloat. But with no relief in sight, the prospect of another major producer filing for bankruptcy is growing, and it might come as early as this year.[50]

Following large acquisitions financed heavily with debt leading up to 2011, cheap natural gas undercut domestic thermal coal markets.

Besides difficult market conditions, analysts consistently express concern over the heavy long-term debt load carried by major coal operators. This is particularly relevant to self-bonding due to the criteria under which guarantors qualify. As noted above, Arch Coal subsidiaries have used Wyoming's tests B and C to self-bond its biggest mine, Black Thunder. These tests differ little; importantly, both require the guarantor to maintain a ratio of total liabilities to net worth of 2.5 or less. Demonstrating a healthy ratio of total liabilities to net worth is a prudent criterion to qualify for self-bonding. Regulators must consider carefully before allowing a company to guarantee further financial obligations without separate surety or collateral when it is already carrying extensive liabilities relative to its present value.

C. Double-pledged Assets

Unfortunately, the qualifying tests for self-bonding laid out under SMCRA do not require deep due diligence with respect to self-bond applicants' potential liabilities. Take, for example, Arch Coal, Inc., whose subsidiaries Thunder Basin Coal Company and Arch Western Resources have met the required ratio. Unlike its subsidiaries, parent company Arch could not qualify as a self-bond guarantor based on recent financial filings.[51] This is because Arch Coal, Inc., whose net worth comprises the assets of its subsidiaries, also carries hefty liabilities, especially in the form of its long-term debt (bond issuances, loans, credit facilities, etc.). As demonstrated below in Table 2, neither Arch Coal, Inc., Peabody Energy Corporation, nor Alpha Natural Resources, Inc. meets the ratio of total liabilities to net worth of 2.5 or less.

While corporate family debt is usually held at the level of the ultimate parent, it is typically guaranteed by the parent's subsidiaries (that is, by the value of the subsidiaries' assets). For example, indentures between Arch Coal and creditors pledge nearly all of its subsidiaries as guarantors of that company's $5.12 billion in debt.[52,53] These subsidiaries' assets are the same as those implicitly backing reclamation self-bonds held by the state of Wyoming and others. This raises a fundamental question about self-bonding: how can assets under obligation as security to Arch Coal's debt also serve as security for mine site reclamation obligations to the state of Wyoming, including Black Thunder, the second largest mine in the country? Should self-bonded operators like Arch Coal enter bankruptcy, as some analysts predict, how does the state of Wyoming assure reclamation bonds coverage will not be interrupted, if, for example, encumbered assets implicitly backing self-bonds were reassigned to new owners in a bankruptcy proceeding?

D. Lessons from Texas

This situation is not an isolated instance. The case of Texas-based Luminant Mining strikingly illustrates the risks posed by insolvency and bankruptcy proceedings to self-bonds backed by encumbered assets.

Lignite miner Luminant Mining's self-bonds were guaranteed by sister-company Luminant Generation, an electrical utility. Luminant Generation's same assets, however, were also legally securing billions of dollars of debt taken on by a parent company that was teetering on the brink of bankruptcy. Despite already being fully encumbered, Luminant Generation's assets were double-pledged to the State of Texas without any portion carved-out to solely secure the self-bonds. In the event that Luminant Generation's assets were reassigned to new owners in bankruptcy proceedings, Texas taxpayers could have been on the hook for $1.01 billion of Luminant Mining's reclamation obligations, having an inferior legal claim to Luminant Generation's assets compared to the parent corporation's creditors.

As predictions of bankruptcy circulated in the business press,[54] the issue was repeatedly raised with the Railroad Commission of Texas (RCT).[55,56] Instead of waiting for a reclamation claim to settle the question of encumbrance, the RCT chose to be proactive. Upon bankruptcy of Luminant Mining's parent company, RCT required a replacement bond for Luminant Mining's self-bonds. As a condition on the collateral bond that was provided as replacement, RCT received legal priority to be paid before the bankruptcy lenders who facilitated the bond.[57] This agreement is a much more

Table 2. Liabilities to Net Worth Ratio Test Applied to Parent Corporations.

	Arch Coal, Inc.[70]	Peabody Energy Corporation[71]	Alpha Natural Resources, Inc.[72]	Cloud Peak Energy Inc.[73]
Long-term debt at Dec. 31, 2014	$ 5,123,485,000	$ 5,965,600,000	$ 3,719,519,000	$ 498,480,000
Total liabilities at Dec. 31, 2014	6,761,569,000	10,464,600,000	7,749,348,000	1,072,084,000
Net worth (Stockholders Equity) at Dec. 31, 2014	1,668,154,000	2,726,500,000	2,986,800,000	1,087,834,000
Ratio of total liabilities to net worth at Dec. 31, 2014	4.05	3.84	2.59	0.99
Qualifies? (Ratio ≤ 2.5)	DOES NOT QUALIFY	DOES NOT QUALIFY	DOES NOT QUALIFY	QUALIFIES

effective assurance of reclamation than the former uncollateralized self-bonds.

Neither SMCRA nor its regulations specifically require the deep due diligence necessary to ensure that a self-bond guarantor's assets will be legally available in the event of reclamation claims. Protection of the public interest requires that self-bonding due diligence go beyond simply verifying compliance with the designated financial solvency tests. Instead, an assessment of the encumbrance of self-bond guarantors' assets should be taken by the regulators in the face of the heavy debt loads carried by major coal operators. As demonstrated by the Railroad Commission of Texas, this deeper due diligence led to a more comprehensive understanding of the financial position of Luminant Mining and its affiliates, and led to a revocation of Luminant Mining's self-bonds.

E. Asset Valuations

A further issue that deserves attention is the valuation of the assets backing self-bonds. Assets only have as much value as buyers are willing to pay for them, and there may be a difference between how much the assets are said to be worth and how much they are actually worth in practice. In a period of anemic coal markets and bankruptcy risk, reflected in bargain-basement share prices (see Figure 1, below), assets may no longer be worth their book value. This was the case for James River Coal Company, which sold 3 mines for $52 million during bankruptcy proceedings in August 2014, but still posted a $503 million monthly loss associated with the sale.[58]

The buyer's market for coal assets is most pronounced in the Central Appalachian basin,[59] but affects western coal mining as well.[60] Recently, Australian firm Ambre Energy sold its two North American coal mines and two coal export terminal projects to Resource Capital Funds (RCF), a private equity firm and Ambre's main creditor, for a mere $18 million in cash. Ambre had claimed as recently as the preceding winter that its assets were worth a combined $200-400 million. Ambre's financial difficulties are severe even against the backdrop of an embattled industry,[61] but such steep discounts on both mine and export terminal assets – the latter representing the growth strategy of many domestic coal producers – strongly recommend a deeper dive into the valuation of all assets backing self-bonds.

Figure 1. Alpha Natural Resources (ANR), Arch Coal (ACI), and Peabody Energy (BTU) have lost 93-98% of their value since 2011 despite overall economic recovery. Source: Google Finance.

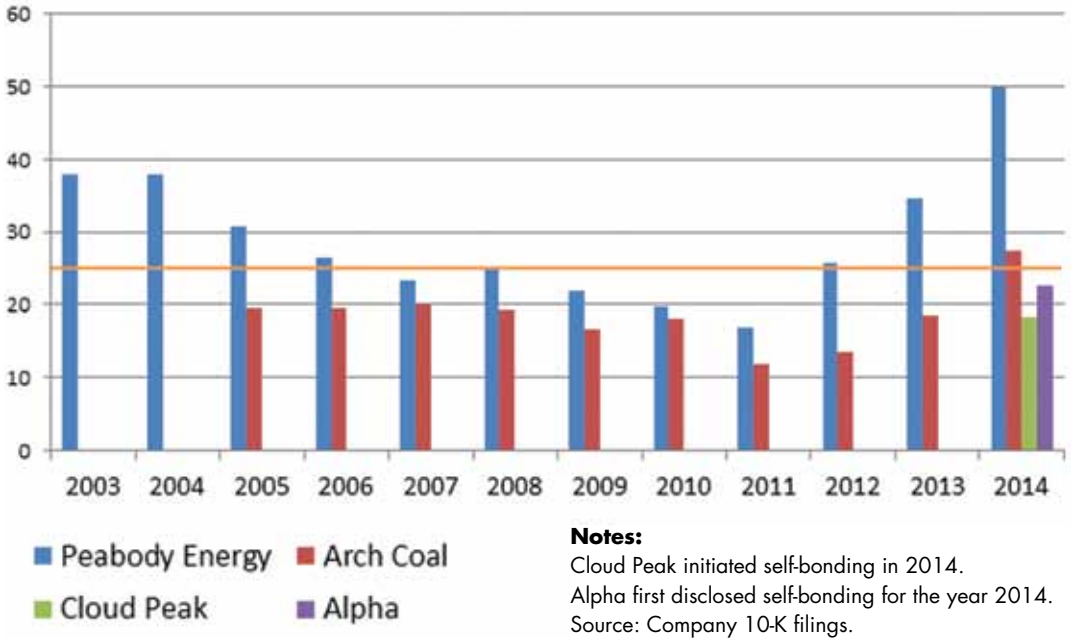
F. Regulatory Compliance Among Western Coal Operators

In recognition of self-bonding's inherent risk to the completion of reclamation, SMCRA regulations contain a limit to self-bonding: guarantors may not guarantee bonds worth more than 25% of their "tangible net worth."[62] The administrative rules in Wyoming,[63] North Dakota,[64] Colorado,[65] and New Mexico[66] contain the same prohibition.

Based on SEC filings of major publicly-traded coal operators in the United States, only Peabody Energy, Arch Coal, Alpha Natural Resources, Cloud Peak and CONSOL Energy disclose self-bonding. Of self-bonding operators in the west, Peabody Energy, Arch Coal, Cloud Peak and Alpha disclose figures for their aggregate levels of self-bonding. Both Peabody and Arch report self-bonding in excess of 25% of net worth during the period for which data is available, 2003 through 2014. These two companies appear to violate federal and state regulations.[67,68]

Figure 2 illustrates reported levels of aggregate self-bonding as a percentage of companies' net worth at year's end. Self-bonding reported by Peabody exceeded 25% of net worth in 2003 (37.9%), 2004 (37.9%), 2005 (30.8%), 2006 (26.4%), 2012 (25.8%), 2013 (34.6%), and 2014 (49.9%). Self-bonding reported by Arch exceeded 25% of net worth in 2014 (27.5%). Self-bond levels were not reported by Arch prior to 2005, by Peabody prior to 2003, or by Alpha prior to 2014. Cloud Peak initiated self-bonding in the second quarter of 2014.

Self-bonding data derived from annual financial disclosures represent total self-bonding across the country, and are therefore non-specific to western coal mining. Given that all state regulations concerning self-bonding must conform to federal standards, a parent corporation's aggregate self-bonding may not exceed the limit of 25% of tangible net worth. This suggests that Peabody Energy is in violation of the 25% threshold in one or more states. In light of the present financial situation of Peabody Energy and other domestic



Notes:
Cloud Peak initiated self-bonding in 2014.
Alpha first disclosed self-bonding for the year 2014.
Source: Company 10-K filings.

Figure 2. Aggregate reclamation self-bonding reported by Peabody Energy, Arch Coal, Cloud Peak, and Alpha Natural Resources, represented as a percentage of reported net worth. Data arrayed in Tables 3, 4, 5 and 6.

coal companies, we believe the administrators of reclamation self-bonding programs should verify the financial positions of self-bond guarantors.

