STEPTOE & JOHNSON LLP
ATTORNEYS AT LAW

Samuel M. Sipe Jr.
202 429 6486
ssipe@steptoe.com

1330 Connecticut Avenue, NW
Washington, DC 20036-1795
Tel 202.429.3000
Fax 202.429.3902
steptoe.com

June 4, 2010

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BY HAND DELIVERY

Ms. Cynthia Brown
Chief, Section of Administration
Office of Proceedings
Surface Transportation Board
395 E Street, SW
Washington, DC 20423-0001

Re: *Petition of Arkansas Electric Cooperative Corporation for a Declaratory Order*, STB Finance Docket 35305

Dear Ms. Brown:

Enclosed for filing in the above-captioned matter are the original and ten copies of the public version of BNSF Railway Company's ("BNSF") Rebuttal Evidence and Argument. Please note that this filing contains color images. We have included one unbound copy of the public volume to be uploaded onto the Board's webpage.

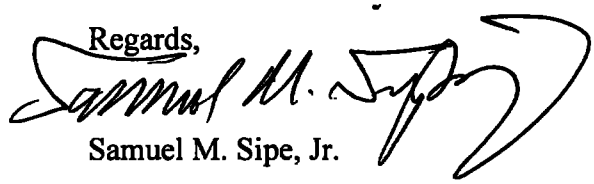
We are also filing under separate cover the highly confidential version of BNSF's Rebuttal Evidence and Argument.

We have included three copies of a CD that contains the highly confidential and public versions of BNSF's Rebuttal Evidence and Argument.

Please date stamp and return the extra copy of this letter to our messenger.

If you have any questions, please do not hesitate to contact me.

Regards,



Samuel M. Sipe, Jr.

Enclosures

cc: Parties of Record

PUBLIC

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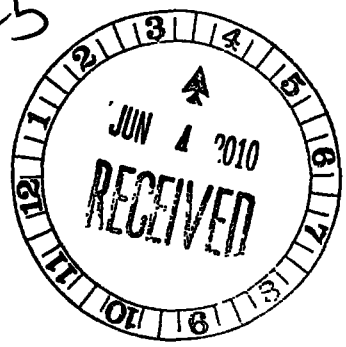

BEFORE THE
SURFACE TRANSPORTATION BOARD

STB Docket No. 35305

PETITION OF ARKANSAS ELECTRIC COOPERATIVE CORPORATION FOR A DECLARATORY ORDER

BNSF RAILWAY COMPANY'S REBUTTAL EVIDENCE AND ARGUMENT

Richard E. Weicher
Jill K. Mulligan
BNSF RAILWAY COMPANY
2500 Lou Menk Drive
Fort Worth, TX 76131
(817) 352-2353

Samuel M. Sipe, Jr.
Anthony J. LaRocca
Brooke L. Gaede
Kathryn J. Gainey
Roy E. Litland
STEPTOE & JOHNSON LLP
1330 Connecticut Avenue, N.W.
Washington, DC 20036
(202) 429-3000

ATTORNEYS FOR
BNSF RAILWAY COMPANY

June 4, 2010

TABLE OF CONTENTS

BNSF RAILWAY COMPANY'S REBUTTAL EVIDENCE AND ARGUMENT

BNSF Railway Company ("BNSF") hereby submits its Rebuttal Evidence and Argument in this declaratory order proceeding. In this Rebuttal Evidence and Argument, BNSF responds to the reply evidence and argument filed on April 30, 2010 by Arkansas Electric Cooperative Corporation ("AECC"), Western Coal Traffic League and Concerned Captive Coal Shippers ("WCTL/CCCS"), and the American Public Power Association, Edison Electric Institute and National Rural Electric Cooperative Association ("APPA/EEI/NRECA"), and to the Reply Comments of the United States Department of Transportation ("DOT").

COUNSEL'S REBUTTAL ARGUMENT AND SUMMARY OF EVIDENCE

This declaratory order proceeding raises two issues for the Board's consideration: (1) Whether BNSF has the right to adopt an operating rule that requires shippers to take measures to keep their coal from escaping out of loaded coal cars during transit; and (2) Whether the specific limits on coal dust emissions established by BNSF in Rules Publication 6041-B, Items 100 and 101 are unreasonable.

BNSF's Right To Adopt Standards for Coal Dust Emissions

As BNSF explained on opening, the law is clear that a railroad has the right to establish operating rules to enhance the safety, reliability and efficiency of its rail network. *N. Am. Freight Car Ass'n v. BNSF Railway Co.*, STB Docket No. 42060 (Sub-No.1) (served Jan. 24, 2007). The shippers do not seriously contest that railroads have long been authorized to establish rules governing the loading and securing of freight to avoid a release of the shipper's freight onto the railroad right of way. Moreover, since the railroad is in the best position to determine how to operate the railroad in an efficient manner, a railroad's operating rule will generally be struck down only if it lacks a rational basis. *Granite State Concrete Co. v. STB*, 417 F.3d 85, 95 (1st

Cir. 2005). The Board is not and should not be in the business of second-guessing operating rules that have a valid basis in a railroad's operating needs.

The operating rule at issue here is designed to protect BNSF's physical plant from being degraded by coal dust and to guard against the risk of a disruption in the provision of transportation service to BNSF's coal customers. The scientific evidence demonstrates beyond serious dispute that coal dust is a pernicious ballast fouling agent that damages the track structure and can lead to derailments. BNSF, as an owner of the rail lines providing coal transportation service in the Powder River Basin ("PRB"), has an obvious and legitimate interest in preventing the degradation of its property and ensuring the safe, reliable and efficient use of its rail network by keeping coal dust out of the ballast.

The shippers' position is that BNSF, as a common carrier, is obligated to deal with any damage to its property that shippers may cause through maintenance or other corrective measures. The DOT, on reply, disagrees with the shippers on this point and acknowledges BNSF's right to require shippers to keep their coal in the cars. But the DOT inconsistently suggests that the Board might need to consider the relative costs of up-front containment (keeping the coal in the cars in the first place) and after-the-fact maintenance (cleaning up the coal dust after it has blown out of the cars) in determining whether BNSF can require shippers to take measures to curtail coal dust emissions.

The DOT's suggestion that comparative cost analysis might be appropriate in this proceeding is misplaced and ignores the important policy issues at stake here. The physical characteristics of coal dust and the difficulty in monitoring its accumulation mean that even with expanded maintenance, the risk of a service interruption due to track instability cannot be eliminated. Expanded maintenance after coal dust has been released can never be as effective a

solution to coal dust fouling as prevention. Reliable transportation of PRB coal to electric utilities located across a broad geographic area is too important to the national economy to allow shippers to keep fouling the rail ballast with coal dust emissions. Regardless of the relative costs of containment and maintenance, it would be extremely shortsighted to allow the shippers to continue undermining the stability of the track structure in the PRB with coal dust and just hope that BNSF can keep up sufficiently with the dust emissions to avert derailments.

Authorities in all other jurisdictions where the problem of coal dust has been considered have determined that railroads can and should adopt measures to keep coal in the loaded cars to the extent possible. These jurisdictions have generally been motivated by a concern over the nuisance of coal dust, an issue that the DOT completely ignored. Even in China, railroads have adopted coal dust curtailment measures through the spraying of surfactants. The Board should not give in to the PRB coal shippers' shortsighted interests and go against the broad consensus that has emerged world-wide that coal dust should not be allowed to blow out of loaded cars unhindered.

The Reasonableness Of BNSF's Coal Dust Standards

In addressing the reasonableness of BNSF's specific coal dust emissions standards, the shippers disregard BNSF's objective of preventing supply chain disruptions, even though that objective is consistent with their own interests. The shippers ask the Board to assess BNSF's emissions limits as if BNSF, or a regulatory agency, was trying to regulate coal dust emissions to a specified level of coal dust units. But BNSF is not trying to regulate coal dust emissions. The objective of BNSF's coal dust emissions standards is simply to have the shippers adopt curtailment measures that will substantially eliminate coal dust emissions from loaded coal trains in transit. Since BNSF has left it to the shippers to determine how best to curtail coal dust

emissions, BNSF needs to have a means to monitor the shippers' curtailment efforts. The specific coal dust emissions standards that BNSF has established, and the approach it is following to monitor coal dust emissions, are reasonable means of determining whether shippers are taking effective measures to curtail coal dust emissions.

The shippers raise a flurry of technical questions about BNSF's coal dust monitoring methodology and the establishment of emissions limits in an effort to make the "science" issues appear more complicated than they are. Since the shippers only criticize and offer no constructive alternatives, it appears that their objective is just to avoid responsibility for coal dust altogether. It is true that the electronic monitoring equipment that BNSF is using to measure coal dust from passing trains is sophisticated, and there could be disputes among scientists and engineers as to how best to use the equipment. But the Board does not need to resolve those disputes. The question for the Board is whether BNSF's standards provide a reasonable basis for monitoring the shippers' coal dust curtailment measures, not whether other monitoring approaches might exist or whether other emissions standards might also be reasonable. The specific coal dust emissions limits established by BNSF have a rational basis, are based on extensive data, and are achievable with existing and available technology. If they are followed, there will be a substantial reduction in coal dust and the risk of service interruptions due to coal dust will be substantially removed. BNSF's standards are a reasonable means of achieving a result that is strongly in the public interest.

Enforcement Issues

When the Board initiated this declaratory order proceeding, it identified a third possible issue: "whether refusal to provide service for non-compliance with the Tariff provisions or other actions to enforce compliance would violate BNSF's common carrier obligation." *Ark. Elec.*

Coop. Corp. - Pet. for a Decl. Order, STB Fin. Docket No. 35305, slip op. at 1 (served Dec. 1, 2009). That issue is premature. BNSF has not established measures to enforce compliance with its coal dust emissions standards. If the Board rejects the shippers' claim that BNSF's standards are unreasonable, BNSF expects that its shippers will begin to implement curtailment measures voluntarily and BNSF will work with them to ensure that those measures are effective. If enforcement measures are adopted, they will take into account the shippers' good faith efforts to comply with the emissions limits. Moreover, as explained by Mr. Bobb, BNSF is committing to provide sufficient notice of any intent to take enforcement action with respect to its common carrier shippers in particular cases to give the affected shipper(s) time to seek the Board's intervention if necessary.

BNSF has spent several years studying the problem of coal dust. It is now time to take affirmative steps to deal with the coal dust problem. It would be irresponsible to put off action further. BNSF's study of the coal dust problem will continue, and BNSF will commit to keeping the Board informed of the ongoing results of its coal dust study efforts. But doing nothing is not an alternative. BNSF urges the Board to support BNSF's efforts to maintain the physical integrity of the PRB rail network by allowing BNSF's coal dust standards to become effective.[1]

These issues are discussed further below and in the verified statements of seven witnesses who support BNSF's Rebuttal Evidence and Argument:

- Stevan Bobb: Mr. Bobb, BNSF's Group Vice President, Coal Marketing, submitted a verified statement on opening. In his rebuttal verified statement, Mr. Bobb emphasizes that the objective of BNSF's coal dust emissions standards is to ensure the reliability and efficiency of PRB coal transportation

[1] On May 10, 2010, the Board extended the schedule for submitting evidence in this proceeding. In light of the schedule extension, BNSF has extended its suspension of the effective date of the challenged rules until October 1, 2010, to give the Board sufficient opportunity to address the issues raised by the commenting parties.

and he urges the Board to support BNSF's efforts to promote these important policies. Mr. Bobb also provides the Board with a commitment to keep the Board informed of BNSF's on-going monitoring of coal dust.

- William VanHook: Mr. VanHook, BNSF's Assistant Vice-President and Chief Engineer-Systems Maintenance and Planning, submitted verified statements on opening and reply. In his rebuttal verified statement, Mr. VanHook addresses shipper claims that coal dust fouling should be addressed through expanded maintenance. He also explains why a valid comparison cannot be made of the cost of containing coal dust in loaded coal cars and the cost of expanded maintenance due to coal dust fouling. He also rebuts shippers' claims that there is no evidence that surfactant application will effectively eliminate coal dust emissions.

- Charles Sultana: Mr. Sultana, a Six Sigma Specialist in BNSF's Mechanical Department, submitted verified statements on opening and reply. On rebuttal, Mr. Sultana responds to questions raised about BNSF's use of data from E-Samplers to establish coal dust emissions standards.

- E. David Emmitt: Dr. Emmitt, the President and Senior Scientist of Simpson Weather Associates, submitted verified statements on opening and reply. Dr. Emmitt's rebuttal verified statement addresses certain claims by shippers about the interpretation of data gathered at Trackside Monitors used to measure dust emissions from passing trains.

- Erol Tutumluer: Dr. Tutumluer, a Professor of Civil and Environmental Engineering at the University of Illinois at Urbana-Champagne, submitted a verified statement on opening. On rebuttal, Professor Tutumluer responds to questions about his research methodology on the impact of coal dust on ballast integrity.

- Joseph Kalt and Glenn Mitchell: Joseph Kalt is the Ford Foundation Professor of International Political Economy at the John F. Kennedy School of Government at Harvard University. Glenn Mitchell is an economist and Vice President at Compass Lexecon. Professor Kalt and Dr. Mitchell explain why, from the perspective of economic and public policy, it would not be appropriate to base a decision on the reasonableness of BNSF's coal dust emissions standards on a traditional cost comparison of the costs to contain coal dust in loaded cars and the cost of dealing with coal dust fouling through expanded maintenance.[2]

[2] In addition, all documents referred to in BNSF's Rebuttal Evidence that contain a document reference number indicating that they were produced in discovery are contained on the disk that is included in Appendix A to the Counsel's Rebuttal Argument.

ARGUMENT

I. BNSF Has The Right To Establish Rules Limiting The Emission Of Coal Dust From Loaded Cars.

A. The Legal Foundation For BNSF's Coal Dust Emissions Standards.

On opening, BNSF explained the legal bases for its coal dust emissions standards. Rail carriers have broad authority to adopt reasonable operating rules to promote safe, efficient, and reliable operations. *See N. Am. Freight Car Ass'n v. BNSF Ry. Co.*, STB Docket No. 42060, slip op. at 8-15 (Jan. 24, 2007) (dismissing complaint that BNSF's demurrage and storage charges for empty private cars constituted an unreasonable practice and acknowledging that efficient equipment utilization is not an unreasonable objective for a railroad's operating rules); *Platt v. LeCocq*, 158 F. 723, 730-31 (8th Cir. 1907) ("A common carrier . . . has the right to make and enforce reasonable regulations which may lawfully fix the times, the places, the methods, and the forms in which it will receive the various commodities it undertakes to carry, and the rules which it thus adopts are presumptively right and reasonable."); 49 U.S.C. § 107092(2) ("A rail carrier providing transportation or service subject to the jurisdiction of the Board under this part shall establish reasonable rules and practices on matters related to that transportation or service.").

BNSF also showed that this broad authority allows rail carriers to establish packing and loading standards. The law reflects the commonsense principle that the best way to ensure safe, efficient, and reliable rail transportation is for shippers to load freight in a manner that does not allow the freight to escape from rail cars. Even WCTL/CCCS concedes that "[c]arriers can adopt reasonable rules governing the safe loading of rail cars." WCTL/CCCS Reply at 25. Moreover, it is the responsibility of the shipper to ensure that their freight remains in the loaded cars. The DOT acknowledged that "shippers of virtually every other product of which the DOT is aware take steps to ensure that their property remains intact in or on rail cars during

transport . . . [and] [t]here is no apparent reason why coal should be any different." DOT Reply Comments at 5.

Finally, while a railroad's operating rules cannot be unreasonable, the Board's reasonableness inquiry is not a vehicle for the Board to substitute its judgment for a rail carrier's judgment. In determining whether an operating rule is reasonable, the Board should defer to a rail carrier's decisions because "it is ordinarily the railroads' prerogative to handle traffic as they see fit." *See Trainload Rates on Radioactive Materials, E. R.R.s*, 362 I.C.C. 756, 772 (1980). The Board should be "reluctant to interfere with a management judgment as to how to conduct railroad operations." *Id.* at 773. Instead of second-guessing BNSF's decisions, the Board "simply ha[s] to determine whether, on the record, [BNSF] had good reasons to be concerned about [coal dust] and whether its responses to those concerns were reasonable." *Granite State Concrete Co. v. STB*, 417 F.3d 85, 95 (1st Cir. 2005).

B. The Shippers' Legal Arguments Are Without Merit.

BNSF has cited ample legal authority in support of its coal dust emissions standards. Most of the shippers' responses to BNSF's legal arguments merit little discussion. The shippers' primary challenge to the legal foundation for BNSF's coal dust emissions standards is that they are "unprecedented." AECC Reply at 4. However, there is ample precedent for loading rules requiring shippers to securely load their freight. *See, e.g.*, AAR Open Top Loading Rules Manual. Moreover, the fact that BNSF has not previously adopted coal dust rules or standards does not prevent BNSF from adopting reasonable operating rules today. *See N. Am. Freight Car Ass'n*, slip op. at 6 (stating that past practice of not imposing certain charges "does not mean that [the new charges are] unlawful . . . under today's conditions").

The shippers also claim that they have no responsibility for securely loading their coal so that it does not escape from rail cars during transit.[3] The claim does not merit serious attention. As DOT recognizes, it is the "responsibility of the owner of the product being shipped to package or load the product so that it remains within the equipment being used for transport, especially if at some point consequences emerge." DOT Reply Comments at 5.

The shippers also claim, erroneously, that BNSF bears the burden of proving that its coal dust tariff is reasonable. *See* WCTL/CCCS Reply at 25 n.17; TUCO Op. at 4-5. This argument ignores the Board's recent statement in *North America Freight Car Association* that "[t]he burden [of proof] has consistently been placed on complainants to prove the merits of an unreasonable practice claim." *N. Am. Freight Car Ass'n v. BNSF Ry. Co.*, STB Docket No. 42060, slip op. at 5 (Jan. 24, 2007). There, the Board explained that the D.C. Circuit's opinion in *Consolidated Rail Corp. v. ICC*, 646 F.2d 642 (D.C. Cir. 1981) ("*Conrail*"), placing the burden of proof on the railroad was inapposite because *Conrail* addressed unique facts involving comprehensively-regulated transportation of spent nuclear fuel. *N. Am. Freight Car Ass'n*, slip op. at 5. Here, the only authority shippers rely upon for their burden-of-proof argument is a decision involving a context similar to that in *Conrail*. *See* WCTL/CCCS Reply at 25 n. 17, *citing Union Pacific Railroad – Petition for a Declaratory Order*, STB Fin. Docket No. 35219, at 4 (June 11, 2009) (addressing railroad proposal in the context of comprehensively-regulated transportation of hazardous materials). As in *North America Freight Car Association*, the

[3] *See* WCTL/CCCS Reply at 24-25 ("[I]f any dust comes off the top of a train, after it is loaded, it does so while BNSF is operating the train, and results from forces beyond the control of the shipper . . . ."); APPA Reply at 4 ("Coal Shippers . . . are not involved in the loading or transportation of PRB coal; . . . and they have no involvement in the transportation of their coal until the loaded cars are delivered to their power plants."); AECC Reply at 6 ("Preventing fugitive coal dust from blowing off the tops of coal cars in transit is not 'an incident of loading' the coal, but an incident of transporting it, for which the railroad, not the shipper, should be responsible.").

authority relied upon by the shippers "was premised on facts not present here" and "[t]here is no basis for shifting the burden in this proceeding." *N. Am. Freight Car Ass'n,* slip op. at 5, 8.

The shippers further argue that since BNSF is a common carrier, it must accept the damage done to its property as a result of handling freight and deal with that damage through traditional maintenance and replacement of assets. *See* AECC Reply at 13; WCTL/CCCS Reply at 9. But as the DOT explained, a common carrier may need to deal with the normal wear and tear that results from the handling of freight, but it is not required to accept the damage done to its property by shippers that have allowed their freight to escape from loaded cars. As the DOT recognized, "the properties of coal dust and the amounts in which it escapes in the PRB region add an element beyond normal wear and tear." DOT Reply Comments at 6. As CSXT noted, railroads are owners of property and they therefore have an inherent right to prevent others from degrading that property. Moreover, like CSXT, BNSF "knows of no inherent right on the part of a customer to leave an unrestricted portion of its property on its supplier's land." *See* CSXT Reply at 5. BNSF's common carrier obligation to transport freight does not carry with it an obligation to suffer extraordinary wear and tear caused by the release of shippers' freight onto BNSF's property.

Shippers argue that BNSF has somehow consented to the release of coal dust on its property. AECC Reply at 3. However, BNSF's coal dust tariff provisions clearly demonstrate the opposite—BNSF is not consenting to the presence of coal dust in significant quantities on its lines and is establishing standards that will substantially eliminate that coal dust. The shippers cite as support for their position that shippers have the right to foul a railroad's property an Arkansas court's unpublished three-sentence summary decision dismissing trespass and nuisance claims asserted by UP in a case involving coal dust. *See* WCTL/CCCS Reply at 22-23, *citing*

Union Pacific Railroad v. Entergy Arkansas, Inc., Case No. CV2006-2711 (Cir. Ct. Pulasky County, Ark. Sept. 12, 2007).[4] The Arkansas court's decision does not state its reasoning. But to the extent the court accepted the plaintiff's argument that there was no trespass because UP had consented to the release of coal dust, the decision is clearly distinguishable since BNSF is making it abundantly clear with its coal dust emissions standard that it is not consenting to the further release of coal dust on BNSF's line.

II. Expanded Maintenance Is Not A Responsible Or Appropriate Way Of Dealing With Coal Dust From PRB Trains.

The shippers argued on opening that coal dust is just a figment of BNSF's imagination. On reply, AECC continues to refer to "BNSF's coal dust bogeyman." AECC Reply at 13. But the evidence of extensive dusting in the PRB is overwhelming, and the shippers do not attempt to show that coal dusting does not occur. Moreover, the shippers' own consultants acknowledge that "ballast strength is significantly compromised when the ballast is saturated by wet coal dust." Nelson Reply V.S. at 2; *see also* McDonald Reply V.S. at 1, 3 ("there is no dispute that coal dust and other ballast fines can interfere with the proper functioning of ballast" by "clog[ging] drainage and lead[ing] to unstable track and roadbed"). The shippers' position is that the Board should ignore the risks of service interruptions from ballast fouled by coal dust and hope that expanded maintenance can deal with the issue before any consequences arise. The Board would be ill advised to pursue such a shortsighted approach to a problem that has national implications.

[4] That case involved, among other things, claims by Entergy that it was injured as a result of UP's decline in service levels after the 2005 derailments. UP asserted counterclaims involving trespass and nuisance from the coal dust emitted from Entergy trains.

A. Coal Must Be Kept In The Loaded Coal Cars To Ensure The Reliability of the Coal Supply Chain.

The shippers' position that the Board should not worry about the impact of coal dust on the reliability of PRB transportation service is inconsistent with the position they took in 2006 before the Federal Energy Regulatory Commission ("FERC") when they complained to FERC that the Board was not giving adequate attention to rail reliability issues. *See* June 15, 2006, Statement of Alan Richardson (President and CEO, APPA) at 4, FERC Docket No. AD06-8 ("Richardson Statement") ("APPA does not believe the issue of low coal stockpiles and their potential effect on reliability and markets is receiving sufficient, if any, attention from the Surface Transportation Board."); June 23, 2006, Tr. at 29, FERC Docket No. AD06-8 (statement by Entergy's VP of Commercial operations that the "[r]ailroads are not held accountable by any regulatory agency").[5] Indeed, these shipper associations went so far as to propose that the FERC begin "tracking railroad coal delivery performance." Richardson Statement at 14; June 19, 2006, Am. Statement of William Mohl (Entergy's then-VP, Commercial Operations) at 15, FERC Docket No. AD06-8 (recommending "regular joint review of coal transportation deliveries by the FERC and the STB").

The STB responded to these coal shipper claims by establishing the Rail Energy Transportation Advisory Committee ("RETAC") and emphasizing that it "views the reliability of the nation's energy supply as crucial to this nation's economic and national security, and the transportation by rail of coal and other energy resources as a vital link in the energy supply chain." *Establishment of a Rail Energy Transportation Advisory Committee*, STB Ex Parte No. 670, slip op. at 2 (served July 17, 2007). Having successfully urged the Board to focus on issues

[5] Copies of all FERC materials referred to herein are contained on the disk that is included in Appendix A to the Counsel's Rebuttal Argument.

of reliability after the 2005 derailments, the shippers cannot logically ask the Board to ignore the importance of reliable PRB transportation in addressing BNSF's coal dust emissions standards.

There is irrefutable scientific data that coal dust is a dangerous ballast fouling agent that can seriously affect the stability of track structure on heavily traveled PRB lines. Professor Tutumluer is the leading researcher on the effect of fugitive coal dust upon railroad ballast. As Professor Tutumluer explained on opening, "the physical and mechanical properties of coal dust and other laboratory tests indicate that coal dust is one of the worst fouling agents" when compared to other contaminants. *See* Tutumluer Op. V.S. at 1. Coal dust absorbs water, expands when exposed to water, and acts as a lubricant. *See id.* at 9-11. Even in very small quantities, coal dust can weaken the strength, stability and load-bearing capacity of rail ballast. *Id.* On reply, the shippers halfheartedly question Professor Tutumluer's research methods, but Professor Tutumluer explains in his rebuttal verified statement that the conclusions he reached were based on sound laboratory methodologies that have direct relevance to operating conditions in the PRB.

Moreover, despite the feigned skepticism of shippers as to the extent of coal dust fouling in the PRB, the evidence is overwhelming that substantial quantities of coal dust are found throughout the PRB, including large amounts of coal dust in the ballast itself. The visual evidence is undeniable. BNSF has submitted numerous photographs showing the widespread accumulation of coal dust on the track bed and right of way[6] as well as videos showing large quantities of coal dust emitted from loaded coal trains.[7] BNSF presents additional photographs in its rebuttal evidence that were taken as part of an effort to estimate the costs that would be

[6] *See* BNSF Counsel's Op. Exs. 1-3; VanHook Op. V.S. Ex. 2, 3, 15; Sloggett Reply V.S. Ex. 1; Emmitt Reply V.S. Ex. 9.

[7] *See* BNSF Counsel's Op. Ex. 4; VanHook Reply V.S. Ex. 1; Emmitt Reply V.S. Ex. 8.

associated with a broad clean-up of PRB rail lines. VanHook Rebuttal V.S., Ex. 5. BNSF's General Director of Maintenance responsible for the PRB, Mr. Sloggett, described BNSF's use of vacuum trucks and other heavy equipment to remove coal dust, as well as the 2008 removal of over 300 rail cars of coal dust that had accumulated on certain parts of the Orin Subdivision. *See* Sloggett Op. V.S. at 8-9; Sloggett Reply V.S. at 5-7. Despite BNSF's extensive removal efforts, coal dust continues to accumulate rapidly. *See* Slogget Op. V.S. at 5-6; Sloggett Reply V.S. at 8-9 and Ex. 1. In his rebuttal verified statement, Mr. VanHook points to the numerous documents produced by BNSF in discovery detailing large amounts of coal dust found in the ballast itself, both by volume and by weight.

The shippers' response to this evidence of widespread coal dust fouling is that BNSF should just clean it up after the fact. But the evidence is also clear that expanded maintenance cannot eliminate the risk of service failures. Coal dust in the ballast cannot be monitored easily and there are currently no effective techniques to look into the sub-surface ballast and determine whether it is fouled and requires undercutting. *See, e.g.*, BNSF Op. at 13; Sloggett Op. V.S. at 4. Even small amounts of coal dust in the ballast can be a serious problem if coal dust is concentrated on the edges or "toe" of the ballast where it creates a "bathtub" effect, preventing water from draining out of the ballast section directly under the tracks. *See* VanHook Reply V.S. at 7-9 and accompanying photographs/diagrams. The evidence shows that rapid accumulation of coal dust can occur even in areas that were recently constructed or undercut. *See, e.g.*, Sloggett Op. V.S. at 5-6; Sloggett Reply V.S. at 8-9 and Ex. 1. When coal dust is hidden below the ballast surface, even the best maintenance and inspection efforts may not be sufficient to identify and prevent a problem before it occurs.

Moreover, expanded maintenance has adverse impacts on the efficiency of PRB service and the capacity available to provide coal transportation. The maintenance required to deal with coal dust fouling takes line segments out of service for hours at a time, requiring trains to be rerouted or held for extended periods. Sloggett Reply V.S. at 6; Smith Reply V.S. at 5-7. Shippers point out that transit times on PRB trains have improved recently and argue, based on this recent experience, that the Board need not worry about reduced capacity due to expanded maintenance. Once again, the shippers' position is shortsighted. The recent improvements in transit time are largely the result of decreased traffic volumes due to the downturn in the economy. When the economy recovers, demand for coal transportation will increase and capacity shortages will once again become a serious concern if capacity is tied up performing extraordinary maintenance to deal with coal dust fouling.

The shippers also continue to urge the Board to ignore the most obvious manifestation of the coal dust problem – the 2005 Joint Line derailments. They argue repeatedly that there is no evidence that coal dust caused the 2005 derailments. *See* AECC Reply at 9-13; WCTL/CCCS Reply at 6-8; and APPA Reply at 6-8. But BNSF does not contend that coal dust was the exclusive cause of the 2005 derailments. Those derailments were caused by a confluence of events, and the important point about the 2005 derailments for this proceeding is that coal dust was a contributing factor to the severe service interruptions that resulted from those derailments. There is no need to speculate about the possible consequences of coal dust in the ballast. The 2005 derailments make clear that BNSF's concerns about coal dust are valid ones.

In any event, AECC is simply wrong to claim that "BNSF presented *no evidence* that coal dust caused or contributed to the derailments." AECC Reply at 10 (emphasis in original).

- Mr. Fox, who was BNSF's Vice President, Engineering, at the time of the derailments, explained how the combination of extraordinary rain and snow in

a short period of time, sub-surface moisture from the frozen ground beginning to thaw, and coal dust accumulation compromised the track structure. *See* Fox Op. V.S. at 5. Mr. Fox further testified that BNSF's "ability to accommodate record volumes of coal up to the point of the derailments confirmed [BNSF's] belief that the coal lines were well maintained." *Id.* at 5.

- BNSF's internal investigation of the 2005 derailments identified coal dust as a root cause of the derailments. *See* BNSF Counsel's Reply Appx. A at 1-2 {{

}}.[8]

- Other contemporaneous BNSF documents identified coal dust as a primary or contributing factor to the derailments. *See id.* at 2-3 {{

}}

- BNSF documents indicate that maintenance was not deferred, as the shippers allege. *See, e.g., id.* at 7 {{

}}; VanHook Reply V.S. at 22-23. In fact, contemporaneous documents show that maintenance to address coal dust-related problems had been recently performed in the areas where the derailments occurred, but that coal dust had rapidly accumulated in spite of BNSF's maintenance efforts. *See* BNSF Counsel's Reply Appx. A at 3 {{

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- Numerous key indicators of railroad reliability in the years preceding the derailments indicated that the Joint Line was performing extremely well, giving BNSF no advance warning of the ballast section's potential vulnerability. *See id.* at 4-5. These indicators include {{

[8] Highly Confidential materials are designated with double brackets – "{{".

}} *See id.*; *see also* Van Hook Reply V.S. at 17-22.

The shippers' fallback argument is that even if coal dust contributed to the 2005 derailments, there is no further need to worry about the impact of coal dust because expanded maintenance can deal with the problem, as evidenced by the fact that since 2005 there has not been a significant derailment due to coal dust. *See* WCTL/CCCS Reply at 9; APPA/EEI/NRECA Reply at 5. It would not be sound regulatory policy to justify inaction on grounds that nothing bad has happened yet. There had not been a serious deep water oil rig blow out until one happened in the Gulf of Mexico on April 20, 2010. While BNSF is doing its best to keep coal dust fouling under control, there is simply no way to eliminate the risk of a service interruption through after-the-fact cleaning and maintenance of the rail lines. The large potential impact of a disruption of the Nation's energy supply makes it irresponsible for the shippers to insist on being able to continue fouling the rail ballast with coal dust emissions.

B. BNSF's Right To Limit Coal Dust Emissions Should Not Turn On A Comparison Of The Estimated Cost To Keep Coal Dust In The Cars And The Cost Of After-The-Fact Maintenance.

The shippers argue that the reasonableness of BNSF's coal dust emissions standards should be determined based on a comparison of BNSF's incremental maintenance costs associated with coal dust and the costs to shippers to comply with BNSF's coal dust emissions standards. *See* AECC Op. at 4-5, 18-19; AECC Reply at 6, 11-12; WCTL/CCCS Op. at 37-47. In the style of other cases where costs are at issue, the shippers then present a highly misleading and manipulated estimate of costs suggesting that the costs to comply with BNSF's coal dust standards exceed substantially BNSF's maintenance costs.

The DOT acknowledges BNSF's right, as the owner and operator of the railroad, to require a shipper to keep its freight contained in the coal cars. As the DOT explained, it is the

"responsibility of the owner of the product being shipped to package or load the product so that it remains within the equipment being used for transport, especially if at some point consequences emerge." DOT Reply Comments at 5. But while the DOT concluded that the shippers have the obligation to keep their coal in the cars, DOT also suggested that the shippers could avoid that obligation by paying for the incremental costs of maintenance without even making a good faith effort to meet that obligation if incremental maintenance was the most "cost-effective" way of dealing with the coal dust problem. According to DOT, "absent a compelling reason to do otherwise, those alternatives that effectively address the issue with the least expenditure of resources should be preferred over those that require more." *Id.*

The DOT cites *Consolidated Rail Corp. v. I.C.C.*, 646 F.2d 642 (D.C. Cir. 1081) and *International Union, United Auto., Aerospace & Agr. Implement Workers v. Occupational Safety and Health Admin.*, 938 F.2d 1310 (D.C. Cir. 1991), for the principle that "sound public policy militates in favor of resolving the coal dust problem in the most cost-effective way." DOT Reply Comments at 7. But the DOT overlooks more recent cases that have rejected the position that a determination of the reasonableness of a railroad's operating rule should turn on a comparison of the costs of alternatives:

> Congress did not limit the Board to a single test or standard for determining whether a rule or practice is reasonable; instead, it gave the Board "broad discretion to conduct case-by-case fact-specific inquiries to give meaning to those terms, which are not self-defining, in the wide variety of factual circumstances encountered."

N. Am. Freight Car Ass'n, slip op. at 8, *quoting Granite State Concrete Co. v. STB*, 417 F.3d 85, 92 (1st Cir. 2005).

Moreover, the law is clear that it would be arbitrary to rely on a cost analysis that failed to account for important costs or benefits. *See Ctr. for Biological Diversity v. Nat'l Highway*

Transp. Safety Admin., 538 F.3d 1172, 1200 (9th Cir. 2008) (criticizing agency's cost-benefit analysis because important benefits were "nowhere accounted for . . . whether quantitatively or qualitatively"). The comparative cost analysis advocated by the shippers would be invalid because it would ignore the largest potential cost that could arise in the maintenance cost scenario. The costs associated with a severe service interruption are highly uncertain, as is the likelihood that such a disruption would occur, but no one can reasonably doubt that if service disruptions were to occur as a result of coal dust fouling, the costs could be extremely high. There is no reasonable way to estimate and account for those costs in the sort of cost comparison approach advocated by the shippers. In fact, they do not even acknowledge the existence of such costs. Moreover, the cost comparison approach advocated by the shippers would ignore other important costs. The costs associated with inefficient use of rail capacity in the PRB, which is a critical part of the Nation's energy supply chain, are undoubtedly substantial but difficult to quantify. BNSF's Assistant Vice President and Chief Engineer-Systems Maintenance and Planning, Mr. VanHook, shows in his rebuttal verified statement that delay-related costs associated with maintenance activity caused by coal dust would be difficult to estimate but they could be as high as {{ }} million, not including the delay-related costs incurred by UP on its separately owned lines. The nuisance costs of coal dust are potentially very high but difficult to estimate. None of these costs can be easily quantified, but it would be arbitrary to rely on a cost analysis that failed to account for them.

The Board also "must review the carriers' actions according to the congressional directions embodied in the various relevant provisions of the [ICA]." *Shippers Comm., OT-5 v. The Ann Arbor R.R. Co.*, 5 I.C.C.2d 856, 863 (1989). Congress has directed the Board to promote safe, efficient, and reliable rail transportation. *See* 49 U.S.C. § 10101(3), (4), (9), (14).

Consistent with Congress' directions, the Board recently formed the RETAC to provide advice to the Board on issues relating to rail safety, efficiency, and reliability, and the Board emphasized that it "views the reliability of the nation's energy supply as crucial to this nation's economic and national security, and the transportation by rail of coal and other energy resources as a vital link in the energy supply chain." *Establishment of a Rail Energy Transportation Advisory Committee*, STB Ex Parte No. 670, slip op. at 2 (served July 17, 2007). As BNSF has explained, these safety, efficiency, and reliability goals are advanced by BNSF's coal dust tariff, which will reduce the risk of coal dust contributing to a derailment on crucial coal lines and will increase the capacity of those lines by reducing the amount of coal-dust-related maintenance. A cost analysis of the type advocated by shippers would ignore these policy goals that Congress has instructed the Board to implement.

