FEDERAL MINE SAFETY AND HEALTH REVIEW COMMISSION

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April 29, 2015

VIRGINIA DRILLING COMPANY, LLC, Contestant v. SECRETARY OF LABOR MINE SAFETY AND HEALTH ADMINISTRATION (MSHA), Respondent	CONTEST PROCEEDING Docket No. KENT 2011-1466R Citation No. 8262897; 8/24/2011 Mine: Blackhawk No. 2 Surface Mine
SECRETARY OF LABOR MINE SAFETY AND HEALTH ADMINISTRATION (MSHA), Petitioner v. VIRGINIA DRILLING COMPANY, LLC, Respondent	CIVIL PENALTY PROCEEDINGS Docket No. KENT 2012-182 A.C. No. 15-18998-270046-F279 Mine: Blackhawk No. 2 Surface Mine Docket No. KENT 2012-183 A.C. No. 15-19515-270059-F279 Mine: No. 4

DECISION AND ORDER

Appearances: Thomas J. Motzny, Esq., Office of the Solicitor, Department of Labor, Nashville, Tennessee for Secretary of Labor

Todd C. Myers, Esq., Rajkovich, Williams, Kilpatrick & True, PLLC, Lexington, Kentucky for Virginia Drilling Co., LLC

Before: Judge McCarthy

I. Statement of the Case

These cases are before me upon a Notice of Contest and two related Petitions for the Assessment of Civil Penalty under section 105(d) of the Federal Mine Safety and Health Act of

1977, 30 U.S.C. § 815(d).[1] Of the three original citations in these dockets, only Citation No. 8262897 remains at issue.

On August 24, 2011, MSHA inspector Ronnie L. Fletcher issued the citation to Virginia Drilling (Respondent) under §104(a) of the Act, 30 U.S.C. §814(a), for an alleged violation of 30 C.F.R. §77.404(a). Section 77.404(a) states:

> Mobile and stationary machinery and equipment shall be maintained in a safe operating condition and machinery or equipment in unsafe condition shall be removed from service immediately.

The "condition or practice" section of the citation states:

> THE RED MACK ANFO TRUCK #SL170 IS NOT BEING MAINTAINED IN SAFE OPERATING CONDITION. THE DRIVER SIDE SEAT IS WORN OUT. ALSO, A DIESEL FUEL LINE IS LEAKING FUEL ONTO THE EXHAUST MANIFOLD. DUE TO THE HIGH DEGREE OF HEAT IN THIS AREA, THIS CONDITION CREATES A FIRE HAZARD. THIS WOULD ALLOW THE FUEL TO IGNITE AND ACCELERATE A FIRE. THIS EXPOSES THE MINER TO SMOKE INHALATION AND/OR FATAL BURN INJURIES. ALSO, THIS TRUCK IS LOADED WITH APPROXIMATELY 9 TONS OF ANFO, WHICH IS AN EXPLOSIVE FUEL OIL MIXTURE. THIS TRUCK IS USED DAILY TO LOAD HOLES. THE OPERATOR REMOVED THIS TRUCK FROM SERVICE IMMEDIATELY.

Inspector Fletcher designated the condition or practice as significant and substantial (S&S), and he designated the gravity as highly likely to result in an injury or illness that could reasonably be expected to be fatal, with one person affected. P. Ex. 2. Respondent's negligence was designated as moderate. MSHA proposed a penalty of $63,000, which included a 10% reduction for the operator's good-faith abatement.

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[1] Prior to hearing, the parties agreed to settle Citation No. 8262896 in Docket No. KENT 2012-182 and Order No. 8262457 in Docket No. KENT 2012-183. Citation No. 8262896 alleged a violation of 30 C.F.R. § 77.404(a). Section 104(g)(1) Order No. 8262457 alleged a violation of 30 C.F.R. § 48.31. Tr. I, 4, 11; Jt. Ex. 2. According to the terms of the proposed settlement, Citation No. 8262896 and Order No. 8262457 remain unchanged, but the Secretary of Labor justifies respective reductions in proposed penalties from $3,405 to $2,900 and from $4,810 to $3,848 by stating that there are legitimate factual and legal disputes regarding gravity and negligence. Jt. Ex. 2. I have considered the representations and documentation submitted with the partial settlement under the criteria set forth in section 110(i) of the Act, and I approve the proffered settlement as consistent with the purposes of the Act.

The Respondent denies that it violated section 77.404(a) and contends that the truck was safe for operation. Even if there was a violation, Respondent contests the significant and substantial (S&S) designation, gravity determinations, negligence designation, and the appropriateness of the proposed penalty. R. Br. 13-29.