The national conversation around reclamation bonding is vibrant, particularly with respect to self-bonding.[69] This report aims to raise the issues of double-pledged collateral and regulatory compliance in that conversation. Given the possibility of encumbered and overvalued assets that back self-bonds in the western region, reclamation of large swaths of mined land may be at stake. For all states that permit self-bonding, regulators rely on the future financial health of heavily indebted, loss-making coal companies to guarantee extensive mine site reclamation. This challenges the fundamental promise of SMCRA: that any lands mined for coal will be reclaimed for future land users.

Table 3. Peabody Energy Net Worth and Self-Bonding (millions USD).

Year	Net Worth	Aggregate Self-Bonding	Self-Bonding % of Net Worth
2003	1,132.1	428.8	37.88
2004	1,724.6	653.3	37.88
2005	2,178.5	671.8	30.84
2006	2,587.0	685.3	26.49
2007	2,735.3	640.6	23.42
2008	3,119.5	773.4	24.79
2009	3,755.9	821.9	21.88
2010	4,689.3	920.3	19.63
2011	5,515.8	929.6	16.85
2012	4,938.8	1,275.8	25.83
2013	3,947.9	1,365.1	34.58
2014	2,726.5	1,361.4	49.93

Table 4. Arch Coal Net Worth and Self-Bonding (millions USD).

Year	Net Worth	Aggregate Self-Bonding	Self-Bonding % of Net Worth
2005	1,184.2	229.9	19.41
2006	1,365.6	265.2	19.42
2007	1,531.7	306.4	20.00
2008	1,728.7	334.6	19.37
2009	2,115.1	352.0	16.64
2010	2,237.5	406.2	18.15
2011	3,578.0	420.5	11.75
2012	2,854.6	388.4	13.61
2013	2,253.2	417.6	18.53
2014	1,668.2	458.5	27.48

Table 5. Cloud Peak Net Worth and Self-Bonding (millions USD).

Year	Net Worth	Aggregate Self-Bonding	Self-Bonding % of Net Worth
2014	1,087.83	200.0	18.38

Table 6. Alpha Net Worth and Self-Bonding (millions USD).

Year	Net Worth	Aggregate Self-Bonding	Self-Bonding % of Net Worth
2014	2,986.8	676.1	22.63

Given the possibility of encumbered and overvalued assets that back self-bonds in the western region, reclamation of large swaths of mined land may be at stake.

Part 2: Water

Colin Ruggiero

Successful hydrologic reclamation depends on up-front analysis and characterization of pre-mining hydrology.

Editor's Note: This section is based on a white paper prepared by Charles Norris, "Hydrologic Protections within the Federal Surface Mine Control and Reclamation Act," August, 2014, which is included with this report as Appendix A.

In the water-scarce western U.S., groundwater, intermittent surface water and sub-irrigation are vital to the people and communities, domestic livestock and wildlife, and the sustainable productivity and economic base of the region. The shallow coal seams fueling much of the nation's electric generators also contain the groundwater aquifers that nourish springs, wells, streams, natural systems, communities, and the economic well-being of the region. SMCRA acknowledges the distinctive semi-arid hydrology of the Western United States by specifically protecting alluvial valley floors west of the 100th Meridian.

SMCRA places special emphasis on hydrology. Specifically, if the regulating agency finds that the cumulative off-permit hydrologic impacts of all mining in the area are not within acceptable levels, the agency must deny the permit application.

"Environmental problems, at least hydrologic problems that persist with surface coal mining, are not problems with SMCRA or its regulations," according to Chuck Norris, geo-hydrologist, in his white paper analyzing issues with hydrology at Western strip mines.[74] "The problem lies with the actual implementation of the act and its enforcement." This presents an area ripe for regulatory reform and more stringent oversight.

With respect to hydrology, SMCRA was designed by Congress to implement two key mandates, in order to limit the levels of damage allowed inside and outside the immediate area of mining. First, damage to the prevailing hydrologic balance at each mine site and in associated offsite areas must

be minimized.[75] Second, material damage to the hydrologic balance outside each permit area must be prevented.[76]

The fundamental hydrologic protections under SMCRA are not simply extended to a stream, aquifer, water well, or a quantity or flow of ground or surface water. These protections extend to the exchanges between all of these systems over time. The authors of SMCRA understood that water is constantly moving and constantly changing and that damage anywhere along that path or cycle affects everything along that path or cycle; it's the pattern – the balance – that must be protected. It is a holistic understanding that reflects the science of hydrogeology.

Achieving the fundamental mandates of SMCRA is a doable task, and the law enumerates a logical set of steps to allow the law to work. The first four steps are performed by the operator, and the fifth responsibility rests with the regulatory authority:

Ecoflight

1. Characterize the hydrologic balance as it exists pre-mining.

2. Evaluate the mining plan to ascertain how mining would change the hydrologic balance and determine what would be the probable hydrologic consequences of mining.

3. Develop a hydrologic reclamation plan that ameliorates the impacts of mining to the point that damage to the hydrologic balance can be expected to comply with SMCRA limitations.

4. Devise a monitoring plan that will track the changes due to mining to verify the projections of the probable hydrologic consequences, to demonstrate the efficacy of the reclamation plan, and to allow for timely intervention if things are not going as planned.

5. Assess the cumulative hydrologic impacts from the mine and from other mines to determine that, even cumulatively, the mine will prevent material damage to the hydrologic balance outside the permit area. (The regulatory authority performs this step)

SMCRA acknowledges that surface mining inherently will do damage, Norris explains. "You just don't make an omelet without breaking eggs." The statute is designed to limit that damage, minimize it when possible, and remediate it when necessary. SMCRA appreciates that, with respect to hydrology, impacts extend beyond the mine.[77]

A regulatory authority cannot issue a permit for a mine until it has determined that the off-permit hydrologic impacts of the proposed mine, cumulatively with all other past, current and anticipated future mining, will not exceed acceptable levels. This determination is the cumulative hydrologic impact assessment, or CHIA, that is required prior to approval of every permit.

While hydrologic protections within SMCRA are well-thought-out, the process is hampered

by ineffective implementation at the start. Norris suggests that "the characterization of the hydrologic balance is too frequently grossly inadequate. Baseline data collection is generally too limited geographically, geologically, in duration and in frequency. As a result, only a ghost of the hydrologic balance is drawn, with not enough detail to protect it."

Youngs Creek Mine Permit Hydrology Characterization Found Lacking

The Youngs Creek Mine is a proposed new surface mine with a permit to disturb more than 7,000 acres in northeastern Wyoming, twelve miles north of Sheridan. The permit area had hosted a small historic surface mine, and is currently home to a network of coalbed methane wells, center pivot agricultural operations, and grazing. Surface ownership and mineral rights, for approximately 328 million tons of coal, are held privately. The mine area was purchased by Cloud Peak Energy in 2012.

While geologic and hydrologic data from previous mines and external studies were incorporated into the permit, omissions in several key areas leave much to be desired for a meaningful analysis of the permit area's pre-mining hydrologic balance. More thorough data collection would be needed to fully characterize the area's surface and groundwater quality and quantity to fulfill the promise of SMCRA. For example:

- An intermittent stream in the permit area was mistakenly characterized as an ephemeral stream. Intermittent streams are protected from mining under the stream buffer rule.

- Adequate data was not collected to characterize the upper layer of stream valley alluvial sediments, resulting in a major over-simplification of the groundwater model.

While geologic and hydrologic data from previous mines and external studies were incorporated into the permit, omissions in several key areas leave much to be desired for a meaningful analysis of the permit area's pre-mining hydrologic balance.

- The number and placement of groundwater wells is insufficient to characterize bedrock groundwater discharge to and from the alluvium. This resulted in an oversimplification of groundwater exchange between bedrock and alluvium in the groundwater model.

- Stream flow diversions into agricultural ditches were not fully quantified.

- Some of the surface water quality samples were collected following precipitation and before the return of normal stream flow, which may have skewed results.

- Water quality data from the former mine pit was not included in the permit materials, despite the insight into post-reclamation hydrology and spoil water quality the data offers.

- Ongoing groundwater withdrawal due to coalbed methane wells may have changed groundwater dynamics since the conclusion of baseline data collection.

For a more detailed analysis of the Youngs Creek Mine permit, see Appendix B online at www.underminedpromise.org.

LJ Turner

Profile: Powder River Basin rancher LJ Turner

For nearly a century, LJ Turner and his family have run cattle and sheep over the rolling grasslands of Campbell County, Wyoming. Born and raised on land homesteaded in 1918 by his grandfather and father, Turner manages herds of around 200 red Angus cattle and 1000 sheep. The expanses of grass, with just enough springs and streams, allowed his herds to thrive. The rise of extensive mineral extraction over the course of the past few decades has had significant consequences for his livelihood, however, including closures of his family's customary grazing land, extinguished springs, and early-drying creeks and rivers.

Turner currently grazes livestock on 10,000 acres of private and public land, though his family historically ranched nearly three times that area. With the advent of large strip mines just ten miles from his home, leases for 6,000 acres of public land assigned to Turner's family since the 1930s have been turned over to coal mining operations. Coal company acquisitions of adjacent private land have further reduced grazeable area.

Ancillary mine facilities also take their toll. For example, construction of a mine road across Turner's last remaining public pastureland during a recent summer grazing season required his displacement. Facing a paucity of local relocation options, he reasoned that contemporaneously reclaimed mine lands should be available. Turner recalls being told that no mine lands were grazeable when he offered to move his cattle there; the mining company instead offered him $10,000 to relocate for the summer. The only suitable area he could find was over 200 miles away in the Black Hills of South Dakota, and his compensation payment never materialized.

Besides losing thousands of acres of land he and his family historically ranched, Turner has watched scarce water resources dry up. As the coal bed aquifers have been depressurized from mining, springs that have fed streams and watered cattle no longer flow. As a child, Turner remembers that water would bubble up from just such a spring each winter when he would cut blocks of ice from it for home use. As springs have dried up, so have creeks and rivers that Turner and his neighbors depend on. A stream on Turner's ranch that would run until autumn has dried up during the summer for the past two years, as has a five-mile run of the Belle Fourche River on a neighboring ranch. On a pasture near Porcupine Creek, in close proximity to the mines, the drilling of exploratory borings eliminated the flow of minor springs that were useful for Turner's cattle, while railroad construction covered over others.

LJ Turner

With the loss of many sources of water, Turner operates a dozen or so wind-powered wells that reach as deep as 1,000 feet to obtain enough water for his animals. The infrastructure, including pipelines to transport the water, has cost him nearly a quarter million dollars. If the aquifers currently tapped by his wells are drawn down much further, he may not be able to afford to redrill.

Anchors of the regional economy, agricultural operations like Turner's are plagued by uncertainty over the long-term availability of adequate grass and water. Continued mine expansions and the meager reclamation of mine lands in the state of Wyoming magnify this uncertainty: less than 6% of disturbed acres have achieved Phase III bond release. One of the breakdowns in the implementation of SMCRA in the west is the failure to force mine companies to release mined lands and return them to agriculture and wildlife.

Part 3: Wildlife

Colin Ruggiero

The impacts of Coal Mining and Coal Mine Reclamation on Native Wildlife and Plants.