Professor Kalt and Dr. Mitchell explain in their rebuttal verified statement why, from the perspective of economic and public policy, it would not be appropriate to base a decision on the reasonableness of BNSF's coal dust emissions standards in this case on a traditional cost comparison of the costs of preventing coal dust emissions (the containment option) and the costs of addressing coal dust after it has escaped from the loaded cars (the maintenance option). Professor Kalt and Dr. Mitchell explain that when there is a high level of uncertainty about the likelihood of an undesirable event, such as a serious interruption in the supply of PRB coal, traditional cost analyses are likely to produce misleading results because they cannot assess the full spectrum of costs associated with the policy alternatives. Under these circumstances, Professor Kalt and Mr. Mitchell explain, policy should be guided by the "Precautionary Principle," which requires adoption of the alternative that eliminates the risk so long as that alternative is not cost-prohibitive.

The DOT does not indicate whether it believes a traditional cost comparison would be feasible in this case or how the Board should implement the suggestion that "absent a compelling reason to do otherwise, those alternatives that effectively address the issue with the least expenditure of resources should be preferred over those that require more." DOT Reply Comments at 5. Indeed, the DOT recognizes that a cost analysis may not be appropriate if there is a "compelling reason" not to base a decision on a cost comparison. But as explained by Mr. VanHook, there is a compelling reason to keep coal dust in the loaded coal cars in this case, namely the strong public interest in avoiding a future disruption to the coal supply chain due to track instability caused by coal dust fouling.

Moreover, as explained by Mr. VanHook, a valid comparison of containment costs to maintenance costs cannot be made because those alternatives are not substitutes for one another. The DOT's comments assumed that the cost comparison would need to be done based on "alternatives that effectively address the issue" of coal dust. DOT Reply Comments at 7. But after-the-fact maintenance can never be as effective in dealing with coal dust as keeping the coal in the cars in the first place, so the cost comparison advocated by the shippers would not be an apples-to-apples comparison. Indeed, a maintenance regime that came close to approximating the effectiveness of surfactant application in preventing track instability due to coal dust deposits would need to ensure that coal dust was cleaned up from the right of way before it had a chance to accumulate. Mr. VanHook explains that such a program would be so intrusive that it would not be feasible to implement, but if it could be carried out, the cost of such a program would be extraordinarily high.

The risk of a service interruption due to coal dust can be effectively addressed by curtailing coal dust emissions. Moreover, as noted by Professor Kalt and Dr. Mitchell, the

implementation of a surfactant program by shippers would have a minimal impact on the delivered cost of coal. Curtailing coal dust emissions is clearly the most sensible and cost-effective policy choice given the importance of PRB coal to the Nation's energy supply and the modest cost to implement a program that will substantially eliminate coal dust emissions.

III. BNSF's Coal Dust Emissions Standards Are Reasonable.

The ultimate objective of BNSF's coal dust emissions standards is to have shippers take measures that will effectively eliminate coal dust fouling in the PRB. However, BNSF seeks to achieve this objective without dictating to the shippers how coal dust curtailment should be accomplished. BNSF's approach is reasonable. The shippers and their mine agents have control over the loading process at the mines and therefore are in the best position to determine how to load and treat coal to prevent it from escaping in transit from the loaded coal cars. BNSF's approach also gives the shippers the flexibility to choose a curtailment approach best suited to the needs of each shipper and the shipper's mine agent. Moreover, by giving shippers control over the technology used to curtail coal dust emissions, BNSF's approach allows competition among the shippers and their suppliers to produce the most efficient and cost-effective coal dust suppression technologies. Notably, while the shippers criticize BNSF's monitoring approach, they never suggest that a preferable alternative would be to mandate that specific actions such as surfactant application be undertaken at the mines.

Having left it up to the shippers to decide how best to control coal dust emissions, it was necessary for BNSF to establish an emissions standard and a monitoring system that would allow BNSF to determine whether the shippers have, in fact, adopted effective curtailment measures. The question for the Board in this proceeding is whether BNSF's coal dust standards are a reasonable way to achieve this objective. While the shippers try to complicate this issue through

a flurry of technical questions, BNSF's approach is quite straightforward. The fact that no shipper offers an alternative to the approach adopted by BNSF indicates that the shippers' concerns about BNSF's methodology and standards are mere pretexts and that their real objective is to avoid responsibility for coal dust altogether.

The Use of Trackside Monitoring Stations

A major criticism by the shippers of BNSF's approach is that BNSF monitors coal dust emissions from Trackside Monitors ("TSM") that are set up 60 feet away from the tracks. According to the shippers, this means that BNSF is not measuring the dust actually falling into the ballast. This is not a valid criticism. Safety requires that the monitoring stations be set up several feet away from the heavily traveled rail lines. But as Dr. Emmitt explained in his reply verified statement, this does not undermine the validity of BNSF's approach because the coal dust emissions measured at the TSM are a strong covariate of the coal dust falling directly onto the tracks. When there are large quantities of coal dust detected by the TSM, it is reasonable to conclude that there are even larger quantities of coal dust falling more directly onto the tracks. By monitoring dust levels at the TSM, BNSF is able to determine whether shippers have taken effective measures to curtail coal dust emissions.

The shippers argue that the TSMs are like speed traps that have been set up at locations where coal dust emissions are likely to occur. AECC Reply at 22. Dr. Emmitt explains in his rebuttal verified statement that the TSMs would not be very useful if they were located at sites where coal dust emissions are unlikely, since the purpose of the TSM is to determine whether the shippers have taken effective curtailment measures. In any event, Dr. Emmitt explains in his rebuttal statement that the TSM locations are representative of other locations along the PRB rail

lines where coal dust emissions are likely to occur in the absence of measures taken by shippers at the mines to curtail dust emissions.

The fact that the TSMs are placed at fixed locations also explains why a relatively low number of trains currently exceed BNSF's standards. AECC points out that only 14 percent of the trains passing the TSM at Milepost 90.7 on the Joint Line in 2009 emitted dust exceeding BNSF's coal dust standard. AECC argues that in light of this low number, "a reasonable approach would be to identify the 14% of trains that produce an excessive amount of coal dust before they leave the mine, and take corrective action." AECC Reply at 19. But dust events occur episodically throughout the trip, so many untreated trains that do not emit high dust levels at the location of the TSM likely emit dust at other locations. Moreover, as WCTL/CCCS' consultant Dr. Viz acknowledges, it is not possible to identify in advance which trains will produce high dust levels due to the complex factors that cause dust to be emitted from moving trains. Viz Reply V.S. at 8-11.

The Use of E-Samplers To Monitor Coal Dust

The shippers raise two basic concerns about BNSF's use of the E-Samplers to monitor coal dust emission levels at the TSMs. First, as discussed on reply, the shippers complained that BNSF was using the E-Samplers to produce a relative measurement of dust emissions rather than an absolute, weight-based measurement. As BNSF explained on reply, the use of a relative measurement is reasonable and supported by the manufacturer of the equipment. For BNSF to monitor the effectiveness of shippers' coal dust curtailment measures, it is not necessary to determine the absolute level of coal dust emitted by a particular train. A relative measurement allows BNSF to determine whether coal dust emissions have effectively been curtailed by comparing dust levels of a particular train to the dust levels on thousands of other trains that have

previously passed the same TSM. Since the objective of BNSF's monitoring efforts is simply to determine whether effective curtailment measures have been taken, there is no reason to try to relate the E-Sampler readings to the absolute amount of dust emitted by a particular train.

The shippers' second concern is that two different E-Samplers may produce variable dust level readings from the same air sample. According to AECC's witness, Mr. Nelson, the variability of the E-Samplers makes them the equivalent of "random number generators." Nelson Reply V.S. at 12. Mr. Nelson has apparently not taken the time to look at the data. As Mr. Sultana explains in his rebuttal statement, BNSF carried out extensive tests on the E-Samplers to determine the range of variability in dust readings. The data show that there is a clear correlation between dust readings on two side-by-side E-Samplers. While there is some variability in those dust readings due to environmental factors that cannot be controlled, the range of variability can be determined and accounted for in interpreting the E-Sampler output. Mr. Sultana set an emissions limit that took full account of the variability in the E-Sampler readings.

WCTL/CCCS' witness, Dr. Viz, raises a technical question about the use of certain data collected by BNSF in its study of E-Sampler variability (specifically, whether data pairs showing that dust is not present in a particular sample should be excluded). Viz Reply V.S. at 6-7. Mr. Sultana explains that he considered the issue raised by Dr. Viz when he carried out his original study of E-Sampler variability and concluded that Dr. Viz' concerns were unfounded. Mr. Sultana's conclusion was confirmed by an outside expert, Smarter Solutions, that BNSF retained at the time to review BNSF's methodology for setting an emissions limit.

The Use of an IDV.2 Limit

BNSF addressed on reply the shippers' criticism of the use of an "integrated dust value" benchmark for assessing the dust levels of passing trains. The IDV.2 value of a train is a valid basis for measuring the relative amount of dust emitted by a train passing the TSM. The IDV.2 benchmark eliminates dust associated with diesel locomotives and background dust. Photographs submitted by BNSF on reply show that the IDV.2 measurement is clearly correlated to dust emissions from passing trains. It is reasonable to use an IDV.2 standard to determine whether shippers are taking effective measures to curtail coal dust emissions.

The shippers' criticism of BNSF's specific IDV.2 standard is not that it is too high or too low. Indeed, the shippers did not even bother to put in any evidence on the specific level of the IDV.2 standard, choosing instead to challenge the idea that coal dust can be monitored at all. In any event, the specific level of the emissions limit is not as important to BNSF's approach as the shippers suggest. BNSF took pains to ensure that the specific standards were based on data collected over two years of monitoring and that they were set at levels that would eliminate the vast majority of coal dust. But modest changes in the specific IDV.2 level would not have a significant impact on the actions that shippers must take to meet the standard. As discussed in the rebuttal verified statement of Mr. Sultana, when a train passing the TSM exceeds BNSF's standard, it usually does so by a substantial amount. If shippers take effective measures to curtail coal dust, they will likely meet BNSF's emissions standards with plenty of headroom. If they do not, their trains are likely to exceed BNSF's standard by a substantial amount. The specific standards set by BNSF are therefore a reasonable means of determining whether effective measures are being taken by shippers to curtail coal dust regardless of whether different approaches to setting the IDV.2 level might have produced slightly different IDV.2 standards.

The Feasibility of Meeting the IDV.2 Standards

Finally, the shippers claim that there is no evidence that it is possible for shippers to meet BNSF's coal dust emissions limit. In fact, the evidence clearly shows that BNSF's IDV.2 standards can be met through a combination of coal load profiling and application of surfactants. Mr. VanHook summarizes the evidence in his rebuttal statement. When shippers begin to implement coal dust curtailment programs on a large scale, it is highly likely that additional surfactants will become available and that other technologies, such as compaction, will be introduced as alternatives for curtailing coal dust emissions.

IV. BNSF Will Keep The Board Informed Of Its Continued Study Of Coal Dust And Will Not Take Enforcement Action Against Its Common Carrier Shippers Without Sufficient Notice To Affected Shippers.

BNSF has been working on the problem of coal dust for several years. It adopted standards for coal dust emissions only after a careful and extensive study of the problem. It worked with its shippers to provide relevant data in an effort to develop a consensus that coal dust emissions must be curtailed in the interests of all parties involved in PRB coal transportation. As a result of these efforts, several shippers have acknowledged that coal dust is a problem that should be dealt with through curtailment measures, and as discussed by BNSF's Group Vice President, Coal Marketing, Mr. Bobb, BNSF has been able to negotiate transportation contracts with shippers who have agreed to comply with coal dust measures that are generally applied. But shippers are reluctant to undertake curtailment measures until they know that other shippers will also undertake such measures.

It is time to begin implementing coal dust curtailment measures. BNSF recognizes that approval of the coal dust emissions standards at issue here is only a first step and that it will take some time to achieve comprehensive shipper participation in the coal dust curtailment efforts.

The standards at issue here apply only to BNSF's common carrier shippers. Contract shippers, who significantly outnumber common carrier coal shippers, will come into compliance gradually as old contracts expire and coal dust curtailment provisions are adopted in new contracts. But implementation of the challenged standards as a rule applicable to BNSF's common carrier movements is a necessary step to making progress on this issue. If BNSF is not allowed to apply its coal dust emissions standards to common carrier shippers, nothing will get done. Given that the reliability of the critical PRB coal supply chain is at issue here, doing nothing is not an alternative.

BNSF's study of coal dust and curtailment of coal dust emissions is ongoing. BNSF intends to continue to improve its methodology for monitoring coal dust emissions and coal dust deposits along the PRB rail lines. BNSF intends to continue to work with its shippers to ensure that effective measures are taken to curtail coal dust emissions. BNSF also intends to keep close track of progress made in reducing coal dust deposits as shippers begin to implement coal dust curtailment measures. Given the importance of this issue, BNSF expects that the Board will have a continuing interest in monitoring BNSF's ongoing efforts in this area. Therefore, BNSF will commit to keeping the Board informed of its coal dust curtailment efforts on an on-going basis, and BNSF will voluntarily report to the Board the results of its coal dust testing and monitoring.

As previously stated, BNSF is optimistic that if the Board determines that BNSF has the right to establish limits on coal dust emissions, shippers will begin voluntarily to adopt curtailment measures. Suppliers of surfactants and developers of other coal dust curtailment technologies have already seen the potential in the market for providing curtailment services and alternative approaches are being aggressively investigated. Thus, there is no impediment to the

prompt adoption of coal dust curtailment measures if the Board determines that BNSF may proceed to implement its coal dust emissions standards.

The shippers continue to complain that BNSF has not identified what if any measures it might pursue to enforce its coal dust standards. With respect to those shippers that have contractually agreed to comply with BNSF's coal dust emissions standards, enforcement can be addressed on an individual shipper basis under the terms of particular contracts. BNSF is confident that shippers that have agreed to adopt coal dust curtailment measures will comply voluntarily with BNSF's rules, but in any event, the Board does not have authority to become involved in enforcement issues as they relate to private contracts.

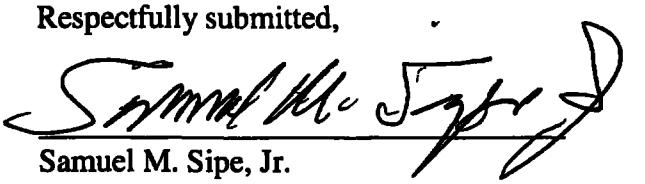
Therefore, on the question of enforcement, the Board need only consider BNSF's common carrier shippers. BNSF also expects that its common carrier shippers will voluntarily comply with BNSF's standards if the Board finds them not to be unreasonable, therefore the question of enforcement may not need to be addressed by the Board. However, BNSF will commit that if it needs to adopt specific enforcement measures to ensure compliance with its coal dust emissions standards, BNSF will provide its common carrier shippers with at least 60 days notice before applying any enforcement measures to give the affected shipper(s) the opportunity to seek the Board's intervention if necessary.

V. Conclusion

The shippers have made it clear that they prefer to avoid all responsibility for curtailing coal dust emissions. Alternatively, they seek to put off taking responsibility for coal dust for as long as possible. The Board should not give in to their shortsighted interests. The PRB rail transportation network is an important part of the Nation's energy supply infrastructure and the reliability of PRB coal supply should not be put at risk by allowing coal dust to foul the rail

ballast. Effective measures are available to curtail coal dust emissions from loaded coal cars and it is time for shippers to begin adopting those measures. BNSF urges the Board to support its efforts to deal with the problem of coal dust by finding that BNSF has the right to establish rules that will curtail coal dust emissions and by finding that the standards that BNSF has set to accomplish this objective are not unreasonable.

Respectfully submitted,



Samuel M. Sipe, Jr.
Anthony J. LaRocca
Brooke L. Gaede
Kathryn J. Gainey
Roy E. Litland
STEPTOE & JOHNSON LLP
1330 Connecticut Avenue, N.W.
Washington, DC 20036
(202) 429-3000

ATTORNEYS FOR
BNSF RAILWAY COMPANY

Richard E. Weicher
Jill K. Mulligan
BNSF RAILWAY COMPANY
2500 Lou Menk Drive
Fort Worth, TX 76131
(817) 352-2353

June 4, 2010

CERTIFICATE OF SERVICE

I hereby certify that on this 4th day of June, 2010, I caused a copy of the foregoing BNSF Railway Company's Rebuttal Evidence and Argument, including the Highly Confidential version, to be served on the following Parties of Record by hand delivery or by Federal Express:

Mr. Eric Von Salzen
McLeod, Watkinson & Miller
One Massachusetts Avenue, NW, Suite 800
Washington, DC 20001
evonsalzen@mwmlaw.com

Counsel for Arkansas Electric Cooperative Corporation

Mr. Joe Rebein
Shook, Hardy & Bacon LLP
2555 Grand Blvd.
Kansas City, Missouri 64108-2613
jrebein@shb.com

Counsel for Union Pacific Railroad Company

Ms. Sandra L. Brown
Thompson Hine LLP
1920 N Street, NW, Suite 800
Washington, DC 20036
Sandra.Brown@ThompsonHine.com

Counsel for Ameren Energy Fuels and Services Company and Texas Municipal Power Agency

Mr. Kelvin J. Dowd
Slover & Loftus LLP
1224 Seventeenth Street, NW
Washington, DC 20036-3003
kjd@sloverandloftus.com

Counsel for Consumers Energy Company

Mr. John H. LeSeur
Slover & Loftus LLP
1224 Seventeenth Street, NW
Washington, DC 20036-3003
jhl@sloverandloftus.com

Counsel for Western Coal Traffic League

Mr. C. Michael Loftus
Slover & Loftus LLP
1224 Seventeenth Street, NW
Washington, DC 20036-3003
cml@sloverandloftus.com

Counsel for Concerned Captive Coal Shippers

Mr. Michael F. McBride
Van Ness Feldman, PC
1050 Thomas Jefferson Street, NW
Suite 700
Washington, DC 20007-3877
mfm@vnf.com

Counsel for American Public Power Association, Edison Electric Institute, and National Rural Electric Cooperative Association

Mr. G. Paul Moates
Sidley Austin LLP
1501 K Street, NW
Washington, DC 20005
pmoates@sidley.com

Counsel for Norfolk Southern Railway Company

Mr. Frank J. Pergolizzi
Slover & Loftus LLP
1224 Seventeenth Street, NW
Washington, DC 20036
fjp@sloverandloftus.com

Counsel for Entergy Arkansas, Inc., Entergy Gulf States Louisiana, LLC, and Entergy Services, Inc.

Mr. Paul Samuel Smith
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Room W94-316 C-30
Washington, DC 20590
paul.smith@dot.gov

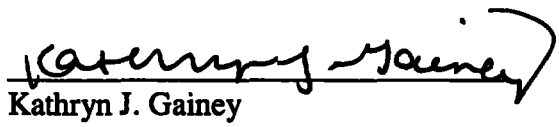
Mr. Thomas W. Wilcox
GKG Law, PC
Canal Square
1054 Thirty-First Street, NW, Suite 200
Washington, DC 20007-4492
twilcox@gkglaw.com

Counsel for National Coal Transportation Association and TUCO Inc.

Mr. Charles A. Stedman
L.E. Peabody & Associates, Inc.
1501 Duke Street, Suite 200
Alexandria, Virginia 22314

and a copy of the foregoing, without the Highly Confidential version, by Federal Express on the following party of record:

Mr. Paul R. Hitchcock
Associate General Counsel
CSX Transportation, Inc.
500 Water Street, J-150
Jacksonville, Florida 32202
Paul_Hitchcock@CSX.com



Kathryn J. Gainey

APPENDIX A
IS FILED UNDER SEAL

BEFORE THE
SURFACE TRANSPORTATION BOARD

STB Finance Docket No. 35305

PETITION OF ARKANSAS ELECTRIC COOPERATIVE CORPORATION FOR A DECLARATORY ORDER

REBUTTAL VERIFIED STATEMENT OF STEVAN B. BOBB

My name is Stevan B. Bobb. I am Group Vice President, Coal Marketing for BNSF Railway Company. I previously submitted a verified statement in support of BNSF's opening evidence in this proceeding on March 16, 2010.

I have reviewed the shipper comments and the comments of the United States Department of Transportation ("DOT") in this proceeding. I am submitting this rebuttal verified statement to urge the Board to affirm that BNSF has the right to address the problem of coal dust escaping from shipper cars onto our rail lines and that the standards we have adopted to assure that shippers take effective measures to keep the coal in the cars are reasonable. The shippers' denial of the seriousness of the coal dust problem in the Powder River Basin is shortsighted. All potentially affected entities – railroads, shippers, mines, utility customers and the Board – have an interest in preserving the reliability and efficiency of the transportation of Powder River Basin coal. BNSF has determined that the only way that can be done with a sufficiently high degree of confidence is by keeping the shippers' coal in the loaded coal cars. BNSF's coal dust emissions standards are reasonable measures to accomplish this important objective.

To my knowledge, this proceeding is the first formal matter before the Board involving coal dust, although I am aware that the problem of coal dust has been discussed in meetings of the Rail Energy Transportation Advisory Committee ("RETAC"). I have been informed by colleagues that coal dust problems have been encountered elsewhere and have been addressed through measures that curtail coal dust emissions. My understanding is that other jurisdictions that have considered the question of coal dust emissions from loaded coal trains have concluded that steps must be taken to keep the coal in the loaded cars. Surfactants have been used in Canada to keep coal in loaded cars since the 1980's. Norfolk Southern has been using surfactants for several years to reduce coal dust emissions from loaded trains in response to concerns raised by the Commonwealth of Virginia. I understand that in Columbia a compaction technology is currently being used to keep coal dust from being blown out of loaded coal trains in transit.

I have recently had contacts with representatives of the Queensland Railroad in Australia which is working on measures to eliminate coal dust. In response to an environmental mandate, Queensland Railroad has established a coal dust monitoring system much like the one established by BNSF. I understand that coal currently being transported by Queensland Railroad is being treated with surfactants to curtail coal dust emissions.

I also learned in early 2010 discussions with the Chinese Ministry of Railways and with the Shenhua Group that the Shenhua Group, a mining and energy company, has begun applying surfactants to loaded coal cars to prevent the loss of coal in transit. Recently I traveled on business to China where I visited coal mines located in Shaanxi

Province and observed the application of a load topping spray to loaded coal cars. Exhibit 1 to this verified statement contains pictures of a spray being applied to the loaded coal cars. I was told that the Chinese have concluded that the cost of surfactant application is less than the cost of the coal lost during transit from untreated coal trains.

The United States typically leads the world in establishing safe and efficient railroad practices. The shippers' position that they should be able to continue loading coal in open top cars without taking measures to inhibit emissions is out of touch with an emerging global consensus that coal dust emissions must be curtailed. Given the large volumes of coal originating in the PRB and the importance of that coal to the nation's energy supply, it would be counterproductive for the Board to deny BNSF the right to require PRB coal shippers to limit their coal dust emissions.

BNSF has determined that coal dust cannot responsibly be dealt with through enhanced maintenance after it has escaped from loaded coal cars. Maintenance is not a substitute for restricting dust emissions because maintenance cannot prevent ballast fouling. BNSF's studies of coal dust after the 2005 derailments has taught us about the pernicious physical characteristics of coal dust as a ballast fouling agent. The only effective way to eliminate the risk of a major interruption in the coal supply chain is to keep coal dust out of the ballast in the first place. It does not make sense to risk a disruption in the supply of PRB coal when reasonable measures are available to prevent coal dust from fouling the ballast.

DOT acknowledges BNSF's right to require that shippers keep their coal in the loaded cars. But DOT also suggests that the wrongful discharge of coal from loaded cars could be addressed after the fact by imposing the costs of enhanced maintenance on

shippers. Because maintenance is not a substitute for preventing dust emissions, the cost comparison approach suggested by DOT would not provide a solution to the coal dust problem.

The reliability of the PRB coal supply network is and should continue to be a priority for the Board. After the 2005 derailments, concerns about the reliability of the energy supply chain led the Federal Energy Regulatory Commission to hold hearings on coal transportation reliability. The Board responded by establishing the RETAC, which was formed to provide advice and guidance to the Board on issues relating to the transportation by rail of energy resources, and by encouraging railroads to work with their shippers to ensure the reliability of coal supply. The Board's commitment to ensuring the reliability of the coal supply network should compel the conclusion that after-the-fact maintenance is not a reasonable substitute for limiting coal dust emissions in the first instance.

A March 4, 2009 RETAC While Paper prepared by the Capacity Planning Subcommittee advised the Board about the importance of avoiding disruptions to the transportation system and energy supply chain. I am currently Co-Chair of RETAC and I was involved in the preparation of the White Paper. The Capacity Planning Subcommittee includes representatives of coal shippers. The White Paper is attached to this verified statement at Exhibit 2. RETAC recommended that the Board "[p]romote the development of supply chain monitoring and reporting of systemic constraints and other factors that could significantly disrupt the transportation system and/or energy supply chain" and "identify constraints or weak points with potential to create choke points in the energy supply chain." RETAC White Paper at 4. Coal dust fouling due to the escape

of coal from loaded coal cars clearly has the risk of disrupting the energy supply chain and the potential to create choke points in the energy supply chain. The White Paper also noted the importance of maintaining adequate rail capacity to ensure reliable energy supplies. *Id.* at 4-5. Expanded maintenance due to coal dust fouling takes productive tracks out of service for extended periods and thereby reduces substantially the capacity that can be used to provide transportation service.

BNSF has worked with its coal shippers to advance the objective of preventing supply chain disruption by inhibiting coal dust emissions. Since the 2005 derailments, BNSF has reached contractual agreements with a number of coal shippers to comply with BNSF's standards regarding coal dust curtailment measures assuming that those standards are made generally applicable to BNSF coal shippers. The approach of securing shipper commitment to coal dust emissions standards by representing that BNSF will make those standards generally applicable is a practical necessity if we are going to succeed in curtailing coal dust emissions. Individual coal shippers are not willing to be singled out (even in a confidential contract) to make a commitment regarding coal dust that entails a cost unless they have reason to believe that others similarly situated will bear comparable costs.

Thus, while this proceeding deals only with common carrier movements because the Board's jurisdiction does not extend to contract traffic, the Board needs to be aware that its decision on BNSF's coal dust standards could have an impact on agreements already negotiated with contract shippers. It would be inconsistent for the Board to encourage us to take measures to ensure the reliability of coal supply and then deprive us of the tools we need to put those measures into effect.

Several shippers urge the Board to put off any ruling on BNSF's coal dust standards until BNSF specifies how it intends to enforce its coal dust emissions standards. It is not necessary to address issues relating to enforcement of the coal dust standards at this time and we do not think it makes sense to address enforcement in the abstract. Enforcement is not an issue at this point and the fact that BNSF has not established an enforcement regime should not be used as an excuse to halt progress on curtailing coal dust emissions.

As to BNSF's contract shippers, enforcement of BNSF's coal dust standards is not an issue that the Board need consider. Where shippers have already agreed to adopt coal dust curtailment measures, we expect those shippers to comply with their agreement.

As to BNSF's common carrier shippers, BNSF has not adopted specific enforcement measures. Again, BNSF hopes and expects that its common carrier shippers will also comply voluntarily with BNSF's coal dust emissions standards once they go into effect. If BNSF decides that it needs to take enforcement measures to ensure compliance with our coal dust standards, we will not act precipitously. BNSF will commit to providing at least 60 days notice of its intent to apply enforcement measures against any common carrier shipper that is not in compliance with BNSF's emissions standards so that the affected shipper may seek the Board's intervention if it wishes to do so.

The coal dust emissions standards at issue in this proceeding are the result of a process of data gathering and analysis that began in earnest after the 2005 derailments, but they do not represent the end of the process. We are continuing to study coal dust and testing to find the best ways to limit dust emissions. We expect that the technology

for dealing with this issue will evolve and improve over time. But we cannot afford to sit back and wait for further developments before we take tangible steps to curtail coal dust emissions. BNSF must be able to act now to address the coal dust problem. The do-nothing approach that the shippers advocate is not an acceptable option.

The coal dust issue is obviously an important one for the Board, for coal shippers and for their mine agents, as well as for BNSF. For that reason, BNSF took substantial time to study the coal dust issue before adopting the standards at issue here. BNSF commits here to providing transparency in its continuing study of coal dust. As explained by others, BNSF has established several coal dust monitoring stations, including trackside monitors and dustfall collectors. BNSF offers to provide coal dust monitoring data to the Board on a regular basis as shippers come into compliance with BNSF's standards so that the Board can keep itself informed of progress in this area.

Finally, I would like to inform the Board that BNSF has decided to extend the effective date of its coal dust emissions standards from August 1, 2010 to October 1, 2010. We hope that the Board will issue a decision authorizing us to apply the our coal dust standards, and the extension in the effective date is intended to give the Board sufficient time to resolve the issues raised in this proceeding prior to the effective date.

I declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on June 3, 2010

Stevan B. Bobb

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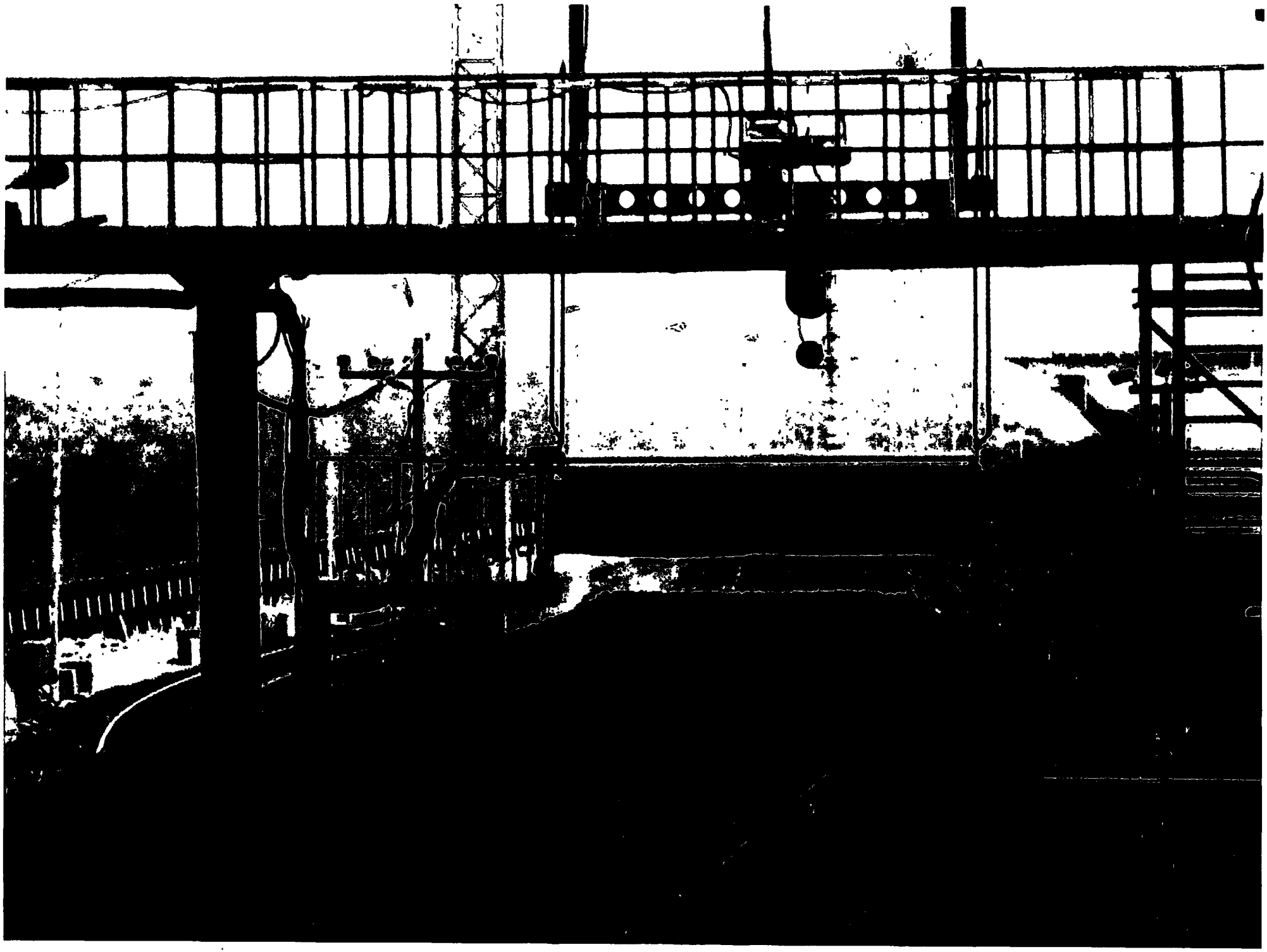

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RAIL ENERGY TRANSPORTATION ADVISORY COMMITTEE
Capacity Planning Subcommittee

WHITE PAPER
March 4, 2009

A. **Subcommittee Members**

Henry Rupert – CSX Transportation, Subcommittee Chair
William Berg – Dairyland Power Cooperative
Steve Bobb – BNSF Ry. Co.
Sameer Gaur – GE Equipment Services
Daryl Haack – Farmer
Bob Hulick – TrinityRail
Ed McKechnie – WATCO Company
Jim Redding – Aventine Renewable Energy
Dan Sabin – Iowa Northern Ry. Co.
Jeff Wallace – Southern Company Generation

B. **RETAC Mission Statement** – RETAC was formed to provide advice and guidance to the Surface Transportation Board, and to serve as a forum for discussion of emerging issues regarding the transportation by rail of energy resources, particularly, but not necessarily limited to, coal, ethanol, and other biofuels. The purpose is to continue discussions regarding issues such as rail performance, capacity constraints, infrastructure planning and development, and effective coordination among suppliers, carriers, and users of energy resources. The goal and scope of this subcommittee falls within the RETAC mission statement.

C. **Subcommittee Goal** – To examine energy supply chain capacity issues that impact the reliability of energy product delivery, primarily coal and ethanol, and develop findings and recommendations to the STB.

Scope –"Advocating approaches to <u>having sufficient physical infrastructure in place and available to move energy resources when and where needed</u>."

It is noted that having "sufficient physical infrastructure" or capacity, is impacted by operating practices, maintenance, productivity initiatives and commercial relationships. As capacity is affected by the practices of shippers and receivers involved in the supply chain, significant economic trade-offs arise when considering solutions to capacity issues. Those issues will be examined in the Best Practices Subcommittee and are outside of the scope of this Subcommittee.

D. **Specific Issues Discussed**

1. How can large investments for energy source development, rail infrastructure, locomotives and rolling stock be made when the political and regulatory climate create so much uncertainty regarding the future use of coal as a primary fuel source in electric generation and renewable fuels as an additional energy source ?

2. What is the nature and extent of the reserve capacity that railroads need in order to meet surges in volume and/or geographic and modal changes in sourcing regions for domestic energy transportation needs?

a) The need for flexibility to shift between coal sourcing regions is increasing as electric power producers seek the ability to respond to dynamic energy markets to ensure electricity can be delivered cleanly and at the lowest possible cost. Likewise, alternative sources of energy introduce greater complexities in geographic and modal shifts for transportation providers.

b) The ability of railroads to provide flexibility is hindered by the time needed to develop such capacity, as well as by uncertainty in the return on investment due to the significant cost of capacity investment and uncertain revenue streams.

3. What mechanism is necessary to ensure that investments in capacity are made where and when needed?

E. **Processes to Address the Issue**

1. The subcommittee is open to all members of RETAC.
2. The Subcommittee first met in May at the Chicago Command Center which manages rail flows through the Chicago Terminal. The meeting began with an overview of the prior capacity presentation to RETAC, continued as a round-table discussion and resulted in a list of broad industry issues and opportunities involving capacity.
3. The co-chairs held a conference call in early August with the Subcommittee chairs to discuss the progress and scope of each Subcommittee. The scope of the capacity Subcommittee was changed as noted above.
4. The Subcommittee met in August at the CSXT Huntington Division office. A few participants took a tour of CSXT's Danville Yard which supports coal train operations in southern West Virginia. The meeting focused on the gap between the changing needs of shippers and receivers, including changes in sourcing and volume surges, and the ability of the railroads to respond given the nature of railroading and the magnitude of funding needed to meet those needs and make an adequate economic return. The group heard presentations regarding the Short-Line Tax Credit and the Cambridge Study commissioned by the AAR.
5. The Subcommittee met in October at Southern Company's Scherer Plant in Macon, GA. The meeting included a tour of the rail unloading system and overview of plant operations.
6. The Subcommittee met in St. Louis in February 2009 to finalize the white paper draft.
7. The group agrees face-to-face meetings are productive and visiting operating sites is beneficial.

F. **Status of Discussions and Consensus Results – see attached**

RETAC CAPACITY SUBCOMMITTEE – Issues and recommendations

Specific Issue #1 – Investment risk and the energy supply chain

How can large investments for energy source development, rail infrastructure, locomotives and rolling stock be made when the political and regulatory climate create so much uncertainty regarding the future use of coal as a primary fuel source in electric generation and renewable fuels as a additional energy source?

