MINUTES
REGULAR MEETING OF THE BOARD OF LAND COMMISSIONERS
Tuesday, February 16, 2010, at 9:00 a.m.
State Capitol Building, Room 303
Helena, MT

PRESENT: Governor Brian Schweitzer, Attorney General Steve Bullock, Auditor Monica Lindeen Secretary of State Linda McCulloch, and Superintendent of Public Instruction Denise Juneau.

Ms. McCulloch moved for approval of the minutes from the January 19, 2010, meeting of the Board of Land Commissioners. Seconded by Mr. Bullock. Carried unanimously.

BUSINESS CONSIDERED

210-4 was taken as the first action item.

210-4 OTTER CREEK BID

Ms. Sexton stated that the coal tracts cover 9500 acres in southeastern Montana. DNRC and the Land Board have entered into an agreement with the Northern Cheyenne Tribe, procured analysis of the resource values, and performed an appraisal of the tracts (*see NorWest appraisal*). A draft bid document was presented to the board in November (*see Item No. 1109-6 from November 16, 2009 Land Board meeting*). The Land Board directed DNRC to advertise the leasing of the tracts at a minimum bid of twenty-five cents per ton and a royalty rate of 12.5 percent (*see December 21, 2009, Land Board minutes*). The deadline for the bid submittals was February 9, 2010. No bids were received, but Arch Coal did submit a letter of interest.

Since then, DNRC has prepared an economic analysis of various alternatives exploring bonus bids and royalty rate options and recommends that that board set the minimum bid and royalty rates for leasing the tracts based on the provided alternatives. DNRC recommends using the original bid package with the amended minimum bid and royalty rate, and to advertise the bid package from February 16 through March 16, 2010. Any bids would be presented to the board at the March meeting.

Beth Kaeding, Northern Plains Resource Council (NPRC), read a prepared statement (*see Related Materials, Attachment 1*).

Representative Duane Ankey, House District 43, stated that those in eastern Montana are very proud of the reclamation job in the Colstrip area. Thousands of jobs and much needed revenue have been provided. The royalties from Otter Creek coal will more than double the income to the trust since its inception. Rep. Ankey made an analogy to illustrate that the market dictates what the coal is worth, regardless of what it might be perceived to be worth. The money earned from the bonus bid would help Montana in these troubled economic times and may keep the government from making some hard budget cuts in the future.

Dan Carlson, Northern Cheyenne Tribe, stated that he lives directly across from where this development may occur, and that the land and water is currently in excellent shape. Mining may have an impact on that. Mr. Carlson spoke of a prophet named Sweet Medicine, who prophesized that:

> *"There will come a time when these people will control you. They will have white skin and hair on their faces. It is during this time that they will go after the black gold [coal]. If you let them do that, you will cease to exist as a people".*

He urged the board to keep that in mind when making their decision.

Bob Guilfoyle, United Mine Workers of America (UMWA), said that development of this sort begets the phrase: "good paying jobs with benefits". He stated that it was not too long ago when coal miners lived in mining camps and were paid in money printed by the mining companies, which was only good at the mining stores, with inflated process. It has only been through the process of collective bargaining that miners have been able to raise the standard of living of working miners to where it is today.

Mr. Guilfoyle suggested attaching conditions to any company that leases the coal. If there is no collective bargaining, there will be no fairness at the mines. He noted that at the Signal Peak mine there were no such conditions, and the company threatened the miners with discharge, reducing or removing benefits, or shutting down operations if the miners tried to unionize. He presented the board with documentation supporting this assertion (*see Related Materials, Attachment 2*). Mr. Guilfoyle noted that the president and CEO of Signal Peak used to head the Federal Mine Safety and Health administration enforcement efforts in the Western United States. Since Signal Peak has undertaken mining in July 2008, it has had six 104(d) orders written (which denote a willful violation of an unwarrantable failure of mine health and safety regulations). He again urged to board to include conditions preventing willful violations of health and safety regulations.

Bob Adams, Montana Conservation Voters, read a prepared statement (*see Related Materials, Attachment 3*).

Mark Fix, NPRC, stated that his ranch would be crossed by approximately three miles of the Tongue River Railroad (TRR), if it is built. He stated his belief that had Arch Coal not spent funds on television advertising, they could have bid at the twenty-five cents per ton bid set by the Land Board.

The bid price should not be decreased. Large corporations do not care about Montana's children, nor will they produce funds to secure their future. Farmers and ranchers have long been the backbone of Montana, and expect to be so far into the future. Mr. Fix asked the Land Board not to let corporations control their votes, but rather to listen to the citizens of Montana. He noted that the board has made it clear that they will not subsidize the building of the TRR. Lowering the bid would do that, as it would free up funds to build the TRR. He urged the board to refrain from any further action on Otter Creek at this time.

Sarah Stock, Northern Rockies Rising Tide (NRRT), expressed her agreement with the comments from NPRC and the Northern Cheyenne Tribe. Due to the evidence that global climate change is real, the exploitation of the Otter Creek coal tracts should not be allowed. A better solution to fund the schools can be found rather than using money gleaned from extractive sources that jeopardize future generations. Ms. Stock said that the heyday of corporate dominance is coming to an end. Montanans from every sector of the political spectrum are fed up with industry handouts. The TRR should not be subsidized, nor should coal development in the Powder River basin. She asked the board not to waffle over the price already set, and to start acting as if they represent the people, rather than catering to destructive industry. Coal is not the only option for jobs, schools, and Montana's future. Ms. Stock asked that renewable development technologies be given the chance to succeed.

Max Granger suggested that the current administration has prioritized economics over the environment, and that Arch Coal has a commitment to "profit over people".

Bruce Miller, International Brotherhood of Electrical Workers (IBEW) Local #1638 in Colstrip, stated that he does not agree with some of the topics discussed. The plant at Colstrip may only have fifteen more years of coal remaining, and it would behoove Montana to open Otter Creek for competitive coal. There has been a consistent rallying cry for jobs, and here is an opportunity for good jobs in all facets of this operation. He expressed his admiration for the reclamation done in the area, as well as at Sarpy Creek. Mr. Miller also praised the mercury capture being done, noting that the company [Westmoreland Coal] invested an initial $12 million, with an additional $8 million annually. He concluded that wind and hydropower are not able to meet power supply demands at this time.

Allison Lawrence, Students for Social, Economic, and Environmental Justice (SSEEJ), asked how much is the future of the youth is worth? They are the ones who must live with the conditions in which you leave our great state. She noted that it is likely that no one in attendance at the Land Board meeting will likely be alive to see the full impact of the mine, and asked the board to please not bid on a future they will not see.

John Williams, Colstrip mayor and Montana Coal Board chair, urged the Land Board to continue to move the process forward. No other industry in modern Montana's history has set such a significant positive impact for the state as the mining of the coal and the resulting power production. Three-quarters of a billion dollars lie in the school trust, millions of which have been contributed by the mining of coal. Every school in southeastern Montana has been funded either partially or fully by the resources of the mining of that coal. He urged the Land Board to continue to move the process forward for jobs and for the future of our state—the children. The resources created in those ancient forests are really a "diamond in the rough" for the state of Montana.

Alexis Hegstad, SSEEJ, reviewed the amount of coal contained at Otter Creek, and CO^2 that would be released were it to be mined and burned. She said that the planet is taken for granted and people need to care for the earth by saying "no" to the leasing of Otter Creek coal.

Wade Sikorski, rancher, stated that next year his family will celebrate a centennial of living on their land near Baker. His family has persevered through drought, grasshoppers, and economic challenges; however, they are concerned about climate change. He presented the board with written testimony (*see Related Materials, Attachment 4*). Mr. Sikorski also gave a summary of a report he authored called *The Climate Crisis and Economic Development* (*see Related Materials, Attachment 5*). He concluded by stating that the factors noted in the report will not lead to economic development, but rather, economic catastrophe. He asked the Land Board to not lease the coal.

Francie Gerbohs, SSEEJ, stated that it is important to her that Montana stays how it is: beautiful, and not full of industries and railroads. She asked the Land Board to not lease the coal.

Jim Atchison, Executive Director of Southeastern Montana Development Corporation (SEMDC), stated that they are a regional, non-profit economic development group that does whatever can be done to create or save jobs in Custer, Rosebud, Powder River, and Treasure counties. Experts have said that between seven to eight percent of the world's coal may lie within Montana borders. If that is true, this is a tremendous

opportunity, and a tremendous asset that needs to be explored. SEMDC feels that responsible natural resource and energy development can be done in a balanced manner with respect to both the environment and the economy. Mr. Atchison stated that all areas of the state have benefitted from coal development. He encouraged the Land Board to be proactive with this tremendous opportunity, to continue the process of working with the private sector, and to go forward and make it happen.

Jim McGarvey, AFL-CIO, asked the Land Board to support sustainable jobs, referencing the closing of Smurfit-Stone Container in Missoula. People who have sustainable jobs pay taxes and have healthcare benefits. There are many supporters for the cultural environment, and the natural environment. He considers himself to be a conservationist, but is also a union member who believes in a social structure. A social structure has to have people working to support it, and the only way to properly support it is with sustainable jobs.

Lonzo West, East Helena Ironworkers, stated that the over 400 workers and their families are proponents of Otter Creek development.

Olaf Stimec, United Association of Plumbers and Pipefitters (UA) Local #41, stated that they are a proponent of leasing the Otter Creek coal tracts. The jobs, good benefits, and the tax base are needed.

Jack Fisher, IBEW Local #233, stated that the IBEW wants to go on record of being supportive of the Otter Creek development.

Anne Hedges, Montana Environmental Information Center (MEIC), read a prepared statement illustrating the financial aspects of the issue (*see Related Materials, Attachment 6*). She also provided a spreadsheet comparing the Otter Creek bonus bid amounts to bonus bids in Wyoming (*see Related Materials, Attachment 7*).

Michael Phelps acknowledged Ms. Juneau for her statements at the December 21, 2009, meeting, noting that she has commanded his respect. He stated that the rest of the board has earned no such respect. He cited Mr. Bullock's supporting vote after his motion to increase the bid price failed *(see December 21, 2009, Land Board minutes);* and Governor Schweitzer's seemingly "disingenuous" statements.

Mitch Hegman, IBEW Montana Electrical Joint Apprenticeship and Training Committee, stated that he and the over 1000 apprentices and journeymen, urge the Land Board to proceed with development at Otter Creek.

John Roeber, Boilermakers Local Lodge #11, stated that they have 256 members, of which only 25 are working in Montana. Other members are considering work in Canada, which will earn a wage, but will not generate the hours needed to retain their benefits.

Jay Reardon, Laborers International Union (LIUNA) Local #1686, stated the union has over 1700 laborers in the public and private sectors on Montana. He encouraged the board to continue moving the process forward. He noted that the opponents will have a presence through the entire permitting process to try to stop it. The issue at hand is moving the process forward to the next step, which is getting a bid and receiving royalty payment that will assist school trust funding, which is the responsibility of the board members. Mr. Reardon urged the board not to abdicate their responsibility.

Jenny Godwin, SSEEJ, stated that she felt it was important to speak again, having given testimony in December *(see December 21, 2009, Land Board minutes),* because it is important to protect Otter Creek, and fighting for her future in Montana to be clean

deserves her determination and commitment. She asked the board to reconsider their decision to lease Otter Creek coal.

Janet McMillan, read a prepared statement (*see Related Materials, Attachment 8*).

Leroy Spang, Northern Cheyenne Tribe president, read a prepared statement (*see Related Materials, Attachment 9*).

Jonathan Matthews concurred with the SSEEJ students' statements that they will be left to deal with the problems created by the decision of the Land Board. The only people speaking in support of the project are people being paid in an official capacity. Mr. Matthews stated that he has not seen science to support the idea of clean coal, but if or when such technologies exist, the coal will still be there, and possibly have more value to the citizens that it does at this time.

Jim Ryan Jr., Sheet Metal Workers International Association (SMW) Local #103, stated that of the 300 Montana union member families, 33 percent are unemployed. SMW also represents Wyoming members, who are currently 100 percent employed. Wyoming generated higher bonus bids and royalties because they do not have as many obstacles to overcome.

Sterling Small, Northern Cheyenne Tribe, gave a brief history of his athletic and academic accomplishments (professional track and field athlete, attended 2008 Olympic trials, and bachelors degree in communications from Boise State). He made the point that in the nearly two years he has been back home on the Northern Cheyenne Reservation, there have been no available jobs. He urged the Land Board to develop Otter Creek coal by lowering the price to a reasonable amount.

Elizabeth Braidedhair, Northern Cheyenne Tribe, stated that since she was 14 years old, she has always been able to find employment on the reservation. Her ancestors did well without coal development. Due to her love of the land, she asked the Land Board not to lease the coal.

Josh Omaetz, Colstrip, stated that he is currently unemployed. He would like to remain in Montana, and asked the Land Board to make sound decisions in moving the Otter Creek coal project forward to help create jobs.

Sarah Anderson, University of Montana student, stated that she wrote to the Land Board in December, and received a response from Governor Schweitzer. She stated that one line seems especially relevant today:

> *"I believe that the responsible development of the Otter Creek tracts, at the right price, and done responsibly, can benefit the state".*

Ms. Anderson stated that she understand the responsibility of the Land Board to maximize the return on the school trust lands. She stated her belief that the board had already set the right price, and asked the board not to lower it.

Kaylyn Curry, SSEEJ, expressed concern for her generation's future. The state needs to focus on sustainable, renewable energy that does not destroy water, soil, and climate.

Al Ekblad, International Union of Operating Engineers (IUOE) Local #400, stated that there are 16,060 members in the union, of which 650 are construction workers and 600 are miners. In 2009, there were never more than 120 construction workers unemployed, and now it is over 200. The idea that people can make a good living in the construction trade is quickly becoming a falsehood. He stated that he supports alternative energy,

but the reality is that everyone has used some type of coal generated energy in the last 24 hours. He asked the board the move the Otter Creek coal project forward.

William Walksalong, Northern Cheyenne executive administrator, stated that Steve Brady, Northern Cheyenne Cultural Committee chairman, asked him to reiterate the seriousness of the prioritization of the preservation of the sacred cultural and historic sites located on the Otter Creek tracts. If and when development occurs, an environmental assessment must include the Northern Cheyenne people.

Mr. Walksalong noted his personal opposition to the transfer of the tracts to the state *(see May 20, 2002, Land Board minutes),* as well as the Dismissal with Prejudice of the Federal lawsuit challenging the transfer *(see Northern Cheyenne Tribe v. Gale Norton, Secretary of the Interior, Case No. 1:02CV00146).* He stressed the importance of patience, noting that the correct answers will come with time.

John Johnson, IUOE Local #400, urged the Land Board to move forward with the Otter Creek coal tract development by setting a bid price.

Bob Hollister, Southeastern Montana Central Labor Council (SMCLC) president and retired IBEW Local #532, noted that he is not being reimbursed nor paid in any manner for his testimony. He stated he is in favor of the proposed, responsible development of Otter Creek.

Dwight Rose, IBEW Local # 233, urged the Land Board move the project forward.

Willie Duffield, Montana Association of Oil, Gas, and Coal Counties (MAOGCC) executive director, said MAOGCC continues to support the development of Otter Creek. The Land Board should not to get sidetracked by the bonus bid price since royalties from the coal will be the bulk of the revenues generated. Mr. Duffield also asked the board to follow the DNRC's original recommendation, which was to set the bonus bid between ten and thirty-five cents per ton.

Alexis Bonogofsky, National Wildlife Federation (NWF), asked the Land Board not to lower the bid price, and close the bidding process completely.

Mike Scott, Sierra Club, noted his attendance and testimony at previous meetings, having discussed the consequences of mining the coal at Otter Creek. He gave statistics on the health consequences of mining to miners and Americans as a whole. He urged the Land Board to leave to coal in the ground and close the process.

Brad Hash, Sierra Club, stated that he strongly opposed the leasing and development of the Otter Creek coal tracts, and urged the board to do the same. Coal fired plants are the leading emitters of mercury, a well-documented neurotoxin. Mr. Hash asked how the Land Board members can lease the Otter Creek coal tracts in good conscience?

Jay Bostrom, Big Sky High School teacher, stated that he took a day of unpaid leave to testify before the Land Board. He stated that he does not see how the process is democratic, as opposed to arbitrary. He also expressed his concern that the U.S. accepts too many things as inevitable, and does not believe that alternatives can exist to the problems being faced at this time.

Susie Rosette, Missoula, stated that she is very opposed to leasing Otter Creek and believes there are alternatives.

Marilyn Hollister stated that she is a proponent of developing Otter Creek responsibly.

Chuck Kerr, Great Northern Properties (GNP) president, stated that he is also CEO of Great Northern Project Development. GNP is a major coal resource owner, and Great Northern Project Development is in the process of developing a coal gasification project in North Dakota, utilizing state of the art clean coal technologies. GNP had to consider the same things being considered by the Land Board today.

Previously GNP had testified before the board against development because the time was not right to do so; however, GNP believes the timing is right, and has leased their coal reserves. Mr. Kerr stated his conviction that Otter Creek would be a highly regulated development. GNP supports the belief that Otter Creek can be responsibly developed.

John Marshall, Hot Springs business owner, enumerated examples of unbalanced returns on investments (ROI), citing Microsoft, and Goldman & Sachs. Arch Coal is looking to garner the same disproportionate return on earlier political donations. Arch Coal and GNP are conjoined as Natural Resource Partners, LP, formed in April 2000. What appears to be an open bidding process is in fact a rigged process. Mr. Marshall asked to Land Board to pass a motion to extend public hearings statewide for the next six to twelve months, bringing board members to the people, rather than forcing the people to travel to Helena.

Kim Eastman, Missoula, stated that she speaks on behalf of family in Libby. She asked the Land Board to consider the fact that the mining companies in Libby knew what the impact would be and chose profit over health. She stated her belief that post-mining restoration is not a good industry, and asked the board to consider the people before the profits.

Shelby Cunliff stated that the complacency of the Land Board on this issue and the greed for the dirty money that accompanies it is appalling, and any damage done by proceeding is irrevocable.

Kyle Mitty, SSEEJ, asked the board to think about the fact that his generation will have to deal with the consequences of the decision made today. He noted that there may be a price on coal, but there can be no price on the lives of the future.

Gayle Joslin, Helena Hunters and Anglers Association, expressed the hope that the Land Board can find the strength to deny leasing on the basis of principle rather than price. There are no assurances that coal mined at Otter Creek would not ship to locations noted for the worst emission violations [citing the 2008 Olympics in Beijing, China, where production had to cease in order to improve the air quality]. Montana voters yearned for leadership courageous enough to take an action to contribute to a healthy planet and verdant landscape.

Ms McCulloch read a prepared statement:

> *"I do have a motion to make. But I'd like to offer a few remarks before I make that motion.*
>
> *I think I am the only Land Board member up here today who has ever lived in the area of this proposed mine (though Monica lived not too far away). I lived in Ashland for almost two years. It's a beautiful part of Montana. I loved watching rainstorms roll in for 8 hours before the rain actually hit our house. There's a lot of Big Sky in that part of Big Sky Country – a place that people are proud to call home, a place where people want to raise their family, a place where those family roots run much*

deeper than any sagebrush, any grass, any riverbed, or any coal seam. It was great to spend some time in Eastern Montana in June for the hearings we held there.

It's tough to make a living in this part of the state. When I was there, I saw firsthand the costs of unemployment – not only on an individual, but on a family and on a community. And the action we take on this mine holds the possibility of creating hundreds of jobs, good paying union jobs, for the area. Real money that will be injected into Eastern Montana's economy, as well as benefit the whole state.

There are those who don't want the mine in our back yard. Let the people of Appalachia and Illinois and Southern Ohio do coal mining. I grew up in Southern Ohio, and I have seen the mountain top removal methods and know of the large number of deaths, injuries and health problems associated with underground mining. I absolutely believe that as long as there is a demand for coal (and that will be for decades under even the most optimistic of scenarios), that we can do it better, safer and with fewer environmental consequences in Montana. I have seen the reclaimed lands at Colstrip with their mixture of native grasses indistinguishable from the unbroken lands except for less sagebrush. I have seen the buffalo they grazed on those lands to get them started because their hooves are exactly right for being part of the natural cycles of the native vegetation.

The Union of Concerned Scientists is one of the most respected groups that are actively working to reduce the human effect on global warming by reducing the greenhouse gases that are put into the atmosphere. This group of scientists wants an aggressive goal of an 80 percent reduction of 2005 level heat-trapping emissions by the year 2050. As part of their analysis, they support the use of advanced coal technology, with a carbon-capture-and-storage demonstration program, because they recognize that coal will be an essential part of the energy sources for the United States and the world over the next 45 years, even if every single one of their recommendations is implemented by the U.S. and the rest of the world. That would be a full-court press, right now, today. In their attempt to reduce the use of fossil fuels, they have never advocated trying to shut down coal mines. That is because they recognize that the use of coal is driven entirely by demand, and not by supply. Shutting down an existing mine or not opening a potential mine may be a symbolic action, but it has exactly zero effect on how much coal gets burned. If Otter Creek coal is not used, other coal will be—in places like the Appalachian Mountains. Our actions here will assure that the Land Board has the power to make sure everything is done right, according to the latest science.

This Land Board has taken other actions towards alternative energy sources. Energy produced from a wind farm reduces the amount of coal that is burned. Just at last month's meeting we approved a wind farm, the first for this Land Board, and if memory serves me, the second in the nine years I have served on this Board. No one showed up last month in support of the wind farm.

Some have said we should wait until we spend $5 million of taxpayer money to study the effects of any proposed mine. If we are able to lease these lands, and that is not a given, we will only give a company the right to propose a mining plan. If they think it is economical, they will then pay the estimated $5 million to gather the information that will allow all the overseeing authorities, including the Land Board, to determine whether the plan should proceed and if so, with what restrictions and mitigating measures required.

We have an obligation to do the right thing <u>for all of Montana</u> when we act on Otter Creek. The purpose of the Land Board is clear and constitutional – we serve as

trustees for beneficiaries of the various state lands. In this case, we are talking about K-12 schools and the children who learn in them. That's why we are not going to give away this coal, and we will not subsidize a railroad.

When we put Otter Creek coal out for lease two months ago, my motion was the first part of a negotiation. In keeping with my goal to not give away this coal, achieve funding for Montana's students and not subsidize the railroad, it is my best estimate that we can get a favorable bid even if we charge 50 percent more that GNP received for its bonus bid, and about three times more than our own appraisal suggested."

Ms. McCulloch made a motion that the Land Board solicit bids on the Otter Creek coal tracts using the original bid package, including the Northern Cheyenne Agreement, with this change: the minimum bonus bid is set at 15 cents per ton and we keep the royalty at 12.5 percent. The bidding period will be open for four weeks, with the results to be presented to the Land Board at the next Land Board meeting."

Ms. Lindeen read a prepared statement:

" It [is] no secret that I have been incredibly conflicted about this decision, throughout this process up to this date, and I know that each one of my fellow Land Board Members have experienced their own conflict as we, and I respect each and every one of them for whatever decision they have come to today.

Without going into a long story about my feelings, because it's really not about me, I just want to say that I truly personally understand the importance of the promise of good paying jobs. My blue collar labor roots run extremely deep and I know that families, not just across Montana, but in particular in Southeastern Montana, not only are they hoping, but they are depending on this for their futures. But at the same time I understand that this does not come without sacrifices. There have been individuals and people who have sacrificed for thirty plus years for natural resource development, and we have to keep those folks in mind as well.

The Land board may or may not be able to reach an agreed upon price, but even if we do there is a long process ahead of us. A mine plan will need to be developed, an EIS must be completed, performance requirements with five separate operating plans must be developed in consultation with the Northern Cheyenne Tribe and be approved by this Land Board, permits must be granted, and so on.

It's no secret that development of the Otter Creek tracts will bring incredible financial benefit to our state, and while this treasure will bring riches; it does not come without sacrifices. While the majority benefit, a few will feel the impacts.

I want it to be known that I will be vigilant in my quest to hold the companies and the State accountable for holding up their end of the bargain. It's the least that can and should be done for those who sacrifice the most for the benefit of the many.

Those who have already sacrificed much deserve more than our thanks. They deserve our commitment to do what is right. We must uphold our promises and obligations to them. Otherwise, we are no better than the corporations that take only for profit in spite of all the promises."

Ms. Lindeen seconded Ms. McCulloch's motion.

Mr. Bullock read a prepared statement:

"Governor, and my colleagues, this is certainly a decision that has received its share of attention.

Often lost in all of the arguments for and against, and not always easy to fit into the two minute news story, are the requirements the Constitution imposes upon us as Land Board members.

This is not a policy decision like a legislator could make for or against continued development of coal. And it is not like the decision whether to sell off a piece of surplus property. The Montana Supreme Court has said that we have a duty to the public that goes beyond that of the ordinary business person. The Court has also said that the Land Board must get full market value, the largest measure of legitimate advantage for any property we lease or sell.

When I voted in December to lease Otter Creek, I said I will support this project if it's done right. And, doing it right, in a manner consistent with our constitutional duties, carries with it at least three considerations:

- First, the coal must be leased and developed in a way that follows our environmental laws and includes continued oversight by this Board.
- Second, the lease must maximize the benefit to the trust, as the constitution requires.
- Third, Montana taxpayers shouldn't be footing the bill for a railroad to benefit coal and power companies.

I do not believe that lowering the bid price to fiftenn cents a ton, or monkeying with the royalty payment, fulfills our obligation to maximize the benefit to the state treasury.

It's easy to think that all we're talking about today - when we talk about the difference between 25 and 15 cents - is one thin dime. But dropping our bonus bid ten cents will cost the state $57 million dollars. $57 - million - dollars. This ten cent reduction will cost the state treasury about the amount generated by every timber sale this Board approved over the last five years.[1]

Even in these tough times, Montana's budget is in a stronger position than almost every other state because we've been fiscally conservative. Unloading this coal with a bonus bid that's a fraction of what our neighbors are charging is not consistent with the fiscal responsibility we've shown. And it certainly, in my estimation, doesn't necessarily meet the constitutional mission to maximize the amount of money we return to the state treasury.

And, as the board is looking at lowering the bid or royalty to make this more attractive for coal developers, I don't think we can do that without acknowledging that we will be funding the Tongue River Railroad.

I've said since the beginning that what I don't want to see is Montana taxpayers footing the bill for a railroad to give coal and energy companies a windfall. And, I have also said that, were the railroad in place, I think everyone would agree that we would be getting more for this lease, than what
Arch has so far signaled it is willing to pay.

[1] 51.7 million or 60.8 million if forest improvement fees are included.

I've asked rail economists to independently analyze this, and they concluded that Wyoming-originated coal will save $2.83/ton in shipping costs if this railroad is completed. While we're debating whether to reduce our bonus bid another ten cents per ton, Wyoming shippers will be getting a discount 28 times that, if the railroad is completed. And while we're talking about reducing the amount to our treasury by $57 million, this review shows that a railroad in the Tongue River can save existing coal mines and power companies potentially well over $100 million each and every year. I just don't think that in these tough economic times Montana taxpayers can be asked to effectively be bailing out multinational coal and energy companies. That's not the state's role.

There will be a time when this project makes sense and I think that there will be a bidder willing to pay full market value for the right to develop this resource. And, as members of the land board, I believe that, at that time, we do have a constitutional obligation to lease this coal. Until then, though, I don't think we need to have a fire sale. I'll be voting against the motion to reduce the bonus bid from twenty-five to fifteen cents per ton."

Ms. Juneau stated that in December she voted against going forward at twenty-five cents per ton bonus bid. She stated that her reasons for doing so are reflected in the December minutes of the meeting *(see December 21, 2010, Land Board minutes)*. Ms. Juneau stated she cannot now support voting for a decrease in the asking price.

Governor Schweitzer stated that there has been discussion about the Land Board's decision being involved in subsidizing and building a railroad (TRR). There has been a private negotiation between Arch Coal and GNP for 732 million tons of coal. Arch Coal was asked if it was necessary for the state to lease its coal in order to move forward, and they said it was not.

Governor Schweitzer stated that Montana, from its inception until 1970, mined 200 million tons of coal. In the history of Montana, 1.5 billion tons of coal has been mined. Railroads were built for all of these mining sites. The fact is that leasing state-owned coal is not going to influence whether that railroad will be built from Miles City to Decker, or from Otter Creek to Decker, or not.

The decision to mine at Otter Creek has already been made, and was not made by the current Land Board. That decision was made between two private companies. Unlike the Land Board, theirs is not a public process. The only way to know is to look at the company books. Arch Coal is a publicly traded company, and the books reflect that Arch Coal has made approximately twenty percent of the ten cent per ton bonus bid made, as purported to have been agreed upon. The argument that action taken by the Land Board will affect whether coal is mined at Otter Creek or whether a railroad is built is not a logical argument.

Governor Schweitzer asked Ms. Sexton the name of the company chosen to appraise the coal?

Ms. Sexton said it is NorWest.

Governor Schweitzer stated that he understood that this company was hired to do core analysis to determine:

- how much coal was there;
- how deep the coal is;
- what the strip ratio is;

- what the BTUs are; and
- what the sodium, ash, and sulphur content are.

Governor Schweitzer asked when that study was done?

Ms. Sexton stated that NorWest began the resource analysis in 2004.

Governor Schweitzer noted that NorWest was already hired to assess the value of the assets at Otter Creek, prior to the seating of the current Land Board. Later they were employed to determine the value of those assets, and what a suggested bonus bid ought to be.