Restoring mined land to meet the needs of native wildlife and plant species is a significant long term challenge. The goal is to reestablish a diverse and productive, functional, and sustainable ecosystem of native plants and wildlife that resembles the diversity and the health of the ecosystem before the land was mined. The habitat needs of wildlife on reclaimed mine lands, however, rarely match up directly with the needs of domestic livestock and therefore the ways that we measure successful reclamation for wildlife will be different than successful reclamation for agricultural purposes.

To restore the land to its original state with the diverse plant and wildlife communities that existed prior to sites being mined is a task that coal mine reclamation specialists have not accomplished. Unfortunately, the definition of successful reclamation of surface mine lands as defined by SMCRA is not designed to appraise total native ecosystem recovery. Rather, successful reclamation as defined by SMCRA involves meeting certain reclamation performance standards including, in most states, replacement of topsoil, restoration of hydrologic function, effective erosion prevention, and reestablishment of a diverse, effective and permanent vegetative cover of the same seasonal variety native to the area. Although important, these standards do not lead us to sites that are equal to pre-mined sites in terms of habitat quality for native wildlife.

This chapter is not meant to be a comprehensive literature review of all issues related to wildlife and coal mining and reclamation but an overview of the challenges that wildlife face during and

after mining operations in their habitat. Although the reclamation of mined land is a large field of study, there are very few independent studies that compare the quantitative and qualitative wildlife population characteristics (e.g. species richness, abundance, density, diversity) to reclaimed mined land plant community features (e.g., species richness, canopy cover, density, standing crop biomass, diversity).

Wildlife is affected by coal mining in a variety of ways. Construction and mining activities cause direct wildlife mortalities in addition to the disturbance and displacement of wildlife populations. Direct mortalities from mining activities occur primarily as the result of interactions between wildlife species and mining equipment, increased traffic and other development. Reptiles, amphibians and small mammals are generally not mobile enough to avoid mining equipment. Mortalities of birds are caused by collisions with electrical transmission lines and other mine support structures while fish mortalities result from the rerouting of streams or the activity from heavy construction near stream channels.[78]

Coal mining displaces and disturbs wildlife populations. In the most obvious way, it forces wildlife living on the lands to move. The survival likelihood of wildlife that are mobile enough to avoid development decreases since they must move to location already occupied by wildlife and will experience greater competition for resources they need to survive. Wildlife species have varying tolerance to noise and human activity but many wildlife species occupying habitat near mines like pronghorn and raptors are disturbed. Studies have shown that energy development taking place within 3 km or less of greater sage grouse

Colin Ruggiero

leks – areas where male sage grouse perform in front of females as part of the birds' mating ritual – can cause an increase in the distance females travel to nesting sites and result in lower rates of nest initiation.[79,80]

Other impacts of coal mining include air pollution and water contamination, which directly affect wildlife. The exhaust from heavy equipment and transport vehicles contains harmful gases including sulfur dioxide and nitrous oxide and as trace metals such as lead. In areas near access roads and other locations with heavy traffic, "increased levels of lead in vegetation and wildlife have been observed."[81] Long term, increased exposure of wildlife to trace elements through dust from various mining activities can cause animals to "suffer from disorders of the mucous membranes and pulmonary complication."[82] Surface water contamination from increased sediment loads and the leaching of toxic elements from exposed ores and rocks can cause decreases in aquatic oxygen content and light penetration, reducing the growth of aquatic plants and resulting in the direct mortality of fish and other aquatic species dependent on the plants as a food source. Although in arid areas the likelihood of surface water contamination is not as high, the general lack of surface water means that any contamination that does occur has a greater impact on wildlife dependent on the water source.[83]

The potential for a site to be successfully reclaimed post-mining depends on numerous factors. The first is the geology and climate of the region. In the arid West, where a majority of coal strip mining occurs, restoring the original native plant communities, which is a precondition to attracting wildlife back, is complicated by low annual precipitation. As a result, the greatest challenges to reclaiming mine lands in the West are "revegetation and the maintenance of the hydrologic conditions in and around the mine site."[84] The second factor is the level of commitment of the mining company to restore the land to the condition it was in before it was mined.

Long term, increased exposure of wildlife to trace elements through dust from various mining activities can cause animals to "suffer from disorders of the mucous membranes and pulmonary complication.

Due to the challenges of restoring native habitat in arid regions, no mined area in the West has been able to reclaim to pre-mining habitat conditions. Mining always alters the ecosystem – topography is gentler, shrub density is lighter, water balance is altered. The long term and cumulative impacts of coal mining and reclamation are significant and permanent.

Reclamation Challenges for Native Plants in Arid and Semi-arid Climates

The 100th Meridian is often cited as the dividing line between the arid West and more humid East. Colorado, Montana, New Mexico, Wyoming, and half of North Dakota all fall to the west of the 100th Meridian. The arid to semiarid climates of these states present a unique challenge to reclamation efforts. Annual precipitation is low and often falls in the form of short, high-intensity storms or snowfall. Annual, seasonal and daily temperatures can fluctuate widely, which limits the effectiveness of precipitation to aid in reestablishing native vegetation. High temperatures during summer days can increase soil temperatures to levels that cause seedlings to dry out.[85] The lack of wind breaks on landscapes that have been mined cause winds to blow though unobstructed, drying out soil and inhibiting seed germination and viability of young plants.

The arid climate that characterizes much of the western coal mining regions results in a substantially slower process of vegetative succession – the process by which plant species in an area change and mature over time. When lands are disturbed, the process of succession begins again. According to a report by the National Academy of Sciences (NAS), "although natural revegetation of a disturbed site may develop in five to twenty years on a high rainfall eastern U.S. site, it may take decades or even centuries for natural revegetation to develop in a desert."[86]

Under SMCRA, mine operators are required to meet certain revegetation standards for bond release, but the characteristics of Western climate challenge the rapidity with which native vegetation is successfully re-established. The cost of successful reclamation increases if the operator uses irrigation, mulching, proper handling of top soil and proper seedbed preparation, all of which increase the chances of reestablishment of native vegetation and a diverse plant community.

Starting From the Bottom Up: The Importance of Soil to Restoring Native Ecosystems

Preparation for revegetation begins with the removal and stockpiling of topsoil. Topsoil, which can be of various depths, is the layer located on top of the subsoil, which the mining industry calls "overburden." Because the subsoil is substantially less productive for plant growth and overall health, an important process during the mining process is to accurately determine the extent of the topsoil and to separate it from the subsoils.

If topsoil is not carefully removed and stored separately from subsoils, the two types of soil are mixed during salvage and storage, resulting in top soil contamination, and reducing the nutrients and quality of the soil for revegetation. According to the Handbook of Western Reclamation Techniques

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from the University of Wyoming, "vegetation establishment and reclamation success are enhanced by proper salvage and replacement of topsoil," as the topsoil not only stores living features such as microorganisms, seeds, and roots, but also important nutrients.[87]

Once topsoil is stripped, it is either carried to a site that has already been mined and regraded, or it is stored in stockpiles for later use. If the coal company does not handle the topsoil correctly, it quickly suffers from compaction, wind and water erosion, and loss of essential nutrients. When topsoil is stored out in the open, exposure to the elements causes essential nutrients to leach out. As a result, when the topsoil is brought back to cover regraded mine sites, essential nutrients for native plants are often depleted. Non-uniform depletion results in nutrient "hot spots" in the soil – areas where minerals have accumulated and concentrated – causing problems for revegetation and wildlife dependent on the vegetation for food.

Mining can also increase "the inventory of contaminants in the upper parts of the soils [over] the course of time," when heavy metals and other potentially toxic substances leach from coal mine spoils into the environment.[88] The uptake and concentration of toxicants by plants can be detrimental not only to the plants, but also to the animals that feed on them. When toxic substances are taken in at a rate faster than the organism can excrete them, bioaccumulation of the substance within the organism occurs; when an herbivore feeds on a plant that has taken up a toxic substance, and a carnivore consumes that herbivore, the toxins are magnified with each level through the process of biomagnification.

In the highly alkaline overburden and soils of the West, most of the potentially toxic substances are "only marginally soluble"; in those situations, the toxicants are not "readily available for plant use."[89]

The specific balance of soil nutrients and metals at individual sites result in conditions that increase the likelihood of plant uptake. For example, plants growing on spoils rich in sodium are more prone to the formation of toxic compounds by boron. In addition, "in the absence of significant copper under alkaline conditions," legumes can take up molybdenum in excessive amounts.[90]

In Colorado, Steele and Grant (1982) found that mine spoils characterized by a more complex topography were able to support a larger number of small mammals and a greater diversity of vegetation than compacted soils.[91] The presence of small mammal communities on reclaimed lands can be important in several ways. In addition to serving as a source of prey for mammalian, avian, and reptilian predators, small mammals can affect the composition and distribution of plant species on a landscape level through their foraging and burrowing activities.[92]

Establishing Diverse Native Plant Communities in an Arid Climate

In the past, driven by efforts to find the cheapest reclamation methods, operators sought to establish plants that would be able to quickly colonize post-mined lands, stabilize the soil, and meet percent cover vegetation requirements. Traditional reclamation processes that mining companies used to restore vegetation on mined lands resulted in the dominance of non-native plants on many early reclamation sites. Using non-native species may stabilize the soil but does not contribute to the restoration of native plant communities important for wildlife habitat.[93]

Provided that exceptions have not been made for certain postmining land uses or for mines with thin or thick subsoils, SMCRA requires that reclamation

Alexis Bonogofsky

personnel "[establish] a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of plant succession and regeneration."[94]

A. Invasive and Non-native Plants

Although reclamation practices have advanced and it is more common for operators to use more native plant species in their efforts, the spread of non-native and invasive species on reclaimed mine land is a huge barrier to reestablishment of a native, healthy ecosystem.

Areas that have been mined are highly vulnerable to invasion by weeds. If left unmanaged, weeds will out-compete native species for nutrients and water resources, choking out new seedlings and further complicating the efforts to use native species for revegetation. Noxious weed infestations can cause "reduced productivity, loss of ecological diversity and wildlife habitat, and livestock health hazards."[95] The prolific presence of weeds on mined areas is caused by mining practices and occasionally the use of non-native species to stabilize the soils.

Common weeds on western coal mines include cheatgrass, Japanese brome, Canada thistle, and whitetop.[96] Cheatgrass – which covers around 50 to 53 million acres in the arid West – establishes

Famartin/Wikimedia Commons

The prolific presence of weeds on mined areas is caused by mining practices and occasionally the use of non-native species to stabilize the soils.

itself easily on disturbed areas. The weed is unpalatable to domestic livestock and wildlife, reduces the value of habitat, and by establishing and expanding into sagebrush areas, encroaches into vital habitat for wildlife, particularly for pronghorn and sage grouse.[97]

B. Diversity of the Plant Community

A recent vegetation study done on a reclaimed coal mine site at the Belle Ayr Mine in Wyoming shows that the diversity of plant species on reclaimed land versus undisturbed land is significantly less and that the plant communities that are reestablished have more non-native and invasive species than undisturbed plant communities.[98] This is standard for reclaimed land, even though the use of seed mixes and seedlings by reclamation personnel is increasingly varied. In a study of intact sagebrush steppe lands, around 100 to 130 species were identified on 24, 50x10 meter-sized sample plots.[99] In contrast, the mining and reclamation plan for Cloud Peak's Antelope Mine in Wyoming covered only 30 species in its revegetation seed mixes.[100]

Careful and intentional reclamation work can help shorten the amount of time needed for succession in a plant community, "even under the best reclamation technology it is not possible to immediately establish communities that are as diverse or as stable as native communities."[101] Some vegetative species, such as cool season grasses, are quick to re-establish on land that has been mined while others, such as native sagebrush "[take] decades or longer to re-establish."[102]

In many parts of the arid West, sagebrush-steppe habitats consist of a mixture of grasses, forbs, and shrubs; among the shrubs, sagebrush specifically is a necessary and important food for pronghorns and sage grouse in the winter. Native sagebrush-grassland steppe plant communities may require 30 – 60 years to develop through natural successional processes.[103] Changing the composition of the vegetative community, the disturbance of wildlife habitat through mining and the return of such lands to an earlier successional state all combine to affect the wildlife occupying the disturbed area.