Discussion

Mining, railroad and power generation industries are very capital intensive industries which require long lead times to finance and complete projects for capacity expansion and infrastructure improvement.

Growing public, legislative, and regulatory concerns regarding environmental and climate change issues have resulted in a patchwork of complex state and regional initiatives. This patchwork of existing, pending, and potential new regulation and legislation is very complicated and has created much uncertainty surrounding the future demand for coal as a generation fuel source in the United States. This makes it very difficult for mining, railroad, and power generation industries to confidently plan for and invest in significant capacity and infrastructure expansion due to the risk of stranded investment costs.

A clear and concise national energy policy needs to be established in order to improve the ability of these industries to accurately forecast the long term demand for coal and renewable energy, which in turn should allow necessary capacity and infrastructure expansion to occur with much less potential for significant stranded investment costs.

Specific Recommendations to the STB

- STB needs to advocate and educate policy makers on the need for a defined, consistent energy policy.
- Consider continuing a forum such as RETAC that facilitates industry discussions to improve long term demand forecasts, specifically as related to ensuring adequate investment in the supply chain for energy products.

Specific Issue #2 – The increasing need for flexibility in a highly capitalized infrastructure
What is the nature and extent of the reserve capacity that railroads need in order to meet surges in volume and/or geographic and modal changes in sourcing regions for domestic energy transportation needs?

a) The need for flexibility to shift between coal sourcing regions is increasing as electric power producers seek the ability to respond to dynamic energy markets to ensure electricity can be delivered cleanly and at the lowest possible cost. Likewise, alternative sources of energy introduce greater complexities in geographic and modal shifts for transportation providers.

Discussion

Energy producers seek the ability to be able to switch between fuel types and regions swiftly to ensure electricity can be produced in an environmentally compliant and low cost way. On the other hand, railroads cannot always expand or shift capacity and resources quickly enough to meet such changes. The pressure for these shifts will only increase with market volatility, environmental issues and continued globalization of the economy.

Volatility in global and domestic energy markets has increased significantly in the past decade. Although many factors can cause volatility in prices, some of this certainly could be linked directly to the current status of capacity and infrastructure expansion due to issues previously discussed (in specific issue #1).

The volatility is not only in overall prices, but also in the relative price differences between coal types from different geographic regions of the United States (e.g. eastern coal vs. PRB). Additionally, price differences between various fuel types have also become much more volatile (e.g. coal vs. natural gas). Differences by region or fuel type can more and more be attributed to the relative chemical/environmental makeup of the fuel (e.g., sulfur or carbon content). These factors can create swings in the total demand for shipping volumes and also create changes in regional shipping patterns.

The evolution of alternative fuels such as wind and cellulose biofuels will add to the complexities of the supply chain. Regional sourcing of feed stocks from more localized production will alter traditional traffic flows while incentives for more renewable fuels and disincentives against the greater use of coal will encourage new commercial markets for use of forest and crop waste and quick-growth grasses. Incentives need to be provided to handle the consequences of these changing conditions.

Specific Recommendations to the STB

- Promote the development of best practices designed to improve flexibility and to minimize supply chain cost and to forestall disruptions through better coordination of operations planning and forecasting.
- Promote the development of supply chain monitoring and reporting of systemic constraints and other factors that could significantly disrupt the transportation system and/or energy supply chain, resulting in changes to long term forecasts.
- Specifically identify constraints or weak points with potential to create choke points in the energy supply chain.
- STB should continue supporting a mechanism such as RETAC to promote a dialogue of issues within the energy industry supply chain.

Specific Issue #2.b

b) The ability of railroads to provide flexibility is hindered by the time needed to develop such capacity, as well as by uncertainty in the return on investment due to the significant cost of capacity investment and uncertain revenue streams.

Discussion

Significant changes to existing transportation flows and/or new transportation demand can stress the rail network and impact the quality of service. Examples include the recent surge in coal exports and the flow of ethanol into gasoline blending locations that typically have not unloaded large volumes of rail cars.

The amount of reserve capacity railroads are carrying to meet such surges or shifts is not necessarily easy to measure, nor is it widely communicated to or well understood by all who might be using the rail system. An electric utility system is required to carry a very specific and well defined amount of reserve capacity. Railroads are not required to do so, and furthermore, unlike an electric utility that moves a single product on their system (electric power), railroads must consider demand and capacity needs of multiple products. Further, most electric utilities may include reserve capacity in their rate base – and earn an allowable rate of return on that reserve capacity – provided it is approved as used and useful. Railroads, on the other hand, can earn returns on investments only when (or if) the investment is actually used to handle freight that would not otherwise have been moved. It is not clear if/how rail capacity planning and actual rail system operations should differentiate between energy products and other competing rail traffic.

An investment tax credit could potentially result in more rail capacity and infrastructure expansion than would otherwise have been the case. Such investment might be beneficial if it creates additional capacity to provide energy producers, shippers, and railroads the flexibility to shift sourcing regions or increase volumes. As long as the energy consumer can benefit from such changes, and the tax credit does not simply replace railroad investment that would have taken place anyway, then this potentially seems to be good public policy.

Specific Recommendations to the STB

- Develop methodologies to ensure STB regulatory action supports adequate transportation capacity to respond to reasonable changes in demand or source regions.
- Facilitate methodologies within the energy supply chain to determine what level and location of reserve transportation capacity is reasonably likely to be required and would be economically justified to avoid the inherent risk of not having adequate capacity to respond to reasonable changes in demand or source regions.
- Promote longer term policies that allow the railroads to earn sufficient revenues to permit them to build up to the reasonable reserve target levels

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Specific Issue #3 Bridging the investment gap

What mechanism is necessary to ensure that investments in capacity are made where and when needed?

Discussion

Forecasts of population and economic growth, if realized, will potentially strain the nation's transportation infrastructure. In fact, some estimates suggest that the rail industry will grow 67% by the year 2020. Therefore, railroads must invest today to meet tomorrow's transportation and energy needs.

A railroad's capital budget typically consists of expenditures for track maintenance (rail, ties, ballast and bridges), locomotives, rolling stock (railcars of various types), technology and capacity. Capacity expenditures are directly related to infrastructure projects that increase the number of trains that can operate safely over a particular segment of railroad over a given period of time. Candidate projects are determined by performing choke point analyses, an operations research technique that models traffic flows and density. The model reduces the number of trains that could theoretically operate by a predetermined factor to ensure that when delays or breakdowns occur, the system can recover in a reasonable amount of time. When railroads operate above capacity, the recovery period is long and traffic disruptions result.

Typically, capacity projects are evaluated independently and generally must exceed a hurdle rate of return to be considered by a railroad. A priority list is developed and the number of projects approved depends on available capital dollars. Each year, several capacity projects remain on the drawing board.

Capacity planning and choke point analyses are highly dependent on volume projections provided to railroads by customers. Broader market indicators and independent assessments are also used to project changes in volume. An example would be population growth and changing demographics that impact consumer or industrial activity.

A potential a step is the **Freight Rail Infrastructure Capacity Expansion Act of 2009 (FRICEA)** which would amend the Internal Revenue Code to allow a tax credit of 25% on the cost of new qualified freight rail infrastructure property and qualified locomotive property. The bill was referred to the House Ways and Means Committee in January 2009

Railroads view the bill as a step to improve the capacity of the overall network by advancing projects that would have otherwise been delayed or never approved. However, many customers expressed the need to see direct benefit from capacity investments and to hold railroads and other tax credit recipients accountable for ensuring that qualifying investments meet the test of adding capacity that would have not otherwise been completed.

The consensus view of the Subcommittee is that:

- RETAC members agree that additional investment is needed and that FRIECA could lead to increased investments and capital spending.
- In general, shippers do not oppose the tax credit.
- Shippers would be more willing to provide support for the legislation with more assurance that qualifying investments actually increase capacity beyond that which would have otherwise occurred and do so in such a way as to equitably distribute the benefits of the increased capacity.
- Many regulated electric utilities have the ability to earn authorized rates of return on investment in physical assets, and can meet their mandated reserve requirements by investing in and adding needed infrastructure. Railroads and other private enterprises, however, may require assistance to bridge the financial gap and investment risk.

Specific Recommendations to the STB

- RETAC needs to emphasize that the effectiveness of the energy supply chain, rail in particular, in meeting the needs of energy consumers is dependent on commitments from users that support the necessary investments.

- RETAC needs to develop a practical economic view of the gap between the perceived needs of the energy market and the amount of infrastructure investment necessary to meet those needs.

PUBLIC VERSION

BEFORE THE
SURFACE TRANSPORTATION BOARD

STB Finance Docket No. 35305

PETITION OF ARKANSAS ELECTRIC COOPERATIVE CORPORATION FOR A DECLARATORY ORDER

REBUTTAL VERIFIED STATEMENT OF WILLIAM VANHOOK

My name is William VanHook. I am Assistant Vice President and Chief Engineer-Systems Maintenance and Planning for BNSF Railway Company ("BNSF"). I previously submitted verified statements in this proceeding as part of BNSF's opening and reply evidence. As I explained in my opening and reply verified statements, I have been responsible since 2005 for coordinating and overseeing BNSF's efforts to study the scope of the coal dust problem in the Powder River Basin ("PRB") and for investigating measures to curtail coal dust emissions.

I submit this rebuttal verified statement to respond to the shippers' argument made in their reply filings that coal dust accumulations are a problem that BNSF should deal with solely through expanded maintenance. As I explain, reliance on expanded maintenance would be an irresponsible and shortsighted response to a problem that could affect the reliability of the coal supply chain, particularly where it is feasible to eliminate the problem altogether by substantially curtailing coal dust emissions in the first place. I also respond to the suggestion by the United States Department of Transportation ("DOT") that the decision whether to require shippers to keep their coal in the loaded coal cars may turn on a comparison of the costs to contain the coal in the cars and the costs to clean up after the coal has been allowed to spill out of the cars. As I have explained previously, BNSF's coal dust emissions standards are intended to address the risks to the reliability and efficiency of the PRB rail lines that result from coal dust escaping

from loaded coal cars. After-the-fact clean-up and maintenance, while very costly, cannot address these risks as effectively as prevention so there is no way to make a meaningful apples-to-apples cost comparison. Finally, I demonstrate that the shippers' claims that there are no feasible means of satisfying BNSF's coal dust emissions standards are wrong.

I. Coal Dust On The PRB Lines Cannot Responsibly Be Dealt With Merely By Expanding Traditional Maintenance Practices.

The shipper commenters' primary argument against BNSF's coal dust emissions standards appears to be that coal dust is a problem that can and should be dealt with merely by expanding traditional maintenance that is already carried out on the PRB lines. WCTL/CCCS Reply at 8-9; McDonald Reply V.S. at 6; Crowley Reply V.S. at 2, 8; AECC Reply at 24-27; DeBerg Reply V.S. at 6-7; Nelson Reply V.S. at 9-10. They acknowledge that "ballast strength is significantly compromised when the ballast is saturated by wet coal dust." Nelson Reply V.S. at 2. *See also* McDonald Reply V.S. at 1, 3 (explaining that "there is no dispute that coal dust and other ballast fines can interfere with the proper functioning of ballast" by "clog[ging] drainage and lead[ing] to unstable track and roadbed"). But they nevertheless argue that the Board should allow them to continue letting their coal blow out of loaded coal cars unimpeded.

Their first argument for allowing the continued emission of coal dust is that BNSF has overstated the extent of the coal dust problem. They claim that there is not any evidence that coal dust comes off of the top of loaded cars in significant quantities or that there are high levels of coal dust in the ballast. WCTL/CCCS Reply at 12-16; AECC Reply at 22-27; DeBerg Reply V.S. at 3-9; Nelson Reply V.S. at 2-10. They are wrong on both points.

BNSF has already submitted substantial evidence showing that large quantities of coal dust come off of loaded coal cars in transit. As DOT acknowledged, "[t]he record clearly demonstrates that coal dust does escape from trains in the Powder River Basin . . . and that some

quantity falls on or in the immediate vicinity of the tracks, including the ballast." DOT Reply at 2. BNSF estimates that hundreds of pounds of coal are lost from the top of each car on average. Mr. Bobb explains in his rebuttal statement that the Chinese have begun to use surfactants because they concluded that the value of the coal lost from the top of cars exceeds the costs of surfactants. Obviously, coal losses from the top of loaded coal cars are substantial.[1] As I noted in my reply verified statement, if BNSF's estimates of coal losses are correct, the value of the coal that would be kept in the loaded cars by applying an effective surfactant would be almost {{ }}[2] million per year. VanHook Reply V.S. at 32. As to the evidence that the coal dust escaping from loaded cars ends up in the ballast, again BNSF has submitted extensive evidence showing the widespread fouling of ballast by coal dust on rail lines in the PRB.[3]

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[1] On reply, Dr. Emmitt described studies done in Australia of coal losses. *See* Emmitt Reply V.S. at 7-9. Queensland Rail in Australia has implemented a surfactant program to address coal dust losses. *See* Exhibit 1. As I noted in my opening verified statement, studies have been carried out in Canada as well. *See* VanHook Opening V.S. at 21. As early as 1986, the major coal mining companies in Canada agreed to a number of recommended practices, including surfactant spraying. *Coal Dust Control, Recommended Practices for Loading, Unloading and Transporting Coal by Rail*, Environment Canada (1986), attached at Exhibit 2.

[2] Highly Confidential materials are designated with double brackets – "{{".

[3] Large quantities of coal dust emissions fall from loaded coal cars into the ballast or its immediate vicinity. *See* BNSF_COALDUST_0048986 (50% of the fines are coal and 12.5% of ballast is coal); BNSF_COALDUST_0048438 (29% of the waste pile by volume is coal); BNSF_COALDUST_0028418 (50% of the fines are coal); BNSF_COALDUST_0016148 (60% coal by weight); BNSF_COALDUST_0034270 (30% of the fines by volume are coal); BNSF_COALDUST_0035071 (an average of 80 pounds of coal dust accumulated annually in coal dust traps on the ground next to the tracks); BNSF_COALDUST_0021992 (coal dust accumulates in the right of way but diesel exhaust particulate does not due to differences in size between coal dust and diesel exhaust particulate). Indeed, the quantities of coal dust were so great that BNSF studied the risk of combustion from the ballast during undercutting. *See* BNSF_COALDUST_0016150. All documents referred to herein that contain a document reference number were produced in discovery and copies are contained on the DVD that is included in Appendix A to Counsel's Rebuttal Argument.

The shippers' second argument is that BNSF can deal with coal dust fouling through maintenance as evidenced by the fact that BNSF has been able to avoid any serious derailment attributable to coal dust since 2005. This is an extremely shortsighted argument. BNSF substantially increased its maintenance activity on the PRB rail lines in the aftermath of the 2005 derailments and in response to its ongoing studies of coal dust fouling in the PRB. Fortunately, BNSF has been able to avoid any disruption in the coal supply chain due to derailments. But the shippers' argument ignores the difficulties posed by dealing with coal dust after it has been deposited along the right of way. Coal dust often makes its way into the ballast without leaving obvious traces on the surface of the ballast. Coal dust accumulates unevenly, and in some locations rapidly. BNSF has found troubling levels of coal dust in areas that were cleaned as recently as six months previously.[4] In addition, the specific distribution of coal dust within the ballast, which can rarely be determined from the surface, can have a large impact on drainage. I described in my reply verified statement the "bathtub" effect that can result from coal dust accumulations on the shoulders of the track structure. These practical difficulties in cleaning up coal dust after the fact make it impossible to eliminate the risk of a service interruption through expanded maintenance alone. BNSF has reasonably determined that it is not appropriate just to hope that BNSF's ever-expanding maintenance efforts can keep up with the continuing coal dust emissions.

The shippers also argue that the Board should not worry about any impact of expanded maintenance on capacity utilization since service levels have improved recently notwithstanding the increased maintenance being performed on the PRB lines. WCTL/CCCS Reply at 11-12; McDonald Reply V.S. at 5-6; Crowley Reply V.S. at 8-9. It is true that service levels have

[4] *See* Sloggett Opening V.S. at 5-6.

improved, but the improvements are due largely to reduced volumes of coal shipments attributable to the recent economic downturn. Coal transportation will increase as the economy picks up, and the loss of effective capacity on the PRB lines due to high levels of maintenance would interfere with the railroads' ability to meet that increased demand. WCTL/CCCS' consultant, Mr. McDonald, acknowledges that the railroads might need to add new capacity when this occurs: "[C]apacity may again need to be added to prevent the increased maintenance needs from unreasonably disrupting train operations." McDonald Reply V.S. at 7. But railroads should not have to incur substantial costs to add capacity to deal with shipper's coal dust that should not be falling onto our property in the first place.

Finally, the shippers continue to claim that the Board should ignore the 2005 Joint Line derailments in addressing BNSF's coal dust emissions standards because those derailments were caused by inadequate maintenance practices. AECC Reply at 9-13; Nelson Reply V.S. at 16-20; WCTL/CCCS Reply at 6-8; McDonald Reply V.S. at 1-3; APPA/EEI/NRECA Reply at 6-10. I addressed those claims in my reply verified statement, and I do not repeat that discussion here. But I will note that the shippers continue to misrepresent BNSF's position on the 2005 derailments. BNSF has not claimed that "Coal Dust Caused The 2005 Derailments" as AECC repeatedly asserts. AECC Reply at 9. The 2005 derailments were caused by a confluence of events, and the presence of coal dust was clearly an important contributing factor. As long as coal dust is allowed to fall out of loaded coal cars onto the rail ballast, the risk of a service interruption will remain. The reliability and efficiency of the PRB coal supply network requires that coal dust emissions be substantially prevented, not that BNSF be required to clean up after the fact.

II. A Valid Comparison Of Containment Costs To Maintenance Costs Cannot Be Made Because They Are Not Substitutes For One Another.

DOT recognizes that it is the "responsibility of the owner of the product being shipped to package or load the product so that it remains within the equipment being used for transport, especially if at some point consequences emerge." DOT Reply at 5. BNSF's coal dust standards simply require that the shippers take steps to fulfill this responsibility by keeping their freight in the rail cars. But DOT also suggests that it might be appropriate to allow shippers to continue letting coal dust escape from loaded coal cars against BNSF's wishes if it costs less to deal with coal dust after it has blown out of coal cars than it costs to contain the coal dust in the cars. DOT says that "absent a compelling reason to do otherwise, those alternatives that effectively address the issue with the least expenditure of resources should be preferred over those that require more." *Id.* at 7.

The Board should not carry out a complex cost comparison in this case. DOT recognizes that a cost comparison might not be appropriate or relevant if there is a "compelling reason" not to base a decision on a cost comparison. As I have previously explained, there *is* a "compelling reason" to require shippers to keep their coal in the loaded coal cars, namely to avoid the risk of destabilized track structure that results from ballast fouled by coal dust. I explained above that expanded maintenance cannot effectively eliminate the risk of service interruptions due to coal dust. Given the importance of PRB coal in U.S. energy markets, the prevention of future service disruptions is a "compelling reason" to require shippers to keep their coal in the loaded cars regardless of the comparative costs of dealing with coal dust after it has escaped the loaded cars.

DOT's suggestion that the Board might address BNSF's coal dust emissions standards on the basis of a comparison of containment and maintenance costs also ignores the fact that many of the most substantial costs that would need to be considered in such a cost comparison are not

capable of being estimated with any degree of certainty. A cost comparison that ignores the most important costs obviously is not very valuable or informative. For example, it would be very difficult and inherently speculative to estimate the costs associated with a major derailment. We know those costs would be extremely large, but they would be difficult to quantify and would depend on the consequences of a major derailment.[5] There are other costs associated with coal dust emissions as well that would be ignored in a simple cost comparison of containment versus maintenance, such as the cost to add new capacity to deal with coal dust when demand increases and the nuisance value of the coal dust that is blown off the loaded cars.[6] Other costs are highly uncertain. For example, as I noted in my reply verified statement, I would expect the cost of surfactants to come down significantly once the shippers begin applying surfactants to loaded cars, but there is no reliable way to estimate the extent of those cost reductions, or to evaluate the possibility that more cost-effective curtailment measures will come into existence once shippers show they are serious about curtailing coal dust emissions.

One category of costs that DOT recognized would have to be considered in a cost comparison of containment and maintenance costs is the "costs of reduced capacity that accompany maintenance." *See* DOT Reply at 7 n. 7. While BNSF's witnesses explained on reply how expanded maintenance substantially interferes with railroad operations and reduces the capacity available to provide transportation service, it is difficult to quantify the costs

[5] Eleven utilities estimated that they incurred a total of $228 million in costs from the service delays after the 2005 derailments. Congressional Research Service, *Rail Transportation of Coal to Power Plants: Reliability Issues* (Sept. 26, 2007).

[6] It was reported recently in the press that coal dust from one of the PRB rail lines was washed onto the organic garden of a nearby landowner. George Ledbetter, *Coal Dust Runoff Inundates Family's Organic Garden*, The Chadron Record (May 2010). As BNSF noted on reply, there have been lawsuits related to coal dust. *See Alaska Community Action on Toxics & Alaska Chapter of the Sierra Club v. Aurora Energy Servs., LLC & Ala. R.R. Corp.*, No. 09-255 (D. Alaska filed Dec. 28, 2009).

associated with delays that occur as a result of expanded maintenance. Indeed, the shippers' cost analysis on opening completely excluded such costs. A major challenge in calculating delay-related costs is to determine the extent to which particular slow orders and maintenance windows are attributable to problems caused by coal dust. In Exhibit 3 to my rebuttal statement, I show that the estimated costs associated with delay from coal dust maintenance activities vary widely based on the assumption made as to the percentage of slow orders and maintenance windows that are attributable to coal dust. While it is clear that delay-related costs are substantial, a precise estimate of those costs is difficult and uncertain.

In addition to the uncertainty as to many of the costs that would have to be estimated in carrying out a valid cost comparison, a comparison of maintenance costs and containment costs could never be done on an apples-to-apples comparison. DOT's comments assumed that the cost comparison would need to be done based on "alternatives that effectively address the issue" of coal dust. DOT Reply at 7. But after-the-fact maintenance can never be as effective in dealing with coal dust as keeping the coal in the cars in the first place. Even if a highly aggressive maintenance program could substantially reduce the risk of a service interruption, it could never be as effective in averting service failures as preventing the escape of coal dust in the first place. Therefore, there is an inherent imbalance in comparing the costs of maintenance and containment, which are not true substitutes for one another.

To illustrate the fundamental difference between containment and after-the-fact maintenance, consider the cost and feasibility of post emissions clean up that would be required if one sought to achieve the same result as containment through enhanced maintenance. Application of surfactants effectively prevents coal dust from escaping out of the loaded coal cars. A maintenance regime that came close to approximating the effectiveness of surfactant

application in preventing track instability due to coal dust deposits would need to ensure that coal dust was cleaned up from the right of way before it had a chance to accumulate. DOT's suggested cost analysis assumed that the cost comparison would look at alternatives that were equally effective in addressing the problem of coal dust. But a clean up program that approximated the effectiveness of surfactant application would not be feasible. It would not be possible to operate the high volume PRB coal lines with the level of activity that would be required to clean up coal dust before it had the chance to accumulate.

In addition to being infeasible, a program that ensured the clean up of the right of way on a frequent and regular basis to prevent any coal dust accumulation would also be extraordinarily costly. I asked Mark Murphy of Conestoga-Rovers & Associates ("CRA") to estimate the cost of a single right of way clean up on the Orin Subdivision. I noted in my opening verified statement that BNSF has worked with Mr. Murphy and CRA on coal dust issues for several years. Mr. Murphy has helped BNSF implement the monitoring stations and assisted in designing coal loading chutes to implement the coal dust profile requirement. *See* VanHook Opening V.S. at 13. As I explained, in 2008, BNSF carried out extensive efforts to clean up coal dust in areas around bridges, creek beds, and a few other designated locations. As a result of those efforts, BNSF collected over 300 carloads of coal dust that it disposed of in a landfill in North Dakota. BNSF_COALDUST_0063271.

To estimate the costs of coal dust clean up for the entire Orin Subdivision, Mr. Murphy made a HiRail inspection of the Joint Line and visually estimated the volume of coal dust currently on the right of way on the Orin Subdivision. His methodology and estimate of coal dust volumes is set out in Exhibit 4. He also took photographs at each milepost to document his findings. The photographs are included on the DVD in Appendix A to Counsel's Rebuttal

Argument. Mr. Murphy observed that there were substantial accumulations of coal dust at the same locations where the 2008 cleaning was carried out, as well as other areas along the entire Orin Subdivision. *See* Exhibit 5 (containing photographs from Mr. Murphy's HiRail inspection). As explained in Exhibit 4, Mr. Murphy estimated the cost of a right of way clean up on the Orin Subdivision to be over {{ .}} Additional costs would have to be incurred for transportation of the coal dust to a landfill, disposal of the coal dust, and backfilling and re-seeding.

The costs of a program to clean up coal dust on the Joint Line and other BNSF and UP lines leading out of the PRB before the coal dust had a chance to accumulate would dwarf the costs of a program that contains the coal in loaded cars. Such a clean up program would be necessary to make a maintenance option even approach the effectiveness of a containment program. Since it is not feasible to implement a clean up program that could address the coal dust problem in a way that is comparable to the containment option, it is not possible to make a valid cost comparison of the two scenarios.

The Board should not be concerned that the inability to carry out a cost comparison will lead to an inappropriate outcome in this case. There are ample reasons to believe that a program of expanded maintenance, including the huge clean up costs, would be excessively costly if a realistic cost comparison could be done. Moreover, any cost comparison would have to be carried out on a present value basis, recognizing that a decision will affect expenditures associated with coal dust over several years. But the present value of the maintenance option would have to account for the fact that the full maintenance costs would be immediately incurred, while the costs of the containment option will ramp up over several years as contracts

expire and shippers become subject to a curtailment requirement.[7] Based on what can be reasonably known about the costs of the two scenarios, the Board should be confident that the containment option is the most economically efficient outcome.

III. There Is Abundant Evidence That Application Of Surfactants Will Effectively Eliminate Coal Dust Emissions.

The shippers claim that there is no available evidence that application of surfactants will allow them to meet BNSF's coal dust emissions standards. WCTL/CCCS Reply at 19-21; APPA/EEI/NRECA Reply at 12. This is not true. There is ample evidence that surfactants, when used in conjunction with load profile grooming, will substantially eliminate coal dust emissions and permit the shippers to meet BNSF's coal dust emissions standards. VanHook Opening V.S. at 21-23.

Field testing of numerous types of surfactants have shown substantial decreases in dusting when compared to untreated cars. Results from tests in September 2005 through August 2006 showed dust reduction ranging from 77% to 99% as compared to untreated trains. *See* BNSF_COALDUST_0001166. In 2008, extensive trials of ten different surfactant products also showed substantial decreases in dusting. Seven of these products showed dust reduction from 70% to 95%, as measured by the passive collectors located on the rear sills of test trains. *See* BNSF_COALDUST_0070970.

Since there are feasible ways to keep coal dust in loaded coal cars, it makes no sense to allow shippers to continue letting the coal escape from the cars in transit. If nothing is done to curtail coal dust emissions, vast quantities of coal would be allowed to blow out of coal cars

[7] A valid present value analysis would also have to account for the likelihood that surfactant costs will likely decrease over time, while inflation will drive up maintenance costs, which are driven largely by labor costs.

along the rail lines that serve PRB coal trains. It defies common sense and responsible management of the railroad to continue allowing this to happen.

I declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on June 3, 2010

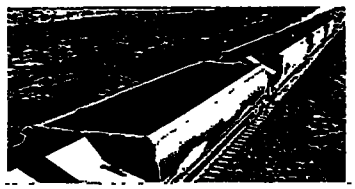
William VanHook

1

April 2010

QRNetwork

Coal Loss Management Project Fact sheet



QR Network's Coal Dust Management Plan (CDMP) has been approved by the Department of Environment and Resource Management (DERM).

The CDMP provides a Central Queensland Coal Supply Chain approach to reducing coal dust from trains in transit.

QR Network will now include dust mitigation requirements in its Transfer Facility Licences with mines.

Three dust monitoring units have been installed: one at Marmor on the Blackwater system, one at Mindi on the Goonyella system, and another at Schillings Lane on the Moura system.

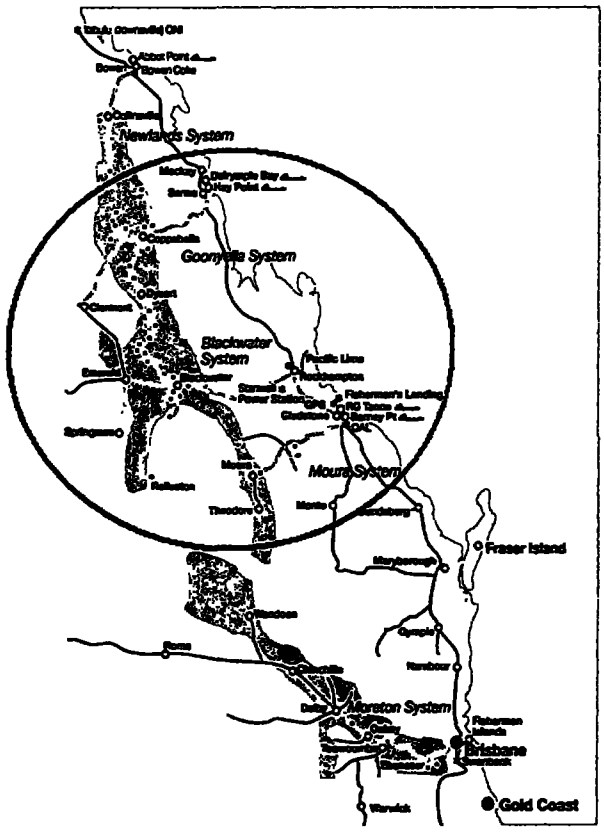
The project will assist with coordinating the development and implementation of:

- Veneering spray stations at 11 of 14 priority Central Queensland mines by end of 2010
- Another five veneering spray stations installed at Central Queensland mines in 2011
- All Central Queensland mines to have veneering spray stations installed by 2013
- Improved loading practises
- Improved profiling
- Pilot wagon cleaning facilities
- Review of operational practises
- Improved wagon design.

Estimated Project Cost

- $4 million

Coal systems covered by CDMP implementation



Project Scope

Oversee the installation of veneering spray stations and improved loading and profiling practises at Central Queensland mines.

Project Delivery

- Develop a project plan for the installation of veneering spray stations.
- Consult and collaborate with the Central Queensland coal supply chain on scheduling for veneering spray station installations.
- Continue with the dust monitoring program that aligns sources of peak dust events with coal trains and load characteristics, and monitors the effectiveness of veneering.

Standard of Work

- QR Network, in consultation with DERM and the Central Queensland Coal Supply Chain will identify a standard for the reduction of dust from trains.
- Ongoing dust monitoring.

Communication Strategy

- A Communication and Stakeholder Management Strategy has been developed. Monthly updates will be provided to key stakeholders who will be consulted throughout the implementation process.

Trigger for Investment

- Department of Environment and Resource Management (DERM) requirement to draft a Transitional Environmental Program.

Estimated Timing of Work

- 11 veneering spray stations installed by end of 2010
- Another five veneering spray stations installed in 2011
- All Central Queensland mines to have veneering spray stations in place by 2013.

Project Benefits

- With other service providers expected to begin transportation of coal in the near future, effective management of coal loss will place QR in a competitive position.
- The effective management and minimisation of the impact of coal loss will convey to communities QR's acknowledgment and dedication to addressing their concerns.
- A proactive response will position QR as a socially responsible citizen who is genuinely concerned about the local communities, and environment, through which it transports coal, and foster strengthened relationships with affected communities.
- Formulating options for dealing with the coal loss issue has the potential to provide economical benefits to QR and coal partners, as minimising coal loss will likely reduce the cost of ballast cleaning and provide increased pathways.

For further information on the project visit:
http://www.qrnetwork.com.au/about-us/environmental-policies/coal-loss-management.aspx
Or contact the team on 3235 5527

2

COAL DUST CONTROL

Recommended practices for loading, unloading and transporting coal by rail

Regional Report No. 86-17

by
Edmund P. Wituschek — Environment Canada
Douglas L. Cope — Environment Canada

April, 1986

Environment Canada | Environnement Canada

Environment Canada
Conservation and Protection
Environmental Protection Service
Pacific and Yukon Region

CONTENTS

LIST OF FIGURES

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This document has been reviewed by the members of the Technical Review Group on Coal Dust Control representing Alberta and British Columbia coal producers, railway transportation companies, terminal operators, and federal, provincial and regional district and municipal levels of government. The authors extend their appreciation to the following committee members for their invaluable contribution, co-operation and efforts:

Nick Agnew	The Coal Association of Canada
Rich Ansley	Crows Nest Resources Ltd.
John Baumfield	Corporation of the District of Kent
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Art Congdon	CP Rail
Emile Dubois	Luscar Ltd.
Cam Edwards	Environment Canada
David Farrell	Obed Mountain Coal Company Ltd.
Rick Ferster	Luscar Ltd.
Glen Gallagher	Canadian Transport Commission
Terry Garvey	Westar Mining
John Holmes	Environment Canada
Pat Killeen	Westshore Terminals Ltd.
Fred Lederer	Neptune Bulk Terminals Ltd.
Lorne Lyndon	Fording Coal Ltd.
Wayne Maksylewich	BC Rail
Dick O'Rourke	CN Rail
David Poon	Environment Canada
Don Rae	Gregg River Resources Ltd.
Jim Robertson	Teck Mining Group Ltd.
Chuck Saunders	Bryon Creek Collieries
Bob Smith	Greater Vancouver Regional District
Claudio Guarnaschelli	Associated R&D Engineering Inc. Consultant to Environment Canada

Dr. Guarnaschelli provided technical advice during the preparation of this report and is a contributing author.

1.0 INTRODUCTION

Environmental concerns over fugitive emissions of coal dust during transport of coal by rail have been recognized since the introduction of large-scale export coal shipment. The concerns have been related mainly to nuisance soiling caused by the deposition of coal dust on properties adjacent to the rail corridors. To alleviate these concerns, a number of practices considered reasonable and practical are recommended in this document.

The Recommended Practices have no legal status. They are intended to provide guidance to the mining, handling and transportation sectors of the coal industry in Western Canada on the design and operation of dust control systems for loaded and empty trains. Many of the measures have already been implemented by some of the companies. Other companies and new coal producers are encouraged to adopt the practices presented herein.

Proper implementation of the recommendations should achieve effective coal dust control and minimize environmental impacts. In the event of any exceptional coal dust problem at any location along a rail route, control measures beyond those identified here may be imposed by the regulatory authorities. Additional mitigation measures will be determined on site specific factors after consultations with the companies involved.

This document has been developed with the assistance of a federal-provincial-industry Technical Review Group formed in 1984. The first task of the group was to review a draft background report titled *"Report on the Emission Control of Fugitive Coal Dust from Coal Trains."* (Environmental Protection Service, 1984) and to endorse its publication. That report provided detailed information on various aspects of the problem and lists available control technologies.

The Recommended Practices emphasize a specific dust abatement measure for loaded trains, namely the application of chemical dust suppressants, as the best practical technology currently available. Because industry and government continue to evaluate new methods and to make improvements, it is recognized that future experience may require changes to these practices.

BACKGROUND INFORMATION

2.0

2.1 Coal production and transportation

(Background Report: Sections 3 2 and 3 3)

The major coal exporting areas in Canada are located in the northeast and southeast regions of British Columbia and western Alberta. Other deposits, which supply mainly domestic markets, are mined in Nova Scotia, New Brunswick and Saskatchewan.

The coal exported from western Canada is shipped to three tidewater terminals in British Columbia, located in the northern and southern areas of the province. Long transportation distances, (exceeding 1,100 kilometres) present a considerable challenge to developing effective dust control measures.

Coal for export is usually processed at the mine site using conventional coal preparation method The clean wet coal is thermally dried to a moisture content of 8% or less prior to shipment by train. Most of the dried coal is stored in covered sheds or silos located at the train load out facility. The moisture content of the coal reflects customer specifications and minimizes handling and shipping problems.

2.2 Train operations

(Reference Section 3.1)

Each coal train in western Canada consists of approximately 100 open-top gondola rail cars capable of carrying 91 tonnes each. In 1985 forty train sets comprising 4500 rail cars were in service. The rail cars are owned by different agencies, including the coal producers, the rail companies, private utilities and private leasing companies. Although cars are similar in design and dimensions, many variations occur, particularly in the sill height of the cars. Consequently, some trains will have cars of different heights, and this is reported to affect the operation of the loading and spraying systems.

Even though load out facilities vary from mine to mine, flood-loading chutes are used almost exclusively to fill the cars as the train moves continuosly through the loading loop. Chutes are operated either manually or automatically. Loading a standard train set takes up to four hours. The larger mines in western Canada load an average of two trains per day.