DNRC put out a request for proposal (RFP), for appraisal of the state coal. The cost for the analysis was $70,000. NorWest did a two-fold analysis using comparable sales and an income analysis, and made a recommendation for the appraisal.

Governor Schweitzer referenced the analysis document:

> *"NorWest concludes that a bonus bid between five cents and seven cents per ton of recoverable coal, as determined through the comparable lease sales, and income approaches, represents the fair market value for Otter Creek tracts".*

He asked how much was paid for the coring study in 2004?

Ms. Sexton stated that it cost $300,000.

Governor Schweitzer stated that DNRC paid NorWest $370,000 to give an unbiased opinion about the coal. NorWest reported that the state owns approximately 570 million tons coal, with a strip ratio of between 1.5/3 : 1. They also determined that a reasonable bonus bid, which is a first step in the leasing process, is somewhere between and five and seven cents. After determining the value of Otter Creek, the Land Board took public input from all areas of the state.

Governor Schweitzer stated that there are three ways the state makes money when selling coal assets, the first being the bonus bid. The company then has ten years to develop the lease, as long as they have paid the state the bonus bid. Sometimes all the state ever receives is the bonus bid, which is often the case in oil and gas leasing. As previously noted, approximately 95 percent of oil and gas leases are never developed.

Governor Schweitzer noted that in the development of coal the bonus bid is usually quite small, because there is a long process to go forward to decide whether there will be a mine, and to obtain the permits. He acknowledged that there have been much higher bonus bids in other areas. A private analysis placed the bonus bid at ten cents, though spread over a period of five years. Present value adjustment indicates that the deal is actually around eight cents. The Land Board decided in December to value the coal at twenty-five cents, which is three times higher than the market value and four times higher than the Norwest appraisal said it was worth.

Governor Schweitzer drew an analogy to public auctions, where an opening price is made, and if there are no bids, the price is lowered. The Land Board started their bid at four times the assessed market value. He reiterated that the bonus bid is on two percent of potential income generated. The 12.5 percent royalty rate would be more than one billion dollars. There is also is a 15 percent coal severance tax, which would also be more than one billion dollars.

Governor Schweitzer stated that the motion today is for 2.5 times the appraised value, and approximately 150 percent of what the two private coal companies paid. Governor Schweitzer noted that other appraisals have been done. He noted one by Tom Powers, economist at the University of Montana, which determined that the value of the tracts due to distance to rail, sodium content, and other factors, was very close to zero.

Governor Schweitzer said that coal will continued to provide approximately 50 percent of the electricity in America. Coal mining became prominent in the west after the 1970 Clean Air Act was passed, requiring coal to have lower sulphur content. At a recent meeting in Washington D.C., President Barack Obama stated that coal is the most abundant energy source in America, and that it will be mined for decades to come. This was reiterated by the Secretary of Energy, Dr. Steven Chu (Nobel Prize winner), who also stated that the challenge is to find a means for carbon sequestration, and that America needs to lead the way, so it the technology can be shared with the rest of the world.

Governor Schweitzer stressed that policies regarding whether or not coal will be mined is not set in Helena, but in Washington D.C. The 732 million tons of coal that is already sold between two private companies is not coal that is destined to a new coal fired plant. Arch coal sells 140 million tons of coal per year, almost all of it domestically. They already have a market for 140 million tons of coal per year, and they are either going to continue to mine that in Wyoming, as they are currently; or, when those reserves are gone, they will move to another location. They have selected Otter Creek, plan to mine 732 million tons of coal, and money has already been exchanged. If this board votes not to lease coal at any price, there will still be development at Otter Creek.

Governor Schweitzer stated that the Land Board has a fiduciary responsibility to set the highest price that will facilitate the process moving forward. He stated that he will support the motion under the following conditions:

- Budget Director David Ewer will be instructed to relegate $5 million of the budget presented to the next legislative session, so that every high school in Montana will either have solar panels or a wind turbine at their school.[2] In order for the schools to receive this money, a contract must be signed with the Department of Commerce guaranteeing a minimum of five hours teaching time in each of those classrooms with every high school student in Montana. These hours will be devoted to teaching the students how this energy works, and how it is the energy of the future; and
- an additional $5 million will be included in the budget to protect the people, and the water, in the Otter Creek area. This is to ensure that regardless of who sits on the Land Board or is appointed DEQ or DNRC director, the people who live in the Otter Creek area will be protected.

Governor Schweitzer stated that these funds would specifically come from the monies generated from the bonus bid.

Motion to put out the lease proposal for bid as per by Ms. McCulloch's motion carried 3-2 (Ms. Juneau and Mr. Bullock dissenting).

210-1 DEPARTMENT OF MILITARY AFFAIRS: EASEMENT

Ms. Sexton stated this right-of-way application is between the Montana Department of Transportation (MDT) and the Department of Military Affairs (DMA). The parcel is in Missoula County, and will be an in-kind payment of $20,200.

[2] That amounts to approximately $32,000 per school.

Seth Brandenberger, Department of Military Affairs construction manager, stated that an Armed Forces Reserve Center will be built at the intersection of Montana Highway 93, and US Interstate 90. The project costs approximately $16 million. There was a landowner between the site and MDT land, and there were no encroachment permits in place to allow DMA to place fill along the embankment adjoining the properties. DMA removed materials, and there is now a hole needing to be filled. This hole is also affecting storm water culvert systems.

Motion made by Ms. Lindeen to approve the easement. Seconded by Ms. Juneau. Carried unanimously.

210-2 TIMBER SALES:
A. BOORMAN PEAK

Ms. Sexton stated that timber sale is for 7.5 MBF, which includes 482 acres of old growth. The harvest is for old growth maintenance, and will still meet minimum old growth criteria. Approximately 5.4 miles of new road construction will be required.

Ellen Simpson, Montana Wood Products Association (MWPA), stated that this sale is well planned and well laid-out, and would greatly enhance the timber industry at this time.

Jason Todhunter, Montana Logging Association (MLA), called the Boorman Peak sale a success story because it proactively manages old growth health and promotes continued old growth in the future.

Motion made by Mr. Bullock to approve the Boorman Peak timber sale. Seconded by Ms. McCulloch. Carried unanimously.

B. HARLOW DUMP

Ms. Sexton stated that this timber sale is for 2.5 MBF with a higher minimum value of $26.62 per ton.

Ellen Simpson, Montana Wood Products Association (MWPA), gave her support for this sale for the same reasons as the Boorman Peak sale.

Motion made by Ms. McCulloch to approve the Harlow Dump timber sale. Seconded by Ms. Lindeen. Carried unanimously.

210-3 EASEMENTS

Ms. Sexton stated that these are standard rights-of-way applications, generating $5333.

Motion made by Ms. Lindeen to approve the easements. Seconded by Mr. Bullock. Carried unanimously.

210-4 OTTER CREEK BID[3]

Motion to adjourn made by Ms. McCulloch. Seconded by Ms. Lindeen. Carried unanimously.

[3] Item 210-4 was taken as the first item on the agenda.

Beth Kaeding 2/16/2010

Testimony before the Montana Land Board
Otter Creek Coal Tracts
by Beth Kaeding, Northern Plains Resource Council
February 16, 2010

Governor Schweitzer and members of the Land Board: My name is Beth Kaeding. I am a long-time member of Northern Plains Resource Council, and I am representing that organization here today. Thank you for this opportunity to speak.

I know you might think that I sound like a "broken record," but I must say again that throughout the entire process the Land Board has used to address Otter Creek, there has never been a discussion on whether leasing these coal tracts is in the best interest of the State. There has been NO overarching public process that includes an examination of the environmental, economic, and social aspects and costs associated with leasing this coal. Northern Plains believes that it is the public trust responsibility of the Land Board to ensure that this critical first step happens before any irretrievable or irrevocable action is taken on the proposal to lease Otter Creek coal.

The fact that no coal company bid on the Otter Creek lease is more about Big Coal believing it is in a position of power than the bonus bid price. The coal companies are simply bullying the Land Board. The "letter of interest" from Arch Coal's subsidiary is absurd. They suggest that the Land Board consider "lowering the royalty rate on the lease, which should allow bidders to increase the amount of the bonus bid." Increase it to what? Frankly, if the Land Board considers lowering the royalty rate, then you will be betraying the public trust responsibility you have to the schools – and transferring the consequences of the loss of income to the School Trust Fund to a future administration to deal with.

The Land Board should not make a weak deal. I have spent time reviewing all the past Land Board meeting minutes on this issue. At more than one meeting, Land Board members have talked about the need to set a fair bonus bid price yet not give the state's resources away at "fire sale" prices. In April 2009, Governor Schweitzer stated his concern about the possibility of only getting one bid and stated that because the Land Board has to answer to the people of Montana for the next fifty years that it must cut the best deal possible for the state of Montana. He posited that because there are only a few coal companies that have an interest in Otter Creek they could get together and collaborate to submit a single bid – if that happened the net loser would be the people of Montana according to Governor Schweitzer. Well that has happened with the lack of any bid.

On February 10, the Northwest Power and Conservation Council (serving Oregon, Washington, Idaho, and Montana) stated that 85% of the new demand for electricity in the next 20 years can be met through improved efficiency and conservation, with additional wind power development and natural gas making up the difference. No new coal plants will be needed. This is not the right time to be leasing Otter Creek coal. Coal is at the low point in its economic cycle. IF coal continues to be part America's energy future, Otter Creek coal will still be there – it is going nowhere. Otter Creek coal is best left where it is for now – in the ground.

You cannot ignore the fact that developing Otter Creek coal means the construction of the Tongue River Railroad – and that railroad will devastate another productive rural valley. The state should play NO part in any way of financing that rail line, and lowering the bonus bid price is essentially giving the TRR a subsidy.

The history of Montana since our territorial days has been that our natural resources have been "given away" in the name of jobs and economic development — but it is the corporations (often based out of state) that become rich, and the legacy left to Montanans are the scarred and damaged lands and polluted waters and air. More often than not, it is the taxpayers who are stuck with picking up the pieces and cleaning up the messes. Leasing Otter Creek coal promises nothing more than that same old history. Turning productive soils, native vegetation, and functioning aquifers upside down to develop a polluting, unsustainable coal industry that will ultimately collapse leaving scarred, depleted lands while also contributing to the degradation of our global climate is not what leaders with vision should be contemplating.

I do not believe that you are obligated to lease this coal simply because the state owns it. Your duty as Land Board members is to make responsible, stewardship-based decisions when you consider options for generating income from Montana's state lands.

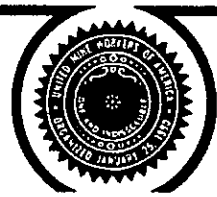
Northern Plains appeals to you to hold to the 25¢/ton minimum bonus bid price that was a part of December 21 Land Board motion. Further, Northern Plains believes that you should revisit your decision to begin the leasing process for this coal resource. Now is not the time to open a new coal mine with all the problems we have detailed in past written and oral testimony. No bids were received. Table the project.

RELATED MATERIALS
ATTACHMENT 2

United Mine Workers

INTERNATIONAL UNION
8315 LEE HIGHWAY
FAIRFAX, VA 22031-2215

TELEPHONE 703-208-7200
FAX 703-208-7132



REGION IV ORGANIZING OFFICE
6525 W. 44TH AVENUE
WHEAT RIDGE, CO 80033

TELEPHONE 303-425-7110
FAX 303-425-0401

February 22, 2010

Ms. Aliselina Strong
Directors Office / Legal Department
Montana DNRC
Box 201601
Helena, Montana 59620-1601

Dear Ms. Strong:

Please find enclosed the information you requested. The following is a brief description of each document.

Item 1: This is a copy of the front page of the Signal Peak Employee Handbook and shows the misrepresentation of Montana Labor Law as "at will". Attached to Item 1 is the pertinent Wrongful Discharge language from the Montana Code.

Item 2: A letter from Signal Peak management to its employees which violates Section 8(a)(1) of the National Labor Relations Act. Attached to Item 2 is pertinent language from the NLRA describing violations of Section 8(a)(1).

Item 3: Is a listing of mine inspections by the Federal Mine Safety & Health Administration (MSHA) at Signal Peak. It shows the 86 citations written during the last quarterly inspection and the number of 103(G) inspections that were requested by the employees at the mine.

Item 4: This is a listing of citations, orders, and safeguards written by the Federal Mine Safety & Health Administration at Signal Peak and shows the six (6) 104(D)(1) and 104(D)(2) orders and citations which caused MSHA to shut the mine down due to the "unwarrantable failure" of the mine owners and their willful disregard of the Federal Mine Health and Safety standards of its employees.

Item 5: Is an explanation sheet that explains what a 104(D) order or citation is, along with other explanations of the Federal Mine Health & Safety citations, orders, and safeguards.

If I may assist you further, in any way, please contact me via e-mail or telephone at (406) 947-2022.

Sincerely yours,

Bob Guilfoyle

Robert Guilfoyle
Deputy Director
International Organizer

Enclosures

From: AStrong@mt.gov
To: umwminer@hotmail.com
Date: Sun, 21 Feb 2010 15:04:21 -0700
Subject: February 16 Land Board Meeting

Mr. Guilfoyle –

I am transcribing the February 16, 2010 land board meeting minutes. You stated that you had presented information to the board regarding the Signal Peak Mine. I was hoping to have a copy to include with the minutes.

Please advise, and thank you -

Aliselina Strong

Director's Office/Legal Department

Department of Natural Resources & Conservation

(406) 444-5258

1

Signal Peak Energy, LLC & Global Rail Group, LLC
Code of Business Conduct and Ethics

This Code of Business Conduct and Ethics does not, nor is it intended to, contain contractual promises or constitute a contract of employment. Employees remain employees "at-will." This means that, subject to any written contract of employment, any employee may terminate employment at any time for any reason, and that the Company may terminate any employee's employment at any time for any non-discriminatory reason. The Company may change the principles and policies in this Code of Business Conduct and Ethics when such entities consider this to be appropriate or necessary.

MONTANA WRONGFUL DISCHARGE FROM EMPLOYMENT ACT

Montana Code Ann. 39-2-901 (1987)

Short title

§ 901. This part may be cited as the "Wrongful Discharge From Employment Act."

Purpose

§ 902. This part sets forth certain rights and remedies with respect to wrongful discharge. Except as limited in this part, employment having no specified term may be terminated at the will of either the employer or the employee on notice to the other for any reason considered sufficient by the terminating party. Except as provided in 39-2-912, this part provides the exclusive remedy for a wrongful discharge from employment.

Definitions

§ 903. In this part, the following definitions apply:

(1) "Constructive discharge" means the voluntary termination of employment by an employee because of a situation created by an act or omission of the employer which an objective, reasonable person would find so intolerable that voluntary termination is the only reasonable alternative. Constructive discharge does not mean voluntary termination because of an employer's refusal to promote the employee or improve wages, responsibilities, or other terms and conditions of employment.

(2) "Discharge" includes a constructive discharge as defined in subsection (1) and any other termination of employment, including resignation, elimination of the job, layoff for lack of work, failure to recall or rehire, and any other cutback in the number of employees for a legitimate business reason.

(3) "Employee" means a person who works for another for hire. The term does not include a person who is an independent contractor.

(4) "Fringe benefits" means the value of any employer-paid vacation leave, sick leave, medical insurance plan, disability insurance plan, life insurance plan, and pension benefit plan in force on the date of the termination.

(5) "Good cause" means reasonable job-related grounds for dismissal based on a failure to satisfactorily perform job duties, disruption of the employer's operation, or other legitimate business reason.

(6) "Lost wages" means the gross amount of wages that would have been reported to the internal revenue service as gross income on Form W-2 and includes additional compensation deferred at the option of the employee.

(7) "Public policy" means a policy in effect at the time of the discharge concerning the public health, safety, or welfare established by constitutional provision, statute, or administrative rule.

Elements of wrongful discharge

§ 904. A discharge is wrongful only if:

(1) it was in retaliation for the employee's refusal to violate public policy or for reporting a violation of public policy;

(2) the discharge was not for good cause and the employee had completed the employer's probationary period of employment; or

(3) the employer violated the express provisions of its own written personnel policy.

Remedies

§ 905. (1) If an employer has committed a wrongful discharge, the employee may be awarded lost wages and fringe benefits for a period not to exceed 4 years from the date of discharge, together with interest thereon. Interim earnings, including amounts the employee could have earned with reasonable diligence, must be deducted from the amount awarded for lost wages.

(2) The employee may recover punitive damages otherwise allowed by law if it is established by clear and convincing evidence that the employer engaged in actual fraud or actual malice in the discharge of the employee in violation of 39-2-904(1).

(3) There is no right under any legal theory to damages for wrongful discharge under this part for pain and suffering, emotional distress, compensatory damages, punitive damages, or any other form of damages, except as provided for in subsections (1) and (2).

Limitation of actions

§ 911. (1) An action under this part must be filed within 1 year after the date of discharge.

(2) If an employer maintains written internal procedures, other than those specified in 39-2-912, under which an employee may appeal a discharge within the organizational structure of the employer, the employee shall first exhaust those procedures prior to filing an action under this part. The employee's failure to initiate or exhaust available internal procedures is a defense to an action brought under this part. If the employer's internal procedures are not completed within 90 days from the date the employee initiates the internal procedures, the employee may file an action under this part and for purposes of this subsection the employer's internal procedures are considered exhausted. The limitation period in subsection (1) is tolled until the procedures are exhausted. In no case may the provisions of the employer's internal procedures extend the limitation period in subsection (1) more than 120 days.

SIGNAL PEAK ENERGY, LLC

2

Employee Memo

October 14, 2009

To: All Employees
From: Bob Hall, Mine Manager RCH
Greg Roadifer, HR Director GR

Dear Employees:

Our goal at Signal Peak Energy, LLC is to be the safest, most productive mining company in the world. To meet this goal we need the safest and most productive employees. You are the most critical resource to make this company a success. We have and continue to appreciate all of the work and commitment you have put into the development of this mine.

We understand that some union organizers are calling or talking to our employees in an attempt to develop support for unionization at Signal Peak Energy. Although you have the right to consider, please understand that management and ownership do not support unionization for several reasons.

- You are always welcome to discuss concerns or issues directly with us. We want to talk to each of you directly and not have a middle agent or third party represent you. A union can promise you many things but they cannot guarantee you anything. A union may or may not actually address your individual concerns. We can. Never hesitate to talk to us or bring forward your concerns. As stated in the employee handbook, we have open door policies and problem resolution policies available to you.

- We want to build a company where you are rewarded based on overall safety, production and cost efficiencies to go along with your individual performance, skills and experience. Each of you has the individual opportunity to reach a higher wage grade with papers and performance. Don't get caught up in a union organizing effort and overlook how far the wage and benefit package has come in a reasonably short amount of time. Currently, we are paying more than the United Mine Workers of America national contract. We don't want you to lose your individual treatment and your individual ability to be rewarded in the success of this company.

- Even though we are not yet profitable, what you earn today and the strong benefit package we provide has been a result of our collective efforts (without the help of a union). Let us continue to each work hard and develop this mine into a world class coal producer. Reaching world class levels will be the best opportunity for you to continue to be rewarded at higher levels that will benefit you and your family.

- Please understand that unionization generally comes with high costs to you such as dues, fees, fines and assessments. Don't overlook that a union's revenue source is made up of dues and fees from your individual pay. If Signal Peak Energy were unionized, your current pay and benefit package would be eliminated and everything would be renegotiated in good faith. You could lose, as easily as you could gain, in a union negotiation.

8A1

We are open to ideas and suggestions and we encourage your involvement. We respect your right to make a choice about unionization but please make that choice based on all of the facts. With teamwork, we will become the type of coal mine that you will be proud to work for and that will be admired all around the world!

SIGNAL PEAK ENERGY

Bull Mountains Mine No. 1
100 Portal Drive
Roundup, MT 59072
PHONE (406) 323-4500 FAX (406) 323-4555

Basic Guide to the National Labor Relations Act

General Principles of Law Under the Statute and Procedures of the National Labor Relations Board

Unfair Labor Practices of Employers

The unfair labor practices of employers are listed in Section 8(a) of the Act; those of labor organizations in Section 8(b). Section 8(e) lists an unfair labor practice that can be committed only by an employer and a labor organization acting together. The "Types of Cases" chart at pages 18–19 may be helpful in getting to know the relationship between the various unfair labor practice sections of the Act.

Section 8(a)(1)—Interference with Section 7 Rights. Section 8(a)(1) forbids an employer "to interfere with, restrain, or coerce employees in the exercise of the rights guaranteed in section 7." Any prohibited interference by an employer with the rights of employees to organize, to form, join, or assist a labor organization, to bargain collectively, to engage in other concerted activities for mutual aid or protection, or to refrain from any or all of these activities, constitutes a violation of this section. This is a broad prohibition on employer interference, and an employer violates this section whenever it commits any of the other employer unfair labor practices. In consequence, whenever a violation of Section 8(a)(2), (3), (4), or (5) is committed a violation of Section 8(a)(1) is also found. This is called a "derivative violation" of Section 8(a)(1).

Examples of violations of Section 8(a)(1). Employer conduct may, of course, independently violate Section 8(a)(1). Examples of such independent violations are:

- Threatening employees with loss of jobs or benefits if they should join or vote for a union.
- Threatening to close down the plant if a union should be organized in it.
- Questioning employees about their union activities or membership in such circumstances as will tend to restrain or coerce the employees.
- Spying on union gatherings, or pretending to spy.
- Granting wage increases deliberately timed to discourage employees from forming or joining a union.

Section 8(a)(2)—Domination or Illegal Assistance and Support of a Labor Organization. Section 8(a)(2) makes it unlawful for an employer "to dominate or interfere with the formation or administration of any labor organization or contribute financial or other support to it." This section not only outlaws "company unions" that are dominated by the employer, but also forbids an employer to contribute money to a union it favors or to give a union improper advantages that are denied to rival unions.

Domination. A labor organization is considered dominated within the meaning of this section if the employer has interfered with its formation and has assisted and supported its operation and activities to such an extent that it must be looked at as the employer's creation instead of the true bargaining representative of the employees. Such domination is the result of a combination of factors and has been found to exist where there is not only the factor of the employer getting the organization started, but also such other factors as the employer deciding how the organization will be set up and what it will do, or representatives of management actually taking part in the meetings and activities of the organization and trying to influence its actions and policies.

Illegal assistance and support. Certain lesser kinds of employer assistance to a union may constitute unlawful "interference" even if the union is not "dominated" by the employer. For example, an employer may not provide financial support to a union either by direct payments or indirect financial aid. (But an employer does not violate this prohibition by permitting employees to confer with it and/or the union regarding grievances or other union business during working hours without loss of pay.)

When rival unions are competing to organize an employer's employees, the employer is forbidden to give the union it favors privileges it denies to the other union. It is also forbidden to recognize either union once it knows that one of the unions has filed a valid petition with the Board requesting a representation election. When an employer and a union already have an established bargaining relationship, however, the employer is required to continue bargaining with the incumbent even though a rival union is attempting to organize the employees. In these circumstances, the rival's filing of a petition does not prevent continued dealing between the employer and the incumbent unless the incumbent has lost the support of a majority of the employees.

Examples of violation of Section 8(a)(2). An employer violates Section 8(a)(2) by:

- Taking an active part in organizing a union or a committee to represent employees.
- Bringing pressure on employees to support a union financially, except in the enforcement of a lawful union-security agreement.
- Allowing one of several unions, competing to represent employees, to solicit on company premises during working hours and denying other unions the same privilege.
- Soliciting and obtaining from employees and applicants for employment, during the hiring procedure, applications for union membership and signed authorizations for the check-off of union dues.

3

UNITED STATES DEPARTMENT OF LABOR
MINE SAFETY & HEALTH ADMINISTRATION (MSHA)
Protecting Miners' Safety & Health Since 1978

Mine Data Retrieval System
as developed by PEIR

Mine Inspections

Current Mine Information

Mine ID:	**2401950**
Operator:	**Signal Peak Energy LLC**
Opr. Begin Date:	**7/16/2008**
Mine Name:	**Bull Mountains Mine No 1**
Current Controller:	**Global Mining Group LLC; Musselshel Resources LLC**
Mine Status:	Active
Status Date:	9/14/2007
Mined Material:	Coal (Bituminous)
Type of Mine:	Underground
Location:	Musselshell County, MT
State:	MT

Operator History for Mine ID: 2401950

Operator Name	Begin Date	End Date
Signal Peak Energy LLC	7/16/2008	
Bull Mountain Coal Mining Inc	2/4/2002	7/15/2008
Mountain Inc	11/20/1995	2/3/2002
P M Coal Company	9/1/1995	11/19/1995
Rbm Mining Inc	9/1/1991	8/31/1995

How do I use this information? *Click Here*

Please note that the information provided by the Data Retrieval System is based on data gathered from various MSHA systems. As there may be a lag time in data being entered into those systems, there will also be a lag in the reflection of that data on the DRS.

Inspections Summary Report

Please Note: Signal Peak Energy LLC has been the current operator since 7/16/2008

Event Number	See Details	See Viols	Type of Inspection	Begin Date	End Date	# Citations	# Orders	# Safeguards

4267176	Details	Violations	Spot Inspection	1/20/2010	2/2/2010	1	0	0
4267175	Details		103 (g) Written Notification Hazard Complaint Inspectio	1/15/2010	1/25/2010	No Violations Cited		
4267174	Details	Violations	103 (g) Written Notification Hazard Complaint Inspectio	1/13/2010	On Going	4	2	0
4267173	Details	Violations	Regular Safety and Health Inspection	1/11/2010	On Going	21	2	0
4267172	Details	Violations	Spot Inspection	1/5/2010	1/28/2010	1	0	0
4267171	Details	Violations	Fatal Accident Investigation	1/3/2010	On Going	0	1	0
4267385	Details	Violations	Non-Fatal Accident Investigation	12/29/2009	1/19/2010	4	1	0
4267169	Details		103 (g) Written Notification Hazard Complaint Inspectio	12/7/2009	12/7/2009	No Violations Cited		
4267168	Details		103 (g) Written Notification Hazard Complaint Inspectio	11/16/2009	11/17/2009	No Violations Cited		
4267382	Details	Violations	103 (g) Written Notification Hazard Complaint Inspectio	11/2/2009	11/6/2009	1	0	0
4267381	Details	Violations	103 (g) Written Notification Hazard Complaint Inspectio	10/22/2009	10/26/2009	1	0	0
4267166	Details	Violations	Regular Safety and Health Inspection	10/14/2009	12/17/2009	86	2	2
4267818	Details	Violations	103 (g) Written Notification Hazard Complaint Inspectio	10/13/2009	10/18/2009	0	2	0
4267376	Details	Violations	Spot Inspection	9/14/2009	9/27/2009	21	0	0
4267371	Details	Violations	Regular Safety and Health Inspection	7/13/2009	9/11/2009	37	0	0
4266594	Details		Electrical Technical Investigation	6/29/2009	7/1/2009	No Violations Cited		
4267709	Details		Health Technical Investigation	5/11/2009	5/15/2009	No Violations Cited		
4267153	Details	Violations	Regular Safety and Health Inspection	5/4/2009	6/30/2009	28	0	0
4266592	Details	Violations	Spot Inspection	3/31/2009	4/6/2009	4	0	0
4477657	Details		Health Technical Investigation	1/26/2009	2/11/2009	No Violations Cited		
4267145	Details	Violations	Regular Safety and Health Inspection	1/5/2009	2/17/2009	13	0	0
4267249	Details	Violations	103 (g) Written Notification Hazard Complaint Inspectio	12/4/2008	12/8/2008	0	1	0

4267139	Details	Violations	Regular Safety and Health Inspection	10/27/2008	1/5/2009	26	1	0
4267617	Details	Violations	Spot Inspection	9/24/2008	9/29/2008	2	1	0
4267136	Details	Violations	Regular Safety and Health Inspection	9/8/2008	9/19/2008	6	0	0

Return to DRS Home Page

Back to Top

www.msha.gov

www.dol.gov

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Accessibility | Privacy & Security Statement | Disclaimers

Mine Safety and Health Administration (MSHA)
1100 Wilson Boulevard, 21st Floor
Arlington, VA 22209-3939

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UNITED STATES DEPARTMENT OF LABOR
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Protecting Miners' Safety & Health Since 1978

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Mine Data Retrieval System as developed by PEIR

Mine Citations, Orders, and Safeguards

Current Mine Information

Mine ID:	**2401950**
Operator:	**Signal Peak Energy LLC**
Opr. Begin Date:	**7/16/2008**
Mine Name:	**Bull Mountains Mine No 1**
Current Controller:	**Global Mining Group LLC; Musselshel Resources LLC**
Mine Status:	Active
Status Date:	9/14/2007
Mined Material:	Coal (Bituminous)
Type of Mine:	Underground
Location:	Musselshell County, MT
State:	MT

Operator History for Mine ID: 2401950

Operator Name	Begin Date	End Date
Signal Peak Energy LLC	7/16/2008	
Bull Mountain Coal Mining Inc	2/4/2002	7/15/2008
Mountain Inc	11/20/1995	2/3/2002
P M Coal Company	9/1/1995	11/19/1995
Rbm Mining Inc	9/1/1991	8/31/1995

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Please note that the information provided by the Data Retrieval System is based on data gathered from various MSHA systems. As there may be a lag time in data being entered into those systems, there will also be a lag in the reflection of that data on the DRS.

Assessment data is not available prior to 1/1/1995.