Reclaiming the Hydrologic Balance for Wildlife: How Mining Impacts Availability and Quality of Water for Wildlife

Wildlife in the west is under great pressure and must compete with humans for space, water and food. Many of the streams in areas that are under pressure from coal development are ephemeral – only flowing due to spring snowmelt or heavy rain during a summer thunderstorm – and thus contribute little to consistent water availability through the seasons. Therefore, the impacts to water as the result of coal mining are often severe and permanent. Surface coal mining disrupts aquifers and groundwater networks and the quality of water in general deteriorates. Other effects of mining on aquatic wildlife include changes in the volume of surface flow and channel changes due to increases in sediment load, which adversely affect wetlands, riparian areas and their inhabitants.

Groundwater contamination occurs through a variety of ways. For example, water filters down through the spoil (waste) from a mine or through exposure to residues from chemicals used during mining. Not only are effects such as these " difficult to prevent and almost impossible to reverse, [they] may not be detected for decades." Contamination of the groundwater at Colstrip, Montana due to mining operations was not detected until 50 years later.[104]

A. Impacts to Water Quantity and Location of Water Resources

Many areas in the West that are being mined for coal are characterized by the presence of coal seam aquifers. The cutting and draining of the aquifer affects wildlife by causing changes in flow patterns and alterations of surface water, including the depletion of springs and reduced water flow in creeks and streams. A Peabody strip mine in northeast Wyoming drained not just an aquifer but also caused the drying up of a perennial creek on a ranch near the mine. According to groundwater studies undertaken by the Wyoming Geological Survey, several aquifers in Wyoming's portion of the Powder River Basin have been depleted by coal mining in combination with coalbed methane production.[105] Wetland ecosystems and the ability of wildlife to access water in areas not immediately near the mine site can also be affected, as cutting off one aquifer can cause significant impacts on other aquifers nearby, and affect the recharge of alluvial aquifers located in valleys downstream. According to the Bureau of Land Management, the "restoration of aquifers may take 100 years after the pits are filled in."[106]

B. Impacts to Water Quality

Coal mining pollutes both surface and groundwater resources. Coal mining often increases the level of suspended solids and sediment load in streams and wetlands nearby. The presence of high levels of suspended solids in streams can increase ventilation rates, reducing oxygen levels for aquatic life. Suspended solids also decrease the amount of light that penetrates through the water, which limits aquatic primary plant production.

Surface waters are contaminated from the leaching of toxic substances from exposed ore, waste rock, and overburden, or from excess nutrients due to over-fertilization during reclamation. In Wyoming and Idaho, for example, dust from the surface mining of coal in areas with selenium-containing overburden was found to cause levels of the element to increase in the environment.[107] Selenium leaches from coal ash and coal mine waste into nearby water and soil and heavily impacts aquatic ecosystems, where the element can easily reach toxic concentrations and bio-accumulate through the food chain. In several lakes and reservoirs, selenium has been linked to reproductive impairment in fish and waterfowl.[108]

Contamination of groundwater usually occurs as the result of the leaching of ions from soils or the leakage of chemicals from waste-management facilities. Groundwater contamination is less likely to affect wildlife, however, unless the water is "discharged at springs, seeps, or wells, or is pumped to the surface for such uses as irrigation."[109] Contaminated groundwater can be dangerous where it is found in shallow areas; in these cases, plants that take up the contaminated water may wilt or be otherwise heavily damaged, and thus fail to serve as adequate forage for wildlife.

Conclusion

Even when reclaimed lands appear aesthetically pleasing, they are not comparable to the habitats that existed before the land was mined. Plant communities on reclaimed lands – especially in the arid West – must undergo a long period of natural succession before they resemble the pre-mined communities of plants on the land in terms of stability and diversity. Soil and water contamination on reclaimed lands are extremely detrimental to the healthy functioning and diversity of wildlife species.

Even when reclaimed lands appear aesthetically pleasing, they are not comparable to the habitats that existed before the land was mined.

Case Study: Reclamation and Sage Grouse

Bill Dvorak

Sage Grouse: Background

The largest species of grouse in North America, the greater sage grouse *(Centrocercus urophasianus)* once ranged widely across the western United States. Today, however, it is only sparsely distributed across 11 western states.[110] The greater sage grouse was recently listed as threatened under the Endangered Species Act. Either a proposal for listing or a finding that protection is not warranted is set to be announced by the U.S. Fish and Wildlife Service (FWS) in September 2015.[111]

The sage grouse's declining population can be attributed in large part to habitat loss. According to the BLM "the future of the sage grouse, which occurs throughout most of the sagebrush-covered lands of the West, depends largely upon man's ability and willingness to maintain habitat vital to its needs. No other bird is so habitat specific to one particular plant type in meeting its annual life requirements."[112] The sage grouse's obligate relationship with sagebrush stems from the species' use of the plant type for both nesting and dietary purposes – in the spring nesting season, "more than 90% of all sage grouse nests are located under or adjacent to sagebrush plants" and in the winter, sagebrush leaves constitute an almost exclusive source of food for the species.[113] Sage grouse also utilize a variety of sagebrush grassland habitat along their migration routes in the fall, when they move from their spring/summer to winter habitat.[114]

The loss of sagebrush habitat can be attributed to several factors, including fire, conversion of lands to facilitate livestock grazing, invasion of non-native plant species such as cheatgrass, encroachment of native conifers, and use of lands for energy and mineral development. Coal fields in Montana, Wyoming, and Colorado are coterminous with large portions of the greater sage grouse's range.[115]

Coal Mining & Sage Grouse

Mining for coal has destroyed much of the sagebrush habitat that sage grouse depend on. Some mines, such as the Jim Bridger mine in Wyoming, already operate in sage grouse priority habitat. Current mining proposals continue to threaten sage grouse priority habitat, including expansion plans for the Spring Creek and Colowyo mines in Montana and Colorado, respectively, as well as a proposal to mine coal in Wyoming's Carbon Basin.[116]

Although science has improved reclamation – illuminating best practices and fostering a shift from the use of non-native to native species for revegetation – efforts to reclaim lost sagebrush habitat post-mining, in accordance with SMCRA and individual state reclamation standards, continue to face several challenges.

Reclamation over Time

More stringent standards passed by state legislatures have also, over time, encouraged the reseeding of shrubs such as sagebrush, which has helped to increase vegetative diversity by reducing the dominance of grasses on reclaimed lands. Wyoming's Environmental Quality Act, for example, "requires coal mines to include shrubs in the reclamation revegetation species mix and further specifies planting patterns and density required to achieve full reclamation bond release" – at least 20% of the land must be covered by shrub patches, with at least 1 shrub per square meter.[117] Although the requirements, passed in 1996, do not specify sagebrush species as the shrub type to be used for reclamation, Kleinman and Richard note that "because of the requirements to replace or restore the vegetation existing prior to mining disturbance, the replacement of big sagebrush is specified by default."[118]

Case Study: Reclamation and Sage Grouse *(continued)*

A Closer Look

BLM reports that in Colorado's Colowyo and Trapper mines, monitoring data indicate that sage grouse are using reclaimed lands at certain times of the year.[119] However, the contribution of reclaimed sagebrush habitat to sage grouse survival is tempered by the nuances of both reclamation in the West and the needs of sage grouse. While some evidence exists that sage grouse will use reclaimed lands, the rate of reclamation in the West where sage grouse are found, is slow. Calculations based on data from the Office of Surface Mining (OSM), added cumulatively for five western states (Colorado, Montana, New Mexico, North Dakota, and Wyoming) and from 1996 to 2013, indicate that of total acres bonded for current or future disturbance by mining, only about 7.1% have been reclaimed.[120] On a smaller scale, of 150,000 acres managed by Colowyo Coal, only about 1% is in the process of being reclaimed.[121]

Compounding the problem of a slow rate of reclamation are other time lags. Data from Colorado's Trapper Mine indicate that in some cases, "when sage grouse do use reclaimed lands, it is land that has been in reclaimed status for 15 to 20 years."[122] In addition, reclamation personnel may face difficulties in successfully reestablishing sagebrush, where success depends largely on seed quality, seeding rate, winter and early spring precipitation, mulching, and topsoil management, among other factors.[123] When best practices are not used or when weather conditions are unfavorable, such as during years of low precipitation, sagebrush reestablishment is likely to be delayed. With availability often a problem in the arid west, water can thus be an important limiting factor.

Even when sagebrush is successfully reestablished and meets reclamation criteria, it may still lack characteristics of suitable wildlife habitat. In a study of pre-1985 reclaimed mine lands in Wyoming that were 10 to 17 years post-reclamation, Olson et al. found that "shrub canopy cover, density, plant community composition, and diversity on [the] study sites" were all less than optimal for sage grouse and pronghorn.[124] Although shrub density is now a requirement in post-1996 Wyoming, Olson et al. emphasize that such density standards by themselves will not be sufficient to meet the objective of restoring lands to pre-mining wildlife habitat conditions. Sage grouse, for example, prefer sagebrush habitat with a varied composition of grasses, forbs, and shrubs, particularly during nesting. Optimal sagebrush heights range from 17 to 22 cm. Olson et al. further note that although bonds require the shrub community on reclaimed lands to be comparable to pre-mining conditions within the 10-year bonding period that applies to the west, developing the characteristics of native shrub communities can take 30 to 60 years of natural succession.[125]

A focus on the use of reclaimed sagebrush habitat by sage grouse supports not only their conservation, but also helps to ensure adequate restoration of post-mined lands for other sagebrush-dependent species. The sage grouse is considered an umbrella species – a species whose protection indirectly protects other organisms that rely on the same habitat. According to Rowland et al., conservation efforts aimed towards sage grouse may help to conserve other sagebrush obligates and "near-obligates."[126] Among the many other species that rely on sagebrush, and thus also on the successful reclamation of their former habitat, are pronghorn, sage sparrow, pygmy rabbit, and Merriam's shrew.

Avoiding development in sage grouse habitat should be a priority. If, however, development such as coal mining does occur, a shift towards timely and responsible reclamation will be critical in promoting a future landscape that includes the continued presence of sage grouse and other wildlife.

Part 4: Inspections and Enforcement

Ecoflight

2011 Directive results in improvements, but inspections still too low as disturbed acres mount.

In 2007, *Undermined Promise* suggested that OSM's published data "should allow the public and others to determine whether state agencies are carrying out the requisite number of inspections."[127] The annual reports for the years prior to 2011 do not explicitly state the number of required inspections. However, according to 30 CFR §840.11, state regulatory authorities must conduct a minimum number of inspections equal to twelve times the number of active mines. At least four of the 12 must be complete inspections, and the remaining can be partial. For inactive mines, the minimum number of complete inspections is equal to four times the number of mines.[128] Based on these minimums, and the data on the number of actual inspections conducted, the five states together failed to conduct 46 complete inspections and 167 partial inspections in the years 2006 to 2010.[129] Over the same years, a notice of violation (NOV) was issued for approximately every 74.18 complete and partial inspections, suggesting that from 2006 to 2010, some violations may have passed uncited as the result of missed inspections.