A hearing was held in Beckley, West Virginia. The parties presented lay and expert witness testimony, expert witness reports, and other documentary evidence.[2] Witnesses were sequestered.

The primary issues presented are whether Respondent failed to maintain the Mack ANFO truck in safe operating condition under§ 77.404(a) because the driver's side seat was worn out and the diesel fuel line was leaking fuel onto the exhaust manifold; whether the alleged violation was S&S, whether the gravity designations -- that an injury was highly likely and could reasonably be expected to result in a fatal injury to one person -- were correct; whether the "moderate" negligence designation was appropriate; and whether the $63,000 proposed penalty assessment was appropriate.

After careful review of the record, I affirm the S&S designation and find that the fuel line leak was reasonably likely to result in a fire hazard that was reasonably likely (not highly likely) to result in a fatal injury to the driver of the truck, and that Respondent's level of negligence was appropriately designated as moderate. Applying the criteria set forth under Section 110(i) of the Act in light of my findings herein, I assess a $37,416 penalty against Respondent.

On the entire record, including my observation of the demeanor of the witnesses,[3] and after considering the post-hearing briefs, I make the following:

II. Findings of Fact

A. Stipulations of Fact and Law

The parties agreed to the following stipulations.

1) Virginia Drilling Company, LLC, Contractor I.D. No. F279, was an "operator" at Blackhawk #2 Surface Mine, as defined in § 3(d) of the Mine Act, 30 U.S.C. § 803, at all times relevant to these proceedings, and is therefore subject to the Federal Mine Safety and Health Act of 1977.

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[2] Jt. Exs. 1-2, P. Exs. 1-4, and R. Exs. 1-8 were received into evidence. Tr. I, 100; Tr. II, 8, 67, 182, 411.

[3] In resolving conflicts in testimony, I have taken into consideration the demeanor of the witnesses, their interests in this matter, the inherent probability of their testimony in light of other events, corroboration or lack of corroboration for testimony given, experience and credentials, and consistency, or lack thereof, within the testimony of witnesses and between the testimony of witnesses.

2) Blackhawk #2 Surface Mine is a "mine" as that term is defined in Section 3(h) of the Mine Act, 30 U.S.C. § 803(h).

3) Virginia Drilling Company, LLC is subject to the jurisdiction of the Federal Mine Safety and Health Review Commission, and the presiding Administrative Law Judge has authority to hear this case and issue a decision.

4) At all times relevant to these proceedings, Blackhawk #2 Surface Mine and the operations of Virginia Drilling Company, LLC had an effect upon interstate commerce within the meaning and scope of Section 4 of the Mine Act, 30 U.S.C. § 803.

5) Virginia Drilling Company, LLC is a medium-sized operator, with 314,215 hours worked in 2010 and 369,759 hours worked in 2011.

6) Copies of the citation in contest in this case and notes pertaining thereto are authentic and the citation was served on the Respondent by an inspector employed by the Mine Safety and Health Administration.

7) The violation was abated in good faith.

8) The Respondent timely contested the violation.

9) The proposed penalty will not affect the Respondent's ability to continue in business.

10) A "certified blaster" is an agent of the operator.

Jt. Ex. 1.

B. The Inspection and Citation at Issue

Virginia Drilling is a blasting contractor and subsidiary of Virginia Explosives & Drilling Company (VEDCO). Austin Sales and Virginia Drilling have separate MSHA identification numbers. Tr. II, 225. Austin Sales owned the cited truck, performed maintenance and pre-shift examinations on the truck, and placed its logo on the door. P. Ex. 3; Tr. II, 70-71, 76, 275. Counsel for the Secretary explained that MSHA cited Virginia Drilling and not Austin Sales because the shot truck work was being performed under the Virginia Drilling contractor number at the time of the citation. Tr. II, 72.

On the morning of August 24, 2011, inspector Fletcher[4] arrived at the Blackhawk #2 surface mine, a small mine less than a mile long, to conduct an EO1 inspection. Tr. I, 36-38. At

[4] Ronnie Fletcher is a certified surface mine inspector with MSHA. Inspector Fletcher received his authorized representative card in the fall of 2010, about one year before he issued the instant citation. Tr. I, 31, 67. Fletcher is a high-school graduate, with some college credit and 22 years of experience in the mining industry in production and maintenance capacities. Tr. I, 32-33.

2:27 p.m. that afternoon, as a part of his general inspection, Fletcher inspected a red Mack ANFO truck. Tr. I, p. 41.[5] At the time of the inspection, the truck was idling on the drill bench, in front of a loader spread, about a half mile uphill from the parking lot. Tr. I, 41-42. A blaster and blaster helper from Virginia Drilling were drilling holes near the truck when Fletcher arrived. Tr. I, 44.