Citations, Orders, and Safeguards

Mine ID: 2401950 Current Operator: Signal Peak Energy LLC
Please Note: Signal Peak Energy LLC has been the current operator since 7/16/2008

- Indicates violations pending hearings, appeals, and/or other actions.
- Indicates violations that have not yet been assessed.
- These are non-assessable.

Assessment Process Overview

Note: Vacated Citations are not included in any reports on the DRS.

Violator	Contractor ID	Citation/Order No.	Case No.	Date Issued	Final Order Date	Section of Act	Date Terminated	Citation/Order	S & S	Standard	Proposed Penalty ($)	Citation/Order Status	Current Penalty ($)	Amount Paid To Date ($)
Signal Peak Energy LLC		8464210		2/10/2010		104(a)	2/10/2010	C	N	75.1106-3(a)(2)	Not Assessed Yet			
Signal Peak Energy LLC		8464209		2/10/2010		104(a)	2/11/2010	C	N	75.1909(d)	Not Assessed Yet			
Signal Peak Energy LLC		8463674		2/10/2010		104(a)	2/11/2010	C	N	75.380(d)(7)(vii)	Not Assessed Yet			

Signal Peak Energy LLC		8464208		2/10/2010		104(a)	2/10/2010	C	N	75.1914(a)	Not Assessed Yet
Signal Peak Energy LLC		8463673		2/9/2010		104(a)	2/9/2010	C	N	75.360(g)	Not Assessed Yet
C & J Welding & Construction	SDL	8464207		2/9/2010		104(a)	2/9/2010	C	Y	75.211(d)	Not Assessed Yet
Signal Peak Energy LLC		8464203		2/3/2010		104(a)	2/3/2010	C	N	49.16(b)(3)	Not Assessed Yet
Signal Peak Energy LLC		8464204		2/3/2010		104(a)	2/8/2010	C	N	49.50(b)	Not Assessed Yet
Signal Peak Energy LLC		8464206		2/3/2010	✓	104(d)(2)	2/4/2010	O	Y	49.12(b)	Not Assessed Yet
Signal Peak Energy LLC		8464205		2/3/2010	✓	104(d)(2)	2/4/2010	O	N	49.17(a)	Not Assessed Yet
Signal Peak Energy LLC		8464202		2/3/2010		104(a)	2/4/2010	C	N	49.16(a)(5)	Not Assessed Yet
Alpha Coal West, Inc.		8463668		2/2/2010		104(a)	2/2/2010	C	Y	77.1607(b)	Not Assessed Yet
Signal Peak Energy LLC		8463734		1/27/2010		104(a)	1/27/2010	C	N	77.1109(a)	Not Assessed Yet
Signal Peak Energy LLC		8463399		1/27/2010		104(a)	1/27/2010	C	N	75.508-2	Not Assessed Yet
Signal Peak Energy LLC		8463733		1/27/2010		104(a)	1/27/2010	C	N	77.206	Not Assessed Yet
Signal Peak Energy LLC		8463396		1/27/2010		104(a)	1/27/2010	C	N	75.342(a)(4)	Not Assessed Yet
Signal Peak Energy LLC		8463735		1/27/2010		104(a)	1/27/2010	C	N	77.904	Not Assessed Yet
Signal Peak Energy LLC		8463397		1/27/2010		104(a)	1/27/2010	C	N	75.351(h)	Not Assessed Yet
Signal Peak Energy LLC		8463395		1/27/2010		104(a)	1/27/2010	C	N	75.342(a)(4)	Not Assessed Yet
Signal Peak Energy LLC		8463398		1/27/2010		104(a)	1/27/2010	C	N	75.351(e)(1)(iii)	Not Assessed Yet
Signal Peak Energy LLC		8463400		1/27/2010		104(a)	2/2/2010	C	N	75.351(n)	Not Assessed Yet
Signal Peak Energy LLC		8463736		1/27/2010		104(a)	1/27/2010	C	Y	77.405(b)	Not Assessed Yet
Signal Peak Energy LLC		8463666		1/26/2010		104(a)	1/26/2010	C	Y	75.1725(a)	Not Assessed Yet
Signal Peak Energy LLC		6687098		1/26/2010		104(a)	1/26/2010	C	N	75.202(a)	Not Assessed Yet
Signal Peak Energy LLC		8463667		1/26/2010		104(a)	1/27/2010	C	N	75.370(a)(1)	Not Assessed Yet
Signal Peak Energy LLC		8463394		1/26/2010		104(a)	1/26/2010	C	N	75.334(c)(4)	Not Assessed Yet
Signal Peak Energy LLC		8463392		1/25/2010		104(a)	1/25/2010	C	N	75.516-2(c)	Not Assessed Yet
Signal Peak Energy LLC		8463393		1/25/2010		104(a)	1/25/2010	C	N	75.380(d)(7)(iv)	Not Assessed Yet
Signal Peak Energy LLC		7636890		1/19/2010		104(b)	1/27/2010	O	N/A		Non-Assessable
Signal Peak Energy LLC		7636891		1/19/2010	✓	104(d)(2)	1/21/2010	O	Y	75.321(a)(1)	Not Assessed Yet
Signal Peak Energy LLC		7636889		1/17/2010		104(a)	1/19/2010	C	Y	75.321(a)(2)	Not Assessed Yet
Signal Peak Energy LLC		7636888		1/15/2010		104(a)	1/15/2010	C	Y	75.370(a)(1)	Not Assessed Yet
Signal Peak Energy LLC		7636887		1/14/2010		104(a)	1/27/2010	C	Y	75.334(b)(1)	Not Assessed Yet
Signal Peak Energy LLC		7636886		1/14/2010		104(a)	1/17/2010	C	N	75.364(h)	Not Assessed Yet
Signal Peak Energy LLC		8463664		1/12/2010		104(a)	1/12/2010	C	N	77.1104	Not Assessed Yet
Signal Peak Energy LLC		8463665		1/12/2010		104(a)	1/12/2010	C	N	77.1104	Not Assessed Yet
Signal Peak Energy LLC		8463663		1/5/2010		104(a)	1/12/2010	C	N	75.202(a)	Not Assessed Yet
Signal Peak Energy LLC		8463662		1/3/2010		103(k)	1/13/2010	O	N/A		Non-Assessable
Signal Peak Energy LLC		8463720		12/31/2009		104(a)	12/31/2009	C	N	75.360(g)	Not Assessed Yet
Signal Peak Energy LLC		8463719		12/31/2009		104(a)	1/21/2010	C	N	75.202(a)	Not Assessed Yet
Signal Peak Energy LLC		8463716		12/29/2009		103(k)	1/13/2010	O	N/A		Non-Assessable
Signal Peak Energy LLC		8463717		12/29/2009		104(a)	12/30/2009	C	Y	50.10	Not Assessed Yet
Signal Peak Energy LLC		8463718		12/29/2009		104(a)	12/30/2009	C	N	50.12	Not Assessed Yet

Signal Peak Energy LLC		8463661		12/15/2009		104(a)	12/15/2009	C	N	75.360(f)	Not Assessed Yet			
Signal Peak Energy LLC		8463660		12/15/2009		104(a)	12/15/2009	C	N	75.360(e)	Not Assessed Yet			
Signal Peak Energy LLC		8463714	000208871	12/14/2009		104(a)	12/14/2009	C	N	77.512	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463659	000208871	12/13/2009		104(a)	12/13/2009	C	N	75.1910(g)	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463658	000208871	12/13/2009		104(a)	12/13/2009	C	N	75.1914(a)	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463656	000208871	12/7/2009		104(a)	12/7/2009	C	N	75.1403	263.00	Proposed	263.00	0.00
Signal Peak Energy LLC		8463294	000208871	11/19/2009		104(a)	11/19/2009	C	N	75.1505(b)	162.00	Proposed	162.00	0.00
Signal Peak Energy LLC		8463646	000208871	11/19/2009		104(a)	11/19/2009	C	N	75.360(f)	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463647	000208871	11/19/2009		104(a)	12/7/2009	C	N	75.364(b)(1)	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463295	000208871	11/19/2009		104(a)	12/7/2009	C	N	75.202	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463293	000208871	11/18/2009		104(a)	11/18/2009	C	N	77.208(b)	100.00	Proposed	100.00	0.00
Oftedal Construction Inc	XS8	8463291	000207053	11/18/2009	2/3/2010	104(a)	11/18/2009	C	N	77.1110	100.00	Final Order Issued	100.00	0.00
Oftedal Construction Inc	XS8	8463292	000207053	11/18/2009	2/3/2010	104(a)	11/19/2009	C	N	77.404(a)	100.00	Final Order Issued	100.00	0.00
Signal Peak Energy LLC		8463288	000208871	11/18/2009		104(a)	12/7/2009	C	N	75.333(c)(1)	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463645	000208871	11/18/2009		104(a)	11/18/2009	C	N	75.1403	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463644	000208871	11/18/2009		104(a)	11/18/2009	C	Y	77.1710(g)	224.00	Proposed	224.00	0.00
Signal Peak Energy LLC		8463287	000208871	11/17/2009		104(a)	11/17/2009	C	N	75.512	100.00	Proposed	100.00	0.00
Signal Peak Energy LLC		8463290	000208871	11/17/2009		104(a)	11/17/2009	C	N	75.380(d)(7)(i)	162.00	Proposed	162.00	0.00
Signal Peak Energy LLC		8463289	000208871	11/17/2009		104(a)	11/17/2009	C	N	75.380(d)(7)(iv)	540.00	Proposed	540.00	0.00
Signal Peak Energy LLC		8463285	000206531	11/4/2009	1/23/2010	104(a)	11/4/2009	C	N	75.333(h)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463284	000206531	11/3/2009	1/23/2010	104(a)	11/4/2009	C	N	77.404(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7284370	000206531	10/26/2009	1/23/2010	104(a)	12/28/2009	C	Y	70.101	308.00	Closed	308.00	308.00
Signal Peak Energy LLC		8231491	000206531	10/23/2009	1/23/2010	104(a)	10/23/2009	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463281	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1911(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8319947	000206531	10/22/2009	1/23/2010 ✓	104(d)(1)	10/22/2009	O	Y	75.370(a)(1)	2,161.00	Final Order Issued	2,161.00	0.00
Signal Peak Energy LLC		8463280	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	72.503(d)	100.00	Closed	100.00	100.00
C & J Welding & Construction	5DL	8469770	000203901	10/22/2009		104(a)	10/22/2009	C	Y	77.408	1,944.00	In Contest	1,944.00	0.00
Signal Peak Energy LLC		6631252	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8469768	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1914(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463283	000206531	10/22/2009	1/23/2010	104(a)	11/6/2009	C	N	75.1714-3(e)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8416158	000206531	10/22/2009	1/23/2010	104(a)	10/23/2009	C	N	75.370(a)(1)	138.00	Closed	138.00	138.00
Signal Peak Energy LLC		8463279	000206531	10/22/2009	1/23/2010	104(a)	10/23/2009	C	N	75.351(g)(3)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463282	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1914(d)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8231490	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8469767	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1910(l)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6631253	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8469766	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.364(h)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8469769	000206531	10/22/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1911(i)	100.00	Closed	100.00	100.00

Signal Peak Energy LLC		7609799	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1910(i)	100.00	Closed	100.00	100.00
TK Mining Services	K393	7609800	000204069	10/21/2009	1/3/2010	104(a)	10/21/2009	C	N	75.1913(b)	334.00	Delinquent	334.00	0.00
TK Mining Services	K393	6687086	000204069	10/21/2009	1/3/2010	104(a)	10/21/2009	C	N	75.1910(i)	334.00	Delinquent	334.00	0.00
Signal Peak Energy LLC		8463802	000206531	10/21/2009	1/23/2010	104(a)	11/4/2009	C	N	75.1909(d)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8231489	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463638	000206531	10/21/2009	1/23/2010	104(a)	11/2/2009	C	N	77.208(d)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463273	000206531	10/21/2009	1/23/2010	104(a)	11/3/2009	C	N	75.1909(d)	100.00	Closed	100.00	100.00
TK Mining Services	K393	8469765	000204069	10/21/2009	1/3/2010	104(a)	10/21/2009	C	N	75.1910(i)	334.00	Delinquent	334.00	0.00
Signal Peak Energy LLC		8463278	000206531	10/21/2009	1/23/2010	104(a)	11/3/2009	C	N	75.1909(d)	150.00	Closed	150.00	150.00
Signal Peak Energy LLC		8463636	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1914(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463274	000206531	10/21/2009	1/23/2010	104(a)	11/3/2009	C	N	75.1909(d)	100.00	Closed	100.00	100.00
TK Mining Services	K393	8469764	000204069	10/21/2009	1/3/2010	104(a)	10/21/2009	C	N	75.400	334.00	Delinquent	334.00	0.00
TK Mining Services	K393	8463633	000204069	10/21/2009	1/3/2010	104(a)	10/21/2009	C	N	75.506-1(a)	334.00	Delinquent	334.00	0.00
Signal Peak Energy LLC		6687085	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	77.1710(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463275	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1909(a)(3)(iii)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7522990	000206531	10/21/2009	1/23/2010	104(d)(1)	10/21/2009	C	Y	75.364(b)(5)	11,306.00	Final Order Issued	11,306.00	0.00
Signal Peak Energy LLC		8469763	000206531	10/21/2009	1/23/2010	104(a)	11/3/2009	C	N	75.1911(b)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463276	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	75.1910(i)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8469762	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1909(a)(3)(iii)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687084	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	75.512	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7609798	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1910(i)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463637	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	75.1106-5(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8469760	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1909(d)	100.00	Closed	100.00	100.00
TK Mining Services	K393	8463801	000204069	10/21/2009	1/3/2010	104(a)	10/21/2009	C	N	75.400	334.00	Delinquent	334.00	0.00
Signal Peak Energy LLC		8463634	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	75.1909(d)	150.00	Closed	150.00	150.00
Signal Peak Energy LLC		8469759	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1914(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687083	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	75.1914(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463277	000206531	10/21/2009	1/23/2010	104(a)	10/22/2009	C	N	75.1910(i)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8469761	000206531	10/21/2009	1/23/2010	104(a)	10/21/2009	C	N	75.1714-3(b)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7522991	000206531	10/21/2009	1/23/2010	104(d)(1)	11/3/2009	O	Y	75.220(a)(1)	10,705.00	Final Order Issued	10,705.00	0.00
Signal Peak Energy LLC		8463635	000206531	10/21/2009	1/23/2010	104(a)	11/3/2009	C	N	75.1909(d)	150.00	Closed	150.00	150.00
Signal Peak Energy LLC		7522987	000206531	10/20/2009	1/23/2010	104(a)	10/23/2009	C	N	75.370(a)(1)	190.00	Closed	190.00	190.00
Signal Peak Energy LLC		8463632	000206531	10/20/2009	1/23/2010	104(a)	10/20/2009	C	N	75.351(e)(3)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8416156	000206531	10/20/2009	1/23/2010	104(a)	10/21/2009	C	N	75.370(a)(1)	162.00	Closed	162.00	162.00
Signal Peak Energy LLC		8231486		10/20/2009		314(b)	11/3/2009	S	N/A		Non-Assessable			
C & J Welding & Construction	5DL	8463272	000203901	10/20/2009		104(a)	10/20/2009	C	N	77.1710(a)	100.00	In Contest	100.00	0.00
Signal Peak Energy LLC		8231487		10/20/2009		314(b)	11/3/2009	S	N/A		Non-Assessable			
Signal Peak Energy LLC		7522988	000206531	10/20/2009	1/23/2010	104(a)	10/20/2009	C	N	72.630(b)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687082	000206531	10/20/2009	1/23/2010	104(a)	10/20/2009	C	N	77.1102	100.00	Closed	100.00	100.00

Signal Peak Energy LLC		7609797	000206531	10/20/2009	1/23/2010	104(a)	10/26/2009	C	N	75.1914(f)	100.00	Closed	100.00	100.00
TK Mining Services	K393	8463270	000204069	10/20/2009	1/3/2010	104(a)	11/3/2009	C	N	75.1914(g)	334.00	Delinquent	334.00	53.48
Signal Peak Energy LLC		7609796	000206531	10/20/2009	1/23/2010	104(a)	10/21/2009	C	N	75.1914(h)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8231485	000206531	10/20/2009	1/23/2010	104(a)	11/3/2009	C	Y	75.1403-10(i)	745.00	Final Order Issued	745.00	0.00
Signal Peak Energy LLC		6687081	000206531	10/20/2009	1/23/2010	104(a)	10/20/2009	C	N	77.1109(c)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8231488	000206531	10/20/2009	1/23/2010	104(a)	11/3/2009	C	N	72.630(b)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463271	000206531	10/20/2009	1/23/2010	104(a)	10/20/2009	C	N	77.404(c)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7522989	000206531	10/20/2009	1/23/2010	104(a)	10/20/2009	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8416157	000206531	10/20/2009	1/23/2010	104(a)	11/3/2009	C	N	75.362(a)(2)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6631251	000206531	10/20/2009	1/23/2010	104(a)	10/20/2009	C	Y	75.1916(e)	334.00	Final Order Issued	334.00	0.00
Signal Peak Energy LLC		8463267	000203657	10/19/2009	12/25/2009	104(a)	10/19/2009	C	N	75.904	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463268	000203657	10/19/2009	12/25/2009	104(a)	10/19/2009	C	N	75.333(h)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463630	000203657	10/19/2009	12/25/2009	104(a)	10/19/2009	C	N	75.517	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463631	000203657	10/19/2009	12/25/2009	104(a)	10/19/2009	C	N	75.380(d)(7)(iv)	138.00	Closed	138.00	138.00
Signal Peak Energy LLC		8463269	000203657	10/19/2009	12/25/2009	104(a)	10/19/2009	C	N	77.405	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463629	000203657	10/19/2009	12/25/2009	104(a)	10/19/2009	C	N	75.360(g)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463409	000203657	10/14/2009	12/25/2009	104(g)(1)	10/22/2009	O	N	48.8(a)	343.00	Closed	343.00	343.00
Signal Peak Energy LLC		8463410	000203657	10/14/2009	12/25/2009	104(g)(1)	10/22/2009	O	N	48.28(a)	343.00	Closed	343.00	343.00
Signal Peak Energy LLC		7284369	000203657	9/25/2009	12/25/2009	104(a)	10/26/2009	C	N	70.207(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463625	000203657	9/23/2009	12/25/2009	104(a)	9/23/2009	C	N	75.333(c)(3)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463262	000203657	9/23/2009	12/25/2009	104(a)	9/23/2009	C	N	75.380(d)(7)(iv)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463624	000203657	9/23/2009	12/25/2009	104(a)	9/23/2009	C	N	75.1725(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463365	000203657	9/21/2009	12/25/2009	104(a)	9/23/2009	C	Y	75.403	334.00	Closed	334.00	334.00
Signal Peak Energy LLC		8463254	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.351(d)(2)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687075	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	Y	75.1722(a)	392.00	Closed	392.00	392.00
Signal Peak Energy LLC		6687073	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	Y	75.400	2,282.00	Closed	2,282.00	2,282.00
Signal Peak Energy LLC		8463260	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687080	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.364(h)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463256	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.503	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687077	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.811	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463255	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.517	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463257	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.1106-3(c)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687079	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.1403	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463259	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.203	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687076	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.507	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687074	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	Y	75.1731(b)	1,111.00	Closed	1,111.00	1,111.00
Signal Peak Energy LLC		6687078	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.380(d)(7)(vii)(A)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463261	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.512	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463253	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.340(a)(1)(i)	100.00	Closed	100.00	100.00

Signal Peak Energy LLC		8463252	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.503	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463258	000203657	9/15/2009	12/25/2009	104(a)	9/15/2009	C	N	75.1106-3(a)(2)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7609794	000200682	9/2/2009	11/20/2009	104(a)	9/2/2009	C	N	75.1914(h)(1)	117.00	Closed	117.00	117.00
Signal Peak Energy LLC		8463616	000200682	9/1/2009	11/20/2009	104(a)	9/2/2009	C	Y	75.400	1,530.00	Closed	1,530.00	1,530.00
Oftedal Construction Inc	XS8	8463518	000201264	9/1/2009	11/28/2009	104(a)	9/1/2009	C	N	77.1713(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7609793	000200682	9/1/2009	11/20/2009	104(a)	9/1/2009	C	N	75.508	150.00	Closed	150.00	150.00
Signal Peak Energy LLC		8463364	000200682	9/1/2009	11/20/2009	104(a)	9/2/2009	C	N	75.333(b)(3)	100.00	Closed	100.00	100.00
Taggart Global, LLC	Q741	8463519	000200904	9/1/2009	11/26/2009	104(a)	9/1/2009	C	N	77.208(d)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463615	000200682	8/31/2009	11/20/2009	104(a)	9/1/2009	C	Y	75.1403	873.00	Closed	873.00	873.00
Oftedal Construction Inc	XS8	8463517	000201264	8/31/2009	11/28/2009	104(a)	9/15/2009	C	N	77.404(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463360	000200682	8/31/2009	11/20/2009	104(a)	8/31/2009	C	N	75.380(d)(7)(iv)	687.00	Closed	687.00	687.00
Signal Peak Energy LLC		8463361	000200682	8/31/2009	11/20/2009	104(a)	9/1/2009	C	Y	75.400	634.00	Closed	634.00	634.00
Taggart Global, LLC	Q741	8463515	000200904	8/31/2009	11/26/2009	104(a)	8/31/2009	C	N	77.512	100.00	Closed	100.00	100.00
Oftedal Construction Inc	XS8	8463516	000201264	8/31/2009	11/28/2009	104(a)	8/31/2009	C	Y	77.1104	176.00	Closed	176.00	176.00
Signal Peak Energy LLC		8463358	000200682	8/31/2009	11/20/2009	104(a)	9/1/2009	C	N	75.202	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463363	000200682	8/31/2009	11/20/2009	104(a)	9/16/2009	C	N	75.403	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463614	000200682	8/31/2009	11/20/2009	104(a)	9/1/2009	C	N	75.333(h)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463613	000200682	8/31/2009	11/20/2009	104(a)	9/1/2009	C	N	75.503	176.00	Closed	176.00	176.00
Signal Peak Energy LLC		8463362	000200682	8/31/2009	11/20/2009	104(a)	9/1/2009	C	N	75.206(e)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7609792	000200682	8/31/2009	11/20/2009	104(a)	8/31/2009	C	N	75.503	176.00	Closed	176.00	176.00
Signal Peak Energy LLC		8463359	000200682	8/31/2009	11/20/2009	104(a)	9/2/2009	C	N	75.364(b)(2)	100.00	Closed	100.00	100.00
Taggart Global, LLC	Q741	8463514	000200904	8/31/2009		104(a)	8/31/2009	C	N	77.202	100.00	In Contest	100.00	0.00
Signal Peak Energy LLC		6688984	000200682	8/27/2009	11/20/2009	104(a)	10/8/2009	C	N	75.1502(c)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		9895304	000200682	8/26/2009	11/20/2009	104(a)	8/26/2009	C	N	70.208(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463606	000197586	8/12/2009	10/23/2009	104(a)	8/13/2009	C	N	75.333(c)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463605	000197586	8/12/2009	10/23/2009	104(a)	8/13/2009	C	N	75.503	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463607	000197586	8/12/2009	10/23/2009	104(a)	8/13/2009	C	N	75.340(a)	100.00	Closed	100.00	100.00
Springline Construction Inc.	X949	8463604	000197917	8/12/2009	10/29/2009	104(a)	8/12/2009	C	N	77.1710(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463603	000197586	8/11/2009	10/23/2009	104(a)	8/12/2009	C	Y	75.400	3,689.00	Closed	3,689.00	3,689.00
Signal Peak Energy LLC		8463342	000197586	7/28/2009	10/23/2009	104(a)	8/13/2009	C	N	75.351(n)(3)(i)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463340	000197586	7/27/2009	10/23/2009	104(a)	7/28/2009	C	Y	75.400	263.00	Closed	263.00	263.00
Signal Peak Energy LLC		8463338	000197586	7/27/2009	10/23/2009	104(a)	7/27/2009	C	N	77.400(d)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463341	000197586	7/27/2009	10/23/2009	104(a)	7/28/2009	C	N	75.351(c)(3)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463339	000197586	7/27/2009	10/23/2009	104(a)	7/27/2009	C	Y	75.400	3,405.00	Closed	3,405.00	3,405.00
Signal Peak Energy LLC		8463337	000197586	7/21/2009	10/23/2009	104(a)	7/28/2009	C	Y	75.202	745.00	Closed	745.00	745.00
Signal Peak Energy LLC		8463335	000197586	7/20/2009	10/23/2009	104(a)	7/20/2009	C	N	75.1106-3(a)(2)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463336	000197586	7/20/2009	10/23/2009	104(a)	8/31/2009	C	N	62.130(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463334	000197586	7/20/2009	10/23/2009	104(a)	7/21/2009	C	N	75.362(g)(2)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7284366	000197586	7/16/2009	10/23/2009	104(a)	7/16/2009	C	N	70.207(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463333	000197586	7/14/2009	10/23/2009	104(a)	7/14/2009	C	N	75.208	100.00	Closed	100.00	100.00

Signal Peak Energy LLC		8463332	000197586	7/14/2009	10/23/2009	104(a)	7/15/2009	C	N	75.1715	585.00	Closed	585.00	585.00
Signal Peak Energy LLC		7636880	000194380	6/18/2009	9/19/2009	104(a)	6/22/2009	C	N		263.00	Closed	263.00	263.00
Signal Peak Energy LLC		8463224	000191498	6/10/2009	8/21/2009	104(a)	6/11/2009	C	N	75.400	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463225	000191498	6/10/2009	8/21/2009	104(a)	6/11/2009	C	N	75.400	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687476	000191498	6/9/2009	8/21/2009	104(a)	6/9/2009	C	N	75.202(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687475	000191498	6/9/2009	8/21/2009	104(a)	6/10/2009	C	Y	75.380(d)(1)	807.00	Closed	807.00	807.00
Signal Peak Energy LLC		6687474	000191498	6/4/2009	8/21/2009	104(a)	6/4/2009	C	N	75.1722(c)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463220	000191498	6/3/2009	8/21/2009	104(a)	6/3/2009	C	N	75.333(h)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687473	000191498	6/3/2009	8/21/2009	104(a)	6/4/2009	C	Y	75.400	807.00	Closed	807.00	807.00
Signal Peak Energy LLC		6687472	000191498	6/3/2009	8/21/2009	104(a)	6/4/2009	C	N	75.402	108.00	Closed	108.00	108.00
Signal Peak Energy LLC		8463221	000191498	6/3/2009	8/21/2009	104(a)	6/3/2009	C	N	75.340(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687471	000191498	6/3/2009	8/21/2009	104(a)	6/3/2009	C	N	75.1505(b)	108.00	Closed	108.00	108.00
Oftedal Construction Inc	XS8	8463078	000194928	6/2/2009	9/26/2009	104(a)	6/4/2009	C	Y	77.1104	263.00	Closed	263.00	263.00
Signal Peak Energy LLC		8463077	000191498	6/2/2009	8/21/2009	104(a)	6/2/2009	C	N	77.904	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463219	000191498	6/2/2009	8/21/2009	104(a)	6/3/2009	C	N	75.400	100.00	Closed	100.00	100.00
Taggart Global, LLC	Q741	8463076	000191759	6/1/2009	8/27/2009	104(a)	6/1/2009	C	N	77.208(e)	100.00	Closed	100.00	100.00
Taggart Global, LLC	Q741	6687469	000191759	6/1/2009	8/27/2009	104(a)	6/1/2009	C	Y	77.1710(a)	243.00	Closed	243.00	243.00
Taggart Global, LLC	Q741	6687468	000191759	6/1/2009	8/27/2009	104(a)	6/1/2009	C	N	77.208(d)	100.00	Closed	100.00	100.00
Oftedal Construction Inc	XS8	6687470	000194928	6/1/2009	9/26/2009	104(a)	6/1/2009	C	N	77.1607(p)	100.00	Closed	100.00	100.00
Taggart Global, LLC	Q741	6687467	000191759	6/1/2009	8/27/2009	104(a)	6/1/2009	C	Y	77.1710(g)	176.00	Closed	176.00	176.00
Signal Peak Energy LLC		9895291	000191498	5/27/2009	8/21/2009	104(a)	5/27/2009	C	N	70.207(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6688965	000188574	5/13/2009	7/24/2009	104(a)	6/8/2009	C	N	75.221(a)(12)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687458	000188574	5/7/2009	7/24/2009	104(a)	5/7/2009	C	N	75.400	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463213	000188574	5/6/2009	7/24/2009	104(a)	5/6/2009	C	Y	75.1725	585.00	Closed	585.00	585.00
Signal Peak Energy LLC		8463318	000188574	5/6/2009	7/24/2009	104(a)	5/6/2009	C	Y	77.1104	263.00	Closed	263.00	263.00
Signal Peak Energy LLC		8463317	000188574	5/5/2009	7/24/2009	104(a)	5/5/2009	C	Y	75.511	873.00	Closed	873.00	873.00
Signal Peak Energy LLC		8463212	000188574	5/5/2009	7/24/2009	104(a)	5/5/2009	C	N	75.380(d)(7)(iv)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463316	000188574	5/5/2009	7/24/2009	104(a)	5/5/2009	C	N	75.1106-3(a)(2)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		8463211	000188574	5/5/2009	7/24/2009	104(a)	5/5/2009	C	N	75.904	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687456	000188574	5/5/2009	7/24/2009	104(a)	5/5/2009	C	N	75.1403	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687455	000188574	5/5/2009	7/24/2009	104(a)	5/6/2009	C	N	75.400	100.00	Closed	100.00	100.00
Taggart Global, LLC	Q741	6687457	000188841	5/5/2009	7/30/2009	104(a)	5/5/2009	C	N	77.1710(i)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		9895288	000188574	4/22/2009	7/24/2009	104(a)	4/22/2009	C	N	70.208(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7609788	000185600	4/1/2009	6/19/2009	104(a)	4/2/2009	C	N	75.220(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7609789	000185600	4/1/2009	6/19/2009	104(a)	4/2/2009	C	N	75.350(a)(1)	263.00	Closed	263.00	263.00
Signal Peak Energy LLC		6687299	000185600	3/31/2009	6/19/2009	104(a)	3/31/2009	C	N	75.350(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687300	000185600	3/31/2009	6/19/2009	104(a)	3/31/2009	C	N	75.333(c)(1)	176.00	Closed	176.00	176.00
Signal Peak Energy LLC		6687033	000179795	1/26/2009	4/24/2009	104(a)	1/26/2009	C	N	75.1103-8(b)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687035	000179795	1/26/2009	4/24/2009	104(a)	1/26/2009	C	N	75.380(d)(7)(iv)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687034	000179795	1/26/2009	4/24/2009	104(a)	1/26/2009	C	N	75.400	100.00	Closed	100.00	100.00