* These annotated references refer to the appropriate sections in the background report *"Report on the Emission and Control of Fugitive Coal Dust From Coal Trains."*

All of the export terminals on the Pacific Coast at Delta, Vancouver and Prince Rupert employ rotary dumpers to unload trains. The two largest terminals, at Delta and Prince Rupert have continuous rail loops, fully automatic car indexing and tandem dumping facilities. The unloading operation is generally accomplished in 2-4 hours. Under ideal conditions the turnaround or cycle time for a train travelling from the coal fields to and from the terminals (approximately 2200 km) is 72 hours.

2.3 Coal dust emissions

(Reference Section 3.3)

The quanitity of wind-entrained dust from coal cars is the result of many factors. To date, there is no practical method for measuring, directly, the amount of coal dust lost in transit. Although weighing loaded cars before and after a journey has been tried it has proved difficult and inconclusive. Consequently, no firm data on fugitive dust losses are available.

Estimates of coal dust losses range up to 3% of the total coal load for trains travelling a distance of 1000 kms. when no dust control measures are employed. Some estimates of theoretical coal dust losses are presented in Table 1 to illustrate the range of potential controlled and uncontrolled emissions. For the controlled case, it has been assumed that chemical dust suppressants provide a surface crust retention of 85% when the trains arrive at the terminal and that the amount of crust cover retained reflects a proportional degree of emission control.

Dust emissions from empty trains arise from residual coal deposited on external surfaces of the rail car and/or from coal retained inside the car. During cold weather periods, frozen coal retained inside the cars can also be a source of emissions.

2.4 Effects of coal dust emissions

(Reference Sections 3.4, 3.6)

Historically, public concerns have been expressed over the deposition of coal dust near the rail lines as a result of fugitive emissions from loaded and empty trains. The dust causes soiling of personal property, house exteriors and sometimes the interiors of residences and businesses. The aesthetic impact of coal dust from passing trains is classified as a problem of nuisance pollution.

Coal dust levels in ambient air, arising from rail transportation, are not considered to be a hazard to human health. With respect to air quality standards, there are no federal or provincial standards which apply specifically to coal material. Existing air quality objectives for particulate matter apply to total suspended particulates and total dustfall but not to coal particulates.

Table 1

Estimated coal losses for shipments to British Columbia terminals

Uncontrolled emissions

Uncontrolled emission factor (% of load)	Coal loss/train (tonnes)	Potential loss from 24.8 MM tonnes (1984) (tonnes)
0.25	25	62,000
0.50	50	124,000
1.00	100	248,000

Controlled emissions

Uncontrolled emission factor (% of load)	Coal loss train with 85% crust retention (tonnes)	Potential loss from 24.8 MM tonnes (1984) (tonnes)
0.25	3.7	9,300
0.50	7.5	18,600
1.00	15.0	37,200

**The coal producers in western Canada do not accept these calculations as representing actual coal losses.*

2.5 Factors affecting crust retention

(Reference: Sections 4.1, 4.2, 4.3, 4.4)

Studies have shown that many factors affect the crust integrity of chemical dust suppressants. While some are related to the basic properties of the chemical sealants and application techniques, others are caused by different loading and operating practices. For loaded trains, some of the relevant factors include:

a. **Type and application of chemical sealants:**
The basic chemical and physical characteristics of chemical sealants inherently affect their crust forming properties. The concentration and volume of solution applied and the application techniques used are also important variables;

b. **Load profiles:**
Variations in the design of mine load-out facilities and load levelling devices result in wide variations of surface profiles in loaded coal cars among the different companies. Irregular profiles, humps, ridges and slopes near the front and rear of the cars adversely affect uniform application of the chemical sealants. Surface irregularities are also more susceptible to wind erosion which causes crust failure;

c. **Coal car design:**
Some coal train systems operate with cars of different ownership and design. The variations in car capacity and particularly the heights of the cars within a train set makes it difficult for loading operators and spray equipment operators to produce proper loading profiles and to apply adequate amounts of chemical sealants;

d. **Weather Conditions:**
High wind conditions may adversely affect the application of chemical sealants where spray headers are not adequately shielded and extreme cold weather may cause freezing problems in unprotected pipes.

AIR QUALITY MONITORING AND CRUST ASSESSMENT

3.0

The lack of suitable air sampling methods and appropriate analytical techniques for identifying the coal fraction in a particulate matter sample precludes a rigorous evaluation of dust control performance. However, subjective judgement is a useful means by which to assess the effectiveness of the dust abatement measures.

At present, fugitive dust emissions from trains are assessed by observing visible dust from individual trains or by measuring relative ambient aerosol concentrations, while dust control performance is determined by monitoring crust retention on loaded cars arriving at the terminal.

3.1 Visual observations

(Reference: Section 3.9)

Visual observations of coal trains have been useful in assessing the severity of dust from trains at various locations along rail corridors. In a qualitative way, visible dust emissions also reflect the effectiveness of dust control measures. Some disadvantages of this method are:

a. observations are practically impossible at night time;

b. the method lacks a calibration procedure since conventional stack opacity procedures are not applicable;

c. the method is subjective and can vary between observers and between different observations by the same observer;

Based on studies by Environment Canada at Agassiz, B.C. a classification system has been developed to categorize visual emissions into four categories, namely: "heavy," "medium," "light," and "not dusting." Plates 1 and 2 illustrate the visibility of emissions from a "heavy" and "light" dusting train respectively.

This approach has enabled the implementation of a real time reporting procedure from the field whereby the coal producers and terminals are notified whenever a dusting train is observed. In turn, the companies are able to trace equipment malfunctions that caused the dusting train.

Observations of visible dust clouds have also been useful to train crews who are requested to reduce train speed through the Town of Agassiz when a train is dusting.

Visual observations as a monitoring technique have been useful in communities where coal dust impacts are of concern and provide a means of resolving conflicting opinions when assessing control performance. This assessment technique can be applied to both loaded and empty trains.

PLATE 1
"Heavy" dust emissions from a loaded train travelling at 80 km/h with no dust suppressant supplied.

PLATE 2
"Light" dust emissions from a loaded train travelling at 80 km/h with dust suppressant applied.

3.2 Air quality monitoring instrumentation

(Reference. Section 3 7)

A number of different air quality sampling methods have been tested and evaluated to measure ambient particulate levels associated with coal dust emissions from trains.

A summary of the sampling instrumentation and analytical methods is shown in Table 2. The standard instruments which measure particulate matter concentrations are effective and enable a general assessment of air quality. Difficulty arises in relating results from such measurements to public perception and nuisance soiling caused specifically by coal dust.

3.3 Analytical methods

(Reference: Section 3.7)

Filter samples obtained from conventional samplers, namely the high-volume sampler and dustfall sampler, require further analysis to determine the coal fraction in the total particulate matrix. Preliminary studies have focussed on the analysis of the coal fraction on filters from the two samplers.

One method utilizes computer scanning electronic microscopy to identify and count carbon particles on the filter substrate, thus providing the basis for calculating the coal fraction. Another method utilizes the so-called chemical mass balance approach by analyzing a spectrogram of trace metals and organics. Although these methods show some promise more research is required before they can be reliably and routinely implemented.

An optical microscopy method has been developed by the British Columbia Ministry of Environment especially for coal analyses. This method has severe limitations for field applications because it requires a monolayer of particles on a membrane filter.

3.4 Crust retention measurements

(Reference: Section 3 8)

The first technique developed for assessing the performance of dust suppressants employed measurements of crust retention based on the assumption that chemical sealant solutions sprayed on the loaded cars at the mines form a stable crust after curing. Observed crusts are typically 2 centimetres thick, sometimes reaching a thickness of 15 centimetres.

The crust areas that are still intact on arrival at the terminal can be distinguished from areas where crust failure has occurred. A method for measuring crust retention was developed and is described in Section 6. The technique has been accepted by the industry and is presently used in evaluating the performance of existing and new chemical sealants.

MONITOR TYPE	OPERATING MODE
Modified High Volume Sampler	sampler runs for 5-10 minutes during passing train
Standard High Volume Sampler	sampler runs for 24 hour period
Dustfall Sampler	sampler installed for 30 day period
Continuous Particulate Sampler	continuous with real time output of particulate concentration
Soiling Index Sampler	one hour spot samples

Table 2
Summary of air quality monitoring instrumentation

ADVANTAGES	DISADVANTAGES
able to capture particulates larger than aerodynamic size limit of standard sampler able to identify specific dusting trains reasonable correlation with opacity of visual dust emissions	data cannot be related to standard air quality objectives manpower intensive coal dust fraction is difficult to analyze
data can be related to standard air quality objectives provides indication of total suspended particulate levels unattended operation except for servicing	cannot be used for episode monitoring to identify specific dusting trains coal dust fraction on filter is difficult to analyze
data can be related to standard air quality objectives provides indication of total suspended particulate levels unattended operation except for servicing	cannot be used for episode monitoring to identify specific dusting trains coal dust fraction is difficult to analyze
limited results show potential for correlating data to the opacity of visual dust emissions real time output enables identification of specific dusting trains unattended operation except for servicing	unattended operation cannot be used to instantaneously identify coal dusting trains instrument should be calibrated for each type of coal dust limited to fine particles — no samples collected for analysis
results can be related to air quality objectives unattended operation except for servicing	unable to capture large coal dust particles not sufficiently sensitive to correlate with opacity unable to identify in real time specific dusting trains

4.0 COAL DUST CONTROL MEASURES

4.1 Surface profile

(Reference: Section 5 2)

The experience gained over the past few years, together with the studies that have been carried out by industry, have shown that surface profiles are the single most important factor in ensuring crust integrity. A uniform flat surface profile across the full length and width of a loaded car will result in the most stable crust. A flat surface profile is desirable for the following reasons:

1. The chemical application and solution penetration are uniform, in contrast to irregular profiles with humps, ridges or steep end slopes, where the solution tends to run off the slopes and pond in low spots;

2. The crust formed over a flat surface profile is structurally more stable than the crust resting on irregular profiles. The resulting "mat" is less subject to failure from load settling and car vibrations;

3. A flat surface profile minimizes air turbulence over the surface in contrast to irregular profiles that show preferential crust erosion from air turbulence;

4. The exposed surface area is minimized.

4.2 Chemical sealants

(Reference: Section 4.1)

Extensive research has been carried out on the various types of sealants being marketed as coal dust suppressants. Diverse formulations are available, including oils, waste oils, oil emulsions, latex sealants, lignin derivatives, polyacrylamides and proprietary formations.

Oil and asphalt emulsions show good wetting for coal and form a pliable crust with good regenerative properties. However, these compounds may adversely affect rubber conveyor belts. Some latex-based chemical sealants form highly brittle crusts which are easily damaged and display little or no regenerative properties. Emulsions may require pretreatment or wetting of the coal surface with a surfactant to increase penetration. Water soluble lignin derivatives are subject to leaching during rainfall.

It should be noted that some of the chemicals are environmentally toxic and present potential problems if spray run-off and spillage is allowed to fall onto ground unprotected by a collection pad.

In general, the following properties are deemed desirable for dust suppressants:

- good affinity for coal
- ability to form a viscous crust with good regenerative properties over a range of ambient temperature conditions:
- direct application to coal surface without requiring a prewetting agent:
- formation of a crust which is resistant to leaching and other weather-related damage:
- formation of a well-mixed, stable solution which can be applied without clogging piping or nozzles;
- formation of a crust which adheres well to the substrate, particularly on slopes and irregular surfaces;
- formation of a crust which is resistant to shock and vibration damage;
- minimal fouling of rail cars, conveyor belts or other equipment;
- short curing time;
- non-toxic to human health during handling;
- non-toxic from an environmental point of view;
- cost effective.

The concentration and volume of the applied solution required to achieve effective dust control varies amongst products and continues to be an important subject of research between mining companies and chemical suppliers.

4.3
Spraying systems

(Reference: Section 4.1)

A variety of designs of spraying facilities are presently in use at different mines. Features vary in terms of the number of spray headers, the height of spray headers above the car and the number of nozzles on the header. Some mines, for example, use only a single spray header, while others employ a number of consecutive spray headers. At one location, multiple headers are used to spray cars alternately with chemical sealant and water as the cars move through the spray installations. The intent of water soaking is to improve penetration of the sealant into the top surface layer of coal. However, laboratory tests with some water-latex emulsions have shown that water soaking increases the depth of solution penetration at the expense of crust strength. Curing time also increases with dilution and the resulting crust, although thicker, is less cohesive.

Even though there are freeze protection methods for piping, spray headers and nozzles, under extreme weather conditions problems may be encountered with frozen and plugged systems.

Spraying patterns at some locations are not designed to ensure that the solution reaches the sidewalls and endwalls of the cars. In some cases improper nozzle selection or lack of system pressure may be a contributing factor.

Wind distortion of the spray pattern may result in improperly sprayed cars. Poor spraying is attributed in part to insufficient system pressure or headers positioned too high above the cars.These problems can be minimized with proper design, although at some locations wind screens may be required.

In addition to the shortcomings listed above, mechanical or other failures can cause some cars within a train or an entire train to leave a load out without it being sprayed.

Plate 3 shows a spray facility with a single spray header in operation, preceded by a load levelling and compacting device designed to achieve a flat profile.

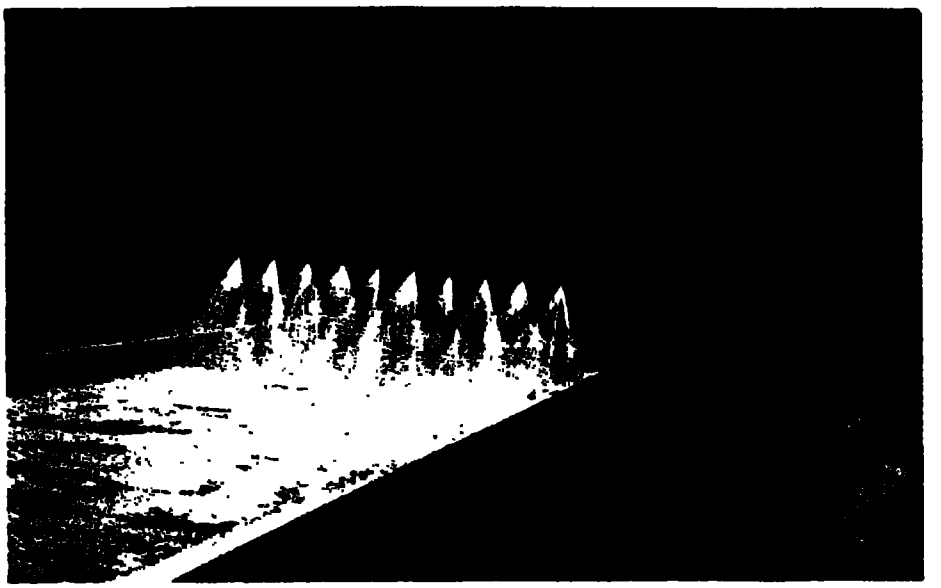

PLATE 3
Spray facility with single spray header preceded by a load levelling and compacting device.

PLATE 4
Flood loading chute with load levelling apparatus.

5.0 OPERATIONAL FACTORS

5.1 Load leveling

(Reference: Section 4.3)

As discussed in Section 4.1, flattening the surface profile on loaded coal cars is a crucial preparatory step in a dust control system that employs chemical dust suppressants. Various levelling systems have been developed at different mines. Cars are usually loaded with full card width flood-loading chutes. At some load-outs heavy rubber flaps are attached to the trailing edge of the loading chute or to the shed outlet doors so that the flaps drag along the coal surface, giving it a flatter profile. Other load-levelling systems emply levelling bars, plow-type levellers and rollers. The weight of some of these devices also compacts the surface, thus enhancing crust stability. Plate 4 shows a train being loaded with a flood-loading chute equipped with a flexible rubber sill sweeping device.

There are two major factors which influence the surface profile: the time involved in releasing the coal charge in the chute and the time required to shut off the charge and, in some cases, lift the chute above the rear sills of the coal cars. This timing is important as it will determine the angle and depth of the slopes left at the front and rear of the car. With a manually operated loading chute the skill of the loading operator is critical in this regard. Timing problems may be minimized by the use of automatic controls or by training of the loading operator.

An additional factor which determines the type of loading profile is the random occurrence of coal cars of different sill height within the train set. This requires the loading operator (or automated loading system) to adjust the position of the loading chute and the load-levelling device for each successive car of different height. The delays and errors accompanying these adjustments frequently cause distorted profiles and long end slopes. Studies have shown that cars from mines which load cars of uniform height have consistently flatter loads than cars from mines where car heights vary.

Coal remaining on the car sills after loading is another source of fugitive dust.

5.2 Load compacting

Compaction of the coal surface markedly enhances the crust retention on levelled coal cars. This effect is clearly shown in Plate 5 where a compaction device was activated to compact the load over the back half of the car while the front half of the load was not compacted. The sealant application rate was uniform over the entire length of the car.

5.3 Overloading

(Reference. Section 4.6)

The present maximum weight rating of the rail track is 119275 kilograms. Occasionally loaded cars exceed this limit and the accepted practice in such instances has been to remove some of the cargo with front end loaders or similar equipment.

5.4 Load settling

(Reference: Section 4.1)

While a train is in motion, the coal is subjected to continuous low level vibration, as well as high intensity shocks during starting and stopping. This causes the load to compact and settle. In a fully loaded car, the load can settle up to 30 cm after travelling 1100 kms. The majority of the settling occurs in the first 150 kms. This phenomenon affects the surface crust to varying degrees, depending on the extent of settling. the integrity of the surface crust and the extent of end and side surface slopes. End and side slopes which may have inherently weaker surface crusts due to varying degrees of run-off during spraying are particularly prone to deterioration as the load settles. Although load settling cannot be prevented a flat surface profile and a resilient surface crust will maximize crust retention.

5.5 Empty cars

(Reference: Section 4.7)

Cars unloaded in rotary dumpers at the exporting terminals may retain significant quantitites of coal on exterior horizontal surfaces, such as the upper and lower sills and front and rear platforms, as well as on the inside of the car. Properly designed air or water car-cleaning systems will remove the external coal deposits.

During cold weather periods, substantial quantities of frozen coal may remain in cars at the Vancouver terminals where thaw sheds are not used.

Frozen coal carry-back generally varies from 0 to 6.3 tonnes per car, and in extreme cases may be as high as 25 tonnes, or 25% of car capacity. Apart from economic considerations associated with reduced load capacity, frozen coal can be a source of dust emissions. Industry is encouraged to continue its investigations into methods for reducing the problem of frozen coal.

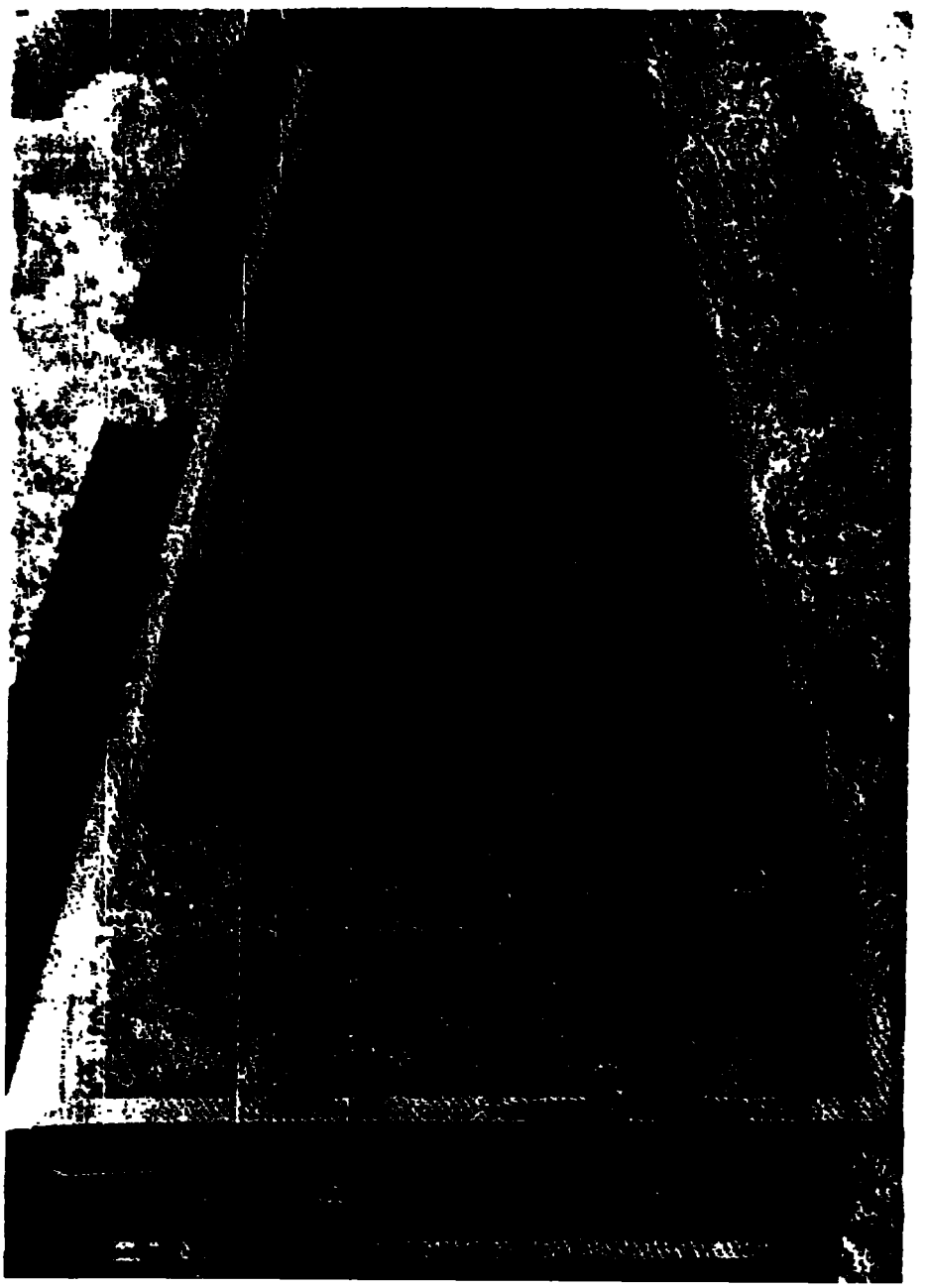

PLATE 5
Illustration of enhanced crust retention on the rear half of a coal car attributed to compaction.

RECOMMENDED CRUST RETENTION OBJECTIVE 6.0

(Reference: Sections 3.8.2 and 7.2)

The effectiveness of dust control measures can be assessed using the concept of crust retention. It is based on visual observations of exposed surface areas not covered by the crust when a train arrives at a terminal.

A minimum acceptable level of dust control is generally achieved under all conditions if the crust retention of a train is at least 85%. The minimum objective for crust retention is therefore 85% and should be calculated as a "train average." The 85% retention average is a simple average, based on the average crust retention on 30 cars within a train set including, if possible, the first 10 cars, 10 cars in the mid-section, and the last 10 cars.

Although a flat surface profile is optimum, end slopes may be encountered. Therefore, each "car average" should be calculated by taking into account the exposed surface on the front slope, rear slope and the center flat section of the load. The suggested formula for this profile, as shown in Figure 1, is calculated as follows:

$$\%CR = 100 - \frac{[(Lf/\cos a)(\%EF) + (L - Lf - Lr)(\%EC) + (Lr/\cos b)(\%ER)]}{[(Lf/\cos a) + (L - Lf - Lr) + (Lr/\cos b)]}$$

where: CR = crust area retained on the surface of a coal car
EF = exposed area on the front slope (%)
EC = exposed area on the center section (%)
ER = exposed area on the rear slope (%)
Lf = horizontal length of front slope
Lr = horizontal length of rear slope
L = total car length

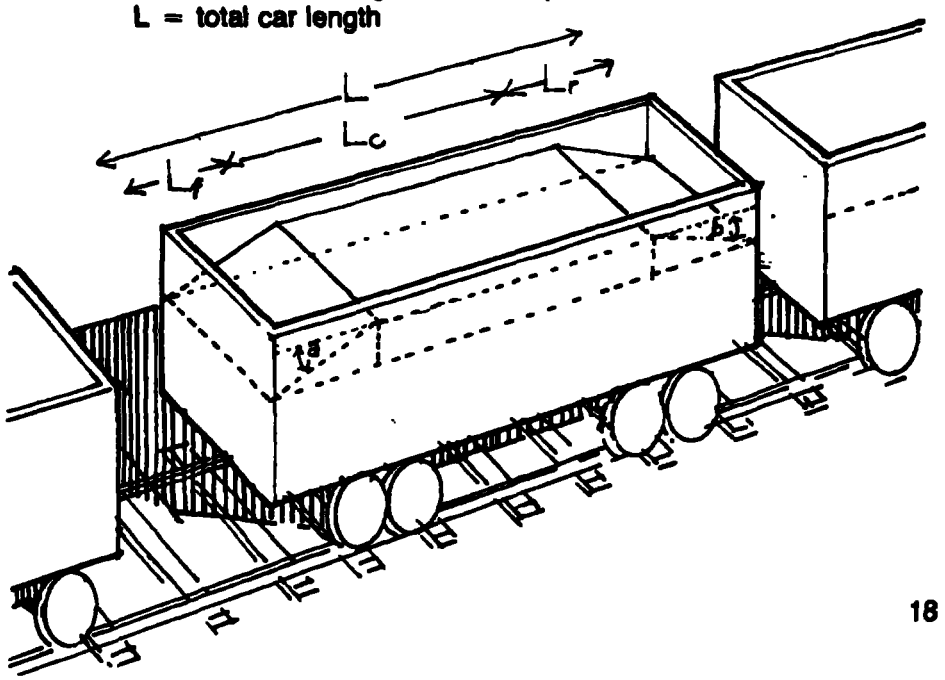

FIGURE 1
Typical load profile for determining crust retention.

Plates 6, 7 and 8 illustrate crust retentions of 90%, 80% and 60% respectively on different trains arriving at a Vancouver terminal.

PLATE 6
90% crust retention on a coal car after travelling 1000 km.

PLATE 7
80% crust retention on a coal car after travelling 1000 km.

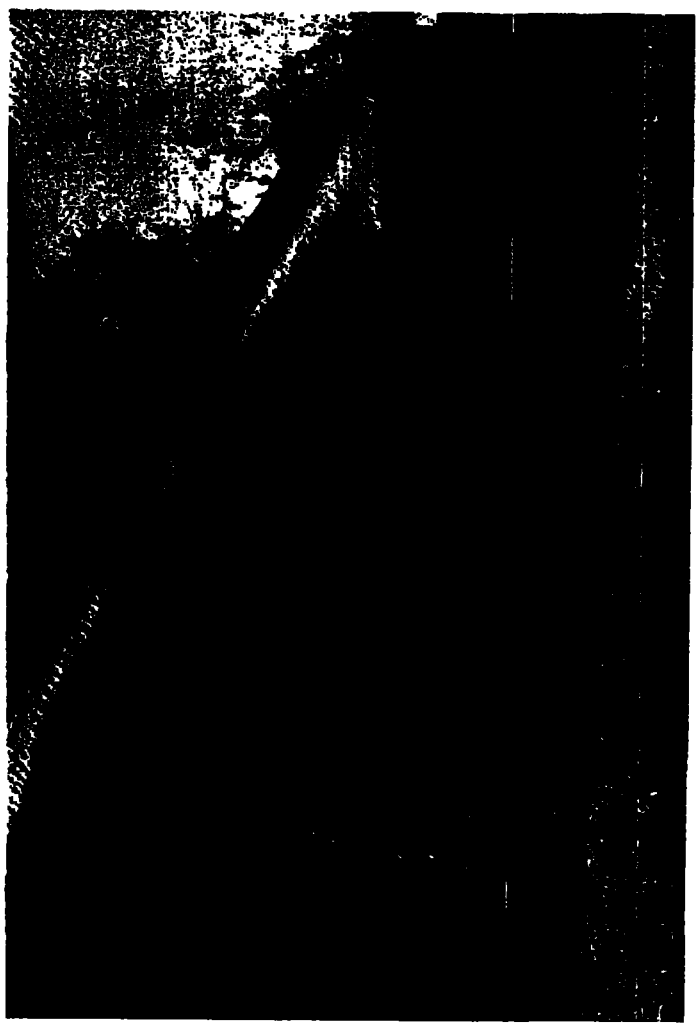

PLATE 8
60% crust retention on a coal car after travelling 1000 km.

7.0 RECOMMENDED DESIGN FEATURES

Consistent performance of the coal dust control measures can be achieved through implementation of the design features and operating practices recommended in this section. In the event of exceptional coal dust problems at any location along a coal transportation corridor, control measures beyond those presented in this section may be required. These special requirements can only be assessed on the basis of particular circumstances prevailing at those locations.

7.1 Design recommendations for load out facilities

(Reference: Section 7.1)

The optimum design criteria for loading, levelling and spraying systems are presented below. Some of these criteria may not apply where it is demonstrated that satisfactory control is being achieved. In general, each load out facility should be designed to:

a. achieve a uniform flat surface profile along the full length and width of all loaded rail cars, using either properly designed loading chutes or separate levelling devices;

b. provide a device to remove loose coal from the rail car sills using either sill sweeping devices incorporated as part of the load out station or a separate mechanism located before the chemical spraying station;

c. provide a chemical application spraying system consisting of primary and secondary spray units, each equipped with its own pumping unit, discharge piping, flow meter and spray header. The secondary spray unit should be located a sufficient distance from the primary unit to allow the identification of problem cars and to facilitate re-spraying. At facilities where only one spray header is used, trains should be backed up and re-sprayed if improperly sprayed the first time;

d. employ spray patterns that achieve complete and uniform coverage over all areas of the load surface within a car, regardless of the train speed through the load out;

e. provide freeze protection for effective operation during cold weather periods;

f. use spray nozzles compatible with the chemical requirements of the chemical solution and applied pressure;

g. provide wind screens to prevent spray pattern distortion at sites where high winds prevail;

h. provide a compressed air supply to clear blocked nozzles;

i. provide adequate mixing in the tanks where batch solutions are mixed;

j. provide a sufficient volume of mixed solution to spray a complete train when batch mixing systems are used;

k. provide automatic low level sensor and audible alarm on the solution storage tank for batch mixing systems or on the chemical storage tank for in-line mixing systems:

l. provide a flow metering device on the piping to the spray header to record flow rates and total volumes applied to each train;

m. provide variable flow to the spray header in order to apply more solution volume to the end slopes in relation to the center flat section of the load profile.

7.2 Design recommendations for empty rail car cleaning facilities

(Reference: Section 7.5)

Where there is a continual coal dust problem from empty trains, each terminal should provide an exterior rail car cleaning facility designed to remove loose coal deposited on the external car surfaces.

Water washing systems should have:

a. adequate system pressure and spray pattern to reach all exterior surfaces of the car:

b. a self-draining system for the piping and spray headers to prevent freezing in cold weather operation.

c. a wash water collection pad at the spray station to collect the wash water for recycling;

d. a waste water treatment facility to meet local requirements for suspended solid removal before discharging to the receiving environment.

Air cleaning systems should provide:

a. adequate system pressure and air jet pattern capable of reaching all exterior surfaces of the car;

b. an enclosure for the rail car cleaning system. The enclosure should be equipped with an adequate air exhaust system;

c. a high efficiency emission control system on the air exhaust from the cleaning station capable of meeting the air pollution control requirements of local regulatory authorities.

Recommended operating practices

7.3

7.3.1 Load out facilities

(Reference: Section 7.1)

As a general requirement, the coal producers should plan and implement training programs for company employees assigned to the loading, levelling and spraying operations and emphasize the importance of proper system operations for achieving coal dust control. Training in environmental control could be integrated with other employee training programs such as technical and safety programs.

Proper maintenance of load levelling equipment, sill cleaning devices and spraying equipment is essential. A comprehensive schedule of preventive maintenance of these systems should be implemented and an adequate supply of chemicals, spray nozzles and other essentials should be kept in stock. Each mine should develop a set of procedures to be followed in the event of equipment malfunction during the load out operation in order to avoid the possibility of poorly sprayed cars leaving the mine.

Operating procedures should include the following main features:

a. verify the proper operation of all equipment when loading the first cars, in particular the operations of the load leveller/compactor, sill sweeper and chemical spray system;

b. when load adjustments are made at the mine, the load should be levelled and re-sprayed with sealant prior to departure from the mine site;

c. verify the concentration and volume of the chemical solution before spraying a train for batch mix systems, and pump flow rates and settings for in-line mixing systems;

d. ensure that an appropriate volume of mixed solution is applied to each car;

e. inspect and adjust, if required, the operation of the system during the spraying of the first few cars;

f. re-spray any improperly sprayed cars;

g. maintain records of solution concentration and volume for each train, including notes on system malfunctions, profile problems or other deficiencies.

While research and development are encouraged, proposed changes in chemical sealants should be first reviewed by the senior operating employees responsible for dust control operations and then approved for testing and/or routine use.

7.3.2 Empty car cleaning facility: coal terminal

(Reference: Section 7.6)

Personnel involved with the operation and maintenance of the car cleaning system should be formally trained and advised on environmental requirements.

Equipment malfunctions should be corrected immediately. Standby truck mounted spray systems, normally used at terminals to control fugitive coal pile emissions, should be used to used to wash rail cars in case of malfunctions in the car cleaning system.

Trains should be visually inspected and cleared by a designated employee prior to departing the terminal.

7.3.3 Coal train operations

(Reference: Section 7.5)

Railway companies should provide coal train sets consisting of cars of uniform height when practical. Where cars of different height must be used within a train set, cars of similar height should be grouped together.

Locomotive speed control systems at load out facilities should be maintained operational to ensure proper loading of coal.

In the event of heavy dust emissions from loaded or empty trains, train crews should be instructed to reduce the train speed to prevent dust emissions through communities where coal dust impacts are of concern.

RECOMMENDED MONITORING

8.0

The monitoring requirements are a general provision to accommodate situations where and when environmental problems may arise along a transportation corridor and are not intended to impose monitoring by industry when no problem exists.

8.1 Performance monitoring

(Reference: Section 7.3)

Crust retention monitoring should be carried out using the methodology outlined in Section 6 or an equivalent method. It is suggested that each mining company arrange with its associated terminal operator to monitor one out of twenty of its trains arriving at the terminal. Records of data should be maintained and submitted as required to the appropriate government authorities.

In some cases the reliability of the control measures may be sufficiently high as to not require any crust retention monitoring, while in other cases more frequent monitoring may be needed. Alternatively, monitoring frequencies may require adjustment during seasons when dust emissions are a problem.

The coal producers, together with the associated terminal operators, should co-ordinate the performance monitoring program.

8.2 Environmental monitoring

(Reference: Section 7.3)

Along rail corridors where coal dust emissions are an environmental problem, the coal producers should consider monitoring visible dust emissions from trains, air quality and crust retention as appropriate. While loaded trains are the sole responsibility of the coal producers, both the coal producers and the terminal operators share the responsibility for empty coal trains.

A communication procedure should be implemented to report dusting trains on a real time basis back to the respective coal producers or terminal operators whenever a rail corridor monitoring program is established.

The data from all monitoring programs should be submitted to the appropriate government agencies as required.

REFERENCE

Report on the Emission and Control of Fugitive Coal Dust from Coal Trains. *Environmental Protection Service, Environment Canada,* April, 1986.

3

Exhibit 3

Delay-Related Costs Associated with Coal Dust

As I explain in my verified statement, it is not possible to make a valid comparison of the costs associated with keeping coal in the coal cars (the containment alternative) and dealing with coal after it has blown onto the right of way (the maintenance alternative) due, among other things, to the difficulty and uncertainty of estimating several of the costs that would have to be considered. One of those costs is the capacity-related cost associated with delays caused by coal dust maintenance activities. The DOT acknowledged that the "costs of reduced capacity that accompany maintenance" would have to be considered in any cost comparison. DOT Reply at 7. But an estimate of those capacity-related costs would be uncertain given the need to determine the extent to which existing maintenance activity is attributable to coal dust. BNSF's witnesses have made it clear that a substantial portion of BNSF's existing ongoing maintenance is attributable to coal dust fouling. But a precise estimate of the percentage of slow orders and maintenance windows attributable to coal dust fouling is difficult to make.

To demonstrate the importance of delay-related costs and the range of those costs that would result from different estimates of the amount of maintenance attributable to coal dust fouling, I estimated delay-related costs on BNSF's coal lines for 2009. *See* Attachments A, B, and C.

I used the following methodology to estimate the range of costs for slow orders associated with coal dust:

- BNSF maintains data in the normal course of business on the average annual eastbound and average annual westbound slow order delay minutes per train for each subdivision. I obtained these data for the subdivisions in BNSF's coal loop and BNSF's four adjacent subdivisions for 2009.

- I obtained the average daily loaded coal trains and average daily empty coal trains for each subdivision in 2009. I multiplied these numbers by 365 to calculate the annual loaded coal trains and annual empty coal trains for each subdivision in 2009.

- I next calculated the annual slow order delay minutes for loaded and unloaded coal trains for each subdivision. I did so by multiplying the average annual eastbound slow order delay minutes by the number of annual loaded coal trains, and I multiplied the average annual westbound slow order delay minutes by the number of annual empty coal trains. I added these two numbers together, which produces the total annual slow order delay minutes for each subdivision in 2009. To convert this number to the total annual slow order delay hours, I divided by 60.