Figure 3. West Regional Inspections per Year. Sources: OSM 20th Anniversary Report (1978 to 1997); OSM Annual Reports (1998-2011); OSM State Oversight Reports (2012-2013). Data available from 1978 to 2013.
Note: Number of Inspections = State Complete Inspections + State Partial Inspections + Federal Oversight Inspections & Site Visits

Beginning in 2011, OSM's annual state oversight reports have listed the number of complete and partial inspections required under SMCRA, in addition to the actual number of conducted inspections. According to this data, available for the three years from 2011 to 2013, only New Mexico in 2011 failed to complete the minimum number of required complete and partial inspections.

Since *Undermined Promise* was published in 2007, the total number of inspections for the five states has experienced an overall decline. This is largely due to decreases in the number of inspectable units across the five states. At the same time, however, the annual total number of new acres permitted has continued to rise.

Individual State Performance

No state successfully conducted all the required complete and partial inspections for every year from 2006 to 2013. Colorado and North Dakota missed the fewest inspections. Colorado only failed to conduct 13 partial, active-mine inspections in 2009 and North Dakota was only short 14 complete, inactive-mine inspections in 2010.[130] North Dakota was the best performer overall completing the greatest number of complete and partial inspections above the required minimum numbers. From 2006 to 2013, approximately 9 full-time employees conducted 2,062 more complete and partial inspections of North Dakota's active mines than the minimum required. Montana inspectors completed the second highest number of additional inspections, with 80 more complete and partial active-mine inspections than required.

In 2007, *Undermined Promis*e highlighted Wyoming as having the least adequate inspection program of the five states, based on the number of missed required inspections. From 2006 to 2013, Wyoming continued to have the largest number of missed inspections: 15 complete and 60 partial inspections. Montana was a close second at 13 missed complete and 56 missed partial inspections; and New Mexico had four missed complete and 38 missed partial inspections.

From 2006 to 2013, New Mexico also issued the most NOVs relative to the number of complete and partial state inspections conducted. Montana was second, followed by Wyoming, Colorado, and North Dakota.

Aggregated data for the five states indicate that the number of violations (Notices of Violation, or NOV's) issued per inspection has decreased over time. Because the total number of inspections has also decreased, the trend is not due to a smaller ratio of NOV's to inspections; rather, both the number of inspections and issued NOV's have declined since 1996. SMCRA requires an NOV if an inspector sees a violation – a unique feature, unlike other energy mineral inspection regimes. Part of the decrease may be attributed to a decline in the number of inspectable units over time. However, as noted in *Undermined Promise,* insufficiently thorough inspections are also likely contributors to the decline in issued violations. Furthermore, under SMCRA, "states 'have the right to amend their [regulatory] programs,' subject to OSM approval," and this right allows them to "change their rules to permit practices that previously were not allowed."[131]

Colin Ruggiero

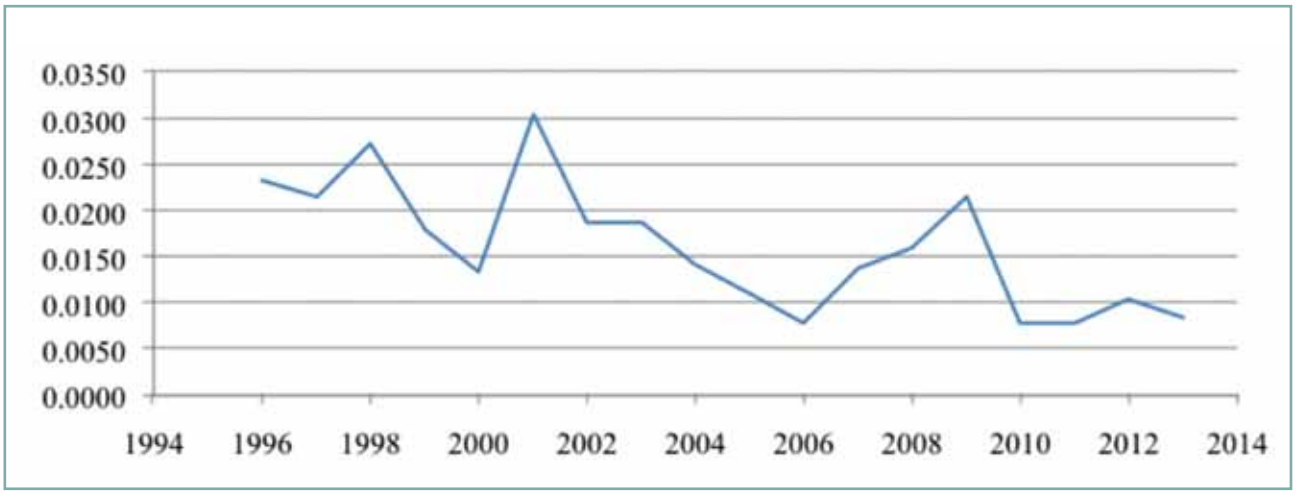

Figure 4. State Notices of Violation per Inspection. Sources: OSM Annual Reports (1996-2011); OSM State Oversight Reports (2012-2013). Data available from 1996 to 2013.
Note: State Notice of Violations (NOV) / Inspection = State Notice of Violations/(Complete + Partial State Inspections)

Not Enough State Regulatory Employees

From 2006 to 2013, the combined regulatory staff for the five states decreased by approximately 13.8%, while total permitted acreage expanded by 15.0%. Although the total number of inspectable units has declined since 2005, the total number of acres permitted for disturbance and the total number of actual, disturbed acres, increased every year. Over the same period, the number of employees in the state regulatory programs has decreased. Inadequate staffing contributes, in part, to a lack of thorough inspections, and in turn, missed violations. Wyoming and New Mexico, two of the primary offenders for missed inspections, experienced the largest drops in regulatory staff from 1996.

From 2006 to 2013, Wyoming's regulatory staff decreased by approximately 40%. Although the state's total number of inspectable units has declined, Wyoming produces more than three times the tonnage of coal produced by the other four states combined, suggesting that the need for regulatory staff has not declined by 40%.

Federal Oversight

Although OSM's environmental protection budget (adjusted for inflation), fell between 2005 and 2007, it started increasing again in 2008. The budget includes funding for the evaluation of state programs.

In 2007, *Undermined Promise* reported that "in all, [OSM] has done less than 3 percent of the number of inspections the states have done each year;" for 2006 to 2013, this percentage remains the same.[132] At 2.75% of the total number of state inspections, the number of federal site visits continues to be low despite increases in the total amount of acreage disturbed by mining in the five states.

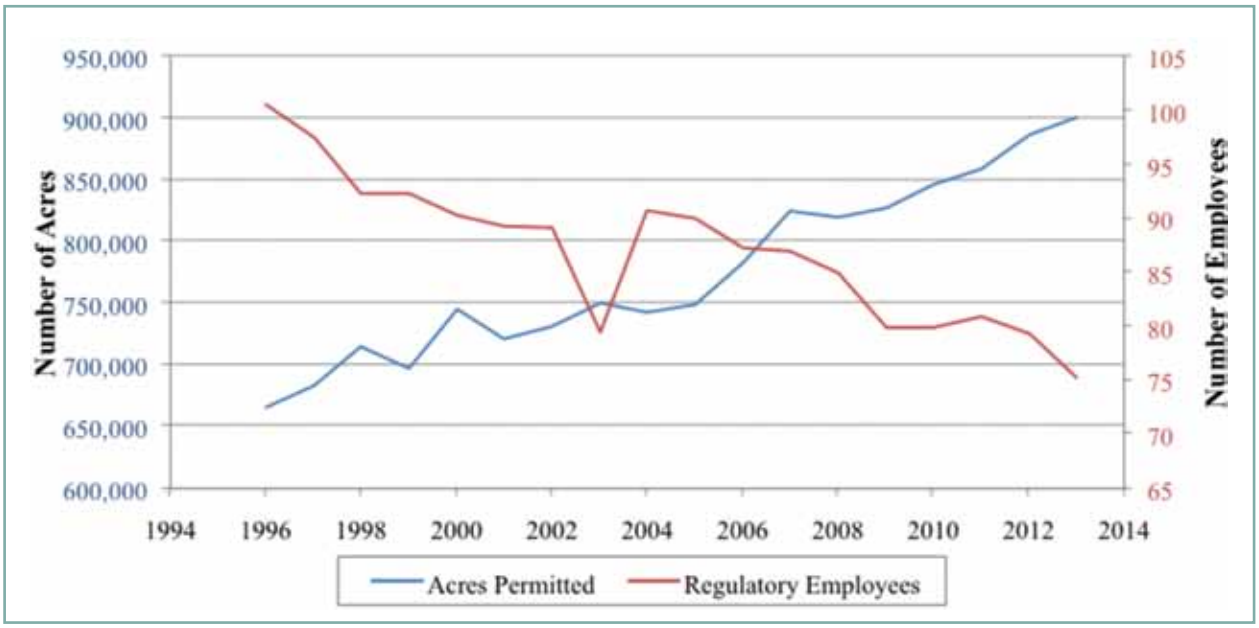

Figure 5. Acres Permitted vs. State Regulatory Employees, Western Region Total. Sources: OSM Annual Reports (1996-2011); OSM State Oversight Reports (2012-2013). Data available from 1996 to 2013.

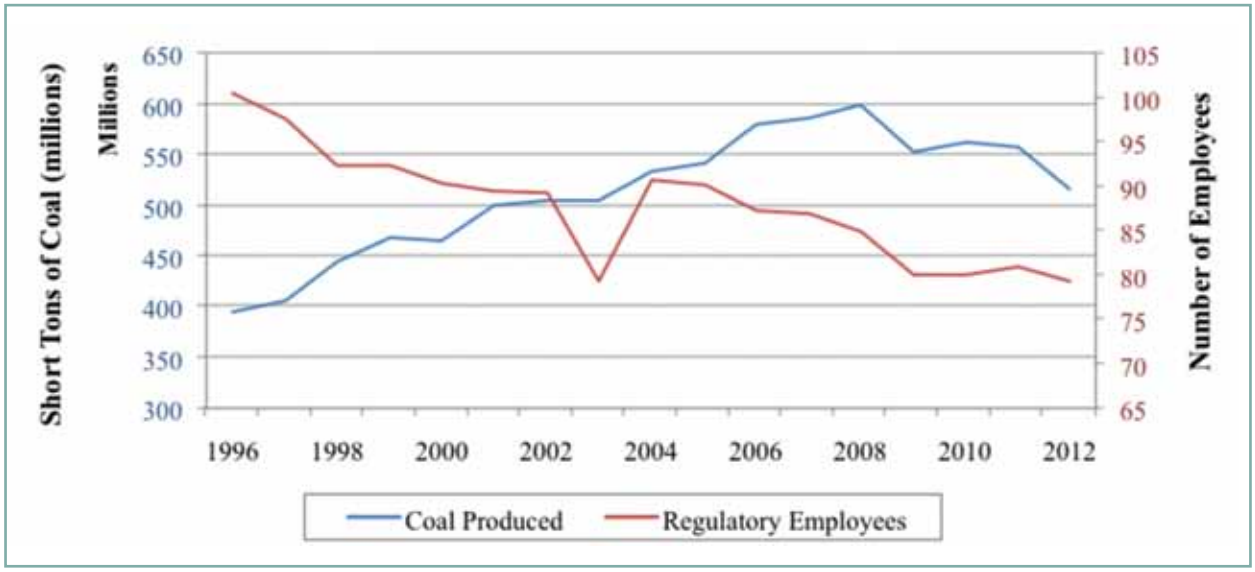

Figure 6. Coal Produced vs. Regulatory Employees, Western Region Total. Sources: *Coal Production* - U.S. EIA Historical detailed coal production data (1996-2012); *Regulatory Employees* - OSM Annual Reports (1996-2011); OSM State Oversight Reports (2012). Data available from 1996 to 2012.