Winn Construction, Inc.	W462	6687253	000180038	1/26/2009	4/30/2009	104(a)	1/26/2009	C	Y	77.1710(a)	108.00	Closed	108.00	108.00
Southern Systems, Inc	K289	6687251	000180037	1/26/2009	4/30/2009	104(a)	1/26/2009	C	Y	77.1607(n)	243.00	Closed	243.00	243.00
Signal Peak Energy LLC		6687408	000179795	1/26/2009	4/24/2009	104(a)	1/27/2009	C	Y	75.1403	224.00	Closed	224.00	224.00
Southern Systems, Inc	K289	6687252	000180037	1/26/2009	4/30/2009	104(a)	1/26/2009	C	N	77.502	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687407	000179795	1/25/2009	4/24/2009	104(a)	1/26/2009	C	N	75.904	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686798	000177263	1/7/2009	3/28/2009	104(a)	1/7/2009	C	N	75.512	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686797	000177263	1/6/2009	3/28/2009	104(a)	1/6/2009	C	N	77.1710(i)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687250	000177263	1/6/2009	3/28/2009	104(a)	1/7/2009	C	Y	75.400	224.00	Closed	224.00	224.00
Signal Peak Energy LLC		6687249	000177263	1/6/2009	3/28/2009	104(a)	1/25/2009	C	N	75.333(h)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686796	000177263	1/6/2009	3/28/2009	104(a)	1/7/2009	C	N	75.512	100.00	Closed	100.00	100.00
Southern Systems, Inc	K289	6686836		12/4/2008		107(a)	12/5/2008	O	N/A		Non-Assessable			
Signal Peak Energy LLC		6686664	000174722	11/19/2008	2/21/2009	104(a)	11/19/2008	C	N	77.1607(p)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686775	000174722	11/19/2008	2/21/2009	104(a)	11/19/2008	C	N	75.1907(a)	263.00	Closed	263.00	263.00
Signal Peak Energy LLC		6686774	000174722	11/19/2008	2/21/2009	104(a)	11/19/2008	C	N	75.1715	100.00	Closed	100.00	100.00
Southern Systems, Inc	K289	6686770	000172337	11/18/2008	1/30/2009	104(a)	11/18/2008	C	N	47.44(b)	100.00	Closed	100.00	100.00
Southern Systems, Inc	K289	6686768	000172337	11/18/2008	1/30/2009	104(g)(1)	11/28/2008	O	Y	48.25(a)	971.00	Closed	971.00	971.00
Southern Systems, Inc	K289	6686771	000172337	11/18/2008	1/30/2009	104(a)	11/18/2008	C	Y	77.502	540.00	Closed	540.00	540.00
Oftedal Construction Inc	XS8	6687220	000175204	11/18/2008	2/28/2009	104(a)	11/19/2008	C	Y	77.1605(k)	634.00	Closed	634.00	634.00
Southern Systems, Inc	K289	6686660	000172337	11/18/2008	1/30/2009	104(a)	11/19/2008	C	N	77.904	100.00	Closed	100.00	100.00
Southern Systems, Inc	K289	6686661	000172337	11/18/2008	1/30/2009	104(a)	11/18/2008	C	Y	77.502	243.00	Closed	243.00	243.00
Oftedal Construction Inc	XS8	6686663	000172739	11/18/2008	2/6/2009	104(a)	11/19/2008	C	N	77.502-2	100.00	Closed	100.00	100.00
Oftedal Construction Inc	XS8	6687221	000175204	11/18/2008	2/28/2009	104(a)	11/19/2008	C	Y	77.1104	190.00	Closed	190.00	190.00
Signal Peak Energy LLC		6687222	000174722	11/18/2008	2/21/2009	104(a)	11/19/2008	C	Y	77.205(e)	308.00	Closed	308.00	308.00
Signal Peak Energy LLC		6687223	000174722	11/18/2008	2/21/2009	104(a)	11/18/2008	C	N	77.502	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687224	000174722	11/18/2008	2/21/2009	104(a)	11/18/2008	C	N	47.44(b)	207.00	Closed	207.00	207.00
Oftedal Construction Inc	XS8	6686662	000172739	11/18/2008	2/6/2009	104(a)	11/18/2008	C	N	77.410(b)	100.00	Closed	100.00	100.00
Southern Systems, Inc	K289	6686773	000174956	11/18/2008	2/25/2009	104(a)	11/18/2008	C	N	77.505	100.00	Closed	100.00	100.00
Oftedal Construction Inc	XS8	6687218	000175204	11/18/2008	2/28/2009	104(a)	11/19/2008	C	N	77.404(a)	100.00	Closed	100.00	100.00
Southern Systems, Inc	K289	6686769	000172337	11/18/2008	1/30/2009	104(a)	11/18/2008	C	N	77.502	100.00	Closed	100.00	100.00
Oftedal Construction Inc	XS8	6687219	000175204	11/18/2008	2/28/2009	104(a)	11/19/2008	C	Y	77.1104	634.00	Closed	634.00	634.00
Oftedal Construction Inc	XS8	6687217	000175204	11/18/2008	2/28/2009	104(a)	11/19/2008	C	N	77.404(a)	127.00	Closed	127.00	127.00
Signal Peak Energy LLC		6686767	000174722	11/18/2008	2/21/2009	104(a)	11/18/2008	C	Y	77.1710(g)	100.00	Closed	100.00	100.00
Oftedal Construction Inc	XS8	6687216	000175204	11/18/2008	2/28/2009	104(a)	11/19/2008	C	N	77.1104	127.00	Closed	127.00	127.00
Southern Systems, Inc	K289	6686772	000172337	11/18/2008	1/30/2009	104(a)	11/18/2008	C	N	77.502	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686757	000172069	10/29/2008	1/23/2009	104(a)	10/29/2008	C	Y	75.400	308.00	Closed	308.00	308.00
Signal Peak Energy LLC		6686755	000172069	10/28/2008	1/23/2009	104(a)	10/28/2008	C	N	75.1714-4(b)	207.00	Closed	207.00	207.00
Signal Peak Energy LLC		6687208	000172069	10/28/2008	1/23/2009	104(a)	11/19/2008	C	N	49.17(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686756	000172069	10/28/2008	1/23/2009	104(a)	10/28/2008	C	N	75.1725(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		7284354	000172069	10/24/2008	1/23/2009	104(a)	12/10/2008	C	N	70.208(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686937	000168975	9/26/2008	12/20/2008	104(a)	9/26/2008	C	N	48.31	100.00	Closed	100.00	100.00

Oftedal Construction Inc	XS8	6686935	000169554	9/25/2008	12/31/2008	104(a)	9/25/2008	C	N	77.1110	100.00	Closed	100.00	100.00
Oftedal Construction Inc	XS8	6686936	000169554	9/25/2008	12/31/2008	104(g)(1)	9/26/2008	O	N	48.25(a)	112.00	Closed	112.00	112.00
Signal Peak Energy LLC		6686735	000172069	9/11/2008	1/23/2009	104(a)	9/12/2008	C	N	75.351(e)(3)	108.00	Closed	108.00	108.00
Signal Peak Energy LLC		6687013	000172069	9/10/2008	1/23/2009	104(a)	9/11/2008	C	Y	75.364(b)	1,530.00	Closed	1,530.00	1,530.00
Signal Peak Energy LLC		6687012	000172069	9/10/2008	1/23/2009	104(a)	9/10/2008	C	N	75.1712-6(b)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6686734	000172069	9/9/2008	1/23/2009	104(a)	9/9/2008	C	N	75.370(a)(1)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687202	000172069	9/9/2008	1/23/2009	104(a)	9/9/2008	C	N	77.404(a)	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		6687201	000172069	9/9/2008	1/23/2009	104(a)	9/9/2008	C	N	77.1104	100.00	Closed	100.00	100.00
Signal Peak Energy LLC		9895272	000172069	8/19/2008	1/23/2009	104(a)	8/19/2008	C	N	70.208(a)	100.00	Closed	100.00	100.00

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Mine Safety and Health Administration (MSHA)
1100 Wilson Boulevard, 21st Floor
Arlington, VA 22209-3939

Phone: (202) 693-9400
Fax-on-demand: (202) 693-9401
Technical (web) questions: Webmaster
On-line Filing Help: MSHAhelpdesk@dol.gov
or call (877) 778-6055
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Office of Assessments
Citation and Order Explanations

A. Accident and Rescue/Recovery Procedures [103(k) Orders]

The inspector will generally use Section 103(k) to protect the safety of any person in the mine when a mine condition exists as a result of an accident that threatens the safety of miners. The 103(k) order does not preclude the issuance of a Section 107(a) order if an imminent danger situation is found. It is imperative that discretion and good judgment be exercised by the inspector when using the broad authority provided by the Mine Act.

In instances where an accident has resulted in the death or serious injury to a miner, and the inspector believes that the hazardous condition(s) or practice(s) causing that accident is likely to exist elsewhere at the mine, the Section 103(k) order shall include all such areas of the mine. In some instances it will be obvious that the conditions are peculiar to the accident site, and, therefore, the Section 103(k) order would not apply to areas other than the accident site.

The 103(k) order should remain in effect until a systematic evaluation of the conditions and safety practices is conducted and a determination is made that hazards similar to those which caused or contributed to the accident have been eliminated. The evaluation can be made prior to the accident investigation or concurrent with it. After this evaluation and determination has been made, the Section 103(k) order may be modified to permit an area of the mine to resume operations, or terminated, provided that such action will not pose a hazard to the miners.

IV. SECTION 104(a) CITATIONS [104(a) Citations]

This section is the primary tool for obtaining compliance with the Mine Act, mandatory health or safety standards, rules, orders, or regulations.

A Section 104(a) citation must establish:

- o a violation of a standard, regulation, or section of the Mine Act;
- o the degree of hazard that exists;
- o the degree of exposure to the hazard; and
- o the degree of negligence by the mine operator. The time fixed for abatement of a violation shall be determined, whenever practical, after a discussion with the mine operator or the operator's agent.

VI. "S&S" CRITERIA [Significant and Substantial]

By checking "Yes" in Item 10C (Significant and Substantial or "S&S"), the inspector has indicated that based upon the particular facts surrounding the violation there exists a reasonable likelihood the hazard contributed to will result in an injury or illness of a reasonably serious nature.

Violations of the Mine Act, without an accompanying mandatory standard, shall always be designated as "non significant and substantial." For these violations, Section II, item 10A shall be evaluated as "No likelihood", item 10B will be marked "No Lost Workdays", and item 10C shall be checked "No." Further, these violations shall have the following sentence added to the body of the violation description in Section I, item 8: The condition has not been designated as "significant and substantial" because the conduct violated a provision of the Mine Act rather than a mandatory safety or health standard.

In determining whether conditions created by a violation could significantly and substantially contribute to the cause and effect of a mine safety or health hazard, inspectors must determine:

o whether there is an underlying violation of a mandatory health or safety standard;
o whether there is a discrete safety or health hazard -- that is, a measure of danger to safety or health -- contributed to by the violation;
o whether there is a reasonable likelihood that the hazard contributed to will result in an injury or illness; and
o whether there is a reasonable likelihood that the injury or illness in question will be of a reasonably serious nature.

All of these determinations must be made before a violation can be designated as "significant and substantial."

The Federal Mine Safety and Health Review Commission has further determined that "...the relevant time frame for determining whether a reasonable likelihood of injury exists includes both the time that a violative condition existed prior to the citation and the time that it would have existed if normal mining operations had continued." The violation would be evaluated as "S&S" if miners were not in the area when the violation was observed, but they had been, would be, or could be if normal mining operations were to continue, and the other "S&S" criteria were met.

XI. NOTICE TO PROVIDE SAFEGUARDS 314(b)]

Section 314(b) of the Mine Act is specific to coal only and is intended for use in regards to haulage and hoisting related hazards that are identified at a specific mine.

When preparing for an inspection, an inspector must review the safeguard summary sheet in the uniform mine file so that he/she knows what safeguards have been previously issued for the mine. The inspector should also be familiar with the requirements for each safeguard.

When an inspector identifies a hazard specific to the mine and similar to those already identified in 30 CFR, Subpart O, Sections 75.1403-2 through 75.1403-11, he/she will issue a notice to provide safeguards to the mine operator if one has not been previously issued.

In those cases where the provisions of a safeguard notice are found to be violated at a mine, a citation or order will be issued as appropriate. The safeguard originally issued will be referenced in the initial action block on the citation and order form (7000-3).

XII. SECTION 104(b) ORDERS [104(b)]

The inspector shall review the circumstances when the time fixed for a citation's abatement has expired. In determining whether to issue a Section 104(b) order, the inspector must determine whether there is a reasonable basis for extending the abatement date. If an extension of time is not justified and the cited condition or practice is not abated, the inspector must issue a Section 104(b) order of withdrawal. Upon abatement of the condition or practice cited in the original citation, the order can be terminated.

XIII. SECTION 104(d) CITATIONS AND ORDERS [104(d) Citations]

A. Criteria for Issuing a 104(d)(1) Citation

A 104(d)(1) citation shall be issued if:

1. there is a violation of a mandatory health or safety standard;
2. the violation significantly and substantially contributes to the cause and effect of a mine safety or health hazard; and
3. there is an unwarrantable failure of the mine operator or contractor to comply with the standard.

Note: A violation of a Section of the Mine Act cannot be issued as a 104(d) citation or a 104(d) order even if the negligence evaluation is determined to be "high" or "reckless disregard." Also, a violation of other than mandatory health or safety standards (e.g., Part 40, 41, 43, 44, 45, or 50) cannot be issued as a 104(d) citation or order even if the negligence evaluation is "high" or "reckless disregard."

A violation is caused by an unwarrantable failure if it is determined that the mine operator or contractor has engaged in aggravated conduct constituting more than ordinary negligence.

XIV. SECTION 104(e) PATTERN OF VIOLATIONS [104(e) Citations]

Section 104(e) of the Mine Act provides for severe sanctions against mine operators who have a pattern of violations of mandatory health and safety standards that could significantly and substantially contribute to the cause and effect of the health and safety hazards.

On October 1, 1990, regulations identifying mine operators who met the criteria for pattern of violations as outlined in 30 CFR Part 104 became effective. These regulations include procedures for initial screening of mines that may be developing a pattern of violations; criteria for determining whether a pattern of violations exists at a mine; procedures for issuance of potential pattern notice and final pattern notice; and procedures for termination of a Notice of Pattern of Violations.

If, upon any inspection within 90 days after the issuance of a Notice of Pattern of Violation, an inspector finds any "S&S" violation of a mandatory health or safety standard, the inspector shall issue a 104(e)(1) withdrawal order. The withdrawal order shall remain in effect until MSHA determines that the violation has been abated. Additional 104(e)(1) withdrawal orders will be issued if any further violations of an "S&S" nature are also observed during the course of the same inspection.

XVI. SECTION 107(a) IMMINENT DANGER ORDERS

Imminent danger is defined in the Mine Act as "the existence of any condition or practice in a coal or other mine which could reasonably be expected to cause death or serious physical harm before such condition or practice can be abated." An inspector cannot issue a Section 107(a) order for "control purposes" in the absence of an imminent danger. The Mine Act and all legal decisions clearly spell out the need for the existence of an imminent danger to justify the issuance of a 107(a) order. The courts have noted that an imminent danger exists only when the hazardous condition has a reasonable potential to cause death or serious injury within a short period of time.

An imminent danger order cannot be issued for an accident which has already occurred unless the imminence still exists. Immediate physical exposure to the imminent danger does not have to be witnessed by the inspector to issue a 107(a) order.

Because the purpose of Section 107(a) orders is to immediately remove miners from exposure to serious hazards and to prevent miners from entering such hazardous areas, an imminent danger must be impending at the time an order is issued. Therefore, when an imminent danger is observed, the inspector must, as soon as possible and at the time the imminent danger is being observed, either issue a written or an oral Section 107(a) order. An oral order should be documented in writing as soon as practical.

If an oral Section 107(a) order is issued, it should be stated in precise terms such as: "I am issuing you a Section 107(a) imminent danger order." At the least, the inspector must use the words "imminent danger" or "107(a)" at the time the oral order is issued.

A written order, issued after an oral Section 107(a) order, must clearly state that it is confirming an oral imminent danger order and identify:

- the individual to whom the oral order was issued;
- the time and date the oral order was issued;
- the location at which the oral order was issued; and
- the reason the oral order was issued. (This reason should be presented in the standard manner developed for the issuance of Section 107(a) orders.)

Imminent danger orders shall contain a detailed description of the conditions or practices which cause and constitute the imminent danger and a description of the area of the mine from which persons must be withdrawn and prohibited from entering. Only those persons described in Section 104(c) of the Mine Act may enter the affected area while the order is in place.

An imminent danger withdrawal order usually involves one or more violations of a mandatory health or safety standard. All contributing violations are to be addressed as separate citations or orders referring back to the 107(a) Imminent Danger Order.

Mine Safety and Health Administration (MSHA)
1100 Wilson Boulevard, 21st Floor
Arlington, VA 22209-3939

Phone: (202) 693-9400
Fax-on-demand: (202) 693-9401
Technical (web) questions: Webmaster
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RELATED MATERIALS
ATTACHMENT 3

To: Governor Schweitzer and Members of the State Land Board
From: Bob Adams, representing Montana Conservation Voters (MCV)
Date: February 16, 2010

Subject: Otter Creek Coal minimum bid

Synopsis: MCV respectfully requests that the minimum acceptable bonus bid and royalty bid set at the December 21st, 2009 Land Board meeting NOT be reduced.

Governor Schweitzer and Montana Land Board Members,

I am Bob Adams, again speaking to you in behalf of Montana Conservation Voters.

MCV believes that when the balance is struck and all costs are considered, the evidence clearly leads to the conclusion you must stand by your December 21st decision that set a minimum bonus bid for the Otter Creek coal at 25 cents per ton. We wish you had chosen not to offer it for bid at all; but having done so, stick with that minimum bid.

Look again at the uncalculated costs to Montana ...and to the nation...should the coal be leased and then mined: In Montana, those costs would include disruption of generations-old family farm and ranch operations, destruction of an aquifer, pollution of air and water, the loss of cultural resources, sacrificing the aesthetic of the land. It is as true on this date as it was back on December 21st___and it will be true on some sad and future date___if that coal is taken from the land.

In addition to those most basic arguments against leasing the coal at all...or at variance with the minimum bid established...is **your commitment** stated in two respects last December 21st:

1) That you would not give away Montana's resources, Otter Creek coal in this instance, for less than the minimum bid YOU established; and
2) You would not subsidize the building of the Tongue River Railroad

So...we call on you to stand by the 25 cents per ton minimum bid.

--Wyoming coal is selling at multiples of this; we cannot afford less.
--If you drop the bid amount, all of the difference would, in effect, help subsidize a Tongue River Railroad.

You, members of the Land Board, are trustees for all Montanans. In the best fiduciary tradition, then, represent us all **for the long term**. Don't drop the bid amount!

Thank you, from Montana Conservation Voters.

Bob Adams
1029 State Street
Helena, MT 59601

Testimony before the Land Board on Leasing the Otter Creek Coal Tracts: February 16, 2010

By: Wade Sikorski

Those who advocate developing Montana's vast coal resources say that it will help our economy. I am here to say that I don't think so. The costs of developing our coal will far out weigh the benefits. Unless it is safely and effectively sequestered, any coal that we sell will increase the amount of carbon dioxide in the atmosphere, which will ratchet up climate change. Agriculture, forestry, and tourism are all likely to suffer economically from climate change in Montana. In fact, it is already happening.

My family owns a ranch in southeastern Montana, where I live and work. Over the last decade, I have noticed that steel fence posts are being driven into the ground by the weight of the snow from spring blizzards, kind of like a straw settling into a milkshake. As the years go by, I increasingly find myself jacking the posts up out of the ground when I make the rounds checking fences in the spring. When I was a child, the wire would break, but the ground would be frozen when the spring blizzards came and the steel posts would stay where they were. This is a small complaint to be sure, almost too insignificant to mention--if it were not a harbinger of much more.

On another part of our ranch, we have a draw filled with trees. Recently, we discovered that they are all aging, near death, and no new trees are replacing them. Alarmed, we invited a government scientist in to try and figure out what was wrong. He speculated that a shift in grazing patterns had changed everything. The buffalo used to concentrate their grazing, tearing up the ground with their hooves, perhaps giving tree seeds a chance to get started. To see if this explained what was happening, he had us fence in two test plots on the draw. One we grazed heavily, the other we didn't graze at all. However, grazing didn't change anything. No new trees were starting in either plot. After some reflection, the scientist told us that he believes that the reason the trees are not reproducing in our draw is a change in the hydrological cycle due to global warming.

As it was with the steel posts, the warmer winters are melting snow throughout the winter. Snow does not accumulate on the ground the way that it used to, piling up deep in the draws where the trees are. Without the heavy snow to water the tree sprouts and to delay the grass, the trees are finding it too hard to compete against the grass.

Other changes on our place suggest serious economic consequences for all of Montana. On our ranch, we have a flood irrigation system of about 60 acres. When I was a child, the spring melt usually filled the system of dikes with runoff from top to bottom. Some years, we might have had two or three times as much water as we needed to flood all the dikes. One of my most vivid memories of my childhood was standing on a muddy dike in the middle of this project, water all around me like a sea. I was dragging ten pounds of mud on each boot, walking up and down the dikes to open and close the watergates.

Little more than three feet tall, I would have been in over my head on either side if I fell in. I remember thinking how cold the water would be if I slipped and fell.

Today, I don't have to worry about that because the water doesn't come anymore. All of the last decade, I could walk the lands between the dikes and not even get my shoes wet. Perhaps our annual precipitation has declined, but not by that much. What has happened is that our long cold winters, where the snow accumulated until spring and then melted in a rush, have changed. Now, the snow melts away throughout the winter. By spring, the ground has thawed and the water soaks in before it has a chance to run off into our irrigation project.

This system, which worked really well throughout my childhood, is not irrigating our land anymore. This is a considerable economic loss to my family. The windrows made by the swather used to be too big for me to jump across. Now our yields are only a fraction of what they were.

According to a recent government report, Montana will average 50, maybe 60, days a year with temperatures over 100 by the end of the century under a high greenhouse gas emissions scenario.[1] On average, temperatures across Montana could increase more than 10 F.[2] An increase of something like 10 F in Montana, which would cause the number of days over 100 F to increase dramatically, would radically decrease the productivity of my family's farm. My personal rule of thumb, which is probably conservative, is that for every day temperatures are over 100, our wheat yields fall one bushel per acre, two if there is a dry breeze. Using no-till continuous cropping, the spring wheat yields on our place now are between 20 and 30 bushels per acre. We can assume that half of those 50 days over 100 will be during the growing season. So, if these projections turn out to be true, and we lose 25 bushels per acre because of higher temperatures, we might not even be getting our seed back by the end of the century.

We have a choice to make. Either we develop our coal resources, or we protect the future of the agriculture, forestry, and tourism industries in Montana. We cannot do both. Please do not allow the coal companies to develop the Otter Creek Coal tracts.

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[1] *Global Climate Change Impacts in the United States*, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.), (Cambridge: Cambridge University Press, 2009), pp 90. http://www.globalchange.gov/usimpacts.

[2] *Global Climate Change Impacts in the United States*, pp. 29.

RELATED MATERIALS
ATTACHMENT 5

Wade Sikorski, Ph.D.

1511 Hwy 7
Baker, MT 59313

The Climate Crisis and Eco/nomic Development

Before it is too late

We are faced with the fact, my friends, that tomorrow is today. We are confronted with the fierce urgency of now. In this unfolding conundrum of life and history, there is such a thing as being too late. Procrastination is still the thief of time. Life often leaves us standing bare, naked, and dejected with a lost opportunity. The 'tide in the affairs of men' does not remain at the flood; it ebbs. We may cry out desperately for time to pause in her passage, but time is deaf to every plea and rushes on. Over the bleached bones and jumbled residues of numerous civilizations are written the pathetic words: 'Too late.'

Martin Luther King

The Economics of the Eco/nomy

Deconstructing the "balance" between the economy and the environment: According to the ethos of economic development, at least as it is commonly presumed, we must strike a balance between the economy and the environment. Environmental protection is a cost that sacrifices economic development. To develop Montana, advocates of economic development say, we must develop our coalfields, especially the Otter Creek Tracts, drain our aquifers to extract coal bed methane, build the Tongue River Railroad to haul the coal out, and build the TransCanada Keystone pipeline to bring the Alberta tar sand oil into the country. There may be environmental harm, these advocates of economic development sometimes admit, but they quickly add that we must all learn to make sacrifices for a greater good, giving up some things we value to get others we value more. Environmental protection harms the economy, reduces profits, decreases investment, and eliminates jobs, we are told, and so, we must strike a balance, make a sacrifice, and be realistic in our goals.

That's the story we are told over and over again until it seems impossible to think otherwise. However, repetition doesn't make anything any truer; it just makes it harder to think about what is going on. If we actually think about the "balance" we are invited to strike, carefully exploring its implications based on what this would actually mean, we will find being "balanced" is not practical, realistic, or wise, but a corporate public relations artifice produced by assumptions that, though innocent enough in the beginning, were never carefully considered. As science is increasingly showing us, there are not two things in balance, the economy and the environment, one going up while the other goes down, but only one thing that must, before it is too late for future generations, be considered as a whole, the eco/nomy.

If we think about our economic relation to the environment carefully, fully exploring the consequences of our actions, we will find that environmental harm is always economic harm. For example, as Steve Running, a University of Montana Montana's expert, argued to the Land Board late in 2009 before it decided on leasing the Otter Creek coal tracts, the global warming that will result from burning the 1.3 billion tons of coal in the Otter Creek area will harm not only the environment but the state economy as well. When the Otter Creek coal is burned, more than 2.5 billion tons of carbon dioxide will be released into the atmosphere, which will significantly harm other, more sustainable, revenues from State land, including hydropower, farming, grazing, and forestry.[1] The sacrifice made for coal development is not just to the environment, it is to the economy as well. We can develop coal, or we can maintain agriculture. We can't do both. The balance isn't between the environment and the economy; it is much more complicated than that.

Word origins: As many have pointed out, the words 'economy' and 'ecology' have a similar root, eco, which is derived from *oikos*, the ancient Greek word for dwelling place,

[1] Anne Hedges, "Mining Coal at Otter Creek—A Colossally Bad Idea," *Down to Earth* (Dec 2009, Vol. XXXV, No. 4), pp 1.

especially a house, which was called *woikos*, and had a meaning similar to the Latin *uicus*, and the Medieval Latin *vicus*, which became the English words *village* and *vicinity*. *Oikos* is also a root in the Greek word *oikonomos*, which means steward, which is related to *nemein*, to distribute. So, *oikonomia*, what we now understand as economy, meant household management.[2] All of this suggests that the eco/nomy is not separate from the ecosystem, sitting opposite of it on the other side of a balance, but identical with it. Ecology and economics have the same object of study, the *oikos*.

Framing our world more abstractly than the ancients did, we moderns are not in the habit of thinking about eco/nomics in this way, as something so practical, caring, and close to home, involving cooking, maintaining a garden and an orchard, keeping livestock, storing food, and perhaps bartering for things the household could not produce. Instead, we think of economics as a science that is as mathematical as it is global, a complex study of supply and demand, which mostly involves the human world of money, markets, and prices. In modern economics, things are commodities, products measured by their exchange value, as a means for profit, rarely by their use value. We think of the household as merely a metaphor for national economy, the global market. But perhaps we are missing something that the roots of the words 'economy' and 'ecology' both remember.

Where the modern science of economics is vast and global, its roots in Greek language are practical and local, involving the care not only of family and friends, but also of buildings, livestock, gardens, and orchards. The roots of economics draw us near to the dwelling place, the needs of maintaining a household, which, in the world the word originally came from, did not necessarily involve market exchange. Actually, the ancient household was probably more concerned with growing a garden, maintaining an orchard, and perhaps hunting and foraging in the wild forest. That was what responsible stewardship of the household was mostly about in the ancient world, dealing with the ecosystem, nature's economies. Now, "household management" seems to be above nature, beyond it, separate from it, and, as a result, economics and ecology study two entirely different things, economics the human world and ecology the natural world. Because of this artificial distinction between the human world and the natural world, nurturing nature is now a "cost" that must be "balanced" against environmental "values."