- I next determined that the cost of train delay is about {{ }} per hour. BNSF's Finance Department makes annual calculations of delay costs based on BNSF's R-1 data. For locomotive costs, I used the system-wide hourly delay costs for locomotives—{{ }} *See* Attachment D. For car costs, I took the system-wide hourly car delay cost and reduced it by {{ }} to account for the fact that BNSF owns only a portion of the coal car fleet. *See* Attachment D. For labor costs, I estimated crew costs of {{ }} based on BNSF's actual cost of a two-man crew for a twelve-hour day at {{ }}.

- I multiplied the total annual slow order delay hours for each subdivision by the train delay cost of {{ }} per hour to get the total annual slow order cost in 2009. For the Orin Subdivision, the total slow order cost was {{ }} million in 2009.

- To estimate the incremental cost of slow orders associated with coal dust for each subdivision, I assumed that the impact could range from 75% of all slow orders at the high end of the range to 25% of slow orders at the low end. I note that BNSF's witness Mr. Smith on reply estimated that as much as 80% of the slow orders are attributable to coal dust, so this range is quite conservative. (Mr. Smith submitted a verified statement on behalf of BNSF in this proceeding on reply.) I estimate that the incremental cost of the slow orders associated with coal dust for the Orin Subdivision ranges from about {{ }} to {{ }} million.

- Adding the estimated incremental cost for each subdivision, I estimate that the annual incremental slow order delay cost associated with coal dust ranged from {{ }} million on the low end to {{ }} million on the high end for the coal loop subdivisions and BNSF's four adjacent subdivisions. *See* Attachment A.

I used the following methodology to estimate the costs of major maintenance windows associated with coal dust:

- I obtained from Mr. Smith the total number of major maintenance gang days for each subdivision in BNSF's coal loop and four adjacent subdivisions. A major maintenance window involves a production gang, such as for undercutting or rail surfacing. Each gang day represents a major maintenance window. I did not try to account for minor maintenance windows.

- Based on discussions with Mr. Smith, I estimated the number of trains per subdivision that experiences a delay from a major maintenance window on that subdivision and the amount of delay experienced per train. *See* Column "Window Logic" in Attachment B. As I explain below, the hours of delay per maintenance window depends upon the capacity of the lines in each subdivision, and the number of trains affected per maintenance window depends on the traffic volume on the subdivision. These estimates are based on BNSF's experience in scheduling maintenance windows and observing the delays associated with those windows.

    - The Orin Subdivision currently experiences the least amount of delay resulting from a major maintenance window because it has three or four main line tracks, and the traffic volumes are lower because of the economic downturn. I assumed that a maintenance window on the Orin Subdivision results in {{ }} of delay to {{ }} trains.

    - The remaining subdivisions are either single-track line segments or a combination of double- and single-track line segments. These subdivisions have longer delays than the Orin Subdivision because traffic will need to be stopped entirely for single-track line segments or share the track with oncoming traffic for double-track line segments.

    - For three single-track subdivisions, the Canyon, Valley, and Angora Subdivisions, I estimate that a major window causes an average delay of {{ }} trains for {{ }} hours per train.

    - For the Big Horn Subdivision, the number of affected trains is less than other single-track subdivisions, which reflects lower volume on the subdivision. I estimate that a major maintenance window delays {{ }} trains for {{ }} hours.

    - For the Campbell Subdivision, which is a single-track line segment that is nine miles in length, the delays are longer than the other single-track subdivisions because a maintenance window shuts down traffic completely. This delays {{ }} trains for {{ }} hours per train for each window.

- The Black Hills, Butte, Sandhills, and Ravenna Subdivisions are a combination of single-track line segments and double-track segments. I estimated that major maintenance windows on the portion of double-track segments of these subdivisions results in a {{ }} delay to {{ }} trains in one direction and a {{ }} delay to {{ }} trains in the opposite direction. I thus calculated the percentages of double-track and single-track segments for each subdivision and applied the average train delays. For example, the Black Hills and Butte Subdivisions are 80% double-track and 20% single track. I assumed that 80% of the major maintenance windows will occur on the double-track segments and result in a {{ }} delay to {{ }} trains in one direction and a {{ }} delay to {{ }} trains in the opposite direct. I also assumed that 20% of the major maintenance windows on these subdivisions will occur on single-track and result in {{ }} hours of delay to {{ }} trains. I followed the same methodology for the Sandhills and Ravenna Subdivisions, which are 25% and 28% single-track respectively. *See* Attachment B.

- I used these data to calculate the total number of train-hour delays per subdivision by multiplying the hours of delay by the number of affected trains per subdivision and by the number of annual gang days.

- I then used the {{ }} cost per hour of delay described above to estimate the annual cost associated with major maintenance windows per subdivision in 2009.

- As with my slow order estimates, I assumed that the number of major maintenance windows attributable to coal dust ranged from 25% of the total to 75%. I note that this range is conservative since Mr. Smith on reply estimated that as much as 80% of the maintenance windows are attributable to coal dust.

- I calculated that the annual cost of maintenance windows associated with coal dust ranged from about {{ }} million on the low end to {{ }} million on the high end for the subdivisions in the coal loop and BNSF's four adjacent subdivisions. *See* Attachment B.

While it is difficult to make a precise estimate of the delay-related costs, it is clear that they are substantial. The total delay-related costs I estimate for 2009 range from about {{ }} million on the low end to about {{ }} million on the high end. *See* Attachment C. These cost estimates include costs to UP for its share of Joint Line costs, but otherwise do not include any costs that UP would incur off of the Joint Line to deal with coal dust. My estimate

also does not include nuisance costs or costs associated with the need to add any new capacity to make up for the inefficiency of operations that results from the high level of maintenance and clean up needed to deal with coal dust. Therefore, while the cost estimate is extremely high, it is actually quite conservative.

A

THIS EXHIBIT IS A HIGHLY CONFIDENTIAL DOCUMENT

B

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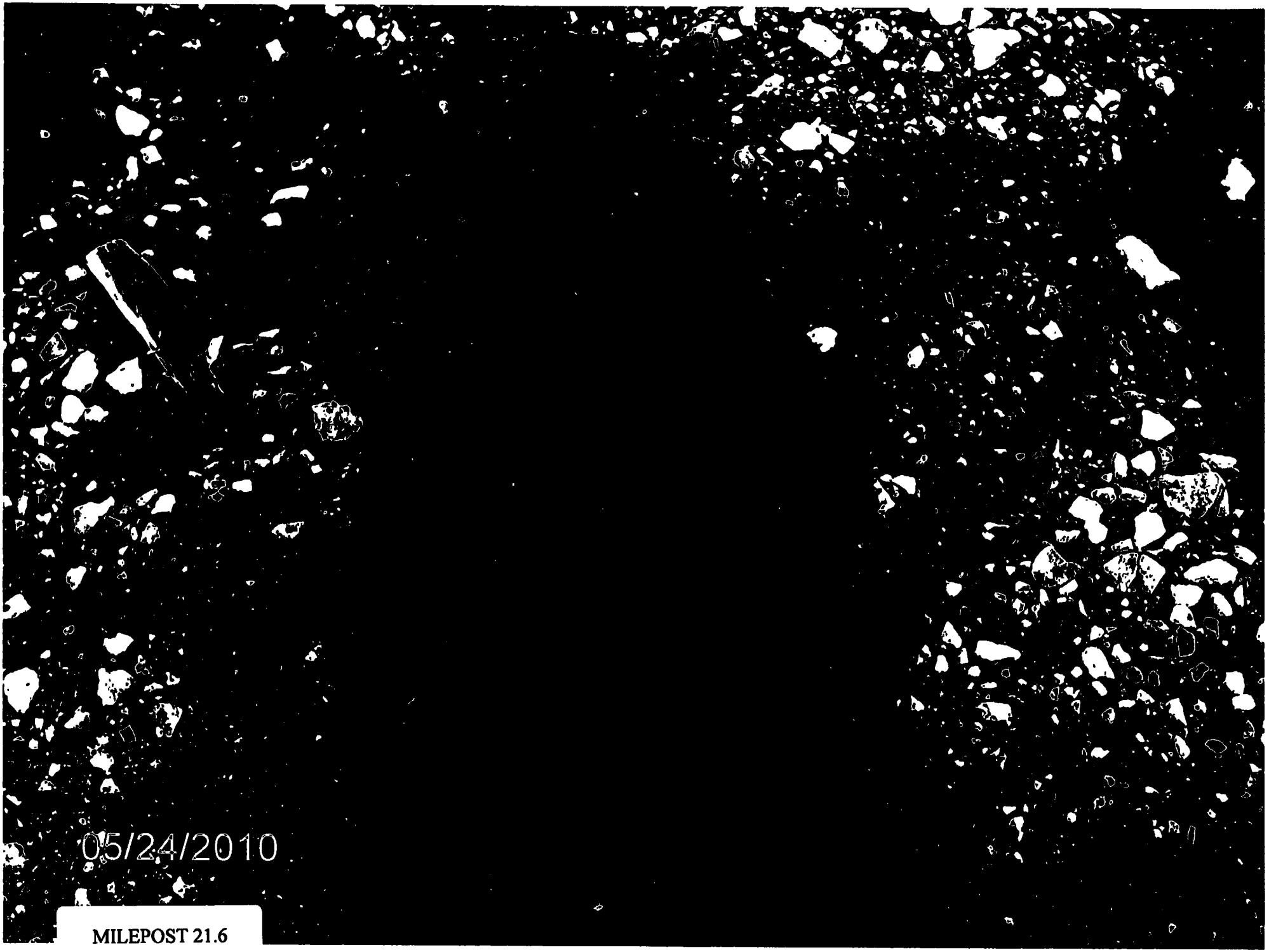

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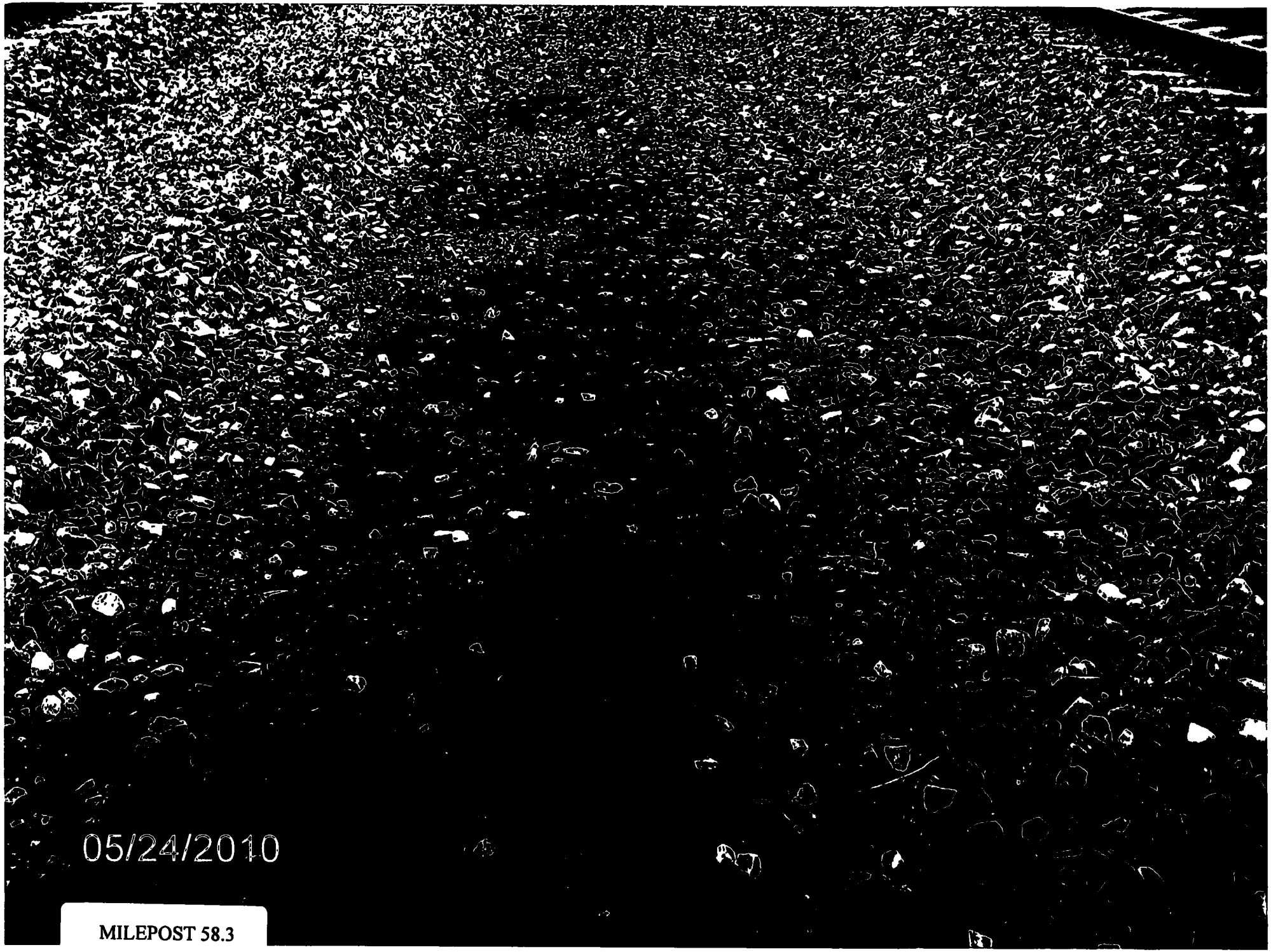

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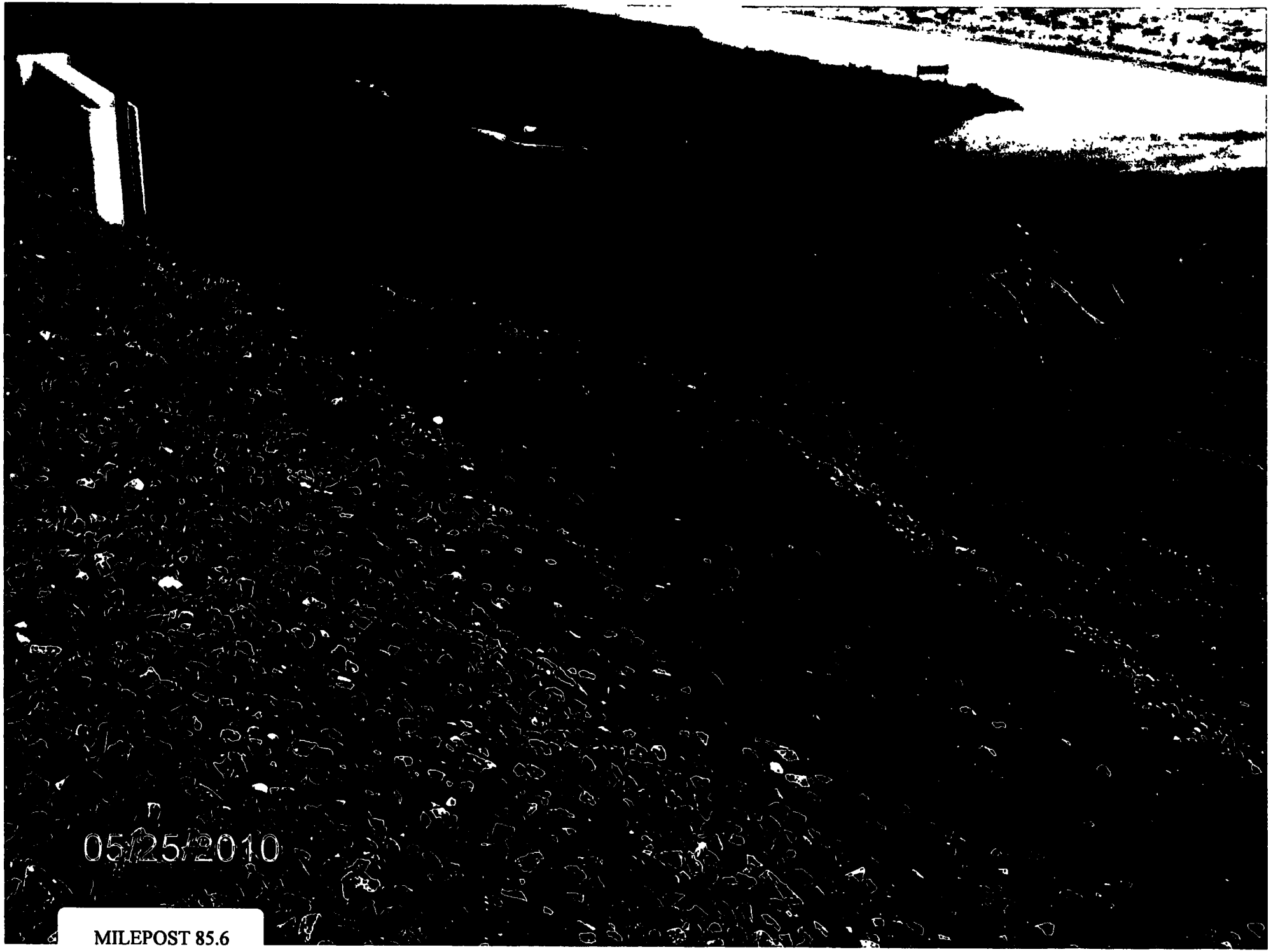

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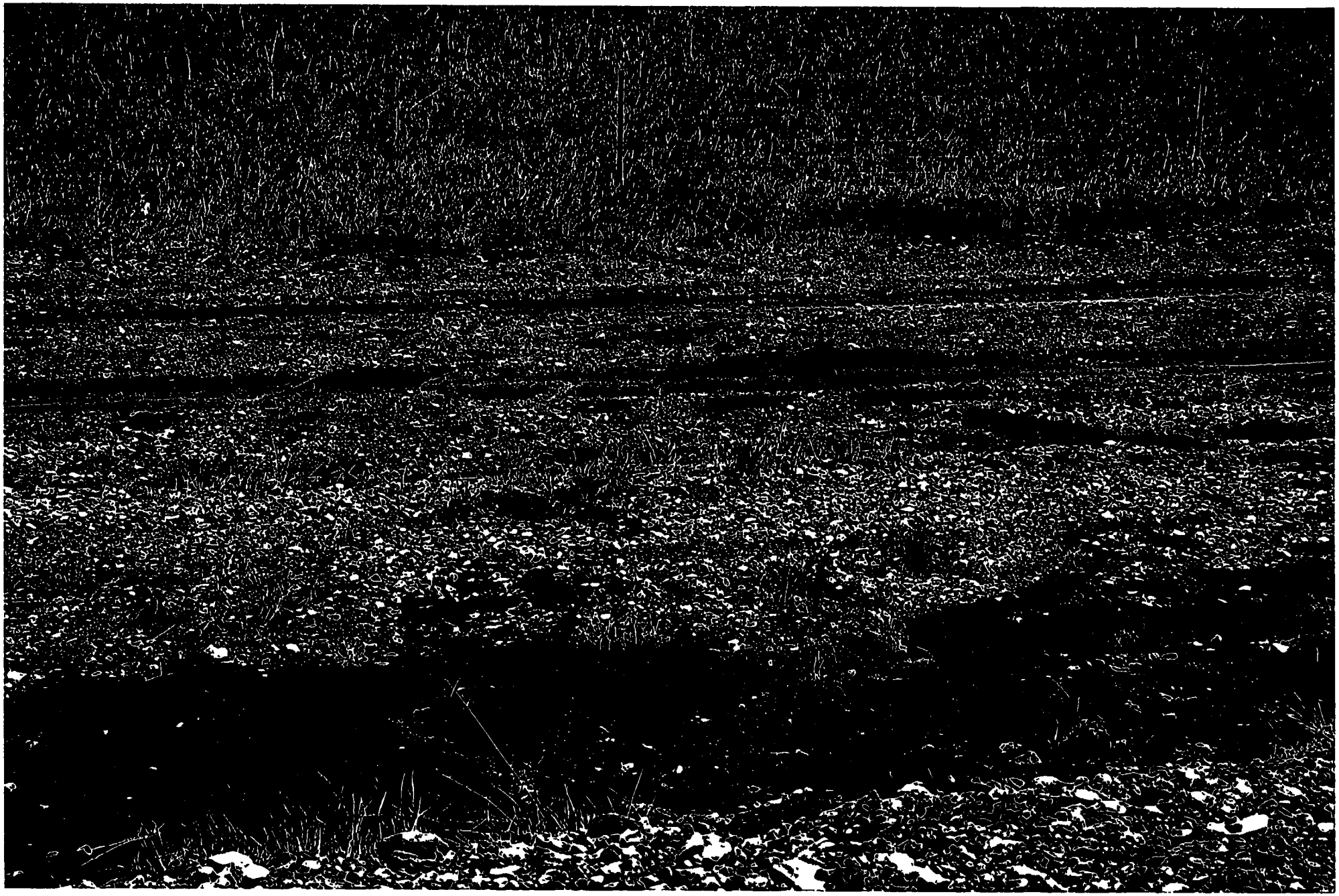

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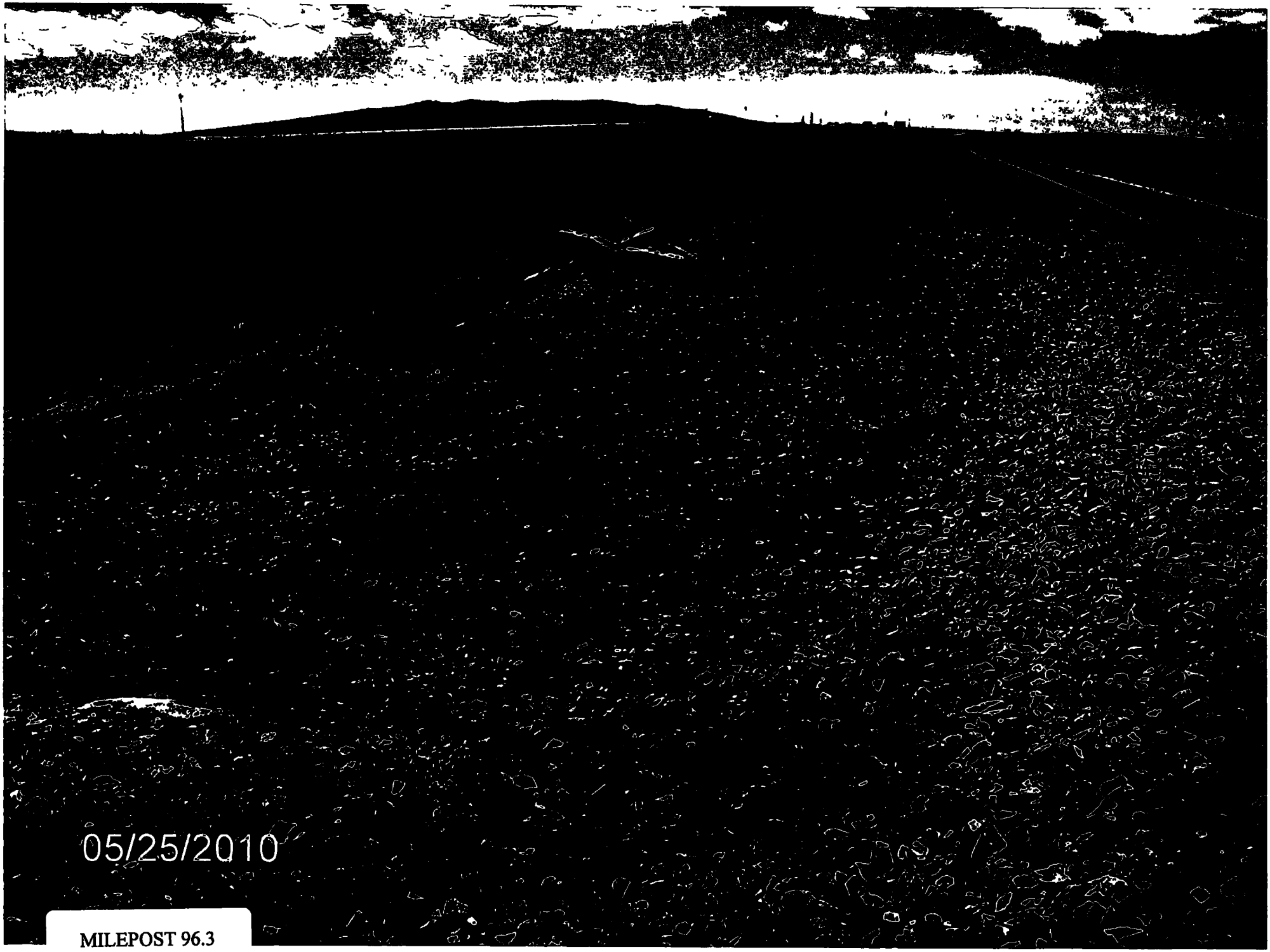

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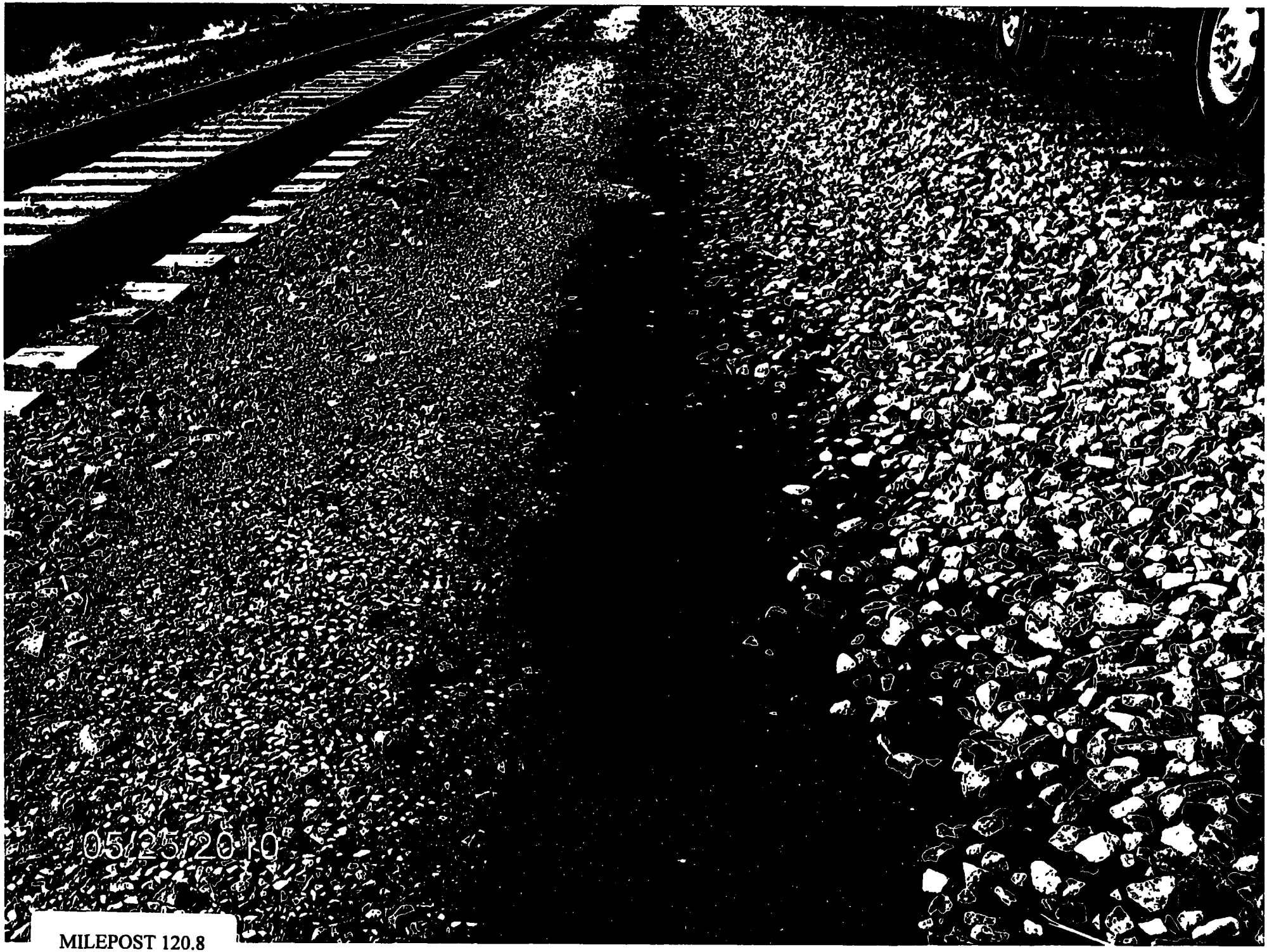

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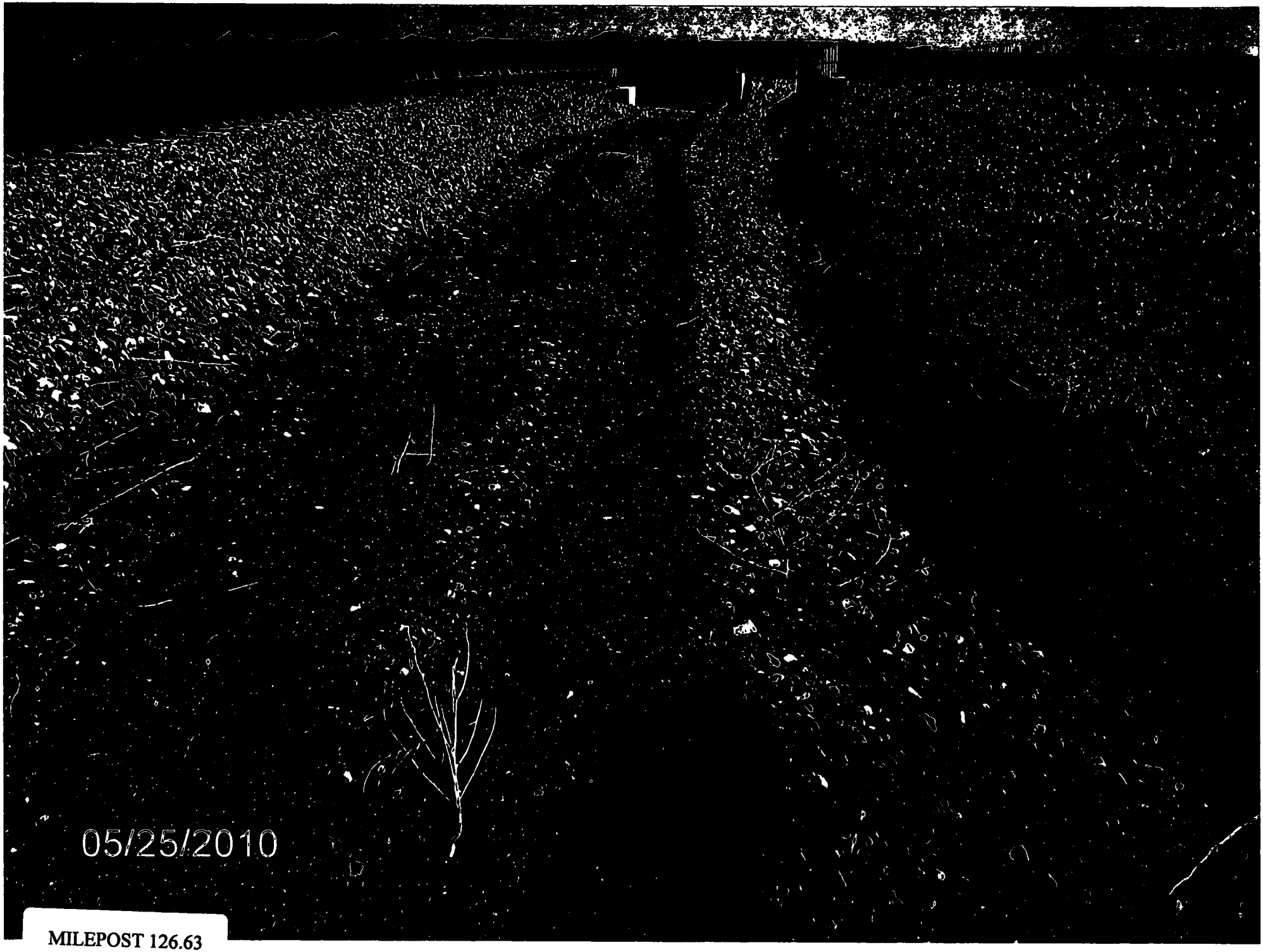

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BEFORE THE
SURFACE TRANSPORTATION BOARD

STB Finance Docket No. 35305

PETITION OF ARKANSAS ELECTRIC COOPERATIVE FOR A DECLARATORY ORDER

REBUTTAL VERIFIED STATEMENT OF CHARLES SULTANA

My name is Charles Sultana. I have submitted verified statements in this proceeding in support of the Opening and Reply Evidence of BNSF Railway Company ("BNSF"). As I have explained previously, I had primary responsibility for determining the specific coal dust emissions levels that are set out in BNSF's coal dust rules. I developed those emissions levels based on extensive data gathered by BNSF and its consultant, Simpson Weather Associates ("SWA"), over a two year period. My prior verified statements explain the rationale, methodology, and data sources underlying BNSF's emissions limits. In my reply verified statement, I responded to criticisms made by the shippers' consultants about my use of an "Integrated Dust Value" ("IDV.2") benchmark for measuring coal dust emissions and about the statistical analysis I used to calculate an IDV.2 standard that will, if followed, substantially reduce coal dust emissions from loaded trains.

In this rebuttal verified statement, I address claims made by a consultant for Arkansas Electric Cooperative Corporation ("AECC"), Michael A. Nelson, and a consultant for the Western Coal Traffic League and Concerned Captive Coal Shippers ("WCTL/CCCS"), Mark J. Viz, relating to BNSF's use of data from the electronic dust monitors, called E-Samplers, as the basis for BNSF's coal dust emissions standards. Messrs. Nelson and Viz focus their criticism on

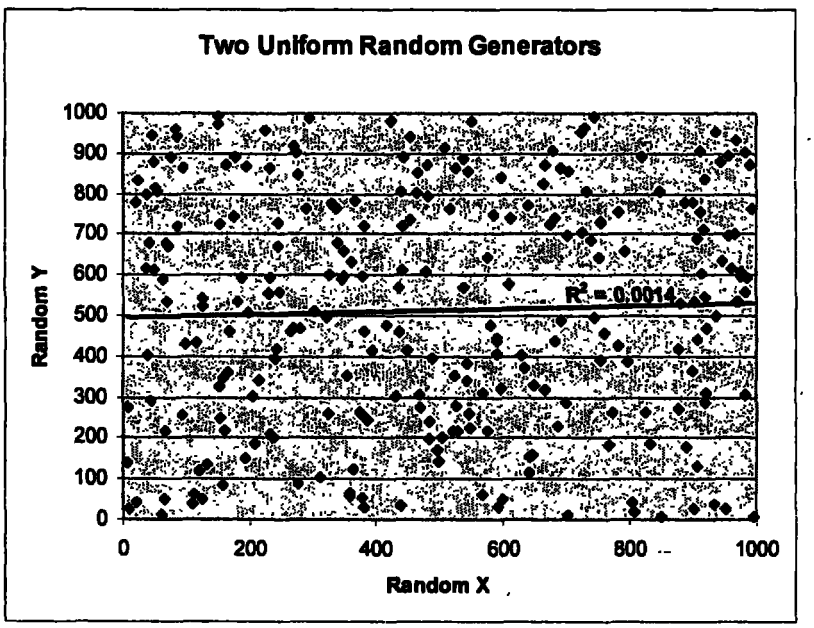
the variability of E-Sampler dust readings, but as I explain below, the variability of E-Sampler results does not render the E-Samplers unreliable or inappropriate for monitoring dust emissions, so long as the variability is taken into account in setting an emissions standard. The methodology I used to determine the range of variability was reasonable, as confirmed by an outside expert with experience in environmental monitoring. I also address a mischaracterization by Dr. Viz of the research I conducted on the relationship between wind speed and coal dust emissions. As I explain, Dr. Viz and I are actually in agreement that all relevant research on coal dust leads to the conclusion that it is extremely difficult to predict in advance which trains will emit dust in large quantities.

I. The E-Samplers Can Reliably Be Used To Identify Heavily Dusting Trains.

As I and other BNSF witnesses in this proceeding have explained, BNSF uses electronic monitoring equipment called E-Samplers to measure the level of dust emitted from trains passing Trackside Monitors ("TSM") that have been set up on the Joint Line and on the Black Hills Subdivision line. The E-Samplers are mounted on towers to the east and west of the line so that dust can be measured at the E-Sampler located downstream of the wind. The E-Samplers take dust level readings at five-second intervals over the time that a train passes the TSM. The E-Sampler readings are sent electronically to SWA where they are integrated over the relevant time period and adjusted to exclude any dust readings that may be associated with diesel locomotives or background dust. The resulting IDV.2 reading is then compared to the emissions standard established by BNSF (300 IDV.2 on the Joint Line and 245 IDV.2 on the Black Hills Subdivision) to determine whether a particular train is in compliance with the standard.