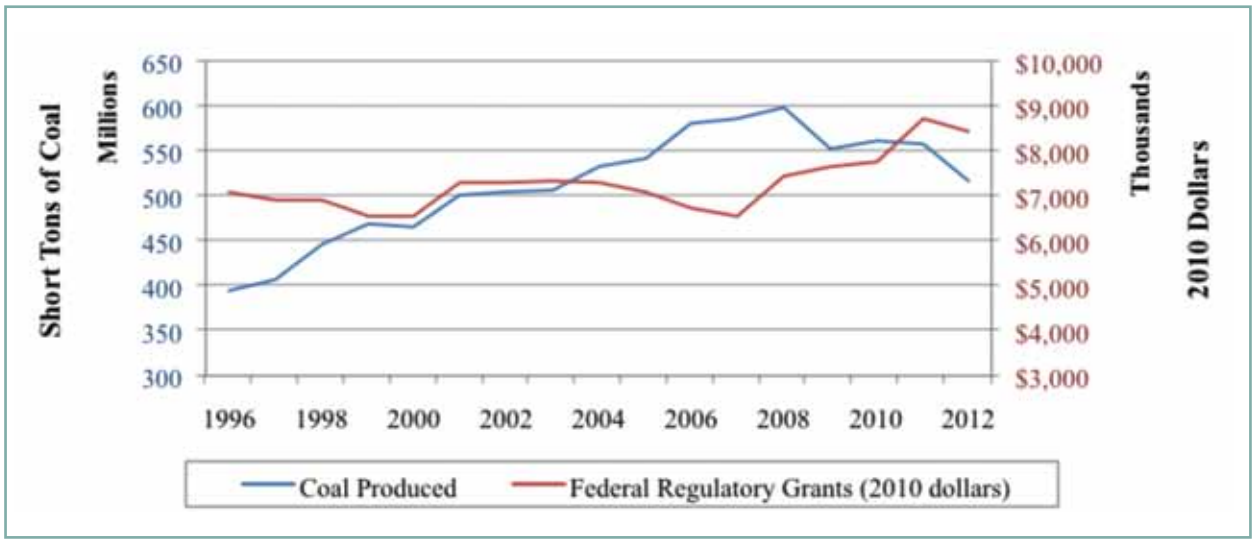

Figure 7. Coal Produced vs. Federal Regulatory Grants (2010 dollars), Western Region Total. Sources: *Coal Production* - U.S. EIA Historical detailed coal production data (1996-2012); *Federal Regulatory Grants* - OSM Annual Reports (1996-2011); OSM State Oversight Reports (2012). Data available from 1996 to 2012.

In considering federal oversight more broadly, *Undermined Promise* cited revisions made in 1999 to OSM's internal agency directive, REG-8, as the cause for the "[significant erosion of] the independence and oversight ability of the agency's field staff."[133] REG-8 was revised in 2011.[134] Although the revisions did not completely ameliorate all of the issues associated with the 1999 directive, they did provide several important, substantive changes.

For example, after the 2011 revisions, a three-tier method for determining the minimum number of annual, federal oversight inspections is now used. Under the method, OSM should inspect at least one inspectable unit annually, for states and tribes with less than 5 units. For states and tribes with anywhere from five to 1,000 inspectable units, OSM should inspect at least 25% of the total units. If a state has more than 1,000 units, the number of required units to be inspected is determined by a sampling formula. The ratio of complete to partial oversight inspections is determined by a percentage – at least 33% of the units inspected must undergo a complete inspection.

The revisions do not address the fact that the states are informed in advance as to which units will be inspected by OSM. According to the revised directive, a random sample of units for oversight inspections is only feasible for states with more than 1,000 units; "for states and tribes with less than 1,000 [inspectable units], the Performance Agreement/Evaluation Plan will specify focused inspections."[135]

The new 2011 revisions also add a "new hydrologic reclamation measurement to Reclamation Success to indicate how well streams are restored or replaced by mining and reclamation," and call for the state regulatory programs to assess contemporaneous reclamation.[136] The latter seeks to address SMCRA's purpose of "[assuring] that adequate procedures are undertaken to reclaim surface area as contemporaneously as possible with the surface coal mining operations."[137]

The revision cites the measurement of contemporaneous reclamation to be the timeliness of Phase I, II, and III bond release.[138] However, as discussed above, in practice, state regulatory programs have substituted the number of acres revegetated, but not necessarily released from bond, to report contemporaneous reclamation in their annual evaluation reports.

Although the 2011 revisions to REG-8 provide some improvements, they nonetheless continue to fall short of demanding effective OSM oversight and enforcing SMCRA's mandate for timely reclamation.

Table 6. Federal "Environmental Protection" Budget Data from OSM Annual Reports.

Year	Unadjusted (Actual) Dollars	2010 Dollars
1997	21,977,000	29,858,048.05
1998	18,983,000	25,394,828.52
1999	19,284,000	25,240,047.44
2000	19,792,404	25,063,022.34
2001	20,884,396	25,714,104.20
2002	21,168,965	25,658,809.52
2003	21,443,704	25,412,653,91
2004	22,028,299	25,428,283.57
2005	22,983,351	25,661,329.16
2006	22,250,046	24,066,250.15
2007	22,444,688	23,604,474.19
2008	24,511,720	24,825,142.32
2009	24,640,709	25,044,884.76
2010	27,098,820	27,098,820.00
2011	29,694,219	28,795,593.51
Total	**339,185,321**	**386,856,291.64**

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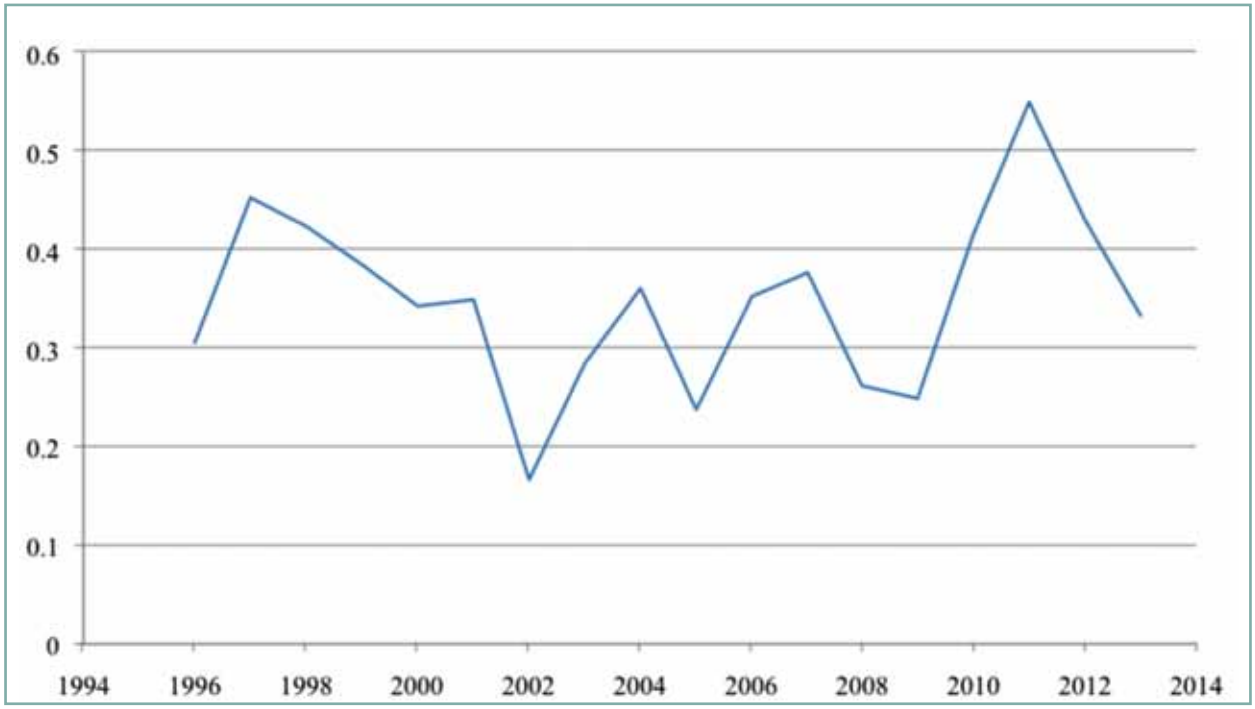

Figure 8. Federal Inspections per Mine, 1996-2013. Sources: OSM Annual Reports (1996-2011); OSM State Oversight Reports (2012-2013). Data available from 1996 to 2013.
Note: Federal Inspections per Mine = Federal Oversight Inspections & Site Visits / Inspectable Units.

Part 5: Recommendations for Reform

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Bond Amounts and Release Process

- **OSM should raise bond amounts to a level that would be sufficient to motivate companies to reclaim mined land and apply for bond release.** The new levels should be sufficient to pay for restoration of the hydrologic balance, including groundwater, if that has not been achieved with initial reclamation efforts. OSM has acknowledged on a number of occasions that current bond levels are too low to provide incentive to mining companies to complete reclamation and apply for bond release. Increasing the bond levels for Phase III reclamation would incentivize bond release and improve reclamation at all phases and would prevent leaving the government with excessive liability if initial reclamation is not properly done.

- **Before a bond can be transferred, adequate public notice of the bond release should be posted, providing the public with an opportunity to review the documents, comment, and, if desired, request a public hearing.** In North Dakota, the bond release process, which allows transferring bonds from one tract to another without the robust public oversight required by SMCRA, could result in insufficient resources for

the Public Service Commission (PSC) to complete reclamation properly, which would defeat the fundamental purpose of SMCRA.

Contemporaneous Reclamation

- **OSM should adopt a regulatory definition of "contemporaneous."** A definition would provide a standard for evaluating and approving mine permit applications, for evaluating the effectiveness of the Act and its enforcement, and help fulfill the primary goal of SMCRA – prompt and effective reclamation of mined land. The definition should consider key benchmarks toward the final goal of successful reclamation. It must address and provide remedies for the wide gap that exists between acres disturbed and Phase III (or in the case of Montana, Phase IV) bond release.

- **Regulators should ensure that mine plans encourage timely, contemporaneous reclamation and bond release.** Mine plans determine the placement of life-of-mine fixtures (haul roads, rail spurs, conveyors, sedimentation ponds, other facilities, etc.) as well as the coal removal technique and sequence. Regulators should work with operators to locate mine facilities so that mined tracts can be reclaimed to full bond release status once mining is finished on a tract. Likewise, coal removal sequences and techniques should be designed to allow significant blocs to proceed to final bond release. This would require designing coal removal with respect to surface and groundwater hydrology. Especially when the post-mining land use is designated as agricultural, regulators should work with mine operators to design large, regular parcels that can be expeditiously returned to productive agricultural use.