Despite this division of labor, there are suggestions, even in the modern world, that the object of study is still the same. Modern ecologists occasionally borrow the equations economists use to model an economy to model an ecosystem. It turns out that different species exchange energy and nutrients in the carbon, nitrogen, and water cycles much the same way that people exchange money, or at least the models are structurally similar.[3]

Nevertheless, this academic division of labor remains, framing the way in which we think, allowing us to deceive ourselves into believing that we must "balance" our

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[2] Eric Partridge, *Origins: A Short Etymological Dictionary of Modern English* (New York: Macmillan Publishing Co., 1966).

[3] Robert Ulanowicz, for example, uses mathematical protocols developed in economics to analyze ecosystem energy flow. Total system throughput (TST) is the equivalent of gross national product (GNP). See, *Growth and Development: Ecosystem Phenomenology* (New York: Springer-Verlag, 1986).

economy against the ecosystem--as if nature were an unlimited resource, and as if we, ourselves, were not natural beings, dependent on the ecosystem for life.

This framing of the world conceals the reality that we are not apart from nature, but totally subsumed by it. Every human economy, be it capitalist, communist, or corporatist, is a wholly owned subsidiary of nature's economy. There are no human economies that are not fully implicated in nature's economies. Pretending otherwise is what brought about the assorted environmental crises that we are facing today--overpopulation, species extinction, toxic pollution, and abrupt climate change. These tragedies are all happening because of the way we frame our relationship to nature.

Reframing economics: To put it another way, we might think of nature as the parent company, and every human economy, whether it is capitalist, communist, or corporatist, as a subsidiary of it. What we are really doing when we "balance" jobs, investment, and profit against the environment is steal from the parent company, moving its assets into the subsidiaries, our human economies. Trying to increase the balance of our bank statements, we bankrupt nature's economies. This can only go on so long. Eventually, the true balance between the economy and the ecosystem has to be paid in full. Either we nurture nature, fully paying for what is due to it, or we will forever be banished from the paradise our Earth has been for us the last 10,000 years.

Science has been hard on anthrocentrism, the philosophy that the universe is there for man. It first taught us that the sun does not go around the earth, but that our sun is but an ordinary star in a vast universe of stars. Then it taught us that humanity evolved not only from the ape, but also from a lowly worm in the mud. Now, ecologists are teaching us that no species is more important than another is. The health of all depends upon the health of each. When the polar bears lose their home, their ecological niche, ours is endangered as well, since it is a part of the vast web of cause and effect tying all of nature's economies. Life on earth is a community, all of us sharing the same household.

The Climate Crisis—from the prairie farm to the planet earth

The most pressing eco/nomic issue we are facing today is the climate crisis. All the other issues we are facing—health care, unemployment, toxic pollution, war, social injustice—are minor in comparison. If we don't stop climate change, and stop it soon, as we shall see, resolving these other issues will be academic. Our eco/nomy, nature's household that sustains all living things, will be shattered and most of us will be dead. This is not an exaggeration, alarmism, or extremism, as I shall attempt to explain. It really is that bad.

My personal experience with climate change: My family owns a ranch in southeastern Montana, where I live and work. Over the last decade, I have noticed that steel fence posts are being driven into the ground by the weight of the snow from spring blizzards, kind of like a straw settling into a milkshake. As the years go by, I increasingly find myself jacking the posts up out of the ground when I make the rounds checking fences in

the spring. When I was a child, the wire would break, but the ground would be frozen when the spring blizzards came and the steel posts would stay where they were. This is a small complaint to be sure, almost too insignificant to mention--if it were not a harbinger of much more.

On another part of our ranch, we have a draw filled with trees. Recently, we discovered that they are all aging, near death, and no new trees are replacing them. Alarmed, we invited a government scientist in to try and figure out what was wrong. He speculated that a shift in grazing patterns had changed everything. The buffalo used to concentrate their grazing, tearing up the ground with their hooves, perhaps giving tree seeds a chance to get started. To see if this explained what was happening, he had us fence in two test plots on the draw. One we grazed heavily, the other we didn't graze at all. However, grazing didn't change anything. No new trees were starting in either plot. After some reflection, the scientist told us that he believes that the reason the trees are not reproducing in our draw is a change in the hydrological cycle due to global warming.

As it was with the steel posts, the warmer winters are melting snow throughout the winter. Snow does not accumulate on the ground the way that it used to, piling up deep in the draws where the trees are. Without the heavy snow to water the tree sprouts and to delay the grass, the trees are finding it too hard to compete against the grass.

Other changes on our place suggest serious economic consequences for all of Montana. On our ranch, we have a flood irrigation system of about 60 acres. When I was a child, the spring melt usually filled the system of dikes with runoff from top to bottom. Some years, we might have had two or three times as much water as we needed to flood all the dikes. One of my most vivid memories of my childhood was standing on a muddy dike in the middle of this project, water all around me like a sea. I was dragging ten pounds of mud on each boot, walking up and down the dikes to open and close the watergates. Little more than three feet tall, I would have been in over my head on either side if I fell in. I remember thinking how cold the water would be if I slipped and fell.

Today, I don't have to worry about that because the water doesn't come anymore. For most of the last decade, I could walk the lands between the dikes and not even get my shoes wet. Perhaps our annual precipitation has declined, but not by that much. What has happened is that our long cold winters, where the snow accumulated until spring and then melted in a rush, have changed. Now, the snow melts away throughout the winter. By spring, the ground has thawed and the water soaks in before it has a chance to run off into our irrigation project.

This system, which worked really well throughout my childhood, is not irrigating our land anymore. This is a considerable economic loss to my family. The windrows made by the swather used to be too big for me to jump across. Now our yields are only a fraction of what they were.

The consequences: According to a recent government report, Montana will average 50, maybe 60, days a year with temperatures over 100 by the end of the century under a high

greenhouse gas emissions scenario.[4] On average, temperatures across Montana could increase more than 10 F.[5] This report might be conservative. According to a recent study by the Massachusetts Institute of Technology, called "Greenhouse Gamble," more realistic modeling showed that under both a "no policy" scenario, which is to say business as usual, and a scenario where nations started to take action in the next few years, the odds have shifted in favor of larger temperature increases than has been previously reported. By the end of the century, there is a 1 in 11 chance that the global average surface temperature would increase by more that 12.6 F. There is a ninety-percent chance that the increase will be between 6.3 and 13.3 degrees F.[6]

> "The take home message from the new greenhouse gamble wheels is that if we do little or nothing about lowering greenhouse gas emissions that the dangers are much greater than we thought three or four years ago," said Ronald G. Prinn, professor of atmospheric chemistry at MIT. "It is making the impetus for serious policy much more urgent than we previously thought."[7]

An increase of something like 10 F in Montana, which would cause the number of days over 100 F to increase dramatically, would radically decrease the productivity of my family's farm. My personal rule of thumb, which is probably conservative, is that for every day temperatures are over 100, our wheat yields fall one bushel per acre, two if there is a dry breeze. Using no-till continuous cropping, the spring wheat yields on our place now are between 20 and 30 bushels per acre. We can assume that half of those 50 days over 100 will be during the growing season. So, if these projections turn out to be true, and we lose 25 bushels per acre because of higher temperatures, we might not even be getting our seed back by the end of the century.

Several times, especially during the droughts of the late 80's, I have driven past our fields in the morning and decided that they looked lush and green, promising at least a decent harvest, and then returned late in the day, after the temperature went over 100, and been amazed at how much the crop had deteriorated. It was as if the ground had sucked the wheat back into it. This isn't just my observation; science supports it as well. Though there will be a fertilizing effect from increased carbon dioxide, this effect will be canceled out before mid century. Crop ecologists believe that for every 1.8 F rise in temperature above historical norms, grain production will drop 10 percent.[8] Even without drought, heat causes significant harm to crops, according to *Global Climate Change Impacts in the United States*:

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[4] *Global Climate Change Impacts in the United States*, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.), (Cambridge: Cambridge University Press, 2009), pp 90. http://www.globalchange.gov/usimpacts.

[5] *Global Climate Change Impacts in the United States*, pp. 29.

[6] Sokolov, A.P., P.H. Stone, C.E. Forest, R.G. Prinn, M.C. Sarofim, M. Webster, S. Paltsev, C.A. Schlosser, D. Kicklighter, S. Dutkiewicz, J. Reilly, C. Wang, B. Felzer, J. Melillo, H.D. Jacoby, "Probabilistic Forecast for 21st Century Climate Based on Uncertainties in Emissions (without Policy) and Climate Parameters," *Journal of Climate*, 22(19): 5175-5204, 2009, http://globalchange.mit.edu/resources/gamble/

[7] Andrew Freedman, "MIT Group Increases Global Warming Projections," *Washington Post* (February 23, 2009). http://voices.washingtonpost.com/capitalweathergang/2009/02/new_research_from_mit_scientis.html

[8] Lester R Brown, *World Grain Stocks Fall to 57 Days of Consumption*. Earth Policy Institute, (June. 2006) http://www.earth-policy.org/Indicators/Grain/2006.htm

> The grain-filling period (the time when the seed grows and matures) of wheat and other small grains shortens dramatically with rising temperatures. Analysis of crop responses suggests that even moderate increases in temperature will decrease yields of corn, wheat, sorghum, bean, rice, cotton, and peanut crops. Some crops are particularly sensitive to high nighttime temperatures, which have been rising even faster than daytime temperatures. Nighttime temperatures are expected to continue to rise in the future. These changes in temperature are especially critical to the reproductive phase of growth because warm nights increase the respiration rate and reduce the amount of carbon that is captured during the day by photosynthesis to be retained in the fruit or grain. Further, as temperatures continue to rise and drought periods increase, crops will be more frequently exposed to temperature thresholds at which pollination and grain-set processes begin to fail and quality of vegetable crops decreases. Grain, soybean, and canola crops have relatively low optimal temperatures, and thus will have reduced yields and will increasingly begin to experience failure as warming proceeds.[9]

A paper by Wolfram Schlenker and Michael J. Roberts finds that corn yields could fall by up to 80% under high emissions scenarios by the end of the century.[10] To put it simply, if temperatures rise as much as they might, we won't be able to grow enough food to feed the world.

What climate scientists agree on: James Hansen, the director of the NASA Goddard Institute for Space Studies and generally considered one of the world's leading authorities on climate change, recently explained the consequences of our failure to connect the economics of energy use with the eco/nomics of results:

> Planet Earth, creation, the world in which civilization developed, the world with climate patterns that we know and stable shorelines, is in imminent peril. The urgency of the situation crystallized only in the past few years. We now have clear evidence of the crisis, provided by increasingly detailed information about how Earth responded to perturbing forces during its history (very sensitively, with some lag caused by the inertia of massive oceans) and by the observations of changes that are beginning to occur around the globe in response to ongoing climate change. The startling conclusion is that continued exploitation of all fossil fuels on Earth threatens not only the other millions of species on the planet

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[9] *Global Climate Change Impacts in the United States*, pp. 72.

[10] Wolfram Schlenker and Michael J. Roberts. "Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change," *Proceedings of the National Academy of Sciences*, 106 (37), September 15 2009, pp.15594-15598.

> but also the survival of humanity itself—and the timetable is shorter than we thought.[11]

James Hansen is not a dissident, isolated from mainstream climate science, it should be emphasized, but a reflection of what the overwhelming majority of climate scientists believe, as Naomi Oreskes reported in *Science*. Because this is a crucial point, I will quote her argument in length:

> The scientific consensus is clearly expressed in the reports of the Intergovernmental Panel on Climate Change (IPCC). Created in 1988 by the World Meteorological Organization and the United Nations Environmental Programme, IPCC's purpose is to evaluate the state of climate science as a basis for informed policy action, primarily on the basis of peer-reviewed and published scientific literature. In its most recent assessment, IPCC states unequivocally that the consensus of scientific opinion is that Earth's climate is being affected by human activities: "Human activities ... are modifying the concentration of atmospheric constituents ... that absorb or scatter radiant energy. ... [M]ost of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations."
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> IPCC is not alone in its conclusions. In recent years, all major scientific bodies in the United States whose members' expertise bears directly on the matter have issued similar statements. For example, the National Academy of Sciences report, *Climate Change Science: An Analysis of Some Key Questions*, begins: "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise." The report explicitly asks whether the IPCC assessment is a fair summary of professional scientific thinking, and answers yes: "The IPCC's conclusion that most of the observed warming of the last 50 years is likely to have been due to the increase in greenhouse gas concentrations accurately reflects the current thinking of the scientific community on this issue."
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> Others agree. The American Meteorological Society, the American Geophysical Union, and the American Association for the Advancement of Science (AAAS) all have issued statements in recent years concluding that the evidence for human modification of climate is compelling. The drafting of such reports and statements involves many opportunities for comment, criticism, and revision, and it is not likely that they would diverge greatly from the opinions of the societies' members. Nevertheless, they might downplay legitimate dissenting opinions. That hypothesis was tested by analyzing 928 abstracts, published in refereed scientific journals between 1993 and 2003, and listed in the ISI database with the keywords "climate change."

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[11] James Hansen, *Storms of my Grandchildren: The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity* (New York: Bloomsbury USA, 2009), pp IX.

> The 928 papers were divided into six categories: explicit endorsement of the consensus position, evaluation of impacts, mitigation proposals, methods, paleoclimate analysis, and rejection of the consensus position. Of all the papers, 75% fell into the first three categories, either explicitly or implicitly accepting the consensus view; 25% dealt with methods or paleoclimate, taking no position on current anthropogenic climate change. Remarkably, none of the papers disagreed with the consensus position.
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> Admittedly, authors evaluating impacts, developing methods, or studying paleoclimatic change might believe that current climate change is natural. However, none of these papers argued that point. This analysis shows that scientists publishing in the peer-reviewed literature agree with IPCC, the National Academy of Sciences, and the public statements of their professional societies. Politicians, economists, journalists, and others may have the impression of confusion, disagreement, or discord among climate scientists, but that impression is incorrect.
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> The scientific consensus might, of course, be wrong. If the history of science teaches anything, it is humility, and no one can be faulted for failing to act on what is not known. But our grandchildren will surely blame us if they find that we understood the reality of anthropogenic climate change and failed to do anything about it. Many details about climate interactions are not well understood, and there are ample grounds for continued research to provide a better basis for understanding climate dynamics. The question of what to do about climate change is also still open. But there is a scientific consensus on the reality of anthropogenic climate change. Climate scientists have repeatedly tried to make this clear. It is time for the rest of us to listen.[12]

The problem of denial: Nevertheless, for all the confidence scientists have in their research into anthropogenic climate change, climate change deniers, funded by Exxon, led by *Fox News*, the *Wall Street Journal* editorial page, Rush Limbaugh, as well as a handful of climate scientists like Fred Singer, Patrick Michaels, and Richard Lindzen, have succeed in generating significant doubt among Americans about climate change. In a 15-nation poll that Pew Global conducted in 2006, just 19% of Americans say they worry a lot about global warming, the lowest in the 15 countries surveyed. In contrast, in Japan 66%, India 65%, Spain 51%, and France 46% say they personally worry a great deal about global warming.[13] A 2009 poll by the Pew Research Center found that "[w]hile 84% of scientists say the earth is getting warmer because of human activity such

[12] Naomi Oreskes, "BEYOND THE IVORY TOWER: The Scientific Consensus on Climate Change," *Science*, (December 3, 2004), p. 1686.

[13] Pew Research Center, "No Global Warming Alarm in the U.S., China," *15-Nation Pew Global Attitudes Survey*, (June 13, 2006). http://pewglobal.org/reports/pdf/252.pdf

as burning fossil fuels, just 49% of the public agrees."[14] Obviously, the American public is being led astray.

Failure to respond to the reality of the climate crisis will have serious consequences, much greater than people seem to realize. According to James Hansen, "Humanity treads today on a slippery slope. As we continue to pump greenhouse gases into the air, we move onto a steeper, even more slippery incline. We seem oblivious to the danger—unaware how close we may be to a situation in which a catastrophic slip becomes practically unavoidable, a slip where we suddenly lose all control and are pulled into a torrential stream that hurls us over a precipice to our demise."[15] He adds later on in his book, ". . . I've come to conclude that if we burn all reserves of oil, gas, and coal, there is a substantial chance we will initiate the run-away greenhouse. If we burn the tar sands and tar shale, I believe the Venus syndrome is a dead certainty."[16]

The beautiful morning star, Venus has a hellish hot atmosphere and surface because of a runaway greenhouse effect. Scientists believe that at one stage in its history, when the sun was cooler than it is now, Venus had water on its surface, and was not that dissimilar from earth. It might even have even been cool enough to have evolved life. However, as the sun warmed, the water on its surface evaporated, carbon dioxide was released from the planet's crust, and the combined greenhouse effect of both water vapor and carbon dioxide amplified each other, dramatically increasing temperature. Now, the surface of Venus is now hot enough to melt lead. If we initiated the Venus syndrome on earth, letting positive feedback loops spiral out of control, our planet might become almost as uninhabitable. Our atmosphere would change dramatically, and eventually most, if not all, life on earth would die.

But earth is not like Venus, at least not yet: According to James Lovelock,[17] Lynn Margulis,[18] and increasing numbers of other scientists,[19] the earth system as a whole, which Lovelock famously dubbed "Gaia," from the Greek word for mother, behaves as a single, self-regulating system--a gigantic single life form. In the same way that our bodies maintain a constant temperature, the earth does the same thing. It self-regulates to maintain homeostasis, a steady climate supportive of life. As a result of complex interactions between the atmosphere, the oceans, the continents, and many different living organisms, various Earth systems function like a thermostat. When things get too cool to be comfortable for life, they release greenhouse gases to warm things up. When it is too warm, they take greenhouse gases out of the air and sequester them in the soil or deep in the ocean.[20] Scientists call this self-regulating process a feedback loop. A negative feedback loop is like thermostat. It dampens a tendency and maintains

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[14] Pew Research Center, "Public Praises Science; Scientists Fault Public, Media," (July 9, 2009). http://people-press.org/report/528

[15] Hansen, *Storms of My Grandchildren*, pp. 70.

[16] Hansen, *Storms of My Grandchildren*, pp. 236.

[17] James Lovelock, *The Ages of Gaia* (New York: WW Norton, 1988).

[18] Lynn Margulis and D. Sagan, *Acquiring Genomes: A Theory of the Origins of Species* (New York: Basic Books, 2002).

[19] Stephen Schneider and James R. Miller, Eileen Crist, and Penelope Boston, eds., *Scientists Debate Gaia: The Next Century* (Cambridge: MIT Press, 2004).

[20] James Lovelock and Lynn Margulis, "Atmospheric homeostasis by and for the biosphere: The Gaia hypothesis," *Tellus*, (26: 1974), pp. 2-10. See also, James Lovelock, *The Ages of Gaia* (New York: W.W. Norton, 1988).

homeostasis, a constant temperature. A positive feedback loop, on the other hand, amplifies a tendency and undermines homeostasis.

Despite the romanticism of thinking of the earth as a single living being, there is nothing romantic or mystical about Lovelock's theory. Homeostasis is maintained by evolutionary selection, though with a twist supplied by Lynn Margulis to evolutionary theory.[21] To illustrate how Earth systems might function to achieve homeostasis, Lovelock created a simple computer model, Daisyworld, to show how evolutionary selection between two different populations of daisies, one white and the other black, would self-regulate. The two populations of daisies maintain homeostasis simply by mere survival of the fittest, selecting for the best fit to available niches. The white daisies, which would reflect more of the sun's heat away from Daisyworld, are selected when the sun becomes too warm and black daisies, which would absorb the sun's heat and keep it in Daisyworld, are selected when the sun is too cool. Through survival of the fittest, Daisyworld maintains temperature homeostasis despite varying heat from the sun. Without any sort of teleology, purpose, or intent, homeostasis emerges in Daisyworld from ordinary evolution.

Other scientists have created much more complex models, which more closely resembled earth's actual complexity. From these models, they have found that the more complex the system, the more likely the possibilities for homeostasis. The more species there were, the more likely some would adapt to changing circumstances, successfully filling available niches, and create a climate that would maintain life.[22]

Scientific theories are judged by the hypotheses they generate and that can be experimentally tested and either confirmed or not. Evolution and anthropogenic global warming are very successful scientific theories that have led to a lot of experimentation that have repeatedly confirmed them. Creationism, or intelligent design, not so much--actually not at all.[23] Like evolution and anthropogenic global warming, the Gaia hypothesis has been quite fruitful. One of the earliest confirmations that life forms on earth regulated climate came when Lovelock and his colleagues discovered that dimethyl sulfide, a chemical produced by ocean algae was involved in the formation of clouds and with climate. For this discovery, Lovelock and his colleagues were awarded the Norbert Gerbier Prize in 1988.[24]

The Gaia hypothesis has predicted that Mars would be currently lifeless, which is so far confirmed, that oxygen in Earth's atmosphere has not varied by more than 5% from 21% for the past 200 million years, which is confirmed up to 1 million years ago, and that boreal and tropical forest are part of global climate regulation, which is generally accepted, and many other things.[25] Controversial at first, Gaia science is making the

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[21] Lynn Margulis, "Gaia by Any Other Name," *Scientists Debate Gaia: The Next Century*, Schneider, Miller, Crist, and Boston eds., (Cambridge: The MIT Press, 2004), pp. 7-12.
[22] Arthur C. Petersen, "Models and Geophysical Hypotheses," *Scientists Debate Gaia: The Next Century*, Schneider, Miller, Crist, and Boston eds., (Cambridge: The MIT Press, 2004), pp. 37-44.
[23] Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962).
[24] James Lovelock, *The Revenge of Gaia: Earth's Climate Crisis and the Fate of Humanity* (New York: Basic Books, 2006), pp. 23.
[25] James Lovelock, *The Vanishing Face of Gaia: A Final Warning* (New York: Basic Books, 2009), Pp. 177-178.

transition from revolutionary science to normal science, as Thomas Kuhn, a philosopher of science, would describe it.[26] Though Lovelock prefers to call his discovery Gaia, the ancient Greek name for the earth mother, most scientists prefer "Earth systems science." They like "Earth systems science" better because it somewhat conceals Lovelock and Margulis's assertion that the earth, as a whole, is a single living being, while Gaia science or geophysiology do not. Lovelock prefers to call his discovery 'Gaia' because it reframes our presence on earth. He believes that we will live differently upon the earth if we treat it as a living being, capable of death, than if we treat it merely as a resource, a pile of rocks over which living species roam.[27]

The evidence for Earth being self-regulating, like in Daisyworld, is strong because there was only one time, about 2 billion years ago, when the sun was releasing just the right amount of energy for life on Earth, the Goldilocks moment. Before that the sun was too cold, and after that too warm. Nevertheless, Earth was able to sustain life before that and after it, changing the composition of the atmosphere as the sun changed to maintain a functional temperature for life. Curiously, even though the sun has been steadily warming ever since its Goldilocks moment, Earth in its recent past has increasingly, at least until humanity came along, been slipping into ice ages. Over the past 65 million years, the sun's brightness has increased about 0.4%, which should have resulted in a temperature *increase* of 1 C from its high 50 million years ago. Instead, temperatures have *decreased* 13 C.[28] Clearly, changes in the sun's temperature cannot explain the broad sweep of climate change. The response of a living Earth has to included as well.

Lovelock believes that the recent ice ages are an attempt by Gaia to deal with a steadily warming sun. Over the last couple of million years, the sun has been getting too hot for comfort, and so Gaia has been taking carbon dioxide out of the air, sequestering it deep in the ocean and other places, making it possible for a larger part of the planet to be covered with snow, which reflects more heat back into space. The flickering between recent ice ages, indicate that Gaia is struggling to maintain homeostasis with a warming sun. So when humanity starts adding vast amounts of carbon dioxide into the air, turning up the biosphere's heat, we are pushing Gaia to the limit of what it can self-regulate. According to Lovelock:

> By adding greenhouse gases to the air and by replacing natural ecosystems, like forests, with farmland we are hitting the Earth with a 'double whammy'. We are interfering with temperature regulation by turning up the heat and then simultaneously removing the natural systems that help to regulate it. What we are now doing is uncannily like the series of foolish actions that led to the Chernobyl nuclear reactor accident. There the engineers turned up the heat

[26] Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).
[27] James Lovelock, *The Revenge of Gaia: Earth's Climate Crisis and the Fate of Humanity* (New York: Basic Books, 2006), pp. 187.
[28] Temperature changes from a graph (Figure 18) made by James Hansen, *Storms of my Grandchildren*, pp. 153.

> after they had disabled the safety systems, and it should have been no surprise that the reactor ran into rapid overheating and caught fire.[29]

In Gaia science, life is not a passive passenger on our planet, an accident of just the right distance from the sun, and just the right chemical composition of the earth's oceans, land mass, and atmosphere, but an active participant in creating the conditions most favorable to its continued existence. However, lest anyone think that Gaia will let us off the hook for polluting, it should be emphasized that homeostasis is an emergent property of the earth system's evolution, and that it has achieved homeostasis in a variety of different states, from a very cold Earth to a very warm one. We must not presume that we humans are the purpose of Gaia, the fruit of its existence, as some might prefer to believe. James Lovelock once remarked, "Gaia is no doting nanny but has all the sympathy for humanity of a microprocessor in the warhead of an intercontinental nuclear missile."[30] Gaia will attempt to stabilize temperatures, keeping the planet hospitable for life, but there is no guarantee that, pushed to its limits, it won't go into a feverish state and eliminate humanity as indifferently as a mammal would a bacteria infection.

Abrupt Climate Change: Both Hansen and Lovelock, and actually, from what I gather, increasingly most other climate scientists as well, agree that the Intergovernmental Panel on Climate Change (IPCC) has understated the danger the planet faces, especially on the possibility of abrupt climate change. Although the IPCC report did warn of the possibility of abrupt climate change, my sense is that the mainstream media and blogs have interpreted the IPCC's 2007 report to mean that a warming world will mean mostly slow transitions--a slowly rising ocean, slowly shrinking icecaps and glaciers, and slowly increasing risk of extreme weather events like droughts and severe storms.

But actually, a warming climate is more like walking across an ice-covered lake that is melting. Though changes seem to be gradual, and it seems like the ice will continue to hold, things can change abruptly, dramatically, and fatally. While you can reasonably project that the ice is slowly thinning as you walk toward open water, you can also reasonably expect the ice will, at some point, fail catastrophically, and you will fall through. Much as you might like to, you can't project exactly when the ice will fail catastrophically. This uncertainty about when abrupt change will happen certainly doesn't mean that there is no cause for worry as you walk toward open water. Even though chances are your next step won't be the one where the ice fails, at some point, you are going to take a step that does it.

It is likewise with global warming. Changes seem to be happening slowly, barely perceptibly, but assuming that small changes do not increase the risk of catastrophe is a dangerous delusion. At some point, abrupt change will happen, dramatically changing the planet we live on. Climate change modeling, though good at mapping out the relationship between increased carbon dioxide and rising temperature, is not so good at

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[29] James Lovelock, *The Vanishing Face of Gaia: A Final Warning* (New York: Basic Books, 2009), pp. 45.

[30] Lovelock quoted in Dorion Sagan and Jessica Hope Whiteside's, "Gradient Reduction Theory: Thermodynamics and the Purpose of Life," *Scientists Debate Gaia: The Next Century*, Schneider, Miller, Crist, and Boston eds., (Cambridge, The MIT Press, 2004), pp. 179.)

telling you when, exactly, too much is too much, and the climate will change abruptly. Although the models do show the relationship between greenhouse gases and temperature, they do not tell us everything we need to know about climate change.

According to recent reports in paleoclimatology, the study of prehistoric climate, changes in climate do not necessarily happen slowly, as has been long assumed, taking place bit by insignificant bit over many thousands of years, but sometimes dramatically, within a decade, sometimes within a single year. Traditionally, paleoclimatologists had assumed that climate changed slowly, like a mountain weathering away, but that all changed when scientists started examining the ice core record from Greenland in the 1970's, as well as lake sediments in Switzerland and pollen profiles in Denmark and elsewhere in Scandinavia. The Greenland ice cores were particularly valuable because snow had accumulated there continuously for several hundred thousand years, leaving a well-demarcated year-by-year record of the weather. Because the ice crystals had permanently trapped a bit of the ancient atmosphere, scientists were able to analyze the chemical composition of the atmosphere the year the snow fell, as well as get a good idea of global temperatures from oxygen isotopes. What they found astonished them.

According to the analysis of Willi Dansgaard and Chet Langway, Earth's climate suddenly began pulling out of the ice age about 14,700 years ago. Then, after only about 2,000 years, it plunged just as suddenly back toward glacial conditions for a thousand years. And then, abruptly, climate conditions recovered and began a more gradual warming toward the relative stability of the past 10,000 years.[31] It appeared that Earth's climate was flickering abruptly back and forth between two sharply different but stable climates, glacial and interglacial, kind of like the way an electron will abruptly shift into a higher or lower orbit around a nucleus without going between. Wallace S. Broecker would later argue that the abrupt changes were caused by a shift in an ocean conveyor system that distributed heat over Earth's surface. When the conveyor system stops, an ice age starts, and when it flows, an interglacial age starts.[32] Because the ocean conveyor system moves large amounts of water, and can redistribute huge amounts of heat from the tropics to the arctic, abrupt changes in the ocean conveyor system could explain abrupt changes in climate.