AECC claims that the E-Samplers cannot reasonably be used to monitor dust emissions from passing trains because E-Samplers are essentially "random number generators." Nelson

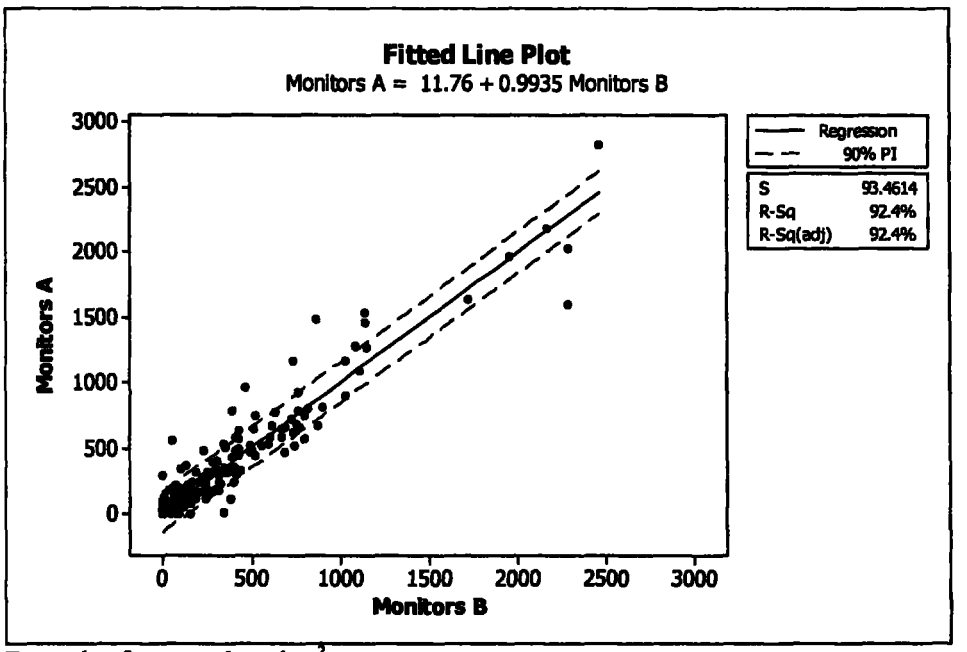
Reply V.S. at 12. As I explained previously, environmental factors associated with coal dust, including the distribution of different sized coal dust particles in a particular air sample, necessarily create some uncertainty about relative dust levels based on a single E-Sampler reading. Before setting BNSF's IDV.2 standards, I reviewed data from several hundred side-by-side E-Sampler readings to determine the variability in E-Sampler readings from a single source of air. I found that the E-Sampler readings on two side-by-side monitors are variable, but nevertheless highly correlated with one another. The E-Sampler readings are not generating "random" results. In statistics, a random process is one whose outcomes follow no describable deterministic pattern. Thus, if the results from the E-Samplers were a truly random process, the E-Sampler data would look like a shot-gun pattern:



Example of random data[1]

[1] Graph created by Microsoft Excel software, using random number function (Contained on DVD in Appendix A to BNSF's Counsel's Rebuttal Argument and Summary of Evidence).

Instead, the E-Samplers display clear relationships between each other. When I plotted the data from the two devices, there is a clear line trending upward that indicates a strong correlation between the readings from two connected E-Samplers:



Example of non-random data[2]

These data indicate that it is possible to use the E-Samplers as a means of identifying high dusting trains so long as the range of variability is taken into account. The graph shows that high IDV.2 values on one monitor generally correspond to high IDV.2 values on the second monitor. But AECC claims that because I adjusted the IDV.2 level from 134 to 300 to account for E-Sampler variability, the resulting standard is "meaningless." AECC Reply at 17. I set the IDV.2 standard at 300 because I wanted to make sure that the E-Samplers would only identify the highest dusting trains. If I had set the IDV.2 level significantly below 300, then due to the

[2] BNSF_COALDUST_0081615. All documents referred to herein that contain a document reference number were produced in discovery and copies are contained on the CD that is included in Appendix A to the Counsel's Rebuttal Argument. In addition, confidential materials are designated by a single bracket – "{" -- and highly confidential materials are designated with double brackets – "{{".

variability of the E-Samplers, some trains with low or moderate levels of dusting might be incorrectly identified as exceeding the standard. For example, the side-by-side testing data from the E-Samplers indicated that an IDV.2 reading of 134 on one E-Sampler might be associated with an IDV.2 reading of, say, 160 on the second E-Sampler. This would indicate that a train with an IDV.2 reading of 160 might actually be emitting coal dust at an IDV.2 level of 134. If I had set the IDV.2 level at 134, then a train registering 160 on the E-Sampler might be deemed a high dusting train even though a second E-Sampler reading might have shown that the train produced a value as low as 134.

AECC's analogy of the E-Samplers to broken speedometers is inapt. The variability in the E-Samplers is not due to a malfunction or miscalibration of the equipment. It is due to uncontrollable variation in the physical characteristics of the coal dust. However, the extent of the variability due to those factors can be measured, and the variability can be taken into account in setting the standard. Since it was possible that a reading between 134 and 300 on one E-Sampler could be associated with a reading below 134 on a second E-Sampler, I set the standard at 300 to be sure that BNSF's monitoring system was not incorrectly identifying trains as high dusting trains when that is not the case. I used a similar methodology to set the site-specific IDV.2 limit applicable to the Black Hills Subdivision.

In assessing the shippers' concerns about the precision of the E-Samplers, it is helpful to look at the actual 2009 dust levels experienced on the Joint Line.[3] As BNSF's witness Mr. VanHook noted in his opening verified statement, relatively few trains account for most of the high dust events recorded at the TSMs. Only about 14% of the trains passing MP 90.7 in 2009 exceeded 300 IDV.2 units. However, most of the high dust events are associated with trains that

[3] *See* BNSF_COALDUST_0078978, MP 90.7 TSM 2009 Usable Loaded Trains Sanitized.pdf.

emit significantly more than 300 IDV.2 dust units. About three-quarters of all trains that exceeded the 300 IDV.2 limit did so by more than 100 dust units. Indeed, nearly half (43 percent) of all trains exceeding the 300 IDV.2 limit were over 600 IDV.2, *i.e.*, twice the limit. These data show that the shippers' concerns about the precision of the E-Samplers are overstated. Even if the E-Samplers are not able to make absolutely precise dust measurements, they effectively identify the trains that account for most of the dust emissions at a particular location and therefore provide a reasonable basis for monitoring the shippers' efforts to eliminate coal dust.

II. BNSF's Study of the E-Sampler Variability Was Valid

Dr. Viz also criticizes the specific analysis I performed of the E-Sampler variability to account for variability in setting BNSF's coal dust emissions standard. As I explained previously, to study E-Sampler variability, I used data from over 400 side-by-side tests of E-Samplers, where two E-Samplers made simultaneous readings on a common dust source. I explain below why Dr. Viz' criticisms of my study are misplaced.

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}} There was no valid reason to exclude these data. The dust monitors in the laboratory were set up and configured like the monitors used in the field. Since the purpose of the study was to measure the variation between two devices, there was no reason to focus only on data collected in the field. The data collected from the laboratory monitors are meaningful data which contribute to understanding the degree of variability and should not be excluded.

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}} Dr. Viz is wrong. Once again, there was no valid reason to exclude these data from the analysis. The "zero/zero" readings were valid measurements indicating that the trains had not emitted measurable levels of coal dust. There is nothing surprising or problematic about these E-Sampler readings that would justify their exclusion from the analysis. A reading of zero on the E-Sampler does not mean that the equipment is malfunctioning. Indeed, where a "zero/zero" reading is made, the data indicate that the E-Samplers are providing data that are consistent with one another. Since the purpose of the study was to determine the extent to which two side-by-side E-Samplers provide similar or divergent readings, the consistency between the two E-Samplers when negligible levels of dust are present provides highly meaningful data. It would have been arbitrary to exclude data that were not the product of malfunctioning equipment.

As discussed in my prior verified statements, when I completed my analysis of the E-Sampler data, I originally contacted Six Sigma Qualtec to conduct an outside review of my variability study. I provided Qualtec with the same set of data I had used in my measurement system analysis. Mr. Sue of Qualtec raised the same issue with me that is discussed by Dr. Viz, namely that the "zero/zero" readings should be excluded from the study. I did not agree that the exclusion of valid data was appropriate and I contacted a different firm, Smarter Solutions, that was more familiar with equipment like the E-Samplers used in environmental monitoring. I also provided Smarter Solutions with the data I used in my analysis. Smarter Solutions confirmed that it would not have been appropriate to exclude the "zero/zero" data since those readings did not appear to be the result of any malfunction in the equipment.[4]

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[4] *See* BNSF_COALDUST_0044418, Memo from Rick Haynes to Tony Sultana (June 2nd, 2008) {{

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AECC argues that when I contacted Smarter Solutions I was "looking for data to prove...what [my] superiors wanted," and that Smarter Solutions "gave [me] the answers [I] wanted." AECC Reply at 18 n.9. This is a completely unfounded allegation. I wanted to confirm that the methodology I used to establish the coal dust emissions standard was appropriate. I asked Smarter Solutions to look at my analysis because I understood that they had expertise with the type of measurement systems that BNSF intended to use to monitor coal dust emissions. They were not chosen because they were going to give BNSF a predetermined conclusion. I did not exclude any data to prejudice the results towards any particular outcome. Documents BNSF produced in discovery, that AECC chose not to cite, make it clear that Smarter Solutions approached this issue from the position of complete independence and impartiality.[5] As I noted previously, Rick Haynes of Smarter Solutions concluded that BNSF's approach was not only reasonable, but that it was highly conservative and that a lower IDV.2 level would have been justified by the data.[6]

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}} Dr. Viz completely mischaracterizes those documents. The documents cited by Dr. Viz state only that the data from

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[5] On two occasions, Smarter Solutions specifically emphasized that they would maintain independence and impartiality throughout their review process. *See* BNSF_COALDUST_0044466, Email from Mallary Musgrove to Tony Sultana (June 11, 2008) {{

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[6] *See* BNSF_COALDUST_0075922, Memo from Rick Haynes to Tony Sultana (June 26, 2008) {{

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the E-Samplers, including the data from the side-by-side tests, show that there is variation in the E-Sampler readings that must be taken into account when the E-Sampler readings are interpreted. It was precisely because E-Sampler readings were not repeatable that I evaluated the degree of variability in E-Sampler readings and took account of that variability when I developed the coal dust standards.

III. Dr. Viz Mischaracterizes The Results Of My Study Of The Wind Effect On Coal Dust Emissions.

Dr. Viz also takes issue with the study I performed on the relationship between wind speed and dusting. As I explained in my opening verified statement, I performed this study at the beginning of my involvement in the coal dust issue in an effort to determine whether incidents of coal dust could reasonably be predicted. As Dr. Viz correctly points out, I concluded that there is not a linear relationship between wind speed and dusting. Viz Reply V.S. at 8. But Dr. Viz mischaracterizes my conclusion when he suggests that I found there to be no relationship at all between wind speed/direction and coal dusting. That was clearly not my conclusion. My conclusion simply was that the relationship was not a linear one. In other words, there is not a direct increase in coal dust emissions proportional to increased wind speed.

Dr. Viz cites a number of studies showing that wind speed is a significant factor in coal dust emissions, along with other weather factors and the properties of the coal itself. Viz Reply V.S. at 9-10. I fully agree. High wind speeds are obviously associated with larger coal dust emissions, even though the relationship is not a linear one. Indeed, the number of factors (high train speeds, high wind speeds, dry coal conditions, and local turbulence from passing trains) involved and the complexity of the relationship among these factors make it extremely difficult to predict when coal dusting will occur. While Dr. Viz mischaracterizes my study, we seem to be in agreement on this important fact. Dr. Viz' observations corroborate BNSF's understanding

that it is very difficult to predict where and when coal dusting will occur. But it is the basic unpredictability of coal dust emissions that requires that corrective measures be taken to address coal dust before the loaded trains begin their line-haul movement.

This conclusion – that coal dust events cannot be predicted in advance – undermines AECC's argument that since only 14 percent of the trains passing MP 90.7 emit dust exceeding BNSF's coal dust standard, "a reasonable approach would be to identify the 14% of trains that produce an excessive amount of coal dust before they leave the mine, and take corrective action." AECC Reply at 19. AECC's argument ignores the fact, recognized by Dr. Viz, that it is impossible to determine in advance which trains will emit dust in transit due to the complexity of factors causing coal dust emissions. AECC's claim also ignores the episodic nature of coal dust events. Trains that do not emit excessive dust levels at MP 90.7 may emit high dust levels at other locations. BNSF's objective is not just to eliminate coal dust at MP 90.7 but to eliminate coal dust along the entire route.

I declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on June 3, 2010

Charles Sultana

BEFORE THE
SURFACE TRANSPORTATION BOARD

STB Finance Docket No. 35305

PETITION OF ARKANSAS ELECTRIC COOPERATIVE FOR A DECLARATORY ORDER

REBUTTAL VERIFIED STATEMENT OF G. DAVID EMMITT

My name is G. David Emmitt. I have previously submitted verified statements in this proceeding on behalf of BNSF Railway Company ("BNSF"). As described in those prior statements, I am the President and Senior Scientist of Simpson Weather Associates ("SWA") and I have worked extensively with BNSF for the past five years to establish a system for monitoring coal dust emissions from loaded coal trains and measuring coal dust accumulation along the principal railroad lines in the Powder River Basin ("PRB"). I have described the extensive data collected from monitoring networks in the PRB, the testing conducted since 2005 by BNSF and SWA on loaded coal trains, the equipment used to monitor coal dust emissions, and the standards used to assess the relative dust emissions from individual trains. I do not repeat that discussion here.

In their reply comments, the shippers make the science issues appear to be much more complicated than they are. There can be no serious dispute that (1) coal dust comes off of loaded coal cars in substantial quantities; (2) coal dust weakens the track structure; (3) the E-Samplers mounted on the TSMs can be used to measure relative dust levels associated with individual trains passing the TSM; (4) even though the E-Samplers are measuring dust in the air, that dust is a strong covariate of the dust that is finding its way directly into the ballast; and (5) while

environmental factors make the E-Sampler readings somewhat variable, the variability can be taken into account in interpreting the E-Sampler data. These simple conclusions are the foundation of a straightforward coal dust monitoring approach, similar to monitoring approaches that have been adopted in other states and other countries where coal dust has been recognized as a problem. Other approaches may be possible, although the shippers have not identified any better alternatives. The monitoring approach that BNSF has adopted is the best approach available with today's technology and it is a reasonable way to monitor the dust levels of passing trains in a challenging operations environment.

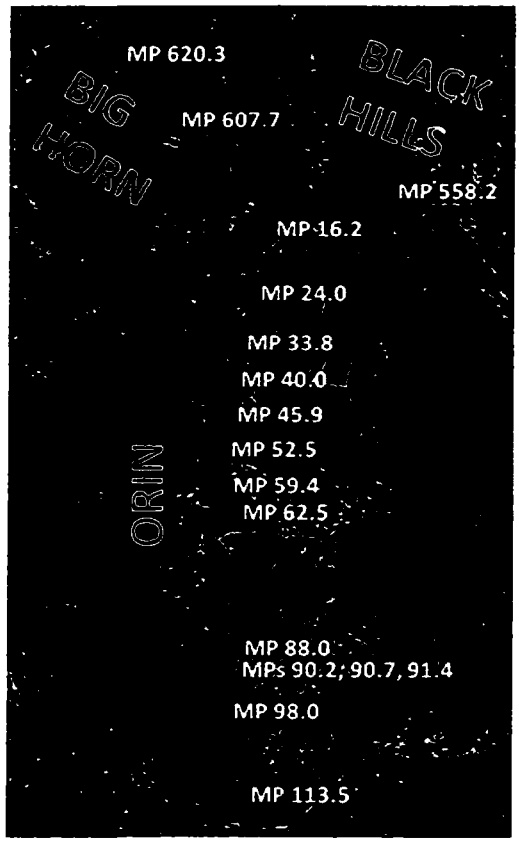
My rebuttal statement focuses on two issues raised by AECC in its reply comments. First, I address the suggestion by AECC that because only a few trains are found to emit high dust levels at the location of the TSM, it would be unreasonable for the shippers to take efforts to curtail coal dust emissions from all loaded trains. Second, I address AECC's claim that there is something inappropriate about the location of the TSMs.

Frequency of Dust Events

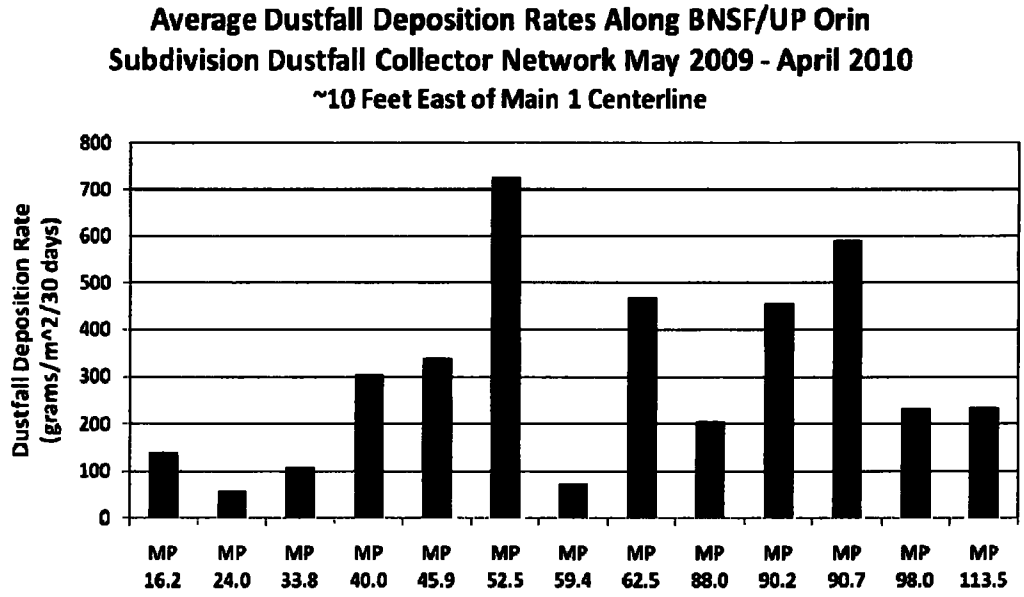
In his opening statement, BNSF's witness Mr. VanHook noted that in 2009, 14% of trains passing the TSM with useable IDV.2 values violated BNSF's emissions standard. VanHook Opening V.S. at 20. AECC draws an incorrect conclusion from this fact: "This whole coal dust problem about which BNSF is complaining involves only 14% of the trains on the Joint Line; the rest are in compliance right now (and most of them haven't been sprayed with anything)." AECC Reply Argument at 19. AECC's logic is faulty because it ignores the episodic nature of coal dust emissions. The fact that 14% of trains passing the TSM at Milepost 90.7 fail to meet BNSF's standard only means that 14% of the trains operating on the Joint Line emitted high levels of dust *at that specific location.* A train that had not been treated to limit coal

dust emissions might not exceed the emissions standard at Milepost 90.7 but could have high dust emissions at other points along the Joint Line. Thus, a 14% rate of violations of the IDV.2 standard at MP90.7 is totally consistent with all untreated trains violating the standard at some point on the Joint Line. Moreover, as a logical matter it makes sense that a train treated to limit emissions at milepost 90.7 would have greatly reduced emissions on the entire Joint Line and other adjacent coal lines.

There is extensive evidence that coal trains have episodic coal dust emissions all along the Joint Line and other lines handling PRB coal trains, and do not dust only at the locations where the TSMs have been set up. As I explained previously, BNSF and SWA have set up an extensive network of dustfall collectors along the rail lines in the Powder River Basin.



The data from the dustfall collectors conclusively demonstrates that trains emit dust all along the Joint Line, and that dust levels at some locations are comparable to or even larger than levels at MP 90.7. The chart below contains data from dustfall collectors on the Joint Line from the period May 2009 to April 2010.



I also explained previously that BNSF and SWA have carried out tests of coal dust emissions on specific loaded trains. In these tests, we have also installed passive collectors onto the rear sills of loaded coal cars and used the passive collectors to capture coal dust blown off the train as it moves in transit. These passive collectors are usually mounted at least 20 cars behind the lead locomotive to avoid influence of the diesel engine. At various stages along the route, the passive collectors are emptied and the accumulated coal is weighed. The passive collectors are paired with a Rail Transportation Emission Profiling System ("RTEPS"), which is essentially a mobile sensor package that collects data on weather conditions and dust emissions with 10 second time resolution. Since 2005, we have conducted more than 100 tests with the RTEPS/PC instruments. As I explained in my opening verified statement, these tests show that episodes of

high dust emissions occur all along the Joint Line and other coal lines. *See* Emmitt Opening V.S. at 12, exhibit 12.

AECC is correct that a train that did not produce dust in excess of BNSF's coal dust emissions standard at Milepost 90.7 would be in compliance with BNSF's coal dust emissions standard even if that train had high dust emissions at a different location on the Joint Line. For practical reasons, BNSF must monitor dust emissions at a fixed location. However, if shippers are required to meet the coal dust standard at the locations where TSMs have been set up, they will need to take measures to curtail coal dust emissions that will reduce or eliminate coal dust emissions elsewhere along the PRB lines. This results from the fact that it is not possible to know in advance which trains are likely to produce high coal dust emissions while passing a specific location. To ensure compliance with BNSF's coal dust standards at the specific TSM locations, shippers will take measures that have the effect of reducing or eliminating coal dust emissions on all of BNSF's PRB coal lines, which is BNSF's objective.

Location of the TSM

AECC criticizes BNSF's monitoring approach as analogous to "'speed traps' set up at the bottom of a hill, where the cop knows the cars will be going faster than normal." AECC Reply at 22. AECC's argument is flawed. First, the objective of BNSF's standard is to monitor the effectiveness of the shippers' efforts to curtail coal dust emissions. It therefore makes eminent sense to set up a monitoring station at a location where coal dust emissions are likely to occur in the absence of curtailment measures. If there was a location where coal dust emissions did not tend to occur, it would make no sense to set up the TSM at that location since the dust emissions data would not provide any meaningful information about the effectiveness of the shippers' coal dust curtailment measures. Second, the data set out above from dustfall collectors located along

the Joint Line show that there are other locations on the Joint Line where comparable, if not higher, levels of coal dust are found.

AECC's consultant, Mr. Nelson, claims that there are several aspects of the location at Milepost 90.7 that make it an invalid or inappropriate site for a TSM. First, Mr. Nelson cites a document from 2007 noting that there were empty trains waiting near the TSM for a signal to proceed forward. Nelson Reply V.S. at 13. Mr. Nelson's suggestion is that the presence of these idling trains might produce large amounts of background dust. But his argument ignores the fact that we do not calculate an IDV.2 for a train if there are high or erratic background levels of dust at the time. Moreover, as I have described previously, where an IDV.2 can be calculated, the IDV.2 reflects only the amount of dust above the background level during train passage. In any event, the signal bridge that caused some empty trains to stop near the TSM was subsequently moved further down the track, so that Mr. Nelson's concerns about empty trains is no longer valid.

Second, Mr. Nelson also notes that there may be "rough track" near Milepost 90.7 resulting from BNSF's maintenance practices that could cause vibrations in the loaded car that generate dust. But BNSF performs the same maintenance at MP 90.7 as it does anywhere else on the Orin Subdivision, so any "vibrations" experienced by loaded coal cars would be apparent all along the Joint Line.

Third, Mr. Nelson alleges that the TSM is located near the bottom of a "big sag." But the elevation of the track at MP 90.7 is not substantially different from other locations on the Joint Line. To the extent there are "sags" in the rail line where the line changes from going downhill to uphill, those "sags" are prevalent along the Joint Line, as they are thoughout BNSF's rail network. There is nothing about Milepost 90.7 that makes it a unique location in this respect.

Finally, Mr. Nelson notes that there is a road that crosses the right-of-way near MP 90.7, and he suggests that road dust from traffic on the road could affect the dust readings at the TSM. Once again, Mr. Nelson's creative speculation is unfounded. As described above, the IDV.2 calculations are made only after determining that there is not a high or erratic background dust level. If there was traffic on the nearby road that produced dusting, the dust associated with that traffic would result in the non-use of the train's data because of the high or erratic background dust as discussed above. Moreover, since cars on the road could not cross the line when any coal train is moving on the line, the likelihood is that the motor vehicle traffic would be stopped at the time the E-Sampler readings are being made, reducing the chance of significant impact of dust influence from such traffic.

I declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on June 3, 2010

G. David Emmitt

BEFORE THE
SURFACE TRANSPORTATION BOARD

STB Finance Docket No. 35305

PETITION OF ARKANSAS ELECTRIC COOPERATIVE CORPORATION FOR A DECLARATORY ORDER

REBUTTAL VERIFIED STATEMENT OF EROL TUTUMLUER

My name is Erol Tutumluer. I previously submitted a verified statement in this proceeding in support of BNSF Railway Company ("BNSF"). As I explained in my opening verified statement, I am a Professor of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign, and I have studied and published papers regarding the effect of coal dust upon railroad ballast. I explained in my opening statement that the physical and mechanical properties of coal dust make it one of the worst fouling agents of rail ballast due to the fact that coal dust has extremely low strength properties, it expands when wet, absorbs water like a sponge, and acts as a lubricant between the ballast stones. The basis for this conclusion was set out in detail in my opening statement as well as in two published papers that were attached to my opening statement as Exhibits 3 and 4.

The purpose of this rebuttal statement is to respond to certain comments by parties opposed to BNSF's proposed coal dust rules that mischaracterize the scientific research findings that I described in detail in my opening verified statement and in published papers. The reply comments by these parties indicate that they failed to understand several important aspects of my research work. In this rebuttal statement, I address four claims raised by shipper commenters: (1) that my coal dust laboratory studies have no relevance to conditions in the field and that my

sampling method was not representative; (2) that my studies were based on the weight of coal dust and therefore are not reliable; (3) that I have no basis for concluding that coal dust was a contributing factor in the 2005 derailments; and (4) that I did not study the effect on ballast of a mixture of coal dust and other fouling agents.

I. Field Conditions and Sampling Methodology

First, the shipper commenters claim that my coal dust laboratory studies were carried out without any reference to real world conditions in the field. WCTL/CCCS at 13-14; Viz Reply V.S. at 11-13. This is not correct. I have extensive field experience relating to coal dust. In the summer of 2007, I spent time in the field working on two research projects. The first project was for BNSF in which I studied the accumulation of coal dust and its fouling of the aggregate ballast layer of the railroad track structure on the Joint Line. Our results were published in the paper attached to my opening verified statement as Exhibit 3. The United States Department of Transportation cited my paper in explaining that "[t]he record also shows that under certain circumstances, particularly when wet, coal dust can undermine the integrity of ballast." DOT Reply at 2. The second project was a study funded by the Federal Railroad Administration ("FRA") regarding developing ground penetrating radar ("GPR") to detect subsurface conditions of railroad track structure from estimates of the track bed materials' physical properties.[1]

In the course of these studies, I traveled to Gillette, Wyoming on July 22-25, 2007, and collected ground ballast aggregate samples from the Joint Line. During this visit to the Orin

[1] The results of that research were published. *See* Roberts R., Al-Qadi, I.L., Tutumluer, E., and Boyle, J. 2009, "Subsurface Evaluation of Railway using Ground Penetrating Radar," Final Report No. DOT/FRA/ORD-09/08, Research Project DFTR53-05-D00200, Federal Railroad Administration, Office of Research and Development. I note that the shipper commenters are incorrect to suggest that the railroads can use GPR to detect coal dust fouling that is not visible from the surface. *See* Nelson Reply V.S. at 8-9. The GPR technique is currently at a research and development stage for future implementation.

Subdivision, I personally observed the substantial coal dust accumulation along the Joint Line. I sampled coal dust from many different milepost locations on the Main Lines 1 and 2 on the Orin Subdivision and analyzed them in the laboratory. I visited Milepost 62.4, which is where the samples were collected for the study attached as Exhibit 3 to my opening verified statement. I am thus personally familiar with the specific location where the samples were collected. I made sure that all coal dust samples from the Orin Subdivision, including those collected from Milepost 62.4 and used in my study, had similar properties. Therefore, the criticism that I only studied coal dust from a single location on the Joint Line is not valid. *See* Viz Reply V.S. at 11-12. The coal dust from that location is representative of coal dust all along the Joint Line.[2]

The shipper commenters claim that it was inappropriate to use large direct shear (shear box) tests rather than studying conditions in the field. WCTL/CCCS Reply at 13-15; Viz Reply V.S. at 13. This claim is misplaced. The shear box test is a direct and highly relevant performance indicator that shows the effect of ballast fouling on the strength of ballast aggregates. Moreover, the tests conducted at the University of Illinois sought to replicate conditions in the field. That is, after compacting clean ballast samples in the shear box device, coal dust obtained from the Joint Line was dropped into the compacted specimen from the top to accurately simulate the field condition of coal dust blowing off the cars and falling into the ballast layer of the track. The ballast material tested was a granite aggregate also obtained from Gillette, Wyoming and commonly used in the Joint Line railroad track structures as the ballast layer.

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[2] The criticism that I used clean ballast as opposed to ballast excavated from the track structure misunderstands the study objective, which was to compare the effect of different fouling agents on ballast strength. *See* WCTL Reply at 14 n.8; Viz Reply V.S. at 12. It would not have been appropriate for that study to use ballast that was already contaminated with coal dust.

II. Reliability of Tests Based on Weight

The criticism by the shipper commenters that our study of the effects of coal dust was unreliable because it was based on the weight of the fouling material shows that these commenters did not understand our research approach. AECC Reply at 23; Nelson Reply V.S. at 2-4. Our research involved two steps. In the first step, we examined how much fouling materials it takes to fill the voids in the aggregates using three fouling agents: coal dust, mineral filler, and subgrade soil. As noted in our study, the voids available for fouling material to fill were the same in all cases. This void space was found for the clean granite sample to be 43% of the total volume, which corresponds to a void ratio of 0.75 or 75% of the aggregate volume. We found that it took much less coal dust by weight to fill the voids, which is not surprising because coal dust has a lower density than mineral filler and subgrade soils. We found that 25% coal dust by weight of aggregates filled all of the voids in the ballast, as compared to 32% clay by weight and 40% mineral filler by weight. Tutumluer Op. V.S. Ex. 4 at 97.

Pure coal dust has a specific gravity of 1.28 as obtained in our laboratory. The ratio of the density of solid constituents of a particular soil material to the density of water (generally at 68°F (20°C)) is called the specific gravity of solid constituents. The specific gravities of well-known ballast contaminants, mineral filler (produced from breakdown of granite or limestone type common ballast aggregate) and clay, typically vary from 2.5 to 2.9 with a statistical average of 2.7 whereas the average specific gravity of sand grains is about 2.65. Thus, compared to most soil materials, the coal dust sample tested is a significantly lighter material with the ability to completely occupy the same constant volume (for example, total void space in a clean ballast layer) with approximately one half of the weight of mineral filler or clay.

In the second step, once the voids were filled, we investigated the effects of the ballast fouling on the shear strength reduction in the aggregate ballast layer of the railroad track

structure. The results of our tests using three types of fouling agents -- coal dust, non-plastic mineral filler, and plastic clayey subgrade soils -- are described in my opening verified statement. Coal dust most clearly caused the worst fouling effects and the greatest shear strength loss while non-plastic mineral filler and plastic clayey subgrade soils caused less detrimental effects as fouling agents. In other words, from a weight standpoint, the ballast voids were filled with much less coal dust than other materials. Once the voids were filled, the ballast strength was most adversely affected by coal dust fouling. These scientific findings cannot be reasonably debated.

III. 2005 Derailments

The shipper commenters contend that I have no basis for concluding that coal dust was a contributing factor in the 2005 derailments. AECC Reply at 11-12; Nelson Reply V.S. at 16; Viz Reply V.S. at 11-12. In connection with my prior work, I had an opportunity to review substantial materials related to the 2005 derailments, and I know from my personal review of those records that the ballast was heavily fouled by coal dust at the derailment locations. These conditions are indicative of a significant reduction in load-bearing capacity. Mr. Nelson agrees that "ballast strength is significantly compromised when the ballast is saturated by wet coal dust." Nelson Reply V.S. at 2. So does the United States Department of Transportation. DOT Reply at 2. These were the exact conditions in 2005 when the derailments occurred on the Joint Line. The derailments occurred where the ballast was heavily fouled by coal dust after a period of heavy precipitation that was preceded by a relatively low level of precipitation for an extended period of time in the region.

IV. The Effect Of Coal Dust With Other Ballast Contaminants

Finally, the shipper commenters note that our studies did not examine the impact upon ballast stability of coal dust mixed with other contaminants. Nelson Reply V.S. at 16; DeBerg

Reply V.S. at 7-8. This is correct. We did not believe that an examination of coal dust in combination with other ballast fouling agents was an appropriate first step in our study. We focused on coal dust first given the large amount of coal dust that is present along the rail lines in the Powder River Basin and the fact that coal dust accumulates rapidly as a result of the very high volume of coal traffic in that area. However, our studies of coal dust and ballast contamination are continuing, and one of the issues we are studying now is the impact on ballast strength when coal dust is mixed with other fouling agents. The fact that additional studies are underway does not diminish the strength of our conclusion that coal dust is a pernicious contaminant of ballast that creates a serious risk of track instability and therefore efforts should be taken to keep the coal dust out of the ballast.

I declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on June 3, 2010

Erol Tutumluer

PUBLIC VERSION

BEFORE THE
SURFACE TRANSPORTATION BOARD

STB Finance Docket No. 35305

PETITION OF ARKANSAS ELECTRIC COOPERATIVE CORPORATION FOR A DECLARATORY ORDER

REBUTTAL VERIFIED STATEMENT OF

JOSEPH P. KALT
and
GLENN MITCHELL

June 4, 2010

I. INTRODUCTION

We are Joseph P. Kalt and Glenn Mitchell. Joseph Kalt is the Ford Foundation Professor of International Political Economy at the John F. Kennedy School of Government at Harvard University. He is also a senior economist with Compass Lexecon. Glenn Mitchell is a Vice President at Compass Lexecon. Our curriculum vitas, attached as Appendices A and B, list prior expert testimony and publications.

Professor Kalt holds B.A., M.A., and Ph.D. degrees in economics and is a specialist in the economics of competition, antitrust, and regulation, with a focus on the natural resource, energy, and transportation sectors. He has conducted research, published, taught, and testified extensively on the economics of competition and regulation, with a particular emphasis on regulated industries. He has studied extensively the economics and regulation of the railroad industry and has presented expert testimony before the Surface Transportation Board ("STB") on numerous occasions.

Prior to joining the faculty of Harvard's Kennedy School of Government as a Professor with tenure in 1986, Professor Kalt served as an Instructor, Assistant Professor, and Associate Professor in the Department of Economics at Harvard (1978-86). In the Department of Economics, Professor Kalt had primary responsibility for teaching graduate and undergraduate courses in the economics of regulation and antitrust. At the Kennedy School his teaching responsibilities have included the economics of regulation and antitrust, economics of public policy and policy design, natural resource and environmental policy, and economic development on American Indian reservations. Professor Kalt has also been the Kennedy School's Academic Dean for Research, Faculty Chair of the Environmental and Natural Resources Program, Faculty Chair of the Economics and Quantitative Methods Section, Chair of Degree Programs, and Chair of Ph.D. Programs.

Since 2005, Professor Kalt has also been a Visiting Professor at the Eller College of Management at the University of Arizona, where he has taught courses in the economics of regulation and antitrust and in economic development. Since 2008, Professor Kalt has also been a visiting professor at the University of Arizona's Rogers college of Law, where he teaches on the law and policy of economic development on American Indian reservations. During his time at the University of Arizona, he has also provided executive education to Native American leaders through the Native Nations Institute, housed at the University's Udall Center for Studies in Public Policy.

Glenn Mitchell holds B.A., M.A., and Ph.D. degrees in economics. He has conducted research and published studies analyzing the economic dimensions of environmental policy, including the effects of regulation on technological change and optimal regulation under uncertainty. He has served as an expert for the Securities and Exchange Commission and has appeared as an expert before federal regulatory bodies in the United States, including the Department of Justice and the Federal Trade Commission. Dr. Mitchell has also served as an Adjunct Professor at the University of Southern California's Marshall School of Business where he was primarily responsible for teaching courses in economics. In 1997, during the course of his Ph.D. research, Dr. Mitchell received a Transportation Economics Award from the Western States Coal Association.

A. Purpose of Analysis

We have been asked by BNSF Railway Company ("BNSF") to comment on economic and public policy principles raised by the Reply Comments of the United States Department of Transportation ("DOT Reply Comments").[1] Specifically, we have been

[1] Reply Comments of the United States Department of Transportation, STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, April 30, 2010 (hereafter "DOT Reply Comments").

asked to address policymaking in situations of uncertainty, including the appropriate application of the Precautionary Principle, as well as the role and limits of cost benefit analyses. We have also been asked to comment on the economic efficiency implications of BNSF's proposed coal dust emissions standard.