- **State programs that allow final bond release upon completion of Phase III should adopt a rule to allow partial bond release for successful benchmarks while retaining sufficient bond funds to evaluate groundwater quantity and quality.** Post-mining, a new hydrologic balance will eventually exist that has seasonal and year-to-year variations, which will take years to establish, measure, and remediate. States and OSM should institute changes to ensure that adequate bond resources remain in place to address issues of groundwater quality and quantity on a timescale that is hydrologically appropriate, while moving forward on bond release for successful benchmarks related to revegetation, wildlife habitat and use, agricultural productivity, and surface water quality and quantity. Land should be returned back to public and productive uses.

Self-Bonding

- **Regulatory authorities must conduct thorough due diligence on the financial positions of present and future self-bond guarantors, particularly with respect to prior or duplicate encumbrance of their assets.** If surface mine reclamation self-bonds are found to be secured by assets that will not be available in the event of a reclamation claim, state regulatory authorities must require alternative, collateralized financial assurance. Most states already permit letters of credit, collateral bonds, etc. The danger of effectively unsecured reclamation bonds is especially acute in a time of significant debt loads and shrinking coal markets. Medium-sized operates have recently filed for bankruptcy protection to reorganize or liquidate, including Patriot Coal and James River Coal Company.

Even if lands have achieved some level of interim reclamation (i.e. regrading and seeding), those lands remain off limits to the public until they obtain final reclamation status and have achieved final bond release.

- **The Department of Interior's Inspector General or the Government Accountability Office should conduct investigations of all state SMCRA regulatory programs that allow self-bonding** and recommend whether the Department should institute rulemaking to ensure that sufficient security is required of coal mine permittees by these programs.

Federal Permits and Leases

- **Agencies should stop issuing permits for new mines or mine expansions in areas where strip-mined land remains unreclaimed after more than 10 years.** Coal mine regulators have the capacity to insist that reclamation proceed to final bond release, because they ultimately determine whether a company should be allowed to continue mining in new areas. This enforcement mechanism keeps the promise of SMCRA, and is necessary to ensure that Western mined lands do not become a wasteland in a harsh climate.

- **The Department of Interior (DOI) should not lease new public lands for mining operations until at least 50% of currently occupied lands are released from final bond obligations, and the Department should not approve any new federal mine plan for a mine to expand onto additional federal public lands until final bond obligations of the existing mining operations have been met.** Even if lands have achieved some level of interim reclamation (i.e. regrading and seeding), those lands remain off limits to the public until they obtain final reclamation status and have achieved final bond release. This problem is particularly prevalent for lands in the Thunder Basin National Grassland system in Wyoming's Southern Powder River Basin. For example:

  - Peabody's North Antelope Rochelle Mine covers an astounding 57,198 acres, including 22,631 acres of federal lands and 5,277 acres of state lands.

  - The mine started operating in 1984 but to date, no acreage has been released from final bond obligations.

This means that the almost thirty thousand acres of public surface within the mining permit area remains controlled by the mine and unavailable to the public or to agricultural leasing. Those public lands are typically fenced off and withheld from public use and are not available for the public land management agencies to manage for multiple uses, like grazing, hunting, and recreation. In essence, the National Grassland west of the coal burn line has turned into a single use area – exclusively leased and managed by coal companies. The Department and the U.S. Forest Service should actively engage in state permitting activities and carry out more effective oversight over the state program in Wyoming to ensure contemporaneous reclamation performance standards are being achieved, especially for public lands and minerals within their jurisdiction.

Hydrologic Balance

- **A defensible determination of the probable hydrologic consequences (PHC) requires a thorough and defensible**

characterization of the hydrologic balance as a first step. If the characterization of the hydrologic balance is incomplete or flawed, it is not possible to correctly predict the consequences of a mining plan on the hydrologic balance during and post-mining. If consequences of a mining plan are unknown, there can be no valid determination that the damage levels to the hydrologic balance comply with the requirements of SMCRA.

- To accurately capture variations of hydrologic conditions under seasonal variation requires data collected each of the four seasons through at least the course of one full year. Since SMCRA does not provide a regulatory definition for seasonal variation, common understandings of seasonal variation should apply. Virtually all areas mined for coal in the United States experience four seasons over the course of a year. These four seasons are each distinct in their climatologic patterns and their relationships to the preceding and following seasons. Thus, it is not possible to generate one season's characteristics from those of another season through some kind of symmetry of the annual cycle. All states in the Western Region should require data from all seasons as part of the characterization of hydrologic balance.

- Daily measurement of perennial stream flow is necessary to distinguish seasonal from event-generated variations. The need for higher frequency of observations of stream flows compared to that needed for groundwater elevations is almost universally ignored by state regulators. While groundwater conditions generally vary slowly, surface water flows and, to a lesser extent, discharge patterns from some springs, are subject to episodic flow variations that occur over a much shorter period than annually or seasonally. Such variations are primarily related to precipitation events or periods of snowmelt that occur either locally or upstream of the point of observation. Isolating the seasonal variations from a flow pattern that superimposes long- and short-term events requires that the observation interval be shorter than the duration of the short-term events in the record. Thus, whereas seasonal groundwater variations can reasonably be observed with monthly observations, identifying the seasonal variations in stream flow requires measuring at least daily, to distinguish seasonal from event-generated variations.

- Flows within and between elements of the hydrologic balance are needed to characterize the baseline hydrologic balance, including seasonal variations of those flows. Characterizing the flows between elements of the hydrologic balance is difficult, but possible if the data on flows within each element of the hydrologic balance are fully characterized. For instance, multiple measurements of flow along the course of a stream allow identification of gaining and losing reaches, which identify areas where groundwater is transferring to surface water and where surface water is transferring to groundwater, respectively. Identifying and locating these types of transfers is an integral part of characterizing the hydrologic balance. This essential step in characterization describes the conditions that set the ultimate performance requirements of SMCRA.

- To be complete, the determination of the PHC should include a determination of the PHC at the time of mining, a determination at the transition period, and a determination of the final post-mining hydrologic balance. Probable hydrologic consequences must include projections of changes to surface water quality and quantity, changes to groundwater quality and quantity, as well as the seasonal variations during mining.

Without this information, a determination cannot be made that the proposed mining will, at all stages, minimize damage in the permit and affected areas and prevent material damage outside the permit area. State regulators and OSM need to be more rigorous in reviewing and requiring this scope of analysis prior to completeness determinations for permit applications.

- **Monitoring must be capable of detecting or projecting harm, if it occurs, and must trigger remedial action when such detections are made. The monitoring plan must include a description of how the monitoring data will be evaluated and what criteria will be used to accomplish these objectives.** Since no permit can be approved if the expected result is unacceptable damage, the monitoring plan serves as a fundamental verification of the PHC determination. If the results confirm the accuracy, or conservatism, of the PHC determination, there will be no unacceptable damage that would trigger remediation. If the monitoring results indicate the PHC determination under-projected the impacts of mining, that insight allows intervention prior to unacceptable damage ever occurring. This is particularly relevant for consequences outside the permit area, where SMCRA mandates that material damage be prevented, not just detected. The proper design of a performance-monitoring program is partially dependent upon a valid determination of the PHC, which, in turn, is highly dependent upon a valid determination of the pre-mining hydrologic balance. Thus, the monitoring program is dependent upon the initial characterization of hydrologic balance.

- **Define what constitutes material damage.** SMCRA requires a definition of material damage for compliance with and enforcement of the law. The onus in developing that definition is upon the regulating authority. No individual regulatory authority has the latitude not to define material damage. No valid coal mining permits can be issued without a definition of material damage. The regulatory authority cannot make a meaningful finding of no material damage if it does not first define it. The operator cannot design an operations plan or a reclamation plan that will prevent material damage outside the permit area if the level that constitutes material damage is not defined. Nor would it be a good business decision to do so; regulatory authorities change priorities through time. An understood standard of "we'll know it when we see it" may change half way through a mining operation, leaving the operator highly exposed.

Wildlife

- **OSM should ensure that wildlife habitat is not converted to agricultural lands through careful specification of the post-mining use.** Restoration of the land to wildlife habitat features is often in conflict with the management objectives of surface owners who desire that land instead be reclaimed to grazing land. This conflict is most evident in the fact that reclamation standards for wildlife are more difficult to meet than those for grazing land. This is particularly true for low precipitation environments like the Powder River Basin

- **OSM should retain sufficient diversity on lands reclaimed to wildlife habitat to restore ecological niches.** Diversity in reclamation is often limited to plant varieties, not plant communities. With this approach, localized environments are lost. It is also important to ensure that "approximate original contour" is sufficiently varied to provide the kind of shelter from wind and predators that the original land did. Diverse topographical elements that catch and retain moisture and provide cover habitats often are not re-established when the land is reclaimed.

- **OSM should track invasive species on a regular basis and not wait until Phase III bond release is applied for.** The spread of non-native and invasive species on reclaimed mine land is a significant barrier to reestablishment of a native, healthy ecosystem. The postponement of Phase III bond release review long after the ten-year waiting period required by law, makes this all the more critical to ensuring restoration of habitat for diverse species of wildlife.

- **OSM should ensure that bonding amounts and terms are sufficient to ensure that wildlife habitat is restored.** Sagebrush and other woody forbs required by wildlife often take longer to establish than grasses.

General

- **Agricultural production data on mined lands should be collected and publicly available so citizens can assess the progress or failure of reclamation of agricultural land.** Where coal mining disturbs crop or grazing land, reestablishing soil quality and productivity is essential to successful reclamation. Where experimental trials are underway to ascertain agricultural productivity on mined lands, collected data should be made public. Under SMCRA, processes to evaluate reclamation and applications for bond release were designed to be transparent and available for public oversight. Accurate information is critical to determine the extent of successful reclamation before bonds are released. This information provides a benchmark for the public to ascertain whether mine reclamation is working, or remedial action needs to occur.

- **Regulators should establish rigorous standards to preserve topsoil health during mining operations.** One of the keys to successfully re-vegetating mine lands is the health of topsoil. Topsoil is supposed to be removed and conserved in stockpiles early in the mining process. Topsoil is spread over mined lands once backfilling and grading is complete. Topsoil is crucial to reestablishing vegetative communities because it is a key site for nutrient cycling and contains the most diverse biological community of any soil horizon. Biological indicators of conserved topsoil health are therefore very important to determining whether it will be agriculturally productive once spread. Storing topsoil in stockpiles promotes leaching of chemical nutrients and dramatically impairs the biological productivity of soil below contact with vegetative cover. An approach less destructive of soil health would be to spread the soil out over a much wider area, with sufficiently diverse plant cover; this would help maintain the soils' biological community and chemical nutrient cycling. Where soils have lost biological and chemical vitality, mitigation strategies such as soil teas and mycorrhizae inoculation should be employed. Maintaining topsoil health will improve the success of reestablishing vegetative communities during reclamation.

Accurate information is critical to determine the extent of successful reclamation before bonds are released. This information provides a benchmark for the public to ascertain whether mine reclamation is working, or remedial action needs to occur.

Endnotes

[1] H.R. Rep. 95-218, 1997 U.S.C.C.A.N. 593 at 1-2.

[2] SMCRA, 30 U.S.C. §1202, sub§§ (c)-(e).