Chaos, nonlinear change, and unpredictability: Broecker's analysis poses a challenge to climate models. Climate science's attempts to predict the future are undermined by evidence that climate change has happened abruptly, in a chaotic or nonlinear fashion. If Earth's climate can move from an interglacial age to an ice age to in a matter of years, and huge glaciers can suddenly begin covering most of North America and Europe, where temperate trees once grew, an anthropogenic forcing, like the greenhouse gases our civilization of productivity is disturbing Earth's atmosphere with, could trigger a similar, equally abrupt, climate change. As Broecker wrote, "We play Russian roulette with

[31] John D. Cox, *Climate Crash: Abrupt Climate Change and What It Means For Our Future* (Washington, D.C.: Joseph Henry Press, 2005), pp. 61.
[32] Wallace S. Broecker, *Abrupt Climate Change: Inevitable Surprises* (Washington: National Academy Press, 2002).

climate, hoping that the future will hold no unpleasant surprises. No one knows what lies in the active chamber of the gun, but I am less optimistic about its contents than many."[33]

If abrupt climate change is a possibility, as paleoclimatology is strongly indicating that it is, then climate modeling is going to have a hard time predicting it. According to an international group of scientists, Claus Hammer, Paul Mayewski, David Peel, and Ninze Stuiver, in a special issue of the *Journal of Geophysical Research*, we can expect unpredictable, abrupt, and dramatic change in a warming world:

> From the central Greenland ice cores, we now know that the Earth has experienced large, rapid, regional to global climate oscillations through most of the last 110,000 years on a scale that human agricultural activities have not yet faced. . . . The ice-core records tell a clear story: humans have come of age agriculturally and industrially in the most stable climate regime of the last 110,000 years. However, even this relatively stable period is marked by change. Change—large, rapid, and global—is more characteristic of the Earth's climate than is stasis. Until we understand the operative mechanisms, it will not be possible to understand current change or predict future change.[34]

The variations in sun spot cycle, changes in the yearly wobbles of the earth, and the changes in Earth's orbit—all the stuff of classical physics--are as gradual as they are predictable. They can easily be simulated in climate models. Less predictable are the changes that come from the chaotic features of complex systems, which are present in various ways in Earth's climate. These chaotic features are often analyzed with words that mathematicians have developed to study catastrophic change in dynamic systems—words like, *nonlinear, feedback, turbulence, critical threshold,* and *multiple equilibria.* These terms are used to study stock market crashes, the population dynamics of species extinctions, the dynamics between tectonic plates that cause earthquakes, collapses in deterrence that might lead to nuclear war, and, yes, climatic systems that change abruptly.[35]

Chaos is present everywhere in the world around us. One example of it is a dripping faucet. Dripping at one rate, the drops are all the same size and precisely spaced. Initially, everything is linear, predictable. Increase the flow just a bit, however, and suddenly both the size of the drops and their spacing becomes random--large drops, small drops, short intervals, long intervals. Another is the flow of smoke rising up from a cigarette in an ashtray. In a room without air currents, the smoke will typically rise in a smooth flow straight up, and then, for the slightest cause, suddenly become dispersed, disorganized, and turbulent. Both of there are examples of a nonlinear threshold. Change unfolds in a linear manner up to a point, entirely predictably, then suddenly the dynamic changes. A small change tips the unfolding pattern, a threshold is crossed, small

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[33] Broecker quoted in, John D. Cox, *Climate Crash: Abrupt Climate Change and What it Means for Our Future* (Washington: Joseph Henry Press, 2005), pp. 110.
[34] *Climate Crash*, pp 127.
[35] James Gleick, *Chaos: Making a New Science* (New York: Penguin Books, 1987).

triggers are amplified, and feedbacks proliferate until a new equilibrium is reached. The nonlinear, or chaotic, properties of air and ocean currents have been known to science since the 1960's, when Edward Lorenz, using a primitive computer model of the atmosphere, discovered that very small changes in initial conditions led to major changes in the final results.[36] So small were the triggers needed to cause huge differences, it has famously been observed, it was as if the turbulence from a butterfly's wings in Mexico might cause a tornado in Kansas.

It may well be that the abrupt flickering between ice ages and interglacial ages in Earth's recent past were caused by the nonlinear properties of ocean currents.[37] If so, predicting how various Earth systems will respond to slowly increasing anthropogenic greenhouse gases may be inherently impossible, as participants at a 2001 workshop at Duke University on nonlinearity in the environment concluded:

> "Abrupt climate change is believed to be the result of instabilities, threshold crossings and other types of nonlinear behavior of the global climate system, but neither the physical mechanisms involved nor the nature of the nonlinearities themselves are well understood," wrote Jose A. Rial, of the University of North Carolina's Chapel Hill Wave Propagation Laboratory, and colleagues in the journal *Climate Change* in 2004. Citing examples of nonlinearities, the group was led "to and inevitable conclusion: since the climate system was complex, occasionally chaotic, dominated by abrupt changes and driven by competing feedbacks with largely unknown thresholds, climate prediction is difficult, if not impractible."[38]

This does not mean that we can ignore the temperature changes general circulation climate models are projecting. Very much the opposite. What it means is that we are recklessly pulling triggers for abrupt change in a climate system that has been relatively stable for the last 10,000 years, the period in which civilization has developed. We are, in effect, stomping on the tail of a very large, very foul-tempered, fire-breathing dragon that has been peacefully sleeping for a long time. We pretend he will never wake. But, defying his certain temper, we risk much more than what we incautiously presume from his many centuries of slumber.

Climate models are projecting the future based on what we know about the climate. They take all the information that scientists have assembled about the relationship between greenhouse gases and their relation to climate from paleoclimatology, oceanography, astronomy, chemistry, and physics, and whatever else scientists believe relevant, and make them into as accurate model of the real world as science can make. These computer models of the earth's climate are very large and complex. It typically takes a month or more for our most powerful supercomputers to run these simulations. Despite

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[36] John D. Cox, *Climate Crash: Abrupt Climate Change and What it Means for Our Future* (Washington: Joseph Henry Press, 2005), pp. 147.
[37] *Climate Crash*, pp. 148.
[38] Rial quoted in *Climate Crash, pp. 149.*

the risk of abrupt change, the projections for climate change that emerge from these models are doing pretty well--so far.

Gavin Schmidt, who develops climate models at the NASA Goddard Institute for Space Studies, recently reviewed climate model projections of the recent past against observed temperatures at RealClimate.org, and found that the models accurately predicted what has so far happened. Compared to the latest data, the models projecting the ocean heat content changes were right on the money. The oldest of the General Circulation Models, developed by James Hansen et all in 1988, is running about 10% higher than expected for Scenario B, but as expected for Scenario C. Schmidt concludes, ". . . despite the fact these are relatively crude metrics against which to judge the models, and there is a substantial degree of unforced variability, the matches to observations are still pretty good, and we are getting to the point where a better winnowing of models dependent on their skill may soon be possible."[39]

Scientists have put a lot of effort into developing climate models, and so far, at least for the recent past, they have accurately projected what has happened. But the projections will probably continue to be accurate only as long as climate forcings remain linear. However, once positive feedback loops start amplifying global warming, and once the threshold into nonlinearity is crossed, anything could happen. We might even fall into another ice age, though most scientists believe this unlikely, given the increased amounts of anthropogenic greenhouse gasses in the atmosphere and the dominance of positive feedback loops over negative feedback loops. More likely is an abrupt transition to a much hotter planet, one that could radically challenge the food and water supply for billions of people. David Archer, a professor of geophysical sciences at the University of Chicago, explains it this way:

> The IPCC (Intergovernmental Panel on Climate Change) forecast for climate change in the coming century is for a generally smooth increase in temperature, changes in rainfall, sea level, and so forth. However, actual climate changes in the past have tended to be abrupt. The forecast resembles a simple climate response to our smoothly dialing up the (carbon dioxide), while the past looks like a series of flip-flops from one climate state to another within a few years. The forecast is based on climate models, which are for the most part unable to simulate the past climate record very well either. In this light, the forecast is a best-case scenario, because it avoids unexpected surprises.[40]

The reason why the IPCC's forecast for the next century is smooth, without the abrupt changes that we know happened in the past, is because climate models are projections, not predictions. This difference, though subtle, is important. Climate models are thought experiments, where parameters are varied based on what scientists know about the

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[39]Gavin Schmidt, "Updates to model-data comparisons," *RealClimate.org* (December 29, 2009), http://www.realclimate.org/index.php/archives/2009/12/updates-to-model-data-comparisons/

[40] David Archer, *The Long Thaw: How Humans are Changing the next 100,000 years of Earth's Climate* (Princeton: Princeton University Press, 2009), pp. 95.

climate. They explain the relationship between carbon dioxide and temperature well, as well as changes in Earth's orbit, wobbles of the Earth's axis, and changes in the Sun's radiation, but they do not handle nonlinear changes well because such changes are unavoidably, and by definition, chaotic, which is to say, too complex, random, and subtle to be fully known. As a result, the triggers for abrupt climate change may be too small to be anticipated by climate models. This is not a fault or failing of modeling science. It is just the way things are. No matter how much modeling science learns about climate thresholds, it probably will never be predict in advance where they lie, exactly at what point we will face abrupt climate change. Scientists will only be able to say that, based on the record of paleoclimatology as well as what they generally know about the climate system, they know such possibilities exist, hazarding guesses what might trigger them. Surprises, as many scientists have warned, should be expected. Nonlinearity exists throughout nature's economies, and if we are to survive, we must tread very carefully, avoiding the thresholds where, forced out of equilibrium, our climate could abruptly and irreversibly change.

Pushing our luck: There are many potential tipping points we risk pushing past. As anthropogenic greenhouse gasses are released, positive feedback loops could increasingly overwhelm negative feedback loops. One of them is the loss of the Arctic Ocean's snow cover. Snow cover is the most reflective surface on Earth, returning around 80% of the sun's energy to space. Open ocean, on the other hand, is one of Earth's most absorptive surfaces, retaining about 80% of the sun's heat. As a result, as the Arctic ice cover melts away, Earth will retain more and more heat. Loss of the Arctic ice cover will have a huge impact. When all the floating ice in the Arctic has melted, the extra heat retained by Earth will be the equivalent of nearly 70% of all the carbon dioxide pollution we have already released.[41] This is a huge amount, with serious consequences, as James Hansen observes:

> The area of Arctic sea ice had been declining faster than models predicted. The end-of-summer sea ice area was 40 percent less in 2007 than in the late 1970s when accurate satellite measurements began. Continued growth of atmospheric carbon dioxide surely will result in an ice-free end-of-summer Arctic within several decades, with detrimental effects on wildlife and indigenous people. . . . The fate of summer sea ice is important. Loss of the ice would affect the stability of the Greenland ice sheet, the stability of methane hydrates in the ocean sediments and tundra, and species viability.[42]

The more the ice sheet goes, the more the planet will warm, which will set off other positive feedback loops. One of them is the release of carbon dioxide and methane from thawing permafrost soils in Alaska and across Siberia. Since they have not thawed for hundreds of thousands of years, permafrost soils have accumulated huge amounts of organic carbon. Across Alaska and Siberia, deposits of nearly pure organic matter called peats are sequestered in the tundra. (Coal came from ancient peats that were buried and

[41] James Lovelock, *The Vanishing Face of Gaia*, pp. 44.
[42] Hansen, *Storms of my Grandchildren*, pp. 165-166.

cooked underground for long times.) As temperatures rise and the peats thaw, organic decomposition sets in, and the peats give off carbon dioxide and methane. There is about 2000 gigatons of carbon available in the Arctic tundra, 1000 gigatons of which are likely to be released in coming centuries. This compares with 5000 gigatons of coal available for mining in the world. Arctic tundra feedbacks from anthropogenic carbon releases could increase warming by 15-80%.[43]

Across the tundra, as warming progresses, the permafrost will also thaw. As it does, the ground will subside, forming sinkholes where water accumulates. The sinkholes will grow into ponds, and the ponds into lakes. The increasingly large bodies of water across the tundra means that, instead of aerobic microbes decomposing the tundra's large amount of accumulated organic matter, anaerobic microbes will be doing it, producing methane, instead of carbon dioxide. Katey Walter Anthony, a research scientist at the University of Alaska Fairbanks Water and Environmental Research Center, was surprised at how much methane accumulates under the ice of these lakes.

> Winter comes early, and one October morning when the black ice was barely thick enough to support my weight I walked out onto the shiny surface and exclaimed, "Aha!" It was as if I were looking at the night sky. Brilliant clusters of white bubbles were trapped in the thin black ice, scattered across the surface, in effect showing me a map of the bubbling point sources, or seeps, in the lakebed below. I stabbed an iron spear into one big white pocket and a wind rushed upward. I struck a match, which ignited a flame that shot up five meters high, knocking me backward, burning my face, and singeing my eyebrows. Methane![44]

Anthony says that enough methane could be released these lakes to significantly change the climate.

> Evidence from polar ice-core records and radiocarbon dating of ancient drained lake basins has revealed that 10,000 to 11,000 years ago thermokarst lakes contributed substantially to abrupt climate warming—up to 87 percent of the Northern Hemisphere methane that helped end the Ice Age. This outpouring tells us that under the right conditions, permafrost thaw and methane release can pick up speed, creating a positive feedback loop: Pleistocene-age carbon is released as methane, contributing to atmospheric warming, which triggers more thawing and more methane release. Now man-made warming threatens to once again trigger large feedbacks.[45]

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[43] David Archer, *The Long Thaw: How Humans are Changing the next 100,000 years of Earth's Climate* (Princeton: Princeton University Press, 2009), pp. 130.
[44] Katey Walter Anthony, "Methane: A Menace Surfaces," *Scientific American* (December, 2009), pp. 72.
[45] Katey Walter Anthony, "Methane: A Menace Surfaces," *Scientific American* (December, 2009), pp. 73.

The Amazon rainforest: As temperatures rise, another positive feedback loop that will kick in is the change of the world's forests, particularly the rain forests, from carbon sinks into major sources of carbon dioxide. Although carbon dioxide does have a fertilizing effect on most plants, at least below certain temperatures, increases in carbon dioxide, quite apart from the harmful effects of high temperatures, could have a very destructive effect on rainforests. The rainforest of the Amazon is easily one of the most amazing ecosystems on Earth. It turns out that the plants of the Amazon rainforest create most of their own rain. It is recycled repeatedly through transpiration from the plants. However, increasing levels of carbon dioxide in the atmosphere are going to disrupt these cycles, as Tim Flannery describes:

> Transpiration is vital to rainfall in the Amazonian rain forest, and it turns out that carbon dioxide does odd things to plant transpiration. Plants, of course, generally don't wish to lose their water vapor, as they have gone to some trouble to convey it from their roots to their leaves (stomata). Their main purpose in doing this is to gain carbon dioxide from the atmosphere, and they will keep their stomata open only as long as required. Thus, as carbon dioxide levels increase, the plants of the Amazonian rain forest will keep their stomata closed for longer, and transpiration will be reduced. And with less transpiration, there will be less rain.[46]

According to a climate model developed by Richard Betts and Peter Cox at the Hadley Center in England, called TRIFFID, by 2100, levels of carbon dioxide will be high enough that rainfall in the rainforest will decline by 20% because of closed stomata. In addition, a shift in weather patterns will also decrease rainfall. Because of all these changes, by 2100 rainfall in the Amazonian basin will fall from 0.2 inch per day to 0.08 inch per day. In the northeastern part of the basin, it will fall to almost nothing.[47] Temperatures will rise by 18 F, rainfall will drop by 64%, the amount of carbon stored in vegetation will fall by 78%, and the amount of carbon stored in the soil will fall by 72%.[48] As a result, the wonderfully dense forest, which supplies a home to so many different species, will be replaced by a grassy savannah, interrupted by only an occasional tree or shrub. Less dramatic, but more widespread, changes can be expected in forests throughout the world.

Possible failure of homeostasis: According to James Lovelock, the ocean's ecosystems will face a similar collapse as temperatures rise. Ocean algae, it turns out, is quite sensitive to temperature increases, dying off when temperatures get to high for it. According to an article written by Jeffrey Polovina published in *Geophysical Research Letters* in 2008, satellite observations of the ocean show that it is already happening.

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[46] Tim Flannery, *The Weather Makers: How Man is Changing the Climate and What it Means for Life on Earth* (New York: Atlantic Monthly Press, 2005), pp 197.

[47] R.A. Betts et al., "The Role of Ecosystem-Atmospheric Interactions in Simulated Amazonian Precipitation Decrease and Forest Dieback under Global Climate Warming," *Theoretical Applied Climatology,* 78 (2004), pp. 157-75.

[48] P.M. Cox et al., "Amazonian forest Dieback under Climate-Carbon Cycle Projections for the Twenty-first Century," *Theoretical Applied Climatology,* 78 (2004), pp. 137-56.

Areas barren of algae growth has increased by 15% in the last 9 years. According to Lovelock, this is ominous because algae growth is a major mechanism for pumping carbon dioxide out of the atmosphere and sequestering it on the ocean floor.[49] Under business as usual, algae could suffer a population crash in the not so distant future.

In 1994, Lovelock and Lee Kump made a geophysical model of the impact of global warming on ocean algae land plants. In Lovelock's model, as both carbon dioxide levels and temperatures increased, plant and algae growth acted to maintain stable temperatures, taking carbon dioxide out of the atmosphere in the same proportion they do in the real world. With increased anthropogenic carbon dioxide, temperature remained stable at first, only slowly increasing because algae and plants were giving negative feedback. However, as carbon dioxide increased to 400 ppm--an amount our atmosphere, currently at 387 ppm, is perilously approaching--the system showed signs of instability. Temperatures fluctuated more, rising and falling in waves that grew more extreme, as the plants and algae struggled to maintain homeostasis. Then abruptly, somewhere between 400 ppm and 500 ppm, a small increase was too much, and the algae and plant populations collapsed, causing a sudden nine-degree C increase in temperature. After that, Earth's temperature stabilized at the abruptly higher temperature.

Lovelock tried removing all of the added carbon dioxide from the model after it stabilized in the hot state, modeling what humanity might attempt to do with geo-engineering. Even when he reduced it to 280 ppm, the model stayed in its hot state. The plants and algae were unable to reestablish previous homeostasis. Lovelock concludes that Earth might have three different stable climate systems--ice age, our current interglacial, and the hot state his model ended up in.[50] The warning from Lovelock's model is clear: Once we make the transition to a hot state, we will not be able to go back. We will be stuck in the world we created. (As an aside, Lovelock wants us to note that just before the model went nonlinear and moved into the hot state, it went through a cool phase where temperatures fell. So, we should not be reassured by apparent improvements temperature when the underlying basis for maintaining homeostasis is being weakened.)

The methane hydrate gun: Methane hydrate deposits on the ocean floor and in the Arctic tundra are an even more troubling possibility for initiating a positive feedback loop that would greatly amplify the effect of anthropogenic greenhouse gasses. At least 20 times more powerful as a greenhouse gas than carbon dioxide, methane is a greenhouse gas that is generated when organic material undergoes anaerobic decay. Methane hydrates are created when organic carbon, mostly from plankton, falls to the bottom of the ocean. Laying there for millions of years, it is covered by hundreds of feet of mud, and it slowly ferments, producing methane. The methane is trapped by accumulating mud, the cold temperature of the ocean floor, and the pressure of the ocean above it. Even though it has been accumulating for million of years, methane hydrate is precariously maintained on the ocean floor. It would float to the surface, like ice, if it were not buried in mud. Landsides, earthquakes, and warming oceans can all release it. Of most concern to us, methane hydrate melts if it gets too warm, releasing the methane from its icy structure.

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[49] Lovelock, *The Vanishing Face of Gaia*, pp. 44.
[50] Lovelock, *The vanishing Face of Gaia*, pp. 52.

Once freed, it will bubble up to the surface of the ocean and mix with atmosphere, where it will have a greenhouse gas effect 20 to 30 times greater than carbon dioxide. After about a decade in the atmosphere, though, it will mostly degrade to carbon dioxide.

There is, unfortunately, an awful lot of methane hydrate on the ocean floor, thousands of gigatons of it. There is as much carbon in ocean floor hydrates as in all the rest of traditional fossil fuel deposits. These hydrate deposits have enormous potential to amplify global warming, as David Archer explains:

> If just 10% of the methane in the hydrates were to reach the atmosphere within a few years, it would be the equivalent of increasing the carbon dioxide concentration of the atmosphere by a factor of 10, an unimaginable climate shock. The methane hydrate reservoir has the potential to warm Earth's climate to Eocene hothouse conditions, within just a few years. The potential for planetary devastation posed by the methane hydrate reservoir therefore seems comparable to the destructive potential from nuclear winter or from a comet or asteroid impact.[51]

Since the hydrates are buried deep in the ocean, under hundreds of meters of mud, and since the depths of the ocean do not mix much with the surface, keeping the ocean depths icy cold, scientists say that it would take a lot of warming for any significant portion of methane hydrate to be released. But, as we saw, estimates of global warming have been rising sharply, and once methane hydrates begin warming the climate, the process would feed on itself. The process could begin in the Arctic, where the water is cold enough for methane hydrates to accumulate in water depths of only 200 meters deep. The Arctic Ocean is warming faster than anywhere else is because of the disappearing sea ice, and methane hydrate deposits there are already showing signs of instability.

James Hansen believes that to keep the methane hydrates safely in place we must not allow carbon dioxide levels to exceed 350 ppm, down considerably from 450 ppm, which he had recommended earlier.

> Paleoclimate evidence and ongoing global changes imply that today's CO_2, about 385 ppm, is already too high to maintain the climate to which humanity, wildlife, and the rest of the biosphere are adapted. Realization that we must reduce the current CO_2 amount has a bright side: effects that had begun to seem inevitable, including impacts of ocean acidification, loss of fresh water supplies, and shifting of climatic zones, may be averted by the necessity of finding an energy course beyond fossil fuels sooner than would otherwise have occurred. We suggest an initial objective of reducing atmospheric CO_2 to 350 ppm, with the target to be adjusted as scientific understanding and empirical evidence of

[51] David Archer, *The Long Thaw: How Humans are Changing the next 100,000 years of Earth's Climate* (Princeton: Princeton University Press, 2009), pp. 131-132.

> climate effects accumulate. Limited opportunities for reduction of non-CO_2 human-caused forcings are important to pursue but do not alter the initial 350 ppm CO_2 target. This target must be pursued on a timescale of decades, as paleoclimate and ongoing changes, and the ocean response time, suggest that it would be foolhardy to allow CO_2 to stay in the dangerous zone for centuries.[52]

We need to keep carbon dioxide levels below 350 ppm to keep Arctic ice cover intact, Hansen argues, otherwise positive feedback loops start engaging, leading to a rapidly warming world.

To put this in perspective, Hansen observes that during the Cenozoic, when temperatures were 14 C higher than they are now, and neither pole had ice cover, carbon dioxide levels were 1,400 ppm. Because of weathering, a process that uses exposed rock formations to take carbon dioxide out of the atmosphere and depose them on the ocean floor as carbonates, carbon dioxide decreased a few ten thousandths of 1 ppm a year. About 34 million years ago, when carbon dioxide levels declined to 450 ppm, the Antarctic ice cap began forming. So we can conclude from that, that carbon dioxide levels below 450 ppm are needed to keep the Antarctic ice cap.

> A striking conclusion from this analysis is the value of carbon dioxide—only 450 ppm, with an estimated uncertainty of 100 ppm—at which the transition occurs from no large ice sheet to a glaciated Antarctica. This has a clear, strong implication for what constitutes a dangerous level of atmospheric carbon dioxide. If humanity burns most of the fossil fuels, doubling or tripling the preindustrial carbon dioxide level, Earth will surely head toward the ice-free condition, with sea level 75 meters (250) feet higher than today. It is difficult to say how long it will take for the melting to be complete, but once ice sheet disintegration gets well under way, it will be impossible to stop.[53]

About a billion people now live along ocean shores at elevations less than 25 meters, according to Hansen, including many of the world's major cities, like New York. It may take centuries, but eventually, if we continue business as usual, the areas these people live in will be taken by the sea.

A bigger worry, though, for Hansen, is what rising temperatures would do to the methane hydrates in the ocean. To get some idea of what could happen, Hansen looks back 55 million years, to what he calls the Paleocene-Eocene thermal maximum (PETM), an abrupt peak of rapid warming, about 5 degrees Celsius, that Hansen believes was caused by methane hydrate deposits on the ocean floor being released into the atmosphere. On the graphs, the PETM looks like an explosion of temperature and light carbon, an isotope

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[52] James Hansen, Makiko Sato, Pushker Kharecha, David Beerling, et al., "Target Atmospheric CO2: Where Should Humanity Aim?" *Open Atmospheric Science Journal*, (February, 2008), pp. 217-31, http://www.bentham.org/open/toascj/openacess2.htm.

[53] James Hansen, *Storms of my Grandchildren*, pp. 160.

of carbon that can only be explained by a sudden release of methane hydrate. The amount is huge--approximately 3,000 gigatons of carbon, about as much as all of today's available oil, gas, and coal reserves. If the irruption of methane hydrates had an external cause, such as an asteroid crashing into the Earth, or massive lava flows under the ocean, we would have little to worry about because the chances of reoccurrence are low. If, however, the release was caused by feedbacks from global warming, caused perhaps by shifts in Earth's orbit, then we have a lot to worry about because that would mean that anthropogenic global warming could start the process.

Unfortunately, available evidence suggests that the PETM release, and subsequent similar releases, were triggered by warming. They happened at times when the orbit of the earth caused warming. So, warming can trigger an abrupt release of methane hydrates.

> If Earth's methane hydrate inventory is suddenly discharged, as during the PETM event, it requires several million years to fully reload the planet's methane hydrate gun. Thus, the next light-carbon methane hydrate event in the Paleocene, about 2 million years after the PETM, was only about half the strength of the PETM. This half-PETM was followed by still weaker and more frequent light carbon warming spikes. These events occurred in conjunction with astronomical warming peaks during the time Earth was on its track toward peak warmth 50 million years ago, which suggests that the warmer Earth made the melting hydrates easier and did not allow the hydrate reservoir to return to pre-PETM size.[54]

The really bad news for us is that, after a long series of ice ages, none of which were interrupted by interglacial periods warm enough to discharge the hydrates, the PETM gun is now fully charged, probably more so than it has ever been. If it went off, it would cause a drastic change in climate, one that might make much of the Earth uninhabitable for humans, or possibly initiate the Venus syndrome, and make the Earth uninhabitable for most, if not all, life. Most scientists believe that it would take considerable warming, perhaps a century or two of business as usual carbon emissions, to trigger the PETM gun. But no one knows for sure. The key to whether a massive methane hydrate release is triggered in the short term, with a little warming, or in the long term, after a lot, probably depends on what happens with ocean circulation.

As we saw, the ocean's conveyor system, which moves huge amounts of heat from the tropics to the Arctic, can abruptly change, triggering abrupt climate change. If the current shifted, and warm water started flowing over methane hydrate deposits that had previously been kept safely cold, the current change could trigger a positive feedback loop that could progressively release large amounts of methane to the atmosphere. Hansen observes that this appears to have happened in the past.

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[54] James Hansen, *Storms of my Grandchildren*, pp. 163.

> Comparisons of the timing of carbon and temperature changes at many ocean sites show that a dramatic change in ocean circulation occurred at the time of the rapid PETM increases of light carbon and temperature. The ocean circulation change indicates that the main location where dense surface water sank toward the ocean bottom shifted from the region around Antarctica to the middle latitudes in the northern hemisphere. Sinking water at the new location was also dense, but warmer and saltier. It is likely that this warmer water instigated the melting of methane hydrates. The methane, and carbon dioxide that formed as methane oxidized, provided an amplifying feedback that resulted in the large PETM spike in global temperature.[55]

We are still a long way from knowing how much warming would trigger an explosive release from the methane hydrate gun on the ocean floor, but we do know that it can go off as a result of warming. It has in the past. And we know that we are releasing large amounts of greenhouse gasses that we have every reason to believe could trigger even more warming from other positive feedback loops.

This is why James Hansen is saying that we must keep the carbon dioxide in Earth's atmosphere below 350 ppm. That will keep both the Arctic and the Antarctic ice caps in place, preventing the positive feedback loops that could trigger, at some point, the methane hydrate gun. As we approach 390, the Arctic ice cover is already disappearing in the summer, and we are very near the point at which James Lovelock says the ocean's algae will start crashing. We risk the fate of the earth all humanity unless we quickly return to 350 ppm.

I have often wondered what kind of god would put a forbidden fruit in the middle of the Garden of Eden. He might have made paradise in so many other ways, but he made it with a deadly fruit and a wily serpent to tempt Adam and Eve. Similarly, we might wonder what kind of god would create an Earth like ours, a tragedy awaiting us even before we evolved. Our forbidden fruit is the carbon-based fuels, which have made our lives a technological wonder. Using them, we risk being expelled forever from the ecological paradise the Earth truly is. We might challenge a god who made the world this way, doubting his goodness for leaving us a trap like this, but that will get us nowhere. We must accept our reality and resist the temptation to eat of the forbidden fruit of carbon-based fuel.