B. Background

Shippers in this proceeding have asked the Board to declare BNSF's proposed coal dust emissions standard to be unreasonable.[2] The issue prompting BNSF's proposed rule is the significant risk of ballast destabilization and resulting service disruptions caused by accumulations of coal dust on rail ballast and along the right-of-way. BNSF, through its proposed rule, seeks to substantially reduce ballast fouling and the risks associated with ballast destabilization by requiring shippers to keep their coal dust in their cars. We refer to this as the "containment option." Shippers, opposed to the containment option, instead assert that problems created when coal dust is allowed to escape cars should be addressed by requiring BNSF to engage in expanded post-escape dust collection and infrastructure maintenance activities. We refer to this as the "maintenance option."

The DOT Reply Comments discuss these options in some detail. Our analysis presented here is limited to the economic and public policy principles raised in the DOT Reply Comments.

To the extent that our analysis has required reliance on specific scientific, technical, or operational details, we have reviewed relevant portions of the record in this matter and rely on the testimony offered by other witnesses. Specifically, we note that:

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[2] See BNSF Railway Company's Opening Evidence and Argument, STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, March 16, 2010 at 1.

- Coal dust is a particularly dangerous ballast contaminant. Even in relatively small accumulations, coal dust can cause "considerable strength reductions in the ballast."[3]

- It is difficult to ensure the stability and safety of the ballast through maintenance alone. Coal dust accumulates rapidly, can be difficult to detect visually, and does not accumulate in a predictable pattern or in uniform volumes. Because of these characteristics, the effectiveness of relying on maintenance alone to reduce risks associated with coal dust accumulation is uncertain.[4]

- The containment option is feasible and ensures the stability and safety of the ballast. Coal dust mitigation measures related to rail transportation have been undertaken in a number of other countries and coal dust emissions from stationary sources have been regulated in this country.[5]

- Owing to uncertainties and limitations on the effectiveness of the maintenance option, and the fact that the containment option would operate at the source, the containment option is the "better safe than sorry" alternative.[6] It is also substantially more effective at avoiding track failure due to accumulations of coal dust that has escaped from cars, and it is similarly substantially more effective at avoiding nuisance effects that fall upon parties beyond those involved in this matter.

C. Summary of Findings

The "Precautionary Principle" is the economic and public policy formalization of the familiar adage: "Better safe than sorry." When there is an uncertain risk of potentially high

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[3] "Verified Statement of Erol Tutumluer In Support of BNSF Railway Company's Opening Evidence," STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, March 16, 2010, (hereafter "Tutumluer V.S.") at 8-11.

[4] For a complete discussion of the complexities of relying on maintenance see, for example, "Verified Statement of Gregory C. Fox In Support of BNSF Railway Company's Opening Evidence," STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, March 16, 2010 (hereafter, "Fox V.S.") at 8-9; Verified Statement of Craig Sloggett In Support of BNSF Railway Company's Opening Evidence," STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, March 16, 2010 (hereafter, "Sloggett V.S.") at 2-6, 10.

[5] See BNSF Railway Company's Reply Evidence and Argument, STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, April 30, 2010 (hereafter "BNSF Reply Evidence") at 7-8. Reply Verified Statement of G. David Emmitt, STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, April 30, 2010 (hereafter "Emmitt Reply V.S.") at 7-8.

[6] Fox V.S. at 9; "Verified Statement of William VanHook In Support of BNSF Railway Company's Opening Evidence," STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, March 16, 2010 (hereafter, "VanHook V.S.") at 13-15.

costs, it makes sense to remove the uncertainty, provided there are feasible methods to do so without imposing other large costs. The Precautionary Principle is a response to limitations often found in standard numeric cost-benefit analysis.

When there is a high level of uncertainty about the likelihood and cost associated with an undesirable event – such as a costly accident or environmental degradation – numerical cost-benefit analysis breaks down as the foundation for policy design. This is because uncertainty as to the probability of the undesirable event makes it infeasible to quantify accurately the full spectrum of the benefits to be had by protecting against the event. The problem of policy design is magnified when the costs of an event are reasonably seen as large, albeit uncertain in their quantification. Under such circumstances, a superficial and incomplete cost-benefit analysis can create the illusion of accuracy, but be grossly misleading in its guidance.

The Precautionary Principle dictates that policy options be constrained to feasible and effective choices which meet the threshold criterion of removing or absolutely minimizing the risk of an undesirable outcome. Within that constrained set of feasible and effective alternatives, policy choices that minimize costs and provide incentives for technological improvement are more economically efficient.

The DOT Reply Comments point to economic principles relevant to public policy design. The Reply Comments, for example, repeatedly refer to the "most cost-effective" mitigation measures in offering a guiding policy principle that appears to suggest a careful weighing of costs among various options. In its comments, DOT states:[7]

> ...[S]ound public policy militates in favor of resolving the problem posed by coal dust emissions in the most cost-effective way....In other words, absent a compelling reason to do otherwise, those alternatives that effectively address

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[7] DOT Reply Comments at 7.

> the issue with the least expenditure of resources should be preferred over those that require more.
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> Because shippers should load their property so that it does not escape from the coal cars in the first place, the failure to do so should make them responsible for paying for the most cost-effective incremental mitigation measures.

If "those alternatives that effectively address the issue" means constraining the set of alternatives to those that remove or minimize uncertainty about track failure, as dictated by the Precautionary Principle, then the DOT's comments express sound economic and public policy principles. Within the constrained set of alternatives that remove uncertainty about track failure, DOT's comments accord with principles of economic efficiency in suggesting that sound policy would find the most effective solution to avoiding track failure associated with escape of shipper's coal dust at the lowest expenditure of resources.

Cost effectiveness analysis refers to searching for the least-cost approach to achieving a given goal or solving a particular problem. If two approaches to a problem do not yield the same outcome – e.g., if the containment option is more effective than the maintenance option at reducing uncertainty regarding the prospect of track failure – cost effectiveness analysis breaks down as a guide to policy design. For this reason, the DOT's Reply Comments' claimed application of cost-effectiveness analysis (i.e., "resolving the problem posed by coal dust emissions in the most cost-effective way") would be a *mis*application if it were intended to compare the costs of two options with different outcomes. Properly applied cost-effectiveness analysis requires that each among selected costly alternatives yield the same benefits. When this is not the case, it is insufficient as policy analysis to compare merely the costs of alternatives: benefits must also be compared. Moreover, when alternatives have differential benefits and those benefits entail substantial uncertainty as to their likelihood and/or magnitude, quantitative cost-benefit analysis breaks

down as a guide to policy. Sound policy then moves to "better safe than sorry." DOT's comments seem to endorse a broad principle of preferring the least-costly alternative from the universe of all *effective* alternatives, without explicitly stating what would qualify as an *effective* solution from among the various alternatives in this case.

The matter of coal dust emissions in the Powder River Basin ("PRB") is an example of a situation where intelligent policy applies the Precautionary Principle.

First, the risk of costly track failure due to ballast destabilization from coal dust accumulation is real, but also uncertain. Such failure has actually occurred and the resulting disruption in service had a widespread and costly impact to shippers and their customers – including utilities that use coal to produce electricity. Should a track failure occur during a time of peak energy use and diminished coal inventories, such track failure could incur huge potential costs from power interruptions in addition to the direct costs of transportation disruption. Accurately quantifying these expected costs in the context of a traditional cost benefit analysis, however, is not realistically feasible.

Second, BNSF's proposed emissions standard, which would involve shippers taking steps to contain the dust escaping from their coal, is a feasible and effective method of substantially reducing the risk of a costly track failure due to coal dust accumulation. BNSF has shown that this approach would be effective at avoiding the large-cost system disruptions attributable to excessive coal dust deposition and would allow only small accumulations, well within the range where the accelerated PRB maintenance schedule can ensure safe, reliable, and efficient rail transportation. In keeping with the Precautionary Principle, transported coal dust containment measures have been undertaken in other countries and have been used in other contexts in this country (such as the U.S. Environmental Protection Agency's (EPA) regulations covering stationary source coal dust).

Third, BNSF's proposed emissions standard can be implemented without large costs. No party claims that costs associated with containing rail borne coal dust would be in excess of the highest estimate put forward in this proceeding by Mr. Thomas Crowley (on behalf of the Western Coal Traffic League and Concerned Captive Coal Shippers).[8] That estimate represents only a small fraction of the overall cost of the delivered coal. Indeed, evidence has been provided indicating that the costs associated with meeting the proposed containment standard would be lower than its opponents suggest.[9] Additionally, the proposed operating rule provides shippers the flexibility to determine how best to meet the emissions standard, so their own profit incentive would ensure that they seek the most cost-effective solution. In fact, the emissions standard would provide efficient incentives for dynamic technological improvement over time – encouraging development of new and even less costly methods for containing coal within shippers' cars.

The alternative supported by the shippers – increased railroad maintenance via post-escape collection and preventive maintenance – does not meet the guidance provided by the Precautionary Principle. There is substantial uncertainty as to whether it is feasible for increased maintenance to effectively remove the risk of ballast destabilization and track failure. Not only does this proposed alternative fail to remove the uncertainty of track failure, system disruption, and other undesirable effects of coal dust deposition, but a reasonable and sufficiently complete estimate of increased maintenance costs could be as much as, or even higher than, the cost of preventing the emissions in the first place. In addition, there is no expectation that costs would decrease significantly over time, because

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[8] Verified Statement of Thomas D. Crowley, STB Finance Docket No. 35305, Arkansas Electric Cooperative Corporation – Petition For Declaratory Order, March 16, 2010 (hereafter, "Crowley V.S.") at 2.

[9] See Reply Verified Statement of William VanHook, STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, April 30, 2010 (hereafter "VanHook Reply V.S.") at 31-33.

maintenance is a well established and labor-intensive process with little room for technological improvement.

DOT specifically does not comment on the analytical method for identifying the "most cost-effective" option for "resolving the problem," and it would be contrary to sound economic and public policy principles to interpret DOT's statements to mean that a traditional cost benefit analysis is required, or even appropriate, in this case. It is simply not feasible to develop accurate policy guidance using the traditional "cost-benefit" method of tabulating and quantifying costs and benefits to determine whether it could be more "most cost-effective" to rely on increased maintenance instead of containment.

II. RELEVANT ECONOMIC AND PUBLIC POLICY PRINCIPLES

A. Uncertain and Potentially Large Bad Events Should Be Avoided When Feasible Mitigation Solutions Are Available that Are Not Cost-Prohibitive.

The Precautionary Principle is intended to address situations where there is a material probability that a highly undesirable event could occur, but where there is a simple and relatively painless method that will avoid the bad event. It is applicable when there is broad uncertainty about the level of risk of the bad event or the level of harm that would be caused by the bad event.[10]

The Precautionary Principle does not dictate that all bad events be avoided. In many cases, the risk of potential harm can be accurately quantified as acceptably low, and mitigation is unnecessary. Alternatively, it may be that the only feasible solution for avoiding the risk creates such substantial harm (or costs) on its own that the cure is worse than the disease. The Precautionary Principle applies when the potential harm of the bad

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[10] Gollier, Christian, Bruno Jullien, and Nicolas Treich, "Scientific Progress and Irreversibility: An Economic Interpretation of the 'Precautionary Principle,'" Journal of Public Economics 75 (2000) 229–253. O'Riordan, T., Cameron, J., 1995. Interpreting the Precautionary Principle, Earthscan Publications, London.

event is broadly unknown and unquantifiable and the mitigation solution is known to be effective and not cost-prohibitive. Thus, for example, we commonly require redundancy and so-called "fail safe" approaches (and penalize those who fail to implement such approaches) when setting minimum quality standards for a wide array of products and processes, ranging from nuclear power plants to commercial airliner operation.

Indeed, examples of the Precautionary Principle at work in our public policies abound:[11] We do not tell automobile drivers to do a cost-benefit analysis of the risks of passing on a blind curve; we just tell them not to do it. We do not do cost benefit analyses in which we weigh the costs of incremental applications of the polio vaccine against the (hopefully) small increase in the likelihood of a massive outbreak of the disease; we just require essentially everyone to be vaccinated. At the same time, intelligent policy under the Precautionary Principle seeks the most cost-effective strategies for avoiding the small-probability, high-cost undesirable event. Thus, instead of building impenetrable barriers between every highway lane across the country, we commonly rely on drivers as the least cost avoiders of catastrophic accident by instructing them when not to pass and fining them if they fail to heed the instructions.

B. Cost-Benefit Analyses in the Presence of Uncertainty Can Be Biased and Misleading.

When substantial costs or benefits cannot be accurately estimated, either due to lack of information about the level of uncertainty (i.e., probability of a bad event) or due to the infeasibility of accurately estimating large costs from a bad event, then a quantitative cost-benefit analysis is inherently incomplete. If presented as complete, it is biased and misleading, providing policy guidance that may actually be worse than no guidance at all.

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[11] See Bodansky, D., "The Precautionary Principle in US Environmental Law," Chapter 12 in O'Riordan, T., Cameron, J., 1995. Interpreting the Precautionary Principle, Earthscan Publications, London.

In particular, an incorrect but apparently precise number can give the impression that one option is inherently better. If the number is wrong or highly uncertain, however, then the "better" option may entail an unacceptably high level of remaining risk of bad events.

The shortcomings inherent in any cost analysis performed in the absence of an ability to meaningfully measure the timing and/or probability of an undesirable event under uncertainty becomes more problematic when the stakes are higher. Thus, for example, we may not know what the probability of a polio outbreak may be or when it might occur if we fail to compel performance to a standard (e.g., requiring vaccinations), and we may not have very good estimates of the magnitude of an outbreak and its catastrophic consequences, but we have reason to fear that a really bad outbreak could occur. Under such circumstances, sound public policy takes precaution against the really bad outcome. If there is a lot to lose, then it makes sense to adopt a feasible, not-cost-prohibitive standard that maximizes the chances of avoiding the disastrous event. It certainly means avoiding being led to a wrong choice – i.e., a choice that fails to minimize prospects of the really bad outcome – based on inaccurate or methodologically incomplete cost-effectiveness analysis.

C. Uniform and Enforceable Performance Standards Can Be Appropriate When Undesirable Consequences Emanate from Multiple Sources and Are Cumulative.

When it is costly to negotiate finely tuned arrangements that assign costs to sources (because, for example, it is technically infeasible to identify sources of harmful emissions) and costs are spread among multiple parties, individual parties have incentives to attempt to shift the costs onto other parties. Under such circumstances, to avoid blame shifting and free riding, application of uniform performance standards on those in the best position to mitigate the risk of a large undesirable outcome represents a sound policy approach.

Under these circumstances, the least-cost method for keeping emissions down to levels which achieve the specific goal of eliminating or minimizing the risks of track failures and associated system disruptions (and thereby achieving DOT's stated goal of implementing the "most cost-effective...mitigation measures" for "resolving the problem")[12] is to establish an emissions standard that can be monitored accurately.[13] By focusing on the offending activity – the emission of shippers' coal dust from their cars, for example – those best in position to control that activity are given maximum incentive to develop the knowledge and technologies for controlling emissions. The profit-maximizing shipper will seek the lowest-cost method of complying with the performance standard.[14] If "one size does not fit all" (because, for example, some shippers find it most cost effective to treat their coal with surfactants while others find compaction most effective[15]) and/or where technological progress is feasible, these incentives can be expected to spur searches for cost-reducing approaches to controlling emissions and cost-reducing technological improvements. As discussed below, this has clear applicability to the containment option.

III. THE PRECAUTIONARY PRINCIPLE APPLIES IN THIS MATTER

Our analysis finds that coal dust escape and deposition in the PRB is a regulatory policy that should be guided by the Precautionary Principle: There is an uncertain risk of an

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[12] DOT Reply Comments at 7.

[13] In circumstances when the regulatory authority has specialized knowledge about emissions control or accurate emissions monitoring is very costly then it may be preferable, from an economic perspective, to adopt a technology-based standard. Such a standard dictates the technological method for controlling emissions, rather than trying to assess whether emissions levels meet a particular quantitative standard. See, for example, Kolstad, C., 2000, Environmental Economics, Oxford University Press, New York, at 141.

[14] Mendelsohn, R., "Endogenous Technical Change and Environmental Regulation," Journal of Environmental Economics and Management, v. 11, 202-207 (1984).

[15] For application here, see Verified Statement of Stevan B. Bobb In Support of BNSF Railway Company's Opening Evidence," STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, March 16, 2010 at 8-9; and VanHook V.S., at 17-18.

event (track failure) with costs that are difficult to quantify ex ante (and even ex post), but which history teaches are definitely high; there is an effective remedy that substantially reduces the risk of the costly event relative to other feasible alternatives; and that remedy is not cost-prohibitive.

A. Coal Dust Accumulation Creates Real, But Uncertain and Difficult to Quantify, Risk of Track Failure and Costly Service Interruption.

There is no question that coal dust is escaping from shippers' cars and accumulating on BNSF's rail infrastructure. Numerous witnesses in this matter have detailed the difficulty in dealing with coal dust after it has been allowed to escape, as well as the safety issues associated with even relatively small accumulations of coal dust.[16] Evidence offered by Professor Tutumluer, a leader in academic research on the effects of coal dust on rail ballast, details the dangerous impact of coal dust on ballast stability;[17] and coal dust has been cited as a significant factor in the 2005 service interruptions on the PRB Joint Line.[18] In fact, service disruptions attendant to the 2005 track failure occasioned intensive investigation by, for example, the Federal Energy Regulatory Commission (concerned about threats to electric power system integrity and service reliability).[19] Costs attributed to the 2005 event included reductions of coal supply to certain power plants, depletions of coal inventories at plants, increases in imported coal, and changes in the "generation supply mix" in some regions.[20]

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[16] See, for example, Sloggett V.S. at 2-10; Fox V.S. at 8-9; Tutumluer V.S. at 1-2, 8-11; and DOT Reply Comments at 1.

[17] Tutumluer V.S. at 8-11.

[18] Fox V.S. at 4; Tutumluer V.S. at 11.

[19] See, for example, FERC Docket No. AD06-8-000, "Discussions With Utility and Railroad Representatives on Market And Reliability Matters," June 15, 2006.

[20] "2006 State of the Market Report," Federal Energy Regulatory Commission, 2006, at ES-4, 3, and 23.

It is also clear that it is not feasible to quantify with certainty the coal dust problem: It is difficult to measure how much dust escapes; there is no way to predict whether (or how much) dust will escape from a given car; dust accumulates rapidly, but does not follow a pattern or accumulate in predictable volumes or in predictable places.[21] It is evidently highly problematic to determine the volume of accumulation, and therefore the need for clean-up, through visual inspection.[22] It is difficult to determine which areas of ballast are most compromised by dust and therefore are most susceptible to instability or failure;[23] and it is difficult to determine how frequently the ballast must be cleared of accumulated coal dust in order to effectively reduce the risk to the stability and safety of the line.[24] All of these factors, in turn, add up to making application of maintenance resources an uncertain proposition when it comes to "resolving the problem."

Quantification of the expected costs of dust-related track failure and system disruption that remain following application of best-available maintenance protocols and practices is similarly problematic. It is difficult to predict where, when and with what severity a track failure might occur, to estimate the length and severity of any service interruption, to quantify the costs to shippers (generally electric utilities), and to determine the impact on electricity generation and pricing. With respect to potential costs, it is relevant that PRB coal fuels a significant portion of electrical generation across a wide area of the United States. Thus, a substantial interruption in the regular supply of coal can have

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[21] See, for example, "Verified Statement of G. David Emmitt In Support of BNSF Railway Company's Opening Evidence," STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, March 16, 2010 at 3-4; "Reply Verified Statement of Craig Sloggett," STB Docket No. 35305, Petition of Arkansas Electric Cooperative Corporation For a Declaratory Order, April 30, 2010 (hereafter "Sloggett Reply V.S.") at 8-10.

[22] See, for example, Sloggett V.S. at 4, Sloggett Reply V.S. at 8-10.

[23] See, for example, VanHook V.S. at 14.

[24] See, for example, Sloggett Reply V.S. at 8-10; Fox V.S. at 8.

widespread consequences. In the event that coal shipment interruptions would result in power plants going offline, for example, experience with "brownouts" and "blackouts" in the United States indicates that the costs of potential electricity interruptions could be in the billions of dollars.[25] Even short of this, coal typically provides so-called "baseload" power, leaving other, much more expensive power generation (such as by oil and gas) to service peak needs.[26] Disruption of coal supplies can readily compel power companies to turn much sooner to these more expensive alternatives. This not only harms electricity consumers directly, but has adverse effects on the productivity of the nation's economy.

B. In This Case, Traditional Analyses Attempting to Weigh Costs and Benefits Would Be Limited and Potentially Misleading.

Any cost-benefit or cost-effectiveness analysis attempting to compare policy options that includes options that do not, in fact, remove (or at least minimize) the risk of track failure are incomplete. This applies with force to any attempt to apply the cost-effectiveness analysis suggested in the DOT Reply Comments' to justify acceptance of shippers' alternative proposal of increased maintenance instead of containment. BNSF's technical experts find that it is not feasible to provide enough maintenance to ensure ballast stability, given the variable nature of coal dust accumulation and the pernicious effects of relatively modest amounts of accumulation.[27] This means a true assessment of the full costs and benefits associated with the shippers' maintenance proposal would have to quantify the risk

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[25] Numerous studies of recent "blackouts" have been conducted. See, for example, costs estimates of the August 2003 Blackout: "Transforming the Grid to Revolutionize Electric Power in North America," Gil Bindewald, U.S. Department of Energy, Edison Electric Institute's Fall 2003 Transmission, Distribution, and Metering Conference, October 13, 2003; Anderson, Patrick L. and Ilhan K. Geckil, "Northeast Blackout Likely to Reduce US Earnings by $6.4 Billion," AEG Working paper 2003-2, August 19, 2003; and ICF Consulting, "The Economic Cost of the Blackout: An Issue Paper on the Northeastern Blackout, August 14, 2003."

[26] See U.S. Energy Information Administration, "Annual Energy Outlook 2010," May 11, 2010 at 2, Figure 1 for a depiction of U.S. electricity consumption by fuel source.

[27] See, for example, VanHook V.S. at 15; Fox V.S. at 8; and Sloggett V.S. at 10.

of track failure under the increased maintenance schedule, as well as the entirety of costs should track failure actually occur.

No such analysis has been provided. As noted, the analysis of, for example, Mr. Crowley, is not a proper cost-effectiveness analysis (since the two options he compares do not perform the same vis-à-vis the residual risk of track failure). Nor is it cost-benefit analysis (since it fails to account for the incremental costs of greater risk of track failure under the maintenance option).

Since the proffered cost-effectiveness analysis of the "increased maintenance" option is necessarily incomplete, this means that one of the economists' traditional decision-making tools, cost-benefit analysis, is to no avail in providing policy guidance. The cost of the alternative (the maintenance option, in this case) that fails to remove or minimize the uncertainty would be incorrect and artificially low. This is why we must turn to other analytical methods to guide the policymaking process. Evaluating each proposal (containment vs. maintenance) within the framework of the Precautionary Principle makes clear that BNSF's proposed operating rule conforms to elements of sound policy.

IV. ECONOMIC AND PUBLIC POLICY PRINCIPLES SUPPORT BNSF'S PROPOSED OPERATING RULE

BNSF's proposed operating rule – requiring shippers to contain their coal within their railcars – satisfies all the elements of sound policy embodied in the Precautionary Principle.

A. BNSF's Proposed Rule Is a Feasible and Effective Method for Abating Risks Associated with Coal Dust.

Containment of coal dust is both feasible and effective. Railroads in Canada, Australia, and Colombia are all taking measures to contain coal dust.[28] Surfactant application is one method, used in Canada and Australia, but there are a number of containment approaches to satisfying the standard. Colombia, for example, uses a roller and compaction technology that could be available for shippers in the PRB.[29] Further, the state of Virginia requires coal dust containment measures be implemented and reported on annually, and the Environmental Protection Agency has recently issued coal dust containment regulations related to emissions from stationary sources.[30]

In cooperation with some PRB shippers, BNSF has conducted surfactant trials which have proved effective.[31] The extensive testing by BNSF establishes that there is at least one method that would contain shippers' coal in the rail cars sufficiently well to meet the emissions standard of preventing dust escape from shippers' cars. Furthermore, we understand that BNSF has selected the emissions standard so as to limit the amount of coal dust blown from cars to small enough volumes (and, consequently, coal dust accumulation in the track ballast would be small enough) that the existing accelerated PRB maintenance schedule would be sufficient to ensure ballast stability.[32] In other words, the proposed operating rule effectively resolves the problem. As noted, the same cannot be said of shippers' maintenance option.

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[28] Emmitt Reply V.S. at 7-9.

[29] See, for example, Emmitt Reply V.S. at 7-9.

[30] See BNSF Reply Evidence at 7-8.

[31] VanHook V.S. at 21-23.

[32] Sloggett Reply V.S. at 10.

B. Implementing BNSF's Proposed Rule Is Not Cost-Prohibitive and Will Promote Innovation.

Mr. Crowley's estimate on the cost of dust containment through surfactant treatment ranges from {{ }} per ton of coal ({{ }} annually).[33] We understand that there may be some dispute among the parties as to the accuracy of those estimates (and, in particular, whether costs of containment would actually be as high as the high end of the asserted range). Yet, even if we accept Mr. Crowley's estimates, the cost of containment through application of surfactants would be between approximately {{ }}of the delivered cost of coal.[34] As the experience of other countries has shown, this is not a cost-prohibitive option. In fact, the foregoing cost figures are relative to a baseline of the status quo of no containment and no increased maintenance. Relative to even Mr. Crowley's figures for the cost of shippers' option of increased maintenance (which he puts at {{ }} million annually or {{ }} per ton of coal[35]), the *incremental* cost, if any,[36] of the containment option is not prohibitive; it verges on the *de minimis*.[37]

There are also important economic reasons to expect that the actual cost of containment will be lower, especially as time goes on. As noted, by creating a performance based standard rather than imposing a specific solution, BNSF's option allows for the least-cost implementation to emerge dynamically and to evolve as technology improves. BNSF's

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[33] Crowley V.S. at 2. Mr. Crowley calculates his annual costs based on {{ }} million tons of coal.

[34] This calculation is based on an assumed delivered cost of coal of $30/ton (VanHook Reply V.S. at 32.). See VanHook Reply V.S. at 31-33 for a more extended discussion of the cost of surfactant relative to the delivered cost of coal.

[35] Crowley V.S. at 17. Calculation of per ton cost of maintenance uses Mr. Crowley's estimate of PRB coal volumes of {{ }} million tons.

[36] See VanHook Reply V.S. at 23-33.

[37] The relevant cost for removing uncertainty, through the containment policy, is only the incremental cost of containment vs. maintenance (which does not remove the uncertainty).

proposal places responsibility for implementing the rule with shippers, who have the profit incentive to use, and continue over time to search for, the least-cost solution. For some, that will likely be the use of surfactant, but others may find it in their interest to use some of the alternatives currently used elsewhere. In the process of reaching such decisions, the performance based standard will promote technological innovation as shippers develop better (cheaper) methods of complying with the operating rule.

Finally, the cost of BNSF's proposed solution would be offset by the added benefit of ameliorating any nuisance associated with allowing the shippers' coal dust to blow beyond the railroad and its roadbed. This offsetting benefit is not, of course, applicable to the shippers' alternative proposal of increased maintenance. Under that alternative, dust escape would not be contained and off-railroad deposition would continue. In the language of economics, shippers' maintenance option would leave such "externalities" uncontrolled and unaddressed. It does *not* leave "them responsible for paying for the most cost-effective incremental mitigation measures" for *these* aspects of their emissions of coal dust. Of course, the same applies to the externalities (e.g., borne by electric power consumers) in the event of the remaining risk of track failures under shippers' maintenance approach.

V. ECONOMIC AND PUBLIC POLICY PRINCIPLES DO NOT SUPPORT SHIPPERS' PROPOSED ALTERNATIVE

It would be contrary to sound economic and public policy principles to interpret DOT's statements to mean that the shipper's proposed alternative should be weighed against the coal dust emissions standard on the basis of the estimated costs for those two alternatives. In its Reply Comments, DOT specifically states that mitigation measures must

"effectively address the issue"[38] of ballast instability and associated risks of track failure. The maintenance solution does not satisfy this criterion: It is not cost-effective in eliminating or minimizing the risks of track failure; it does not create proper incentives; and it is not assured to effectively reduce or minimize the risks associated with ballast instability from coal dust accumulation.

Even apart from these differences in the containment v. after-escape collection and maintenance approaches, interpreting the DOT's statements to suggest weighing the costs and benefits of the two approaches would require a very different analysis than the one proffered by Mr. Crowley which is strikingly inadequate in another, absolutely key respect: It is grossly incomplete as a cost-benefit analysis in so far as it completely fails to measure the additional benefits that the containment standard would provide relative to post-escape collection and maintenance. That is, Mr. Crowley's analysis fails to account for the reasonable prospect that the containment approach would yield substantially lower likelihood of track failure and thereby avoid the costs of such failure and associated system disruption. In short, Mr. Crowley's analysis is at best a *cost* analysis, rather than a *cost-benefit* analysis or even proper cost-effectiveness analysis.

The implication is *not* that we should set about attempting to minutely quantify incremental reductions in the probabilities of track failure under myriad possible conditions and scenarios, and that we should then attempt to quantify the avoided costs of track failure and system disruption under a plethora of conditions and scenarios. Such a strategy misuses cost-benefit analysis and misconstrues its numerical outputs as accuracy. Instead, consideration of the parameters of reduced risk of large, costly consequences of track failure under BNSF's containment approach should properly turn policy toward the Precautionary

[38] DOT Reply Comments at 7.

Principle. Stated another way, Mr. Crowley's analysis of cost understates the cost of the shippers' maintenance approach in so far as it contains no assessment of the risks and costs of track failures under that approach.[39]

In addition to the fact that the effectiveness of the maintenance option as a means of minimizing dust-related track failure is uncertain, a full consideration of the costs associated with increased maintenance makes this alternative particularly unattractive. The evidence presented provides an incomplete picture of the true costs associated with continuing to allow unrestricted coal dust emissions from shippers' rail cars and attempting to meet the problem with after-escape collection and maintenance. There is, first, the inherent difficulty in estimating the true cost of a track failure and resulting service disruption. Furthermore, none of the parties has attempted to estimate any cost associated with coal dust beyond its impact on ballast destabilization, including harm to other railroad infrastructure, the cost of adding additional capacity to maintain required service levels when current capacity is taken out of service for expanded maintenance, or possible coal dust nuisance to others outside of the parties involved in this matter. The difficulty in incorporating accurate estimates of any of these cost elements highlights the limits of relying on a traditional cost benefit analysis to determine the least-cost alternatives in this case. It also further underscores the appropriateness of turning to the Precautionary Principle for guidance in this instance.

BNSF has submitted significantly higher expected costs of maintenance.[40] For the purposes of our analysis, it is important to note that Mr. Crowley's estimates fail to account for the disruption and other costs of capacity-reductions when track is removed from service

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[39] As noted, the analysis also ignores the external costs of off-railroad nuisance effects of continuing dust escape under the maintenance option.

[40] Our purpose here is not to critique Mr. Crowley's analysis in detail, but to assess its implications for DOT's analysis in its Reply Comments. The specific deficiencies of Mr. Crowley's estimates are addressed in the VanHook Reply V.S.

for maintenance (as it would be under shippers' option), as well as other costs discussed above. All of these factors cut in one direction vis-à-vis DOT's considerations: Mr. Crowley's estimates significantly understate the true cost of the maintenance option.

Further, Mr. Crowley's estimates of the costs of BNSF's containment option are static: No account is given to the incentives for cost-reducing innovation that attend to the containment option. Such incentives exist for the maintenance option, but we understand that the technology of maintenance is mature and highly labor intensive, which implies that it would be subject only to normal productivity change, but not significant technological change or breakthrough.[41] This implies little room for substantial cost reduction going forward. Moreover, the shippers' "solution" of increased maintenance fails to give shippers incentives for economic efficiency and cost savings, much less give them the incentive to reduce the offending activity – dust escaping from their cars. Regardless of whether particular shippers can inexpensively contain the coal in their cars, every shipper would be allowed to emit dust onto the railroad, and each shipper would pay higher rates based on BNSF's overall costs of increased maintenance. It would not be realistically feasible to identify which shippers were responsible for what proportion of the coal dust collected by BNSF and the resulting maintenance costs, so every shipper would have to share the cost equally. This creates a "tragedy of the commons," where no shipper has incentive to undertake the very responsibility supposedly relegated to them – keeping their coal in their cars.

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[41] For a discussion of the intensity of maintenance activities, and the limits BNSF faces in terms of labor, equipment and available maintenance windows, see the Sloggett Reply V.S. at 2-8.

VI. CONCLUSION

From an economic and public policy perspective, the Precautionary Principle should be applied when assessing operating rules regulating coal dust emissions. That Principle guides policy with the advice that, among policy options that are not cost-prohibitive, select the option that provides the greatest certainty of avoiding the risks of bad events. In this case, the operating rules proposed by BNSF are within the guidance provided by the Precautonary Principle and have the added benefit of allowing flexibility for least-cost implemenation and promoting cost-reducing innnovation. The alternative proposed by the shippers does not comply with the guidance provided by the Precautionary Principle because it does not remove or minimize the uncertainty associated with track failure. This alone would make it inappropriate to base any decision on estimates of the relative level of costs due to the inherent incompleteness and inaccuracy of cost estimates in this type of situation. Furthermore, the information about costs that has already been presented in this matter suggests no solid cost rationale for adopting a policy that allows the shippers' coal to continue to put track integrity at risk.

I declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on June 4, 2010

Joseph P. Kalt

I declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on June 4, 2010

Glenn Mitchell

A

APPENDIX A

JOSEPH PEGGS KALT

John F. Kennedy School of Government
Harvard University
Cambridge, MA 02138
(617) 495-4966 joe_kalt@harvard.edu

PROFESSIONAL POSITIONS

JOHN F. KENNEDY SCHOOL OF GOVERNMENT, HARVARD UNIVERSITY, CAMBRIDGE, MA

Ford Foundation Professor of International Political Economy, 1992-present

Areas of specialization include Industrial Organization, Economics of Antitrust and Regulation, Natural Resource Economics, Public Choice and Political Economy, Economic Development, Microeconomic Theory.

Co-Director, The Harvard Project on American Indian Economic Development, 1987-present

Faculty Chair, Harvard University Native American Program, 2000-2006

Chair, Economics and Quantitative Methods Cluster, 1995-2000

Professor of Political Economy, 1986-1992

Faculty Chair and Academic Dean for Research, 1992-1994

Chairman, Environment and Natural Resources Program, Center for Science and International Affairs, 1990-1994

Chairman of Degree Programs, 1990-1992

Chairman of Ph.D. Programs, 1989-1990

Assistant Director for Natural Resources, Energy and Environmental Policy Center, 1985-1990

Co-Director, Harvard Study on the Future of Natural Gas Policy (with Frank C. Schuller), Energy and Environmental Policy Center, John F. Kennedy School of Government, 1984-1986

DEPARTMENT OF ECONOMICS, HARVARD UNIVERSITY, CAMBRIDGE, MA

Associate Professor of Economics, 1983-1986

Assistant Professor of Economics, 1980-1983

Instructor in Economics, 1978-1980

Taught Economics of Antitrust and Regulation, Intermediate Microeconomics, and Principles of Economics.

THE UNIVERSITY OF ARIZONA, TUCSON, AZ

Visiting Professor, Eller College of Management, 2005-present

Faculty Chair for Nation Building Programs, Native Nations Institute for Leadership, Management, and Policy, Udall Center for Studies in Public Policy, 2005-present

Visiting Professor, American Indian Studies Program, 2005-2006

COMPASS LEXECON

Senior Economist, 2003-present (and since 1983 with predecessor enterprises)

PRESIDENT'S COUNCIL OF ECONOMIC ADVISERS, WASHINGTON DC
Junior Staff Economist, 1974-1975
Analyzed federal energy, environmental, transportation, and tax policies.

EDUCATION

University of California, Los Angeles, Ph.D. in Economics, 1980; M.A. in Economics, 1977
Doctoral Dissertation: *Federal Control of Petroleum Prices: A Case Study of the Theory of Regulation*
Stanford University, Stanford, CA, B.A. in Economics (Honors), 1973

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"A Harvard Professor Looks at the Effects of Allowing U.S. Hunters to Import Polar Bear Trophies," *Safari Times*, April 1994.

Statement to U.S. Congress, Joint Economic Committee, Subcommittee on Trade, Productivity and Economic Growth, *The Economic Impact of Lower Oil Price*, Hearing of March 12, 1986.

"Administration Backsliding on Energy Policy" (with Peter Navarro), *Wall Street Journal*, editorial page, February 9, 1982.

Statement to the Energy and Natural Resources Committee, U.S. Senate, *Government Responses to Oil Supply Disruptions*, Hearing of July 28-29, 1981, U.S. Government Printing Office, 1981, pp. 623-630 and 787-801.

"Staff Report on Effects of Restrictions on Advertising and Commercial Practice in the Professions: The Case of Optometry," Ronald S. Bond, *et al.*, Executive Summary, Bureau of Economics, Federal Trade Commission, September 1980.