The truck was carrying about nine tons of ammonium nitrate and fuel oil (ANFO), a pre-mixed chemical compound that is offloaded into blasting holes. Tr. I, 59, 89; Tr. II, 35-36, 86, 350. Fletcher testified that a typical ANFO truck safety inspection takes about thirty minutes and consists of checking the brakes, lights, steering and leakage. Tr. I, 45.

When inspecting the truck, Fletcher determined that the driver side seat was worn out. Tr. I, 45-47; P. Ex. 1, p. 6; P. Ex. 2. With regard to the seat, Fletcher testified that most of the vinyl was torn off the bottom of the seat and the foam cushion was badly worn on the left side more than the right side. Tr. I, 47. The driver told Fletcher that the seat was "wearing him out." Tr. I, 48. Fletcher opined that the driver would not be able to sit in the seat properly in such worn condition, which could cause him to lean on one side, slide around the seat, and possibly lose control of the vehicle. Tr. I, 49-51.

Fletcher testified from personal experience that he developed blisters, which required bandaging on his tailbone and buttocks, from driving equipment with "bad seats." Tr. I, 52. Fletcher did not provide any testimony that the worn seat condition compromised the seatbelt.

I find it unnecessary to decide whether Respondent's failure to maintain the driver side seat made the truck unsafe to operate or whether the worn seat was a significant and substantial violation of a mandatory safety hazard because I find below that the fuel leak itself was a significant and substantial violation. Certainly, the worn seat did not render the truck any safer.

While checking the engine area, Fletcher observed that the second cylinder fuel line was leaking directly onto the exhaust manifold. Tr. I, 52-53. Fletcher further observed moisture around that area and a steady drip of fuel about every three seconds. Tr. I, 53. The leaking fuel line was about 3-7 inches from the turbocharger, the hottest part of the engine. Tr. I, 53-54.

A marked photograph of engine areas, including the manifold, turbocharger, injection pump, radiator fan, and area of diesel fuel leak is in evidence as R. Ex.2. Tr. 91-95. The exhaust manifold allows fumes to exit the cylinder head and away from the engine. Tr. II, 92. The turbo charger is bolted to the exhaust manifold at the center and it pushes more air into the engine to make it more efficient. Tr. II, 93, 99. The injector pump delivers a metered amount of fuel to each injection line that goes into the engine and excess fuel is returned to the fuel tank. Tr. II, 98-100, 106, 129. The radiator fan is on the front of this particular engine and blows over the top

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Fletcher has a welding certificate with the state of West Virginia and surface mine foreman papers from the states of Kentucky and West Virginia. Tr. I, 32, 34-35.

[5] The truck is Mack brand R-model, with a 6-cylinder turbo-charged, 300-horsepower diesel engine. The shot truck is usually kept at the powder bin or magazine. Tr. II, 85.

of the engine to help cool the temperature. Tr. II, 97-98. The fuel injection line that was leaking was from the second cylinder. Tr. II, 95-96.

Fletcher opined that if the leak was left uncorrected, it "would catch fire" because the "leak would eventually get faster or maybe even turn into a spray." Tr. I, 54. Fletcher did not observe any smoking, sizzling or smoldering associated with the dripping diesel fuel onto the exhaust manifold. Fletcher did not conduct a heat test because he did not have a heat gun available. Tr. I, 78, 79-80.

Fletcher asked the blaster helper whether the leak had been disclosed on a pre-operational check of the vehicle. Tr. I, 55. Fletcher testified that the blaster helper could not recall whether he had checked under the hood for leaks before the shift began. Tr. I, 55.

As a result of his observations, Fletcher issued Citation No. 8262897 alleging that Respondent failed to maintain the truck in safe operating condition because the "driver side seat [was] worn out" and the "diesel fuel line [was] leaking fuel on to the exhaust manifold." Tr. I, 45-46; P. Exs. 1-2. Fletcher designated the condition or practice as significant and substantial (S&S). He designated the gravity as highly likely to result in an injury or illness that could reasonably be expected to be fatal, with one person affected. P. Ex. 2.

On direct examination Fletcher initially explained his gravity determination of "highly likely" to result in an injury, as follows: "Well, anytime you are dealing with heat - a heat source and flammable liquid, you know, you automatically assume, you know, it's probably highly likely that it's going to ignite." Tr. I, 57. On further redirect, in an apparent effort to blunt a pre-trial deposition concession that the gravity should been written as "reasonably likely," Fletcher conceded that after further reflection, the gravity of the citation should have been written as "reasonably likely to result in an injury." Specifically Fletcher testified as follows:

> Q. [Mr. Motzny] Okay. And