Denying Reality

Despite what thousands of climate scientists working worldwide have observed in innumerable peer reviewed articles in professional journals, despite the statements by

[55] James Hansen, *Storms of my Grandchildren*, pp. 163.

professional organizations involved in climate studies acknowledging the reality of anthropogenic global warming, despite what government reports from many different countries have found, and despite what the Intergovernmental Panel on Climate Change has conclude of all this put together, not everyone believes that anthropogenic climate change is happening. They are like the snake in the Garden of Eden, tempting us with subtle lies to eat the forbidden fruit. Richard Lindzen, a professor at MIT who is a leading denier, has contemptuously dismissed his peers, "(They're) mainly just like little kids locking themselves in dark closets to see how much they can scare each other and themselves."[56] Deniers say that their differences with the scientific consensus indicate that there is real doubt about the impact of anthropogenic greenhouse gasses on the climate, and they insist that the scientific consensus is manufactured, a result of a conspiracy among leading climate scientists to suppress dissent, as Richard Lindzen, complained in a guest editorial in the *Wall Street Journal*. "Scientists who dissent from the alarmism have seen their grant funds disappear, their work derided, and themselves libeled as industry stooges, scientific hacks or worse. Consequently, lies about climate change gain credence even when they fly in the face of the science that supposedly is their basis."[57]

Lindzen is probably the denier other scientists most respect. Needing someone respectable, he was the scientist the Bush Administration used to justify inaction on climate change, as James Hanson observed, "...U.S. policies regarding carbon dioxide during the Bush-Cheney administration seem to have been based on, or at a minimum, congruent with Lindzen's perspective."[58] Shortly after the Bush administration was first elected to office, and had decided not to endorse the Kyoto treaty, which would have limited U.S. greenhouse gas emissions, Hansen and two other government scientists briefed Dick Cheney and other top members of the Bush administration on March 29, 2001. Since the invitation itself indicated a willingness to listen, Hansen was initially optimistic that the Bush administration would respond to science, and fulfill Bush's pledge while he was running for president to stem climate change. However, at the end of the scientists' presentations, Dick Cheney decided that the administration also needed to listen to a denier. He invited Hansen back to brief the administration some more, but to make sure that the "other" perspective was balanced against Hansen's, the administration also invited Richard Lindzen.

Unlike other deniers claiming scientific expertise, Lindzen is able to get his papers contesting climate change into peer-reviewed journals.[59] More commonly, however, he writes guest editorials for the *Wall Street Journal* and *Newsweek,* and articles in *Energy and Environment*, an oil and coal industry journal frequented by deniers that is not peer

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[56] "Could Global Warming Kill Us?" *Larry King Live*, (January 31, 2007). http://transcripts.cnn.com/TRANSCRIPTS/0701/31/lkl.01.html.

[57] Richard Lindzen, "Climate of Fear: Global-warming alarmists intimidate dissenting scientists into silence," *Wall Street Journal* (April 12, 2006).

[58] James Hansen, *Storms of My Grandchildren*, pp. 53-54.

[59] See for example, R.S Lindzen and R.M. Goody, "On the asymmetric diurnal tide," *Pure & Applied Geophysics* (1965) 62, 142–147.
R.S. Lindzen and R.M. Goody, "Radiative and photochemical processes in mesospheric dynamics: Part I. Models for radiative and photochemical processes," *Journal of Atmospheric Science*, (1965), **22**, pp. 341–348.
R.S. Lindzen, "The radiative-photochemical response of the mesosphere to fluctuations in radiation," *Journal of Atmospheric Science*, (1965), **22**, pp. 469–478.

reviewed.[60] Most recently, he, along with Y.S. Choi, published a paper in *Geophysical Research Letters,* a peer reviewed journal, which supposedly disproves the entire global warming theory by demonstrating a negative feedback loop involving clouds powerful enough to counteract all anthropogenic carbon dioxide releases.[61] Although most climate scientists greeted his paper with skepticism, and then quickly found serious flaws in it, some (reluctantly) said it was worth publishing to discuss a possible negative feedback loop. Gavin Schmidt, a regular contributor to *RealClimate.org*, damned Lindzen's paper with faint praise, saying, "First off, (it) was not a nonsense paper – that is, it didn't have completely obvious flaws that should have been caught by peer review (unlike say, McLean et al, 2009 or Douglass et al, 2008)."[62] However, other scientists were less kind, and insisted that it did have flaws that should have been identified in peer review, as Chris O'Dell argued on *RealClimate.org*.

> Very simple attempts to reproduce the LC09 (Lindzen and Choi's) numbers simply didn't work out and revealed some flaws in their process... After some further checking, I came across a paper very similar to LC09 (Lindzen's paper) but written 3 years earlier – Forster & Gregory (2006), hereafter FG06. FG06, however, came to essentially opposite conclusions from LC09, namely that the data implied an overall positive feedback to the earth's climate system, though the results were somewhat uncertain for various reasons as described in the paper (they attempted a proper error analysis). The big question of course was, how is it that LC09 did not even bother to reference FG06, let alone explain the major differences in their results? Maybe Lindzen & Choi didn't know about the existence of FG06, but certainly at least one reviewer should have. And if they also didn't, well then, a very poor choice of reviewers was made.[63]

Lindzen claims to know the climate better than other scientists do, and is right about it when all of them are wrong, yet he ignores another paper that directly contradicted his own, without explaining why it was in error. Andrew Revkin, on the New York Times' blog, DotEarth, reported that he asked a critic of Lindzen's, Kevin Trenberth, to check Lindzen's math. It turned out that once Trenberth did the math correctly, Lindzen's own model showed substantial warming from carbon dioxide.

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[60] For a critique of Lindzen's guest editorial in Newsweek, see, Gavin Schmidt and Michael Mann, "Lindzen in Newsweek," *RealClimate.org* (April 17, 2007). http://www.realclimate.org/index.php/archives/2007/04/lindzen-in-newsweek/

[61] R.S. Lindzen and Y.S. Choi, "On the determination of climate feedbacks from ERBE data," *Geophysical Research Letters* (2009) 36, L16705, doi: 10.1029/2009GL039628.

[62] Gavin Schmidt, "First published response to Lindzen and Choi," RealClimate.org (January 9, 2010) http://www.realclimate.org/index.php/archives/2010/01/first-published-response-to-lindzen-and-choi/

[63] Chris O'Dell, "L&C, GRL, comments on peer review and peer-reviewed comments," *RealClimate.org* (Jan. 10. 2010). http://www.realclimate.org/index.php/archives/2010/01/lc-grl-comments-on-peer-review-and-peer-reviewed-comments/

> ... (Dr. Trenberth) said that, if done correctly, the Lindzen-Choi analysis would have produced a 1.5 degree Fahrenheit warming instead of the 0.9 degree warming the paper initially contained. But rectifying an additional flaw — the paper's selection of sea temperatures in a way that did not appear to be objective — produces a warming of 4.1 degrees, a level at the heart of what most climate simulations and other studies project.[64]

The stolen emails: Despite their problems publishing solid research papers, deniers insist that the vast majority of scientists who believe in anthropogenic global warming are being duped by a conspiracy of elite scientists who control what is published. Deniers have been making much of some emails recently stolen from climate scientists at the University of East Anglia in Norwich, England in November 2009. They say these emails prove scientific corruption among leading advocates of anthropogenic global warming. In a *Wall Street Journal* guest editorial, another denier, Patrick Michaels, formerly a professor of environmental sciences at the University of Virginia (1980-2007), currently a senior fellow at the Cato Institute, says that these stolen emails are proof of bias.

> But there's something much, much worse going on—a silencing of climate scientists, akin to filtering what goes in the bible, that will have consequences for public policy, including the Environmental Protection Agency's (EPA) recent categorization of carbon dioxide as a "pollutant."
>
> The bible I'm referring to, of course, is the refereed scientific literature. It's our canon, and it's all we have really had to go on in climate science (until the Internet has so rudely interrupted). When scientists make putative compendia of that literature, such as is done by the U.N. climate change panel every six years, the writers assume that the peer-reviewed literature is a true and unbiased sample of the state of climate science.
>
> That can no longer be the case. The alliance of scientists at East Anglia, Penn State, and the University Corporation for Atmospheric Research (in Boulder, Colo.) has done its best to bias it.[65]

Like other deniers, Michaels believes that thousands of emails stolen from a computer at East Anglia University in England and published on the Internet prove that the scientific consensus on anthropogenic climate change is false, forced, and fraudulent. He says that deniers are victims of a vast conspiracy to keep them silent, to deny the world the truth about actual human impact on the environment. He thinks that the emails show the

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[64] Andrew Revkin, "A Rebuttal to a Cool Climate Paper," *DotEarth* (Jan. 8, 2010). http://dotearth.blogs.nytimes.com/2010/01/08/a-rebuttal-to-a-cool-climate-paper/?src=twt&twt=dotearth

[65] Patrick J Michaels, "How to Manufacture a Climate Consensus: The East Anglia emails are just the tip of the iceberg. I should know." *The Wall Street Journal* (Dec. 17, 2009) http://www.montanaco-ops.com/index.php?mact=News,cntnt01,detail,0&cntnt01articleid=51&cntnt01origid=74&cntnt01returnid=74

scientists conspiring to withhold data and computer codes from critics,[66] interfering in the peer-review process,[67] deleting emails and raw data to thwart Freedom of Information Requests,[68] and manipulating data to make the argument for anthropogenic climate change appear stronger than it is.

On the other hand, other, less conspiratorially inclined, people who have read the emails have found that the stolen emails prove nothing of the sort. The Associated Press, for instance, conducted a through review of the emails, using five reporters to read and reread the documents, about 1 million words in total. They sent summaries of the emails to seven experts in research ethics, climate science, and science policy. The reporters were told that the emails were much ado about nothing. "This is normal science politics, but on the extreme end, though still within bounds," Dan Sarewitz, a science policy professor at Arizona State University, told the reporters. "We talk about science as this pure ideal and the scientific method as if it is something out of a cookbook, but research is a social and human activity full of all the failings of society and humans, and this reality gets totally magnified by the high political stakes here."

The reporters also sent the controversial emails to three climate scientists viewed as moderates in the field, and none of them said that the emails changed their mind that global warming was anthropogenic and a threat. "My overall interpretation of the scientific basis for (man-made) global warming is unaltered by the contents of these e-mails," Gabriel Vecchi, a National Oceanic and Atmospheric Administration scientist, told them. The reporters also consulted Gerald North, a climate scientist at Texas A&M University, who headed a National Academy of Sciences study that looked at—and upheld as valid—Mann's earlier studies that found the 1990s were the hottest years in centuries. He told the reporters, "In my opinion the meaning is much more innocent than might be perceived by others taken out of context. Much of this is overblown."[69]

The Intergovernmental Panel on Climate Change's chair, Rajendra Pachauri, described the East Anglia's Climate Research Unit scientists "as highly reputed professionals, whose contributions over the years to scientific knowledge are unquestionable" and described their datasets as "totally consistent with those from other institutions, on the basis of which far-reaching and meaningful conclusions were reached in the [2007 report]."[70]

Other relevant institutions have issued statements saying that the emails change nothing. The American Meteorological Society stated, "For climate change research, the body of

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[66] "Climate skeptics claim leaked emails are evidence of collusion among scientists," *The Guardian* (November 24, 2009) http://www.guardian.co.uk/environment/2009/nov/20/climate-sceptics-hackers-leaked-emails.

[67] Johnson, Keith "Climate Emails Stoke Debate: Scientists' Leaked Correspondence Illustrates Bitter Feud over Global Warming," *The Wall Street Journal* (November 23, 2009). http://online.wsj.com/article/SB125883405294859215.html

[68] Moore, Matthew, "Climate change scientists face calls for public inquiry over data manipulation claims," *The Daily Telegraph* (November 24, 2009)

[69] Seth Bornstein, Malcolm Ritter, Raphael Satter, "Climategate: Science Not Faked, But Not Pretty". Associated Press (Dec. 3, 2009) http://www.usnews.com/articles/news/energy/2009/12/12/climategate-science-not-faked-but-not-pretty_print.htm.

[70] "Climate change has no time for delay or denial," *The Guardian* (Jan. 4, 2010), http://www.guardian.co.uk/environment/cif-green/2010/jan/04/climate-change-delay-denial

research in the literature is very large and the dependence on any one set of research results to the comprehensive understanding of the climate system is very, very small. Even if some of the charges of improper behavior in this particular case turn out to be true — which is not yet clearly the case — the impact on the science of climate change would be very limited."[71]

Malicious misreading: Most of the charges the deniers make against the scientists involved are taken out of context, wildly exaggerated, and maliciously misread. For instance, much was made of an email by Phil Jones, where he referred to a "trick" to "hide the decline" in tree ring proxy data for temperature since the 1960's. Deniers take this to mean that the scientists were pulling a fast one, tricking the public into believing something that wasn't true, but they conveniently ignored the fact that scientists commonly use the word 'trick' to mean "a solution." I, myself, have heard scientists use language like this. Back in the 70's, when I was a student at Montana State in Bozeman, I remember a statistics professor explaining to our class how scientists commonly call a solution a trick. So, either the people who say the scientists were tricking the public don't know much about the terms scientists use or they are maliciously misreading the email.

The deniers also ignored the fact, widely accepted by scientists, that tree ring data quit working as a temperature proxy in the 60's, otherwise known as the divergence problem. The effects of industrial pollution, which was increasingly exposing trees to all sorts of new toxins and chemicals in the 60's, has probably compromised the tree ring data. Industrial pollution contains not only carbon dioxide, which has a fertilizing effect on trees, but also nitrates from the increasing use of fertilizer worldwide and from smog, which also would also have a fertilizing effect. Herbicides, chemicals that disrupted plant growth in small quantities, started being used a lot during the 60's. They were also evaporating from fields and being distributed worldwide through the atmosphere. Whatever the cause of the divergence, scientists agreed that tree ring data was not useful as a temperature proxy from the 60's forward. In the emails, the scientists decided that they would "hide the decline" in the tree ring proxy data that was no longer accurate behind real temperature measurements so that the public would not get a false impression from useless proxy data. In other words, the "trick" the scientists were pulling, the "conspiracy" they engaged in, was to not let the public be misled by inaccurate data.[72]

Similarly, deniers made a lot of an email written by Kevin Trenberth, a climatologist at the National Center for Atmospheric Research, where he wrote, "The fact is that we can't account for the lack of warming at the moment and it is a travesty that we can't."[73] By itself, this statement would seem to indicate that Trenberth was admitting that global warming wasn't real. But, in context, that was not anything like what Trenberth was intending. Actually, Trenberth was bitterly complaining about being underfunded. He believed that anthropogenic climate change was real, a looming danger, which was why

[71] "Impact of CRU Hacking on the AMS Statement on Climate Change," American Meteorological Society (November 25, 2009). http://www.webcitation.org/5lnFDGhdZ.
[72] "CRU update 2," University of East Anglia (Nov. 24, 2009) http://www.uea.ac.uk/mac/comm/media/press/2009/nov/CRUupdate
[73] Andrew Revkin, "Hacked E-mail is New Fodder for Climate Dispute," *New York Times* (Nov. 20, 2009).

he believed scientists desperately needed more research tools to monitor short-term variability. If they were going to be able to do any kind geo-engineering to limit the damage, they needed to be able to explain short-term variability to measure the impact of geo-engineering. The "travesty" was that scientists did not have good enough equipment to make the complex temperature measurements needed to explain daily fluctuations--where energy was going, how clouds were being affected, and so on. This was not, by any means, an opinion he kept secret. He complained loudly and often about failing to do what was needed to stop climate change.

In a statement on his NCAR webpage Trenberth states that,

> It is amazing to see this particular quote lambasted so often. It stems from a paper I published this year bemoaning our inability to effectively monitor the energy flows associated with short-term climate variability. It is quite clear from the paper that I was not questioning the link between anthropogenic greenhouse gas emissions and warming, or even suggesting that recent temperatures are unusual in the context of short-term natural variability.[74]

Using other emails, deniers accused Michael Mann, the Penn State University Professor who was the author of many of the stolen emails, of organizing a conspiracy to punish *Climate Research*, for publishing a paper by two deniers, Willie Soon and Sallie L. Baliunas. Their paper reviewed 240 previously published papers and argued that the 20th century was neither particularly warm, nor a unique period in the last thousand years.[75] Sharply contrarian, the paper provoked 13 authors of papers cited by Soon and Baliunas to argue that they had been misinterpreted and that the paper was seriously flawed.[76]

According to these scientists, Soon and Baliunas used moisture data when they should have used temperature data; they didn't distinguish between regional and hemispheric temperature anomalies; and they used proxy evidence not capable of indicating trends. Tim Barnett of the Scripps Institution of Oceanography commented that, "the fact that [the paper] has received any attention at all is a result, again in my view, of its utility to those groups who want the global warming issue to just go away." Malcolm K. Hughes of the University of Arizona, whose work was also discussed in the paper, called it "so fundamentally misconceived and contain[ing] so many egregious errors that it would take weeks to list and explain them all."[77] Worse than that, when two other scientists, Osborn and Briffa, tried to duplicate their calculations, the math didn't even add up.

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[74] Trenberth, NCAR webpage, http://www.cgd.ucar.edu/cas/Trenberth/statement.html

[75] Willie Soon and Sallie Baliunas, "Proxy climatic and environmental changes of the past 1000 years," *Climate Research*, 23 (2009), pp. 89-110. http://www.marshall.org/pdf/materials/136.pdf

[76] Press Release, "Leading Climate Scientists Reaffirm View that Late 20th Century was unusual and Resulted from Human Activity," *American Geophysical Union* (July 7,2003). http://www.agu.org/news/press/pr_archives/2003/prrl0319.html

[77] David Appell and Katy Human, ed., *Critical Perspectives on World Climate* (The Rosen Publishing Group, 2006) pp. 17. ISBN 9781404206885.

The financial interests of Soon and Baliunas were problematic too. The American Petroleum Institute, which would not likely be indifferent to the outcome, paid Soon and Baliunas $53,000 for the study. They were also paid consultants of the Marshall Institute, a conservative think tank, which opposes limits on carbon dioxide emissions.[78]

Dismayed that such a flawed article could get through peer review, suspecting that the editor, Chris De Freitas, had compromised the peer review process and sent the paper to biased reviewers, Michael Mann emailed a colleague, "I think we have to stop considering *Climate Research* as a legitimate peer-reviewed journal. Perhaps we should encourage our colleagues in the climate research community to no longer submit to, or cite papers in, this journal."[79] Deniers seized upon this email to argue that Mann was leading a conspiracy to suppress the truth about how anthropogenic climate change was actually a hoax. A fair interpretation is that Michael Mann was actually attempting to prevent oil and coal interests from compromising the peer review process.

Other climate scientists agreed with him. The chief editor of *Climate Research*, Hans von Storch attempted to make reforms in the journal's peer review process, but other editors at the journal refused. Deciding that the integrity of the journal had been compromised, von Storch resigned, saying that deniers "had identified *Climate Research* as a journal where some editors were not as rigorous in the review process as is otherwise common."[80] Eventually, half of the journal's editorial board resigned with von Storch.[81]

What Michael Mann did, and what the editors who resigned did as well, is important and valuable. To be a part of the scientific community means using evidence and reasoned argument in ways that the community of scientists find acceptable. When corporate interests and ideological fervor compromise the integrity of the peer review process, infiltrating peer reviewed journals with corporate money and biased interest, responsible scientists have to step up and defend science. Deniers have vilified Michael Mann and his colleagues, but once the stolen emails are put in the context of science under corporate siege, as they truly are, there is little the scientists need apologize for. As slippery as the snake in the Garden of Eden, Deniers are tempting us to eat of the forbidden fruit.

A corporate consultant's financial interest in denial: Deniers, like Patrick Michaels above, argue that the emails show the scientists attempting to silence dissidents, destroy data, and refuse to turn over computer code. Deniers would have it that they are defending the integrity of science and the scientists are corrupting it. However, before these charges are taken seriously, the financial interests of the deniers must be examined. Michaels, who is in many ways typical of the deniers, is the founder and sole owner of New Hope Environmental Services, which describes itself on its website as "an advocacy science

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[78] Irene Sanchez, "Warming study draws fire, "*The Harvard Crimson*, (Nov. 13, 2005). http://www.thecrimson.com/article.aspx?ref=348723. Retrieved 2009-05-30

[79] "Lawmakers Probe Climate Emails", *Wall Street Journal*, November 24, 2009. http://online.wsj.com/article/SB125902685372961609.html

[80] Chris Mooney, "Some Like It Hot," *Mother Jones* (May/June, 2005) http://www.motherjones.com/environment/2005/05/some-it-hot.

[81] Clare Goodess, "Stormy Times for Climate Research," *Scientists for Global Responsibility Newsletter*, (November 28, 2003). http://www.sgr.org.uk/climate/StormyTimes_NL28.htm

consulting firm."[82] In an affidavit in a Vermont court case, Michaels described the "mission" of the firm as to "publicize findings on climate change and scientific and social perspectives that may not otherwise appear in the popular literature or media. This entails both response research and public commentary."[83]

Both before he founded his public relations firm and since, Michaels has received substantial amounts of money from oil and coal companies. From 1991 to 1995, Michaels received more than $115,000 from coal and energy interests.[84] After he founded New Hope Environmental Services, it became possible for him to advocate for his clients without saying who they were or how much they were paying him, but some reports still got out. In 2006, a furor erupted when it was discovered that Intermountain Rural Electric Association, which uses coal to fire its generators, paid Michaels $100,000 to help confuse the issue of global warming.[85]

The sources of Michael's funding again became controversial when Greenpeace filed a motion in a lawsuit in Vermont seeking access to the sources of his funding. Instead of revealing who his clients were, Michaels refused to testify. In an affidavit, Michaels stated that:

> (A)s the case moved closer to trial, I learned in conversations with plaintiff's counsel that New Hope's confidential information might not remain confidential if I testified at trial. Consequently, on or around April 7, 2007, I informed plaintiffs counsel that I would not testify at trial. My sole reason in doing so was concern that my trial testimony would result in the loss of confidentiality for the New Hope information. ... (The Greenpeace motion would) result in New Hope losing clients. I am doubtful that New Hope will continue to stay in business as an effective consultancy ... This is precisely why I did not testify at trial. Although this resulted in a short-term loss of income to me, it assured the long-term viability of New Hope. Besides modest speaking fees, New Hope is my sole source of income beyond a negotiated retirement package from the University of Virginia. Thus, the Greenpeace motion, if granted, would imperil my livelihood. New Hope also employs the services of other scientists who receive all or a substantial part of their incomes from New Hope. Their livelihoods are also threatened by the Greenpeace motion.[86]

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[82] Patrick Michaels, New Hope Environmental Services (May,2009), http://www.nhes.com/

[83] Dr. Patrick J. Michaels, "Affidavit of Dr. Patrick J. Michaels", United States District Court for the District of Vermont, Green Mountain Chrysler et al. v. Crombie et al., Docket No. 02:05-CV-302, July 6, 2007.(Pdf)

[84] Ross Gelbspan, "The heat is on: The warming of the world's climate sparks a blaze of denial", *Harpers Magazine* (December 1995).

[85] Clayton Sandell and Bill Blakemore, "ABC News Reporting Cited as Evidence in Congressional Hearing On Global Warming," *ABC News* (August 3, 2006). http://abcnews.go.com/Technology/globalwarming/story?id--22425658page1

[86] Dr. Patrick J. Michaels, "Affidavit of Dr. Patrick J. Michaels", United States District Court for the District of Vermont, Green Mountain Chrysler et al. v. Crombie et al., Docket No. 02:05-CV-302, July 6, 2007.(Pdf)

This is ironic. One of the charges that he made in his editorial in the *Wall Street Journal* on how the East Anglia and Penn State scientists were undermining science by refusing to turn over computer codes and climate data to be properly reviewed by outsiders like him so that their biases could be explored. Nevertheless, when it came time for him to reveal possible sources of his biases, he refused to comply.

Deniers routinely question the motives of climate scientists, speculating about dark conspiracies to grab power and impose a "Greenpeace" lifestyle on everyone, but in this, perhaps, they are projecting their shadow, their own conspiracy to manipulate the public as the paid agents of oil and coal interests who do not want their efforts to manipulate the public revealed. As with Patrick Michaels, most deniers either are getting grants from oil or coal companies or they are directly employed by them. Even Richard Lindzen, one of the few deniers other scientists have some respect for, has been paid $2500 a day by oil and coal interests. His trips to testify before Congress on climate change have been paid for by Western Fuels, and a speech that he wrote, entitled "Global Warming: The Origin and Nature of Alleged Scientific Consensus," was underwritten by OPEC.[87]

A surprisingly large number of deniers are tobacco company scientists. Starting in 1993, Fred Singer, another leading climate denier, has had numerous ties to Phillip Morris, a large tobacco company. He has taken money from the Tobacco Institute, worked with Apco Associates (a PR firm hired by Philip Morris to organize and direct The Advancement of Sound Science Coalition), and was part of an attack on an EPA risk assessment of environmental tobacco smoke.[88] From its beginning in 1993, Patrick Michaels was also a member of The Advancement of Sound Science Coalition.[89]

Richard Lindzen is also a tobacco company scientist. Testifying before Congress decades ago, he raised doubts about the reliability of statistical connections between smoking and health problems. Even today, after even the tobacco companies have given up denying the link between smoking and cancer, Lindzen persists in doubting the link between smoking and cancer. James Hansen wrote in his book that when he asked Lindzen about his earlier position on tobacco, instead of being apologetic for his role in this health nightmare, as one might expect, Lindzen enthusiastically launched into a statistical critique of associations between smoking and cancer.[90] Hansen was amazed that the Bush administration would use a tobacco company scientist to deny global warming, but perhaps he was naïve, presuming that science was actually the issue.

The criticism deniers make of mainstream scientists on climate change needs to put into the context of corporate sponsored opposition to mainstream science. Oil, coal, and other industrial interests have trillions of dollars invested in carbon-based fuels, involving vast networks of pipelines, railroads, refineries, gas stations, and coal-fired generating plants, which all support the agriculture, housing, automotive, and trucking industries. Corporate stakes in a carbon-based economy are staggering, involving almost every

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[87] Ross Gelbspan, "The heat is on: The warming of the world's climate sparks a blaze of denial", *Harpers Magazine* (December 1995). http://dieoff.org/page82.htm

[88] *Source Watch*, "S. Fred Singer," (2010), http://www.sourcewatch.org

[89] *Source Watch*, "Patrick Michaels," (2010), http://www.sourcewatch.org

[90] James Hansen, *Storms of my Grandchildren*, pp. 15.

aspect of our lives. Given the vast amount of public relations resources that carbon-dependent corporations have at their disposal, is anyone surprised that there would be so much "doubt" about the reality of climate change?

Doubt and Science

Although climate deniers have succeeded in convincing a large segment of the public that there is debate among scientists about anthropogenic global warming, as we saw earlier, there actually isn't. Dr. James Baker, former head of the National Oceanic and Atmospheric Administration (NOAA), has said, "There's a better scientific consensus on this (anthropogenic global warming) than on any issue I know—except maybe Newton's second law of (thermo)dynamics."[91] This public doubt about anthropogenic climate change is manufactured, a corporate public relations product, financed by oil and coal interests. It isn't science, however much some of the leading deniers want to make it look like science; it's corporate propaganda, a lie laid on a foundation of fraud. Aside from a minority driven by right-wing ideological purposes, climate deniers have essentially the same goal that all advocates for industry have, to raise doubt about the harm caused by industry, delaying any kind of regulation to protect the public and the planet. As the tobacco companies showed with their denial efforts, the more doubt there is, the more delay there is. The more delay there is, the more money they make. The point behind the deniers' "sound science," "junk science," and "Climategate," is to delay regulation, or any kind of shift to a more responsible energy policy.

The way of institutional research: Science is a way of knowing the world, for finding truth.[92] In this, it is like other institutions that exist in the modern world to find truth--jury trials, legislative debates, police investigations, and public hearings.[93] Science uses the controlled experiment, establishes research bureaucracies, and deploys peer review to produce truth. As a result, modern science is a very disciplined, very rigorous, discussion about nature.[94] In the modern scientific community, truth is revealed by correct method, precise measurement, and rigorous analysis. In its own way, debate among scientists is as rule-bound as a debate in a legislative assembly or in a court case. Because of its institutional character, science is a collective effort, not an individual one. Individual scientists, like Einstein, Richard Feynman, or, in climate science, James Hansen and James Lovelock, may be publicly celebrated for their achievements, but none of them did it alone. It took a village, a whole community of scientists for them to accomplish what they did. Nothing in modern science is true because one scientist makes a discovery. A discovery is a discovery only after other scientists validate it. An individual scientist's

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[91] Ross Gelbspan, "Snowed," *Mother Jones* (May/June, 2005).
[92] Martin Heidegger, "Science and Reflection," *The Question Concerning Technology*, trans. William Lovitt (New York: Harper and Row, 1977).
[93] Michel Foucault, *Power/Knowledge*, trans. Colin Gordon, Leo Marshall, John Mepham, and Kate Soper, (New York: Pantheon Books, 1977).
[94] Wade Sikorski, "Science and Technology," *Modernity and Technology: Harnessing the Earth to the Slavery of Man* (Tuscaloosa: The University of Alabama Press, 1993).

accomplishments matter only because other scientists say they matter. Truth, in modern science, is a collective achievement, not a personal discovery.

Just as Americans charged with a crime have a right to a trial by a jury of their peers, scientists use peer review to sort out good science from bad science. To reduce a discovery to its practical essence, it is all about reading and readers. Scientific papers without readers who can fully understand them are nothing but illegible markings on a piece of paper, as meaningful to the world as a Bible is to a chimpanzee. Without peer review, no discovery exists. Reasonable people may differ over whether a tree that crashes to the ground in forest makes a noise or not if no one is there to hear it, but no one makes a scientific discovery unless other scientists agree that it has happened.

After a scientist (and usually, today, it is a team of scientists) has collected data and written the results up in a paper, it is submitted to a peer-reviewed journal. Upon getting a paper, the editor of the research journal will typically assign it to three readers, sometimes more, rarely less. In climate science, as is usually the case for most sciences, the readers are anonymous. (Occasionally, the reviews are double blind, with the author's name blanked out for the reviewers, so that no one but the editor of the journal knows the identity of anyone. This is supposed to reduce bias, so that a paper is judged on its merits alone, but usually it is pointless because any reviewer that is qualified to be a reviewer can usually figure out who the author is.)

Reviewers advise the editor on whether the paper should be published. Criteria for publishing a paper will vary from journal to journal, but in general, reviewers look for a genuine contribution the discipline. They also look for mistakes in analysis, correct method, appropriate collection of data, and the general coherence of the arguments. Because the advancement of science is more a collective achievement than an individual competition, reviewers are expected to suggest revisions that would make the paper better. The editor reviews the reviewer reports, and makes their own decision on whether to publish and what revisions the authors should make. Peer review is, invariably, an elaborate process. At the end of it, though, readers of the journal, and the public at large, can have some confidence in the quality of the papers published in the journal.

After a paper is published, peer review still continues, in some cases even more intensely. If the paper contests the consensus of the profession, challenging widely held beliefs, it is likely to be the subject of debate, letters to the editor, even other papers. Instead of just a couple of scientists checking the claims in the paper, many scientists will do it. If the paper makes claims based on empirical evidence, other scientists will attempt to duplicate its results, repeating the experiment. If the paper makes its claims analytically, other scientists will check the math. If the scientist's results hold up under this kind of extensive review, their reputation rises accordingly, especially if it establishes a new consensus. They become someone whose work is trusted.

Being of their quantitative orientation, scientists sometimes will quantify their standing in their profession by the number of times other scientists footnote their work. The number of times a scientist is footnoted can affect tenure, promotion, salary, and getting research grants. So, footnotes matter. A scientist that is footnoted a lot, as both James Hansen

and James Lovelock are, is respected; a scientist that is not is invisible. Their papers don't matter.

Footnotes are important in another respect. Research papers are usually short, often only a couple of pages, rarely more than 10 pages long. In these papers, scientists raise questions, form theories, test them in experiments, and report their work to their peers, who judge it. Scientists use footnotes in these papers to locate where their paper stands in dialog with other scientist's papers, whether it is supporting, contesting, or revising their findings. Used in this way, footnotes mark the scientific community's progress forward--the evidence collected, the issues decided, and the new issues opening up. Without footnotes, scientific debates would be pointless, chaotic, and futile. They wouldn't have meaning or structure. Science would be a waste of everyone's time. And so, if a scientist overlooks another scientist's relevant work, peer reviewers are expected to bring it up before the paper is published, so that the author can consider their work and respond to it. By making sure that all relevant work is taken into account, and properly assessed, scientists gain confidence in their collective efforts.

This is how scientists have agreed to work together to find truth. It is a collaborative effort, strictly bound by method, tradition, and a sense of responsibility and community. There are rules, expectations, and norms, for scientists to follow, and following them is important because that is how progress is made. In climate science, however, deniers of anthropogenic climate change are not playing by the rules. When for example, as we saw above, Richard Lindzen and Yong-Sang Choi did not footnote or discuss the work of another scientific team, Forster & Gregory (2006), that had addressed the same issue they had, but come to an opposite conclusion, it was a major fault in their paper, probably sufficient by itself to prevent publication unless addressed. If an earlier study was in error, Lindzen and Choi should have explained why it was in error and why their research was better.[95] That they failed in this, and the fact that their math didn't add up and that they relied on data that was not "objective," is why Kevin Trenberth concluded that Lindzen and Choi's paper has "all the appearance of the authors having contrived to get the answer they got."[96] This is probably the harshest thing a scientist can say about another scientist.

Scientists are expected to resolve their debates in peer-reviewed journals, a carefully constructed forum where the use of evidence, rigorous argument, and footnotes combine to give the scientific community confidence that progress toward truth is the outcome of everyone's efforts. They are not supposed to widen the scope of a conflict over research by going outside this forum, attacking other scientists in the mass media, and seeking to get leverage for their views in the mass media that they could not get inside the scientific community. Yet this is what Lindzen, Michaels, and other deniers have done by taking their case to the *Wall Street Journal's* editorial page and appearing on *Fox News* programs. Lindzen even went so far as to appear on Jessie Ventura's TV program

[95] Climate Progress, "Lindzen debunked again: New scientific study finds his paper downplaying dangers of human-caused warming is "seriously in error," (Jan. 11, 2010). http://climateprogres.org/2010/01/11/science-lindzen-debunked-again-positive-negative-feedbacks-clouds-tropics/?ut

[96] Trenberth, K. E., J. T. Fasullo, C. O'Dell, and T. Wong (2010), Relationships between tropical sea surface temperature and top-of-atmosphere radiation, Geophysical Research Letters, doi:10.1029/2009GL042314, in press.(accepted 5 January 2010)

Conspiracy Theory, where he accused his colleagues of conspiring to deceive the public on global warming.

The danger in widening the scope of the conflict like this is that it will corrupt the institution of science by bringing in people to judge the work of scientists who are not scientists themselves. The deniers claim that they are protecting the integrity of science, but by widening the scope of the conflict, they are actively assaulting it, politicizing science in a way that radically undermines it. They are putting its conclusions on trial in a way that they should not be. Not all opinions are created equal, and not everyone is qualified to judge the work of scientists. Appealing to the general public to destabilize the consensus of climate scientists, exploiting the gullibility of the least educated to dismiss the efforts of the most educated, is not "sound science;" it is junk science.

Peer review is an imperfect human effort, to be sure. Sometimes papers are, indeed, treated unfairly in peer review and good effort is not rewarded. There probably isn't a single academic in the world that has not complained about peer review. (I, myself, have a book on political psychoneuroimmunology--one that is really quite good, by the way--that never got published.[97]) Nevertheless, for all its failings, over the long run, peer review is self-correcting, and it remains the best way that science has of making sure that good research is recognized and that bad research is discarded. Efforts that attack the process, or that bypass it by appealing to an audience that is incapable of judging the merits of an issue, is suspect, even dangerous.

If the climate deniers really are right about global warming, why can't they write analytically sound papers? Why can't they report data that other scientists can duplicate? Why can't they make their cases in peer-reviewed journals, instead of going to the *Wall Street Journal's* editorial page or *Fox News*, where they issue all sorts of libel against science? If the deniers had a case to make, if truth actually was on their side, and they were not merely shilling for the oil and coal industries, they should be able to make the case to the scientific community, giving them something that would make them pause. Instead, they bypass peer review and protest their cause on the editorial pages of the *Wall Street Journal*, *Fox News*, and the Internet, accusing climate scientists of fraud, conspiracy, incompetence, and bullying. This, at bottom, is not an effort to improve science, as the deniers would have it; it is an effort to destroy it.

Public relations tactics and deniers: Although deniers have proven themselves bad scientists, they have proven themselves masters at the art of public relations. Much of what they know about the management of public perception of science probably came from Frank Luntz, a famous consultant for conservative and corporate causes. Luntz is a word master, using simple code words and phrases to manipulate public perception, such as "sound science," "junk science," and "uncertainty." In "The Environment: A Cleaner, Safer, Healthier America," Luntz laid out his strategy to generate doubt about climate change. To counter the notion that "Washington regulations" represent the best way to preserve the environment, Luntz argues that we should rely on a free market to do it, letting the corporations do as they please within the market, which, we are assured, will

[97] Wade Sikorski *Infected with Difference: Healing Dis/ease in the Body Politic.* http://www.midrivers.com/~wds

punish polluters appropriately for pollution. To make sure the environment remains a safe place to dump corporate pollution Luntz advises, as quoted by David Michaels in his book:

> "Winning the Global Warming Debate—An Overview" reads the title at the top of page 137 of Luntz's document. Item number one is this: **"The scientific debate remains open.** Voters believe that there is ***no consensus*** about global warming within the scientific community. Should the public come to believe that the scientific issues are settled, their views on global warming will change accordingly. Therefore, ***you need to continue to make the lack of scientific certainty a primary issue in the debate,*** and defer to scientists and other experts in the field." On the following page is this paragraph: ***"The most important principle in any discussion of global warming is your commitment to sound science.*** Americans unanimously believe all environmental rules and regulations should be based on sound science and common sense. Similarly, our confidence in the ability of science and technology to solve our ills is second to none. Both perceptions will work in your favor if properly cultivated." And below that paragraph is this boxed statement: "**LANGUAGE THAT WORKS [:] '*We must not rush to judgment before all the facts are in. We need to ask more questions. We deserve more answers. And until we learn more, we should not commit America to any international document that handcuffs us either now or into the future.*'"** [Emphasis in the original.][98]

It is a mark of Luntz's genius that he appeals to "sound science" while actually subverting it. In the quote above, Luntz does not care about what scientists say, or what the truth actually is, only about what the public perceives scientists saying. Between science and the public, Luntz would intervene, interposing a framing of the world that sacrifices public interest to corporate interest. To put it simply, he is advising his clients how to manipulate the public so that they will believe lies, not scientists.

The art of the lie: It might be easy to excuse people who join the deniers, believing as Luntz prescribes, so skillful are his efforts, so apparently innocent the cause of his victims, but we must be careful to not give license to excuses. People who believe lies are never entirely innocent, mere helpless victims. People do not believe lies unless they first give consent to them in a subtle way. Liars succeed by engaging the shadow side of their victims, massaging the greedy, lazy, irresponsible aspects of their personalities, letting these ugly aspects of the self grow and flower. Then they implicitly conspire with their victims to pretend that the ugly reality of what is emerging from their souls is not what it is. For affirming the parts of themselves that they would disown, the victims are grateful to the liar, and they grant the liar continued permission to lie to them. They suppress their suspicions, allowing the spiral of deception and self-deception to deepen,

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[98] David Michaels, *Doubt is Their Product: How Industry's Assault on Science Threatens Your Health* (Oxford: The Oxford University Press, 2008), pp. 198. Frank Luntz's paper, "The Environment: A Cleaner, Safer, Healthier America," (2003), where the quote comes from, is available at: http://www.ewg.org:16080/briefings/luntzmemo

expand. By giving their victim's secret self license to come out and play, the liar engages in a subtle conspiracy with their victim's shadow side, playing on their hopes while nurturing their greed, helping them deny their failure to do due diligence while praising them for their diligent efforts on behalf of their shared purpose, which is maintaining the integrity of the lie.

In Montana, we saw how this played out in the prison con at Hardin. Michael Hilton told a story too good to be true, but many people in Hardin believed him because it was so useful to believe. Things have been hard in Hardin; people there are long suffering and desperate. Showering them with gifts, attention, and praise, Hilton told them that they were worthy, that their prison had merit that no one else appreciated. He played on their desperation, their greed, and their insecurity.[99] Believing him, people in Hardin believed in themselves. But it was all an exploitive lie, which is why what he did was so horribly cruel. He cultivated self-delusion, gave people confidence in the false image of themselves they conspired to construct, and then he stole it all away when the truth came out.

People who believe climate deniers are like the people at Hardin who believed Michael Hilton. They want to see themselves as good people, who would never harm the planet or their children. When scientists tell them otherwise, and that they have to change the way they live if their children are to have a future, they feel oppressed, guilty. They feel bad about themselves. But the deniers offer people who don't want to see themselves this way, or change the way they live, an easy way out. They can believe the scientists are frauds, engaged in a conspiracy to deceive them, and that the truth is a lie. It is so much easier this way, and that is why the people who believe the deniers are not merely innocent victims. They believe lies because it lets them off the hook, relieves them of their guilt, and allows them to avoid responsibility. So long as there is "doubt," so long as they are supporting "sound science," not "rushing to judgment," and are waiting for answers "they deserve to have," they can continue as they have. Denial is easy, as Luntz clearly understands; responsibility is not.

The Eco/nomic and Political Consequences of Denial:

Neglecting the eco/nomy for the sake of corporate economics, humanity is at a tipping point, as many of the world's leading climate scientists agree. Focusing on the immediate, the profitable, and the merely human we disregard what the forces we set loose will cause. According to David Archer, a professor of geophysical sciences at the University of Chicago:

[99] Ed Kemmick, "Was Hilton just the latest to seek gains from Hardin," *Billings Gazette* (Oct. 18, 2009). http://billingsgazette.com/news/state-and-regional/montana/article_d218d8d8-bb81-11de-8043-001cc4c03286.html

> We will conclude by considering the awesome potential energy impacts of a gallon of gasoline on Earth. When it is burned, it yields about 2500 kilocalories of energy, but this is just a beginning. Its carbon is released as (carbon dioxide) to the atmosphere, trapping Earth's radiant energy by absorbing infrared radiation. About three-quarters of the (carbon dioxide) will go away in a few centuries, but the rest will remain in the atmosphere for thousands of years.
>
> If we add up the total amount of energy trapped by the (carbon dioxide) from the gallon of gas over its atmosphere lifetime, we find that our gallon of gasoline ultimately traps one hundred billion (100,000,000,000) kilocalories of useless and unwanted greenhouse heat. The bad energy from burning that gallon ultimately outweighs the good energy by a factor of about 40 million.
>
> The enormous world-altering potential of that gallon of gasoline has taken the reins of the Earth's climate away from its natural stabilizing feedback systems, and given them to us. May we use our newfound powers wisely.[100]

The difference between the energy directly generated by burning the gallon of gas and the energy retained by the greenhouse gases that it creates when burned is the difference between the economy and the eco/nomy, the part and the whole, the market and the ecosystem. This difference between what a gallon of gas does to the human economy and what it does to nature's economy can be likened to the national debt. We spend the money now, but our children, their children, and their children's children will pay for it.

Actually, it is worse. The Federal Reserve Board could pay the entire national debt off, every penny. The Fed has that kind of power. In a couple of nanoseconds, the Fed's computers could create all the money we need to do this. In less than a blink of an eye, everything would be paid off. Of course, every economist in the country, left and right, would go goggle eyed and say it shouldn't do that, but never mind them. The point is, it could do this. Human institutions, like the president, Congress, and the Fed, can manage the federal debt. It is just money, something we humans have sovereignty over. Congress can, and routinely does, change the laws of economics by changing the laws regulating money. However, as much as it may change the laws of economics by changing the law, Congress has no authority over the laws of nature. None. It cannot repeal the impact that carbon dioxide has on the climate. The enormous debt we are building up in nature's economy will not go away with some sleight of hand. No corporate public relations team is going to make climate change disappear.

Climate scientists are telling us that we risk much continuing business as usual. As temperatures rise, the Arctic ice cover is melting, increasing the amount of energy Earth absorbs, which in turn raises temperatures even more. The tundra in Alaska and Siberia is melting, releasing carbon dioxide and methane, as are the methane hydrate deposits in the ocean, all of which feeds back, amplifying the harm of anthropogenic releases.

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[100] David Archer, *The Long Thaw: How Humans are Changing the Next 100,000 Years of Earth's Climate* (Princeton: Princeton University Press, 2009), pp 173.

Ecosystems across the world, especially the rainforests, are increasingly in danger of collapse, which will also add more greenhouse gases to the atmosphere. Algae populations in the oceans could collapse in large areas at any moment, eliminating a powerful negative feedback loop that helps maintain Earth's homeostasis. As temperatures raise, the possibility that we will cross a threshold, turning linear change into abrupt, catastrophic, change increases.

Deniers say all this is in doubt. To deniers, I say, prove it. Show us that it is safe to go beyond carbon dioxide levels of 350. Show us a negative feedback loop powerful enough to maintain Earth's homeostasis. Prove to us that the methane hydrate deposits on the bottom of the ocean will not be released with increased warming. Prove to us that the ocean's currents aren't going to suddenly shift, causing warm waters to flow over the methane hydrate deposits. Give us evidence that the amount of carbon dioxide and methane sequestered in the Arctic tundra are not enough to become a significant positive feedback to warming. Reassure us that the world's rainforests are not endangered. Prove it all beyond any reasonable doubt, and then I will agree that we need not take dramatic action to save our Earth.

However, until then, until the scientists are proven wrong, we must take precaution. I agree with the deniers that science is uncertain about many things about climate change--especially that we don't know where all the tipping points are--but I come to an entirely different conclusion about how to respond to scientific uncertainty than deniers do. They say that scientific uncertainty, any kind of doubt, means we need make no change. I say that scientific uncertainty means we must take immediate precaution, take the conservative approach, and make sure we know what the consequences are before we further endanger the world.

Given what climate scientists have proven about climate change, and what deniers have failed to disprove, saying that we must be balanced in our approach to economic development, not letting environmental protection get in the way of the economy, is like saying we should be balanced about letting a baby play in the middle of an interstate highway. The "balance" deniers would strike is a con to cover up a lie. The impossibly ugly fact is that by increasing levels of greenhouse gases, we play Russian roulette with the lives of future generations. The methane hydrate gun is fully charged. It could radically change our climate, killing perhaps billions of people. We don't know what triggers it, but we do know it does go off. Moreover, we know that as the Arctic ice cover melts away, the tundra thaws, and the forests die, we increase the odds of it going off. And yet the deniers would have us ignore all this for the sake of corporate interest.

Waiting until no one doubts future catastrophe would be waiting to long. By then it will be too late. We will cast out of our earthly paradise, forever banished. As Martin Luther King said, "there is such a thing as being too late." We need to take responsibility for the world we are creating now, before it is too late.

February 12, 2010

Dear Land Board Members:

The Montana Environmental Information Center strongly urges you to resist the recommendation by the Montana Department of Natural Resources and Conservation to lower the price of the Otter Creek coal tracts. The Land Board is responsible for managing state school trust lands, not DNRC. The cursory submittal from Arch's Coal's subsidiary was wholly insufficient to justify lowering the value of these tracts at this time. Arch Coal is one of the countries leading coal companies. It can afford to pay a significantly higher price than the already low price of $0.25/ton with a 12.5% royalty. In fact, Arch Coal is doing exactly that in Wyoming.

Arch Coal's submittal on February 8, 2009, was insufficient to justify lowering the bid value for the Otter Creek tracts. A postage stamp and a brief paragraph should not be worth $28 million to $172 million! If the Land Board allows Arch Coal to simply submit an unsupported paragraph as justification for lowering the value of the coal, it may be the best coal company investment in history. Arch's submittal simply said:

"Our modeling examined the feasibility of combining the State's lease with the property Ark Land recently leased from Great Northern Properties. While the combination creates an attractive package from an engineering/mining perspective, the economics at the State's current minimum bid value...do not support the project. ... One alternative that the State may want to consider is lowering the royalty rate on the lease, which would allow bidders to increase the amount of the bonus bid that they are able to pay."

Arch Coal provided no data, no rationale, and no modeling information. Arch Coal provided NOTHING to confirm or support the contention that the state's bid request was too high. There may be myriad reasons why no bids were submitted at this time. But Arch did not provide a single argument to support its suggestion that the state "may want to consider" lowering the price tag. It would be an incomprehensible negotiating tactic to automatically lower the bid at the off-handed, unsubstantiated suggestion of a company that has a financial interest in the outcome. Why would the Land Board simply accept Arch's suggestion without requiring it to support its claim, without doing any independent research on the current market conditions, and without documentation that can be scrutinized by the public and the Land Board? The Land Board has a duty to do more than simply accept the suggestion of a mining company that stands to gain a significant financial benefit from a decrease in value.

The Land Board would do well to investigate Arch coal's activities in Wyoming. As the attached spreadsheet shows, **average bonus bids in Wyoming over the last decade were $0.79/ton with a 12.5% royalty**. For example, the coal at the North Rochelle, Wyoming mine was sold in 2005. Arch's bid of $0.67/ton was rejected and a later bid of $0.97 from Peabody was accepted. Arch successfully bid on two Wyoming mines in the last decade and paid significantly more for the coal than what was originally proposed for Otter Creek. At the Black Thunder mine, Arch paid $0.85/ton in 2004. It paid $0.706/ton at the Jacob's Ranch Mine in 2001. The Btu value, sulfur content, and moisture content are similar at all three mines. The critically important strip ratio is

more favorable at Otter Creek. The only variable that appears worse at Otter Creek is the sodium content. However, Chuck Kerr told the Land Board in September 2009 that sodium content is no longer a limiting variable because new technology is commercially available that eliminates this obstacle for boilers.

As identified in the Norwest appraisal, the only remaining rationale to lower the value of the Otter Creek coal tracts is the lack of rail transportation to the site. The Land Board has repeatedly said it does not want to subsidize the Tongue River Railroad. There can be no debate that the only reason to lower the value of the coal far below Wyoming market prices is to subsidize development of the Tongue River Railroad. The Land Board has claimed it will not do this. But to lower the price of Otter Creek coal *is* to subsidize the Tongue River Railroad, which will harm Montana ranchers, private property rights, and other Montana mines.

Arch Coal is the second largest coal company in the United States. In 2008, it earned $2.9 billion. In 2009, it earned almost $2.6 billion. Its Chief Executive Officer, Steven Leer, earned over $6.5 million in 2008 alone. Arch Coal is a well-financed company that can afford to pay more than $0.25/ton for coal as demonstrated by the fact that it has paid over three times that amount in Wyoming.

Finally, Arch Coal has repeatedly stated that it can move forward with a mine at this site without Montana. Although MEIC opposes any coal mining in the area, from a financial perspective, the Land Board should not take this statement as a threat, instead it should let Arch do so. The Otter Creek coal tracts will only become more valuable once a mine is opened adjacent to the State's holdings.

Part of negotiating is being willing to call someone's bluff. Immediately folding before negotiations can even begin is to negotiate from a position of weakness. Arch Coal already has a distinct advantage because of the remarkably low value established for the initial bid. Do not let them gain even more of an advantage over the State by robbing present and future generations of valuable resources.

Sincerely,

Anne Hedges
Program Director
Montana Environmental Information Center
P.O. Box 1184
Helena, MT 59624
office: (406) 443-2520
cell: (406)461-9546
fax: (406) 443-2507
ahedges@meic.org
http://www.meic.org

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Mine name	Mine Site	Company	**Final Bid $/minable ton**	Original bid rejected (company & price)	NEPA ROD	Sale Date	Coal Quantity (tons)	Btu/lb	Ash %	Sulfur	Moisture	NA	strip ratio (BCY/ton)
Otter Creek							572,300,000	8600/9100	5.5	0.28	27.89	6-7%*	1.4*
Cordero-Rojo	North Maysdorf	Rio Tinto	**0.88**	Rio $0.3842; Rio $0.8013	8/6/07	1/29/09	54,657,000	8586	4.4-5.37	0.27%	29.24%	1.61%	3.7:1
	South Maysdorf	Rio Tinto	**0.87**	Rio $0.4234	8/6/07	4/22/08	288,081,000	8404		0.29%	29.70%	1.47%	
Eagle Butte		R.A.G.	**0.708**		10/18/07	2/20/08	255,000,000	8434		0.40%			2.9:1
North Rochelle	West Roundup	Peabody	**0.97**	Arch $0.67	9/9/04	2/16/05	327,186,000	8790		0.20%		1.60%	4.3:1
N. Antelope/ Rochelle	NARO North	Peabody	**0.92**	Peabody $0.73	7/16/04	12/29/04	324,627,000	9090		0.25%		2.40%	3.9:1
Antelope	West Antelope	Kennecott	**0.75**		10/25/04	12/15/04	194,961,000	8858		0.23%		1.86%	3.0:1
Buckskin Mine	Hay Creek	Kiewit	**0.3**		10/1/04	11/17/04	142,698,000	8346		0.28%		1.75%	2.0:1
Black Thunder	Little Thunder	Arch	**0.85**		8/13/04	9/22/04	718,719,000	8884		0.24%		1.20%	3.4:1
N. Antelope/ Rochelle	NARO South	Peabody	**0.92**		5/6/04	6/29/04	297,469,000	8929		0.20%		2%	2.8:1
Jacobs Ranch Mine	North Jacobs Ranch	Kennecott & Arch	**0.706**		11/28/01	1/16/02	537,542,000	8792	5.46	0.45%	27.40%	1.29%	3.5:1
Average WY bid price			**$0.79/ton**										

* Otter creek sodium content and strip ratio taken from Great Northern data

Strip ratios presented to the Energy and Telecommunications Interim Committee by DNRC are 3:1

Comments to the Land Board

February 16, 2010

When the gold mining industry tried to force Montana to allow harmful practices which could spoil the river and the land of the Blackfoot Valley, the voters sent a clear message.

More recently, when potential dangers upstream threatened the Flathead Valley, public outcry was intense and the response was immediate. Montana's active leadership helped avert development which posed a threat to that valley, recognizing that possible harm to our land and water resources is too high a price to pay for these commercial ventures.

Consider the scenario if it were coal in the Blackfoot or Flathead, instead of gold. I don't think responsible state leadership would encourage a commercial venture like this, if the coal were located in these valleys.

When I was talking to other folks in the Blackfoot Valley, several of them mentioned they had heard the governor is now a neighbor of ours. Since you are a fellow landowner, you may know that these folks, like a lot of other Montanans, are deeply disturbed by the notion of further stripmining in Eastern Montana. They ask, "Where will the water come from? How would they get coal to market? I just couldn't operate my place if a railroad went across it!"

In reality, who WOULD make sure they did it right? Look how difficult it is NOW, to monitor coalbed methane water. Look at what is happening with the leaky ashpits in Colstrip. Between politics and funding, DNRC can't do the work they have to do NOW.

Comments to the Land Board

February 16, 2010

We urge you all to take another look, and deepen your understanding of what the trust responsibility for Montana's land and water really means. That responsibility is not simply to look after the immediate coffers of the state and the schools, but also to protect a beautiful, healthy, and agriculturally viable Montana for future generations. Your duty extends to protecting Eastern Montana as well.

Your understanding of the trust responsibility MUST include the LONG TERM, FUTURE WELL-BEING of Montana. The water, ground, and basic economy and our farmers and ranchers have been here for a long time. God willing, and your good judgment, they will be here for a long time to come.

Our neighbors in the Blackfoot remember that the whole state worked to protect the future of our valley. Now we need leadership at the state level, to protect OTTER CREEK and E. MT. Please do not vote to lower the bonus bid price—in fact we urge you to forget the idea of leasing Otter Creek Coal.

Janet McMillan
10120 Sunset Hill Road
Greenough MT 59823
(406)244-0300

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February 16, 2010

Dear Honorable Members of the Montana Land Board:

I am President Leroy Spang of the Northern Cheyenne Tribe. On behalf of the Northern Cheyenne, thank you for allowing me time to provide formal input in regards to the Otter Creek Coal Development. On June 15, 2009 the Northern Cheyenne Tribal Council unanimously (10 yes and 0 no) passed, adopted and approved **Resolution No. DOI-165 (2009), a resolution stating the position of the Northern Cheyenne Tribe with respect to Otter Creek Coal Development.** The Tribe continues to support the **Tribe-State Settlement Agreement, the Tribe-Great Northern Properties (GNP) Agreement, and the Promised Federal Exchange and Funding Legislation.** In 2003, the Tribal membership by referendum vote expressed its support for these specific agreements and promise associated with the Otter Creek Coal tracts transferred to the State of Montana by the United States.

The Resolution reaffirms the position of the Tribe, as stated in the Tribe-State Settlement Agreement, that if the State, GNP and the Montana Congressional delegation fulfill their respective commitments under the two agreements and the promised Federal Exchange and Funding Legislation, the Tribe will, for the first time, have a net positive stake in nearby off-Reservation coal-related development and will thereafter **support coal-related development at Otter Creek carried out in accordance with any laws that may apply.** Under Article I, Section 1 of the Tribe's governing Bylaws it is the President's duty to see that all enactments, orders and resolutions are properly executed. In addition, my office is authorized with the right to confer with any Federal or State official on any matters that affect the welfare of the Tribe.

It is a fact that the potential leasing and mining of the vast Otter Creek Coal tracts will certainly affect the Northern Cheyenne people and it my duty to assert our Tribe's interests by ensuring that the Resolution No. DOI-165 (2009) is properly executed. The Land Board has copies of the Tribe-State Agreement, the Tribe-GNP agreement and the draft Federal Exchange and Funding Legislation. The Northern Cheyenne Tribe supports the coal-related development at Otter Creek based on the fulfillment of the commitments made by the State, GNP and the Congressional Delegation. The Tribe has already fulfilled a major commitment by **dismissing with prejudice its Federal lawsuit that had been initiated by the Tribe to challenge the transfer of Otter Creek tract to the State.**

The complex issues related to the Otter Creek Coal Exchange I believe would be best addressed by the current Tribal, State, Congressional and GNP leadership. I would rather have the commitments made resolved during my term of elected office. The impacts of the potential leasing and mining of the coal tracts that are 3-4 miles from our homeland will impact Northern Cheyenne Tribal members and all Montanans for generations to come when decisions are made to develop Otter Creek. Our Tribe stands ready to fulfill its commitments and our expectation is for the State, GNP and Montana Congressional delegation to fulfill commitments written and pledged in agreements made by honorable leaders.

Sincerely,

Leroy A Spang

Leroy Spang, President
Northern Cheyenne Tribe

cc: file/nctc`