[3] EIA Table 6.1, Coal Overview. Accessible at: http://www.eia.gov/coal/data.cfm#summary

[4] *See* 30 U.S.C. § 1202 ("It is the purpose of this Act to … assure that adequate procedures are undertaken to reclaim surface areas as contemporaneously as possible with the surface coal mining operations.") *See* also H.R. Rep. 95-218, 1977 U.S.C.C.A.N. 593 at 4.

[5] See testimony of Ellen Pfister before the House Natural Resources Committee, July 25, 2007.

[6] Approved mine permits are described as taking an "opportunistic" approach to water replacement – that is, there is no plan to protect or replace wells or springs potentially or actually disrupted by mining, other than waiting for "time and fate" to do the job. See Ellen Pfister testimony, id.

[7] 30 U.S.C. § 1259 (a): After a surface coal mining and reclamation permit application has been approved but before such a permit is issued, the applicant shall file with the regulatory authority … a bond for performance payable .. and conditional upon faithful performance of all the requirements of this Act and the permit.
See also 30 C.F.R. § 800.11(b)(1: The bonds shall cover the entire permit area, or an identified increment of land within the permit area upon which the operator will initiate and conduct surface coal mining and reclamation operations during the initial term of the permit.)

[8] *See, e.g.*, OSM, 1998 Annual Report at 12: OSM is also … assuring that the land currently being mined is properly reclaimed. This performance measure is the acreage of land that is released every year by active coal mine operators. This is done through a series of bond releases.

[9] Office of Surface Mining, 2014 Evaluation Year reports: Wyoming, Montana, North Dakota

[10] Montana has released only 67 acres from Phase IV (hydrology) bonds.

[11] Office of Surface Mining Reclamation and Enforcement Annual Evaluation Report for the Regulatory Program Administered by the Wyoming Department of Environmental Quality Land Quality Division of Wyoming, Evaluation Year 2014.

[12] Office of Surface Mining Reclamation and Enforcement Annual Evaluation Report for the Regulatory Program Administered by the Wyoming Department of Environmental Quality Land Quality Division of Wyoming, Evaluation Year 2013 (July 1,2012 to June 30, 2013) prepared by Denver Field Division October 2013, page 8.

[13] *Id.*

[14] April 3, 2012 letter to Jeffrey Fleischman, OSM Casper Field Office Director, and Al Klein, OSM Western Regional Office Director, from Gene Wirtz, Beth Kaeding, and Wilma Tope.

[15] OSM Directive REG-8, Transmittal 967. "Oversight of State and Tribal Regulatory Programs." Dated January 31, 2011. Accessible at: http://www.osmre.gov/LRG/docs/directive967.pdf

[16] The Montana program has a final Phase IV bond which is released after the permittee has successfully completed all surface coal mining and reclamation activities and all disturbed lands within any designated drainage basin have been reclaimed.

[17] *Id.*, at iv.

[18] 30 U.S.C. §1269.

[19] Though SMCRA does not specify all acceptable forms of performance bonds for reclamation, it does specifically provide for "bond[s] of applicant without separate surety" (30 U.S.C. §1259[c]), that is, self-bonds. Other acceptable forms of performance bonds are surety bonds and collateral bonds (30 C.F.R. §800.12).

[20] *See* "Background," below.

[21] *See* Table 2, "Liabilities to Net Worth Ratio Test Applied to Parent Corporations," below.

[22] *See* "Double-pledged assets," below.

[23] *See* "Regulatory compliance among western coal operators," below.

[24] For example, Arch Coal's Black Thunder mine's total bond was $432,492,000 from November 2014, according to documents available from Wyoming DEQ. Roughly 87%, or $374,215,000, was under a self-bond.

[25] Figure quoted by CEO Colin Marshall on 2014 second quarter earnings conference call, July 29, 2014. Transcript accessible at: http://seekingalpha.com/article/2356075-cloud-peak-energys-cld-ceo-colin-marshall-on-q2-2014-results-earnings-call-transcript?page=3

[26] Survey results are available on the website of the IMCC, at http://www.imcc.isa.us/Self%20Bonding%20Survey.pdf.

[27] 30 C.F.R. §800.23(b)(3)

[28] "Fixed assets means plants and equipment, but does not include land or coal in place." 30 C.F.R. §800.23(a).

[29] These tests are incorporated verbatim into the state rules of North Dakota, Colorado, and New Mexico. The tests have been slightly modified upon incorporation into the state rules of Wyoming. In Wyoming, the first test (referred to hereafter as test "A") only requires an "A" rating for bond issuances during the previous five years, rather than the most recent issuance regardless of its date. The second and third tests (hereafter tests "B" and "C", respectively) require guarantors to not only meet the ratios for the past year, but also to document the ratios for the four preceding years and offer explanations if the ratios are not met during any of those four years.

[30] Corporate Guarantee for North Antelope Rochelle Mine (permit 569), dated July 1, 2011. On file at Wyoming Department of Environmental Quality.

[31] Coal Application for Renewal of Self-Bonding, Dry Fork Mine (permit 599), dated Nov. 3, 2014. On file at Wyoming Department of Environmental Quality.

[32] Jim Deutsch, Director, Mine Reclamation and Abandoned Mine Lands, North Dakota Public Service Commission. Personal Communication. Dec. 12, 2014.

[33] Wyoming Department of Environmental Quality (WDEQ) Land Quality Division (LQD) Coal Rules and Regulations, Chapter 11, § 2(a)(vii)(B): "The operator has a tangible net worth of at least 10 million dollars, and a ratio of total liabilities to net worth of 2.5 times or less, and a ratio of current assets to current liabilities of 1.2 times or greater. The two ratio requirements must be met for the past year, and documented for the four years preceding the past year. Explanations should be included for any year where the ratios fall below the stated limits."

[34] WDEQ Land Quality Division Coal Rules and Regulations, Chapter 11, § 2(a)(vii)(C): "The operator's fixed assets in the United States total at least 20 million dollars, and the operator has a ratio of total liabilities to net worth of 2.5 times or less, and a ratio of current assets to current liabilities of 1.2 times or greater. The two ratio requirements must be met for the past year and documented for the four years preceding the past year. Explanations should be included for any year where the ratios fall below the stated limits."

[35] Documents on file at Wyoming DEQ offices.

[36] Gorton III, William T. "State and Federal Reclamation Bonding Programs: Lessons learned and current challenges." Prepared for the Interstate Mining Compact Commission 2013 Bonding Workshop: 1-29. Web. http://www.imcc.isa.us/Bill%20Gorton%20Paper.pdf

[37] "The EPA has noted that agencies generally do not have the necessary expertise to monitor and evaluate a company's corporate structure assets, liabilities and net worth that would be necessary to oversee such guarantees." *Id.* at 14.

[38] *Id.* at 15.

[39] Quoting Conrad, "Mine Reclamation Bonding – from Dilemma to Crisis to Reinvention: What's a State Regulator to Do?" Presentation before the Energy and Mineral Law Foundation Winter Workshop on Energy Law, February 11, 2014. Accessible at: http://www.imcc.isa.us/EMLF%20Bonding%20Presentation%20Final.pdf

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[45] "Fitch Downgrades Peabody Energy Corp's IDR to 'BB-'; Outlook Negative." Reuters. Oct. 28, 2014. Accessible at: http://www.reuters.com/article/2014/10/28/fitch-downgrades-peabody-energy-corps-id-idUSFit80852020141028

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[49] "Demand for credit protection on coal producer debt soars amid industry slump." Dan Lowrey. SNL Energy. Oct. 13, 2014. Accessible at: https://www.snl.com/InteractiveX/Article.aspx?cdid=A-29465850-12073

[50] "Dividends fall for embattled coal miners clinging to every last bit of liquidity." Dan Lowrey. SNL Energy. Feb. 2, 2015. Accessible at: https://www.snl.com/InteractiveX/Article.aspx?cdid=A-30904620-11578

[51] Arch Coal Form 10-Q. Filed with the Securities and Exchange Commission on November 7, 2014. Accessible at: https://www.sec.gov/Archives/edgar/data/1037676/000110465914078394/0001104659-14-078394-index.htm

[52] Excluded subsidiaries include those outside the United States and Arch Receivables Company, LLC. See exhibits 4.21, 4.28, and 4.31 to Arch Coal's Form 10-K for the period ending December 31, 2013. Filed February 28, 2014. Accessible at: https://www.sec.gov/Archives/edgar/data/1037676/000104746914001604/0001047469-14-001604-index.htm

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[54] "Creditors Circle Energy Future Holdings Before Potential Bankruptcy." Spector, Mike, and Emily Glazer. The Wall Street Journal. 17 Sept. 2013. Accessible at: http://online.wsj.com/articles/SB10001424127887323981304579081303009713422.

[55] "Energy Future Holdings and Mining Reclamation Bonds in Texas." Tom Sanzillo, Institute for Energy Economics and Financial Analysis. 16 Oct. 2013. Accessible at: http://www.ieefa.org/report-energy-future-holdings-and-mining-reclamation-bonds-in-texas/

[56] The Railroad Commission of Texas is the State's regulatory authority with primacy under SMCRA.

[57] Energy Future Holdings, second quarter Form 10-Q filing with SEC, August 1, 2014.

[58] "James River Coal posts $503M loss on coal mines it sold recently for $52M." Coats, Christopher. SNL Energy. Oct. 2, 2014. Accessible at: https://www.snl.com/InteractiveX/Article.aspx?cdid=A-29386993-11043

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[63] Wyoming Coal Rules, Chapter 11, § 2(a)(xii)(A). Accessible at: http://soswy.state.wy.us/Rules/RULES/8883.pdf

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[65] 2 C.C.R. 407-2 3.02.4(2)(E). Accessible at: http://www.sos.state.co.us/CCR/GenerateRulePdf.do?ruleVersionId=2044&fileName=2%20CCR%20407-2

[66] NMAC § 19.8.14.1410(C). Accessible at: http://www.nmcpr.state.nm.us/nmac/parts/title19/19.008.0014.htm

[67] CONSOL Energy also reports self-bonding in excess of the 25% limit, but no longer operates in the western states covered by this report.

[68] Figures for self-bonding and net worth (stockholder equity) were derived from audited financial statements included with 10-K forms filed with SEC. The 25% limit on self-bonding references "tangible net worth," defined as "net worth minus intangibles such as goodwill and rights to patents or royalties" (30 C.F.R. §800.23[a]). The figure for net worth, that is, Stockholders Equity, is used here. ("Net worth means total assets minus total liabilities and is *equivalent to owners' equity."* Emphasis added. 30 C.F.R. §800.23[a].) Aggregate self-bonding exceeding 25% total net worth must, by definition, exceed 25% tangible net worth.

[69] Much of this conversation has been facilitated through the Interstate Mining Compact Commission: http://www.imcc.isa.us/index.html

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[70] Peabody Energy Form 10-K, filed 2/25/15, accessible at: https://www.sec.gov/Archives/edgar/data/1064728/000106472815000021/btu-20141231x10k.htm

[70] Alpha Natural Resources Form 10-K, filed 2/26/15, accessible at: https://www.sec.gov/Archives/edgar/data/1301063/000130106315000015/anr-12312014x10k.htm

[70] Cloud Peak Form 10-K, filed 2/18/15, accessible at: https://www.sec.gov/Archives/edgar/data/1441849/000110465915011392/a15-1789_110k.htm

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[75] 30 U.S.C. § 1265(b)(10)

[76] 30 U.S.C. § 1260(b)(3)

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[92] Soil Compaction & Small Mammals.pdf, pg. 409

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