"Redistribution of Wealth in Federal Oil Policy," *San Diego Business Journal*, August 18, 1980, pp. 22-23.

"The Energy Crisis—Moral Equivalent of Civil War" (with Peter Navarro), *Regulation*, January/February 1980, pp. 41-43.

"Windfall Profits Tax Will Reap Bonanza—But For Whom?" (with Peter Navarro), *The Miami Herald*, December 23, 1979, editorial page.

SELECTED PRESENTATIONS

Keynote Address: "Resurgence and Renaissance in Indian America," Native American Business Association Annual Convention, Mississippi Choctaw Nation, April 29, 2008.

"Standard Oil to Today: Antitrust Enforcement in the Oil Industry," American Bar Association, 56th Antitrust Law Spring Meeting, Washington, D.C., March 27, 2008.

Keynote Address: "Nation Building: Lessons from Indian Country," National Native American Economic Policy Statement, Phoenix, AZ, May 15, 2007.

Keynote Address: "A Conversation on the State of the Native Nations: A Gathering of Leaders," Res 2007, Las Vegas, NV, March 14, 2007.

"Foundations of Nation Building: The Roles of Culture, Institutions, & Leadership Among Contemporary American Indian Nations," a lecture to faculty, staff and students, Marine Corps University, Quantico, VA, March 12, 2007.

Keynote Address: "The Universal Challenge of Nation Building," First Annual Great Lakes Tribal Economic Development Symposium, Traverse City, MI, October 25-26, 2006.

Transcript of Keynote Address, "Setting the Agenda: What Will Drive Energy's Future?" *Congressional Quarterly Forum*, "The Politics of Oil: U.S. Imperatives, Foreign Consequences," Washington, D.C., September 13, 2005.

"The Role of the Tribal Courts and Economic Development," Bureau of Indian Affairs, *Tribal Courts in the 21st Century*, Billings, MT, August 16, 2005.

"Linking Tribal Sovereignty to Economic Self-Determination in Indian Country," *The Tribal Leaders Forum*, "Sovereignty in Crisis," Las Vegas, NV, May 27, 2005.

"Competition and Regulation in the North American Electricity Industry: Can These Two Seemingly Opposed Forces Coexist?" (with Charles Augustine and Joseph Cavicchi), 24th Annual North American Conference, USAEE/IAEE, Energy, Environment, and Economics in a New Era, Washington, DC, July 8-10, 2004.

"The State of U.S. Railroads and the Challenges Ahead," briefing of Capitol Hill staff, Association of American Railroads, April 17, 2003.

"The State of the Railroad Industry and the Challenges Ahead," briefing of Roger Nober, Chairman, US Surface Transportation Board, Association of American Railroads, January 28, 2003.

"The Wealth of American Indian Nations: Culture and Institutions," Federal Reserve Bank of Boston, December 11, 2002.

"The Roots of California's Energy Crisis: Law, Policy, Politics, and Economics," Regulation Seminar, Center for Business and Government, Kennedy School, Harvard University, November 7, 2002.

"Public Policy Foundations of Nation Building in Indian Country," National Symposium on Legal Foundations of American Indian Self-Governance," Mashantucket Pequot Nation, February 9, 2001.

"Twenty-Five Years of Self-Determination: Lessons from the Harvard Project on American Indian Economic Development," Udall Center for Studies in Public Policy, University of Arizona, November 13-14, 1999.

Proceedings of the Fourth Annual DOE-NARUC Natural Gas Conference, Orlando, FL, February 1995.

Keynote Address, "Sovereignty and American Indian Economic Development," Arizona Town Hall, Grand Canyon, AZ, October 1994.

"Is the Movement Toward a Less-Regulated, More Competitive LDC Sector Inexorable?, (Re)Inventing State/Federal Partnerships: Policies for Optimal Gas Use," U.S. Department of Energy and The National Association of Regulatory Utility Commissioners Annual Conference, Nashville, TN, February 1994.

"Cultural Evolution and Constitutional Public Choice: Institutional Diversity and Economic Performance on American Indian Reservations," Festschrift in Honor of Armen A. Alchian, Western Economic Association, Vancouver, BC, July 1994.

"Precedent and Legal Argument in U.S. Trade Policy: Do they Matter to the Political Economy of the Lumber Dispute?" National Bureau of Economic Research, Conference on Political Economy of Trade Protection, February, September 1994.

"The Redesign of Rate Structures and Capacity Auctioning in the Natural Gas Pipeline Industry," Natural Gas Supply Association, Houston, TX, March 1988.

"Property Rights and American Indian Economic Development," Pacific Research Institute Conference, Alexandria, VA, May 1987.

"The Development of Private Property Markets in Wilderness Recreation: An Assessment of the Policy of Self-Determination by American Indians," Political Economy Research Center Conference, Big Sky, MT, December 4-7, 1985.

"Lessons from the U.S, Experience with Energy Price Regulation," International Association of Energy Economists Delegation to the People's Republic of China, Beijing and Shanghai, PRC, June 1985.

"The Impact of Domestic Regulation on the International Competitiveness of American Industry," Harvard/NEC Conference on International Competition, Ft. Lauderdale, FL, March 7-9, 1985.

"The Welfare and Competitive Effects of Natural Gas Pricing," American Economic Association Annual Meetings, December 1984.

"The Ideological Behavior of Legislators," Stanford University Conference on the Political Economy of Public Policy, March 1984.

"Principal-Agent Slack in the Theory of Bureaucratic Behavior," Columbia University Center for Law and Economic Studies, 1984.

"The Political Power of the Underground Coal Industry," FTC Conference on the Strategic Use of Regulation, March 1984.

"Decontrolling Natural Gas Prices: The Intertemporal Implications of Theory," International Association of Energy Economists Annual Meetings, Houston, TX, November 1981.

"The Role of Government and the Marketplace in the Production and Distribution of Energy," Brown University Symposium on Energy and Economics, March 1981.

"A Political Pressure Theory of Oil Pricing," Conference on New Strategies for Managing U.S. Oil Shortages, Yale University, November 1980.

"The Politics of Energy," Eastern Economic Association Annual Meetings, 1977.

WORKSHOPS PRESENTED

Federal Reserve Bank of Boston; University of Indiana; University of Montana; Oglala Lakota College; University of New Mexico; Columbia University Law School; Department of Economics and John F. Kennedy School of Government, Harvard University; MIT; University of Chicago; Duke University; University of Rochester; Yale University; Virginia Polytechnic Institute; U.S. Federal Trade Commission; University of Texas; University of Arizona; Federal Reserve Bank of Dallas; U.S. Department of Justice; Rice University; Washington University; University of Michigan; University of Saskatchewan; Montana State University; UCLA; University of Maryland; National Bureau of Economic Research; University of Southern California.

TEACHING

Markets and Market Failure with Cases (Harvard Kennedy School of Government, graduate); Native Americans in the 21st Century: Nation Building I & II (Harvard, University-wide, graduate and undergraduate); Competition, Strategy, and Regulation (Harvard Kennedy School of Government, graduate); The Law, Policy, and Economics of Contemporary Tribal Economic Development (University of Arizona, School of Law and College of Management, graduate); Introduction to Environment and Natural Resource Policy (Harvard Kennedy School of

Government, graduate); Seminar in Positive Political Economy (Harvard Kennedy School of Government, graduate); Intermediate Microeconomics for Public Policy (Harvard Kennedy School of Government, graduate); Natural Resources and Public Lands Policy (Harvard Kennedy School of Government, graduate); Economics of Regulation and Antitrust (Harvard Department of Economics, graduate); Economics of Regulation (Harvard Department of Economics, undergraduate); Introduction to Energy and Environmental Policy (Harvard Kennedy School of Government, graduate); Graduate Seminar in Industrial Organization and Regulation (Harvard Department of Economics, graduate); Intermediate Microeconomics (Harvard Department of Economics, undergraduate); Principles of Economics (Harvard Department of Economics, undergraduate); Seminar in Energy and Environmental Policy (Harvard Kennedy School of Government, graduate)

OTHER PROFESSIONAL ACTIVITIES

Board of Directors, Sonoran Institute, 2008-present

National Advisory Board, Big Sky Institute, Montana State University, 2007-present

Board of Trustees, The Communications Institute, 2003-present

Board of Trustees, Fort Apache Heritage Foundation, 2000-present

Mediator (with Keith G. Allred), Nez Perce Tribe and the North Central Idaho Jurisdictional Alliance, MOU signed December 2002

Mediator, *In the Matter of the White Mountain Apache Tribe v. United States Fish and Wildlife Service*, re: endangered species management authority, May-December, 1994

Steering Committee, National Park Service, 75th Anniversary Symposium, 1991-1993

Board of Trustees, Foundation for American Communications, 1989-2003

Editorial Board, *Economic Inquiry*, 1988-2002

Advisory Committee, Oak Ridge National Laboratory, Energy Division, 1987-1989

Commissioner, President's Aviation Safety Commission, 1987-1988

Principal Lecturer in the Program of Economics for Journalists, Foundation for American Communications, teaching economic principles to working journalists in the broadcast and print media, 1979-present

Lecturer in the Economics Institute for Federal Administrative Law Judges, University of Miami School of Law, 1983-1991

Research Fellow, Energy and Environmental Policy Center, John F. Kennedy School of Government, Harvard University, 1981-1987

Editorial Board, MIT Press Series on *Regulation of Economic Activity*, 1984-1992

Research Advisory Committee, American Enterprise Institute, 1979-1985

Editor, *Quarterly Journal of Economics*, 1979-1984

Referee for *American Economic Review, Bell Journal of Economics, Economic Inquiry, Journal of Political Economy, Review of Economics and Statistics, Science Magazine, Journal of Policy Analysis and Management, Social Choice and Welfare, Quarterly Journal of Economics*, MIT Press, North-Holland Press, Harvard University Press, *American Indian Culture and Research Journal*

HONORS AND AWARDS

Public Sector Leadership Award, National Congress of American Indians, Washington, DC, March 1, 2010.

First American Public Policy Award, First American Leadership Awards 2005, "Realizing the Vision: Healthy Communities, Businesses, and Economies," National Center for American Indian Enterprise Development, Phoenix, AZ, June 9, 2005.

Allyn Young Prize for Excellence in the Teaching of the Principles of Economics, Harvard University, 1978-1979 and 1979-1980

Chancellor's Intern Fellowship in Economics, September 1973 to July 1978, one of two awarded in 1973, University of California, Los Angeles

Smith-Richardson Dissertation Fellowship in Political Economy, Foundation for Research in Economics and Education, June 1977 to September 1977, UCLA

Summer Research Fellowship, UCLA Foundation, June 1976 to September 1976

Dissertation Fellowship, Hoover Institution, Stanford University, September 1977 to June 1978

Four years of undergraduate academic scholarships, 1969-1973; graduated with University Distinction and Departmental Honors, Stanford University

Research funding sources have included: Annie E. Casey Foundation; Nathan Cummings Foundation; Department of Indian Affairs and Northern Development (Canada); National Indian Gaming Association; The National Science Foundation; USAID (IRIS Foundation); Pew Charitable Trust; Christian A. Johnson Family Endeavor Foundation; The Ford Foundation; The Kellogg Foundation; Harvard Program on the Environment; The Northwest Area Foundation; the U.S. Department of Energy; the Research Center for Managerial Economics and Public Policy, UCLA Graduate School of Management; the MIT Energy Laboratory; Harvard's Energy and Environmental Policy Center; the Political Economy Research Center; the Center for Economic

Policy Research, Stanford University; the Federal Trade Commission; Resources for the Future; and The Rockefeller Foundation.

EXPERT TESTIMONY

Cypress Semiconductor Corporation

In the US District Court for the Northern District of California Oakland Division, In re SRAM Antitrust Litigation, MDL No. 1819, Expert Report on Behalf of Defendant Cypress Semiconductor Corporation, May 4, 2010.

Dean Foods Company, et al.

In the US District Court for the Eastern District of Tennessee Greenville Division, Food Lion, LLC, et al., Plaintiffs, vs. Dean Foods Company, et al., Defendants, Case No. 2:07-CV-188, Expert Report on Behalf of the Defendants May 3, 2010.

In the US District Court for the Eastern District of Tennessee Greenville Division, Sweetwater Valley Farm, Inc., et al., Plaintiffs, vs. Dean Foods Company, et al., Defendants, MDL No. 1899, Expert Report on Behalf of the Defendants, May 3, 2010.

McKesson Corporation

In the US District Court for the District of Massachusetts, the State of Connecticut v. McKesson Corporation in Civil Action No. 08-10900-PBS, Responsive Expert Report, on Behalf of McKesson Corporation, April 14, 2010.

In the US District Court for the District of Massachusetts, New England Carpenters Health Benefits Fund, et al. v First Databank, Inc. and McKesson Corporation, No. 05-11148-PBS, Report, January 28, 2008; Rebuttal Report, October 1, 2008.

CITGO Petroleum Corporation

In the United States District Court, Northern District of Oklahoma, in Re: Stephenson Oil Company, on behalf of itself and all others similarly situated, Plaintiff, vs. CITGO Petroleum Corporation, Defendant, Case No. 08-CV-380-TCK-TLW, Expert Report on behalf of Defendant, November 20, 2009; Oral Testimony, February 25, 2010.

Confederated Tribes of the Chehalis Reservation

In the United States District, Western District of Washington at Tacoma, in Re: Confederated Tribes of the Chehalis Reservation, Plaintiffs, v. Thurston County Board of Equalization, Defendants, Civil Action No. C08 5562, Expert Report On Behalf of the Confederated Tribes of the Chehalis Reservation, October 15, 2009; Oral Deposition, December 4, 2009.

Rio Tinto

In the Australian Competition Tribunal, Application for the Review of the Deemed Decision by the Commonwealth Treasurer of 23 May 2006 Under Section 44H(9) of the Trade Practices Act in Relation to the Application for Declaration of Services Provided by The Mount Newman Railway Line; Application for Review of the Decision by the Commonwealth

Treasurer of October 27, 2008 Under Section 44h(1) of Trade Practices Act in Relation to the Application for Declaration of a Service Provided by the Robe Railway; Application for Review of the Decision by the Commonwealth Treasurer of October 27, 2008 Under Section 44h(1) of Trade Practices Act in Relation to the Application for Declaration of a Service Provided by the Hamersley Rail Network; and *Application for Review of the Decision by the Commonwealth Treasurer of October 27, 2008 Under Section 44h(1) of Trade Practices Act in Relation to the Application for Declaration of a Service Provided by the Goldsworthy Railway,* Affidavit, July 3, 2009.

North West Shelf Gas Party Ltd.

In the Matter of the Commercial Arbitration Act and an Arbitration Between Woodside Energy Ltd. and Others, Sellers, and Alinta Sales Party Ltd., Buyer, Statement and Expert Report on Behalf of the Sellers, July 3, 2009; Oral Testimony, August 26-27, 2009.

Gunnison Energy Corporation, SG Interests I, Ltd., and SG Interests VII, Ltd.

In the United States District Court for the District of Colorado In re: Riviera Drilling & Exploration Company, Plaintiff, v. Gunnison Energy Corporation, SG Interests I, Ltd., and SG Interests VII, Ltd., Defendants, Civil Action No. 08-cv-02486-REB-CBS, Expert Report, June 24, 2009; Expert Rebuttal Report, August 24, 2009; Deposition, October 20, 2009.

Gannett Company, Inc *et al.*

In the United States District Court for the District of Arizona, State of Arizona ex rel. Terry Goddard, Attorney General, Plaintiff, v. Gannett Company, Inc.; Citizen Publishing Company; Lee Enterprises, Inc.; Star Publishing Company; and TNI Partners, Defendants, Affidavit of Joseph P. Kalt, Ph.D., On Behalf of Defendants, May 18, 2009.

Hyundai Heavy Industries Co., Ltd., *at al.*

International Chamber of Commerce, Court of Arbitration Case No. 15521/JEM/CYK, Hyundai Heavy Industries Co., Ltd., et al., Claimants v. International Petroleum Investment Company, et al., Respondents, Witness Statement of Joseph P. Kalt, Ph.D., February 20, 2009; Oral Testimony, May 27, 2009.

Shell Oil Company; Shell Oil Products Company; Shell Trading (US) Company, LLC; Shell Enterprises, LLC; Motiva Enterprises, LLC; and TMR Company

In the United States District Court for the Southern District of New York, MDL No. 1358, Case No. 04-CV-3417 (SAS), In re: Methyl Tertiary Butyl Ether ("MTBE"), City of New York, Plaintiff v Amerada Hess Corporation, et al., Defendants, Expert Report on Behalf of Shell Defendants, February 13, 2009; Supplemental Expert Report on Behalf of Shell Defendants, March 30, 2009.

City of Los Angeles, California, *et al.*

US District Court, District of Columbia, Federal Maritime Commission v. City of Los Angeles, California, et al. Civil Action No. 1:08-cv-010895-RJL, Declaration, November 26, 2008.

PPL Companies

Federal Energy Regulatory Commission, Docket No. EL08-67-00 Protest of the PPL Companies to the Complaint of the RPM Buyers, Affidavit (with A.J. Cavicchi), July 11, 2008; *Answer of the PPL Companies to the Motion for Leave to Answer and Answer of the RPM Buyers,* Suppl. Affidavit (with A.J. Cavicchi), August 12, 2008.

Federal Government of Canada

London Court of International Arbitration, In the Matter of Arbitration No. 81010, The United States of America v. Canada, Expert Witness Statement of Joseph P. Kalt, February 20, 2009; Rebuttal Expert Witness Report, May 8, 2009; Second Rebuttal Expert Witness Report, July 7, 2009; Oral Testimony, July 22-23, 2009.

London Court of International Arbitration, In the Matter of Arbitration No. 91312, The United States of America v. Canada, Expert Witness Statement of Joseph P. Kalt and David Reishus, May 12, 2009; June 11, 2009.

London Court of International Arbitration, In the Matter of Arbitration No. 7941, The United States of America v. Canada, Statement (with D. Reishus) June 29, 2008; Rebuttal Statement (with D. Reishus), August 11, 2008; Oral Testimony, September 22-23, 2008.

ExxonMobil Corporation; *et al.*

US District Court, District of Columbia, Cause No. 1:04CV00940, City of Moundridge, Kansas et al. v ExxonMobil Corporation, et al., Affidavit, January 11, 2006; Report, June 5, 2008.

City of Las Cruces, New Mexico

State of New Mexico, et al. Plaintiffs, v. City of Las Cruces, New Mexico, and Dona Ana Mutual Domestic Water Consumers Association, Defendants, No. CV-06-1289, Declaration, May 16, 2008.

Association of American Railroads

Surface Transportation Board, Petition of the Association of American Railroads to Institute a Rulemaking Proceeding to Adopt a Replacement Cost Methodology to Determine Railroad Revenue Adequacy, Statement (with J. Klick), May 1, 2008.

Chevron USA, Inc., *et al.*

US District Court, Eastern District of Texas, Texarkana Division, United States of America ex rel. Harrold E. (Gene) Wright v Chevron USA, Inc., et al., No. 5:03cv264, Reports, April 1, 2008 (Unocal, Mobil), April 11, 2008 (Mobil); Depositions, April 14, 20-21, 2008.

Infineon Technologies AG

US District Court, Northern District of California, Dynamic Random Access Memory (DRAM) Antitrust Litigation (Dockets No. 06-cv-1665, 07-cv-1200, 07-cv-1207, 07-cv-1212, 07-cv-1381), Report, March 7, 2008; Deposition, April 26, 2008.

Exxon Mobil Corporation

State of Alaska Department of Natural Resources and Alaska Department of Revenue, Call for Public Comments Regarding the TransCanada Alaska Company, LLC..., Statement, March 6, 2008; *Before the Alaska State 25th Legislature Third Special Session, Regarding the TransCanada Application Pursuant to the Alaska Gasoline Inducement Act*, Statement, July 10, 2008.

Tyco Healthcare Group L.P. and Mallinckrodt Inc.

US District Court, Central District of California, Western Division, Allied Orthopedic Appliances, Inc., et al. v Tyco Healthcare Group L.P. and Mallinckrodt Inc., No. V-05-6419-MFP (AJWx), Report, February 1, 2008; Deposition, March 4, 2008.

P3 Group

Federal Energy Regulatory Commission, Docket No. EL08-34-000, Maryland Public Service Commission v PJM Interconnection, L.L.C., Affidavit (with A.J. Cavicchi), February 19, 2008.

Tractebel Energy Marketing, Inc.

Tractebel Energy Marketing, Inc. v AEP Power Marketing, Inc., et al., Nos. 03 CV 6731, 03 CV 6770, Report, January 21, 2008.

Cabot Corporation

US District Court, District of Massachusetts, AVX Corporation and AVX Limited v Cabot Corporation, C.A. No. 04 CV 10467 RGS, Report, January 15, 2008; Deposition, March 12, 2008.

Columbia Gas Transmission Corporation, *et al.*

US District Court, Southern District of West Virginia, Stand Energy Corp., et al. v Columbia Gas Transmission Corp., et al., No. 2:04-0867, Report, December 18, 2007; *Civil Action Nos. 2:04-0868 through 0874*, Videotaped Deposition, February 7, 2008; *Civil Action No. 2:04-0867*, Expert Report, September 30, 2008.

Nissan North America, Inc.

US District Court, District of Maine, MDL Docket No. 03-md-1532, ALL CASES, In Re: New Motor Vehicles Canadian Export Antitrust Litigation, Report, October 26, 2007; Deposition, December 13, 2007.

Energy Transfer Partners, L.P.

Federal Energy Regulatory Commission, Docket No. IN06-3-002, Answer of Energy Transfer Partners, L.P, Affidavit (with John R. Morris), October 9, 2007; Suppl. Affidavit *Docket No. IN06-3-003* (with John R. Morris), March 31, 2008; Prepared Answering Testimony, March 31, 2009; Confidential Deposition of Joseph P. Kalt, April 21-22, 2009.

Equilon Enterprises LLC, *et al.*

US District Court, Eastern District of Missouri, Eastern Division, Daniels Self, et al. v Equilon Enterprises LLC, et al., Cause No. 4 00CV0193 TIA, Report, September 4, 2007; Deposition, September 22, 2007.

Occidental Petroleum Corporation

Arbitration under the Convention on the Settlement of Investment Disputes Between States and Nationals of Other States and the Treaty Between the United States of America and the Republic of Ecuador Concerning the Encouragement and Reciprocal Protection of Investment, ICSID No. ARB/06/11, Report, September 17, 2007; Rebuttal Witness Statement, June 12, 2009; Oral Testimony, November 7, 2009.

The Hanwha Companies, ORIX Corporation, and Macquarie Life Limited

International Court of Arbitration of the International Chamber of Commerce, Korea Deposit Insurance Corporation v Hanwha Companies, ORIX Corporation, and Macquarie Life Limited, ICC No. 14501/JB/JEM/EBS (c. 14502/JB/JEM/EBS), Report, July 13, 2007; Reply Report, September 7, 2007.

New Times Media LLC, *et al.*

Supreme Court of the State of California, In and For the County of San Francisco, Unlimited Jurisdiction, Bay Guardian Company, Inc. v New Times Media LLC, et al., No.: 04-435584, Report, June 27, 2007; Declaration, June 28, 2007; Deposition, December 18, 2007; Oral Testimony, February 14, 2008.

American Electric Power Service Corporation, *et al.*

Federal Energy Regulatory Commission, The People of the State of Illinois, ex rel., Illinois Attorney General Lisa Madigan v Exelon Generation Co., LLC, et al., Docket No. EL07-47-000, Affidavit (with J. Cavicchi), June 18, 2007.

Western Refining, Inc.

US District Court, Federal Trade Commission v Western Refining, Inc., et al., No. 1:07-CV-00352-JB-ACT, Report, May 2, 2007; Deposition, May 6, 2007; Oral Testimony, May 11, 2007.

Equilon Enterprises LLC dba Shell Oil Products US, *et al.*

US District Court, Central District of California, Southern Division, No. SACV-04-10370 JVS (JTLx), Report, November 20, 2006; Rebuttal Report, December 22, 2006; Declarations, February 12, 2007, February 15, 2007, March 12, 2007, March 26, 2007; Addendum to Rebuttal Report, March 26, 2007; Oral Testimony, June 20, 2007.

Qualcomm, Inc., *et al.*

US District Court, Eastern District of Texas, Tyler Division, Golden Bridge Technology Inc., Plaintiffs v. Nokia, Inc. et al., Defendants, Civil Action No. 6:06-cv-163 LED, Report, November 7, 2006; Deposition, December 8, 2006.

ExxonMobil Corporation

ExxonMobil Royalty Settlement Agreement Reopener: Direct Cost Reopener, Report, July 31, 2006; Rebuttal Report, September 13, 2006.

ExxonMobil Corporation

Internal Revenue Service, Reports, June 29, 2006, December 15, 2006 (with D. Reishus).

Individual Defendants

US District Court, Southern District of Texas, Civil Action No. H-05-0332; U.S. Commodity Futures Trading Commission v Denette Johnson, Report, June 14, 2006; Oral Testimony, August 30, 2006; Affidavit, April 20, 2007; Affidavit, May 23, 2007; Oral Testimony, January 11, 2008.

BP America Production Company, *et al.*

State of New Mexico, County of Santa Fe First Judicial District, No. D-0101-CV-200001620, Laura Dichter, et al. v BP America Production Company, et al., Affidavit, February 8, 2006; Report, March 23, 2007.

TAPS Carriers (BP Pipelines (Alaska) Inc.; *et al.*)

Federal Energy Regulatory Commission, In the Matter of: BP Pipeline (Alaska), Inc., et al.; Docket Nos. OR05-2, OR05-3, OR05-10, IS05-82, IS05-80, IS05-72, IS05-96, IS05-107, IS06-70, IS06-71, IS06-63, IS06-82, IS06-66, IS06-1, OR06-2, Testimony (All TAPS Carriers), December 7, 2005; Testimony (Designated TAPS Carriers), December 7, 2005; Answering Testimony (All TAPS Carriers), May 26, 2006; Rebuttal Testimony (All TAPS Carriers), August 11, 2006; Oral Rebuttal Testimony (All TAPS Carriers), November 2-3, 2006.

BP America Production Company F/K/A Amoco Production Company, *et al.*

District Court of Kleberg County, Texas, Camp Gilliam v BP America Production Company F/K/A Amoco Prod. Co., et al., Cause No. 03-445-D; Report, November 18, 2005; Oral/Video Deposition, January 10, 2006.

General Motors Corporation, *et al.*

US District Court, District of Maine, MDL Docket No. 03-md-1532, ALL CASES, In Re: New Motor Vehicles Canadian Export Antitrust Litigation, Report, September 30, 2005; Deposition, December 6, 2005; Report, December 1, 2006.

OXY USA, Inc.

Eighth Judicial District Court, State of New Mexico, County of Union, No. 04-24 CV, Heimann, et al. v Oxy USA, Inc., Report, July 13, 2005.

US Bancorp

Superior Court of Los Angeles County, Central District, State of California, No. BC 285 134, Auerbach Acquisition Associates, Inc. v Greg Daily et al., Deposition, June 21, 2005.

PPL Corporation

Federal Energy Regulatory Commission, PJM Interconnection, L.L.C., Docket Nos. ER05-1410-000 and EL05-148-000, Motion to Intervene and Protest of the PPL Parties; Affidavit (with A.J. Cavicchi and D. Reishus), October 19, 2005; "A Policy Analysis of PJM's Proposed Four-Year Forward Capacity Market"; submitted in PPL Resource Adequacy Market Proposal, Docket No. PL05-7-000, (with A.J. Cavicchi), June 16, 2005.

SBC Communications, Inc.

Federal Communications Commission, Special Access Rates for Price-Cap Local Exchange Carriers, WC Docket No. 05-25, RM-10593, Statement, June 13, 2005.

General Electric and Bechtel

Arbitration Under an Agreement Between the Government of the Republic of Mauritius and the Government of the Republic of India for the Promotion and Protection of Investments and Under the Citral Rules, Capital India Power Mauritius I and Energy Enterprises (Mauritius) Company (Claimants) and the Government of the Republic of India (Respondent), Report (with D. Newbery and T. Lumsden), May 23, 2005.

Atlantic Richfield Company

State of Wisconsin Circuit Court, Milwaukee County, No. 99-CV-6411, Steven Thomas v Atlantic Richfield Co., et al., Deposition, April 5-6, 2006; Affidavit, April 27, 2007; Videotaped Deposition., Volumes 1 and 2, May 3, 2007.

Superior Court of the State of Rhode Island, No. 99-5226, State of Rhode Island, Attorney General v Lead Industries Association, Inc., et al., Deposition, May 11-12, 2005; Deposition, August 18-19, 2005.

Hamersley Iron/Rio Tinto

Before the National Competition Council, Melbourne, Australia, FMG Access Application, Statement, May 2, 2005; *Pilbara Infrastructure Party, Ltd. Application,* Statement, April 30, 2008.

Duke Energy LNG Services, Inc.

Arbitration under the uncitral rules. L'Enterprise Nationale pour la Recherche, la Production, le Transport, la Transformation et al Commercialisation des Hydrocarbons, and Sonatrading (Amsterdam) B.V., Claimants; and Duke Energy LNG Services, Inc., Report, April 22, 2005; Second Report, November 11, 2005; Oral Testimony, February 16, 2006.

BNSF Railway Company

Surface Transportation Board, Ex Parte 657, Rail Rate Challenges Under the Stand-Alone Cost Methodology, Statement, April 30, 2005; Oral Statement, April 26, 2005; Statement, May 1, 2006; Reply Statement, May 31, 2006; Rebuttal Statement, June 30, 2006.

BNSF Railway Company

Surface Transportation Board, STB Docket No. 42088, Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v BNSF Railway Company, Statement, April 19, 2005; Reply Statement, July 20, 2005; Rebuttal Statement, September 30, 2005.

Community of Awas Tingni

Inter-American Court of Human Rights, Mayagna (Sumo) Indigenous Community of Awas Tingni Against the Republic of Nicaragua, Report (with M. Begay), April 15, 2005.

PPL Corporation

State of New Jersey Board of Public Utilities, The Joint Petition of Public Service Electric and Gas Company and Exelon Corporation for Approval of a Change in Control of Public Service Electric and Gas Company, and Related Authorizations, Docket No. EM05020106, OAL Docket No. PUC-1874-05, Testimony, November 14, 2005; Surrebuttal Testimony,

December 27, 2005; Oral Testimony, January 12, 2006; Reply Testimony, March 17, 2006; Pennsylvania Public Utility Commission, Surrebuttal Testimony, August 26, 2005.

Federal Energy Regulatory Commission, Docket No. EC05-43-000, Testimony, April 11, 2005; Suppl. Testimony, May 27, 2005; Affidavit, August 1, 2005.

Sovereign Risk Insurance Limited

American Arbitration Association, ZC Specialty Insurance Company v Sovereign Risk Insurance Limited, No. 50 T 153 0055203, Report, March 10, 2005; Suppl. Report, April 11, 2005.

ExxonMobil Corporation

State of Alaska v. ExxonMobil; JAMS (Joint Arbitration & Mediation Services) Ref. No. 1220032196; ExxonMobil Royalty Settlement Agreement Reopener: Destination Value, Report, March 4, 2005; Rebuttal Report, March 24, 2005; Oral Testimony, April 7, 2005.

PPL Montana, LLC

Federal Energy Regulatory Commission, RE: PPL Montana, LLC, et al., Docket No. ER99-3491-__, Testimony (with A.J. Cavicchi), November 9, 2004; Affidavit (with A.J. Cavicchi), February 28, 2005; Affidavit (with A.J. Cavicchi), November 14, 2005; First Suppl. Affidavit, (with A.J. Cavicchi), December 23, 2005; Affidavit (with A.J. Cavicchi), February 1, 2006.

T-Mobile

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El Paso Natural Gas
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Honeywell Inc.
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Exxon
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Exxon

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Villa Banfi

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Cities Service Corp.

Office of Hearings and Appeals, U.S. Department of Energy, U.S. Department of Energy v Cities Service Corporation, Testimony, December 1986, February 1987.

Exxon

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Mobil Oil Corporation

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Bethlehem Steel Corporation

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Natural Gas Supply Association

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Group of Oil Refiners

Office of Hearings and Appeals, MDL-378 Stripper Well Exemption Litigation, Testimony, July, September 1984.

Dorchester Gas Corp.

Office of Hearings and Appeals, U.S. Department of Energy v Dorchester Gas Corporation, Testimony, January 1984.

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APPENDIX B

GLENN MITCHELL

COMPASS LEXECON
633 W 5th Street, Suite 1600
Los Angeles, California 90071
Tel. (213) 452-6402 Fax (213) 452-6650

EDUCATION

Ph.D., Economics, UNIVERSITY OF CALIFORNIA SANTA BARBARA, 2000.

M.A., Economics, UNIVERSITY OF CALIFORNIA SANTA BARBARA, 1997.

B.A., Economics, highest honors, UNIVERSITY OF CALIFORNIA DAVIS, 1996.

PRESENT POSITION

COMPASS LEXECON

Vice President (from January 2007)

PROFESSIONAL EXPERIENCE

LECG
Senior Managing Economist (2004-2006)

UNIVERSITY OF SOUTHERN CALIFORNIA, Marshall School of Business,
Adjunct Professor (2004, 2005)

ECONOMIC ANALYSIS
Senior Economist (2002-2004)
Economist (2000-2002)

UNIVERSITY OF CALIFORNIA AT SANTA BARBARA
Research Assistant (1997-2000)
Teaching Assistant (1997-2000)

HONORS AND AWARDS

Jacob Javitz Graduate Fellowship, 1997-2000
Andron Graduate Fellowship, 1996-2000
Transportation Economics Award, Western States Coal Association, 1997

PROFESSIONAL MEMBERSHIPS

Member, American Economic Association
Associate Member, American Bar Association

PUBLICATIONS

"Adjustment costs from environmental change," (2005) with C. Kolstad and D. Kelly, Journal of Environmental Economics and Management.

"Complexity in organizations: consequences for climate policy analysis," (2000) with S. Decanio, B. Watkins, K. Amir-Katefi, & C. Dibble, in Advances in the Economics of Environmental Resources, v. 3, ed. R. Howarth & D. Hall, JAI Press, Greenwich, Connecticut.

EXPERT REPORTS, PRESENTATIONS AND SELECTED ADDITIONAL MATTERS

Comparable Uncontrolled Price Analysis in Relation to Toyota Motor Corporation Australia Limited, with Robert Willig. Presentation to Australian Taxation Office analyzing arm's length consideration for purchase of automobiles imported into Australia, April 2009.

Yahoo! – Google Services Agreement: Economic Analysis of Competitive Effects, with Jon Orszag, Lacey Plache, Robert Willig, Jane Murdoch and Carl Shapiro; White Paper analyzing economic substitution in advertising demand between internet search platforms, presented to U.S. Department of Justice, September 2008.

Entry and Expansion in Video Advertising Distribution, with Janusz Ordover and Jon Orszag; Presentation to U.S. Department of Justice analyzing whether prospective entry and expansion would be effective competitive constraints on the supply of video advertising distribution services, May 2008.

SEC v. Pridgeon, Carradine & Smith. Retained by the Securities and Exchange Commission (Los Angeles office) to provide expert opinion on materiality and other issues in an insider trading matter. Report filed April 2004.

Retained by supplier of electronic design automation software and hardware to analyze relevant market and competitive effects of potential acquisition, July-August 2008.

Retained by manufacturer of flavor enhancement products to present to the United States Federal Trade Commission economic analysis of relevant markets and competitive effects related to the acquisition of a competing product, 2007-2008, with Janusz Ordover.

Retained by satellite distributor of video advertising to present to the United States Department of Justice economic analysis of competitive effects and entry related to the acquisition of a competing distributor, 2007-2008, with Janusz Ordover and Jon Orszag.

Retained by supermarket chain to present to the United States Federal Trade Commission economic analysis of relevant geographic markets and competitive effects related to the acquisition of a competing chain, 2007, with Daniel Rubinfeld

Retained by computer equipment manufacturer to present to the United States Federal Trade Commission economic analysis of relevant market and competitive effects related to the acquisition of a competing manufacturer, 2006-2007, with Daniel Rubinfeld.

Retained by computer equipment manufacturer to present to the United States Federal Trade Commission and to the European Commission economic analysis of relevant market and competitive effects related to an acquisition, 2005-2006, with Daniel Rubinfeld and Atilano "Jorge" Padilla.

Retained by operator of regional sports network to provide economic analysis of relevant market and competitive effects related to exclusive dealings, 2007, with Jon Orszag.

Retained by satellite communication service provider to present to provide economic analysis of relevant market and competitive effects related to the acquisition of a distributor, 2007, with Jon Orszag.

Provided economic research and analysis in support of expert testimony related to the valuation of an NFL franchise, 2003.

Provided economic research and analysis in support of expert testimony related to exclusive dealings, relevant market and competition in ticketing services, 2001-2002.

Provided economic research and analysis in support of expert testimony related to relevant market and competition for professional football (soccer) in the United States and internationally, 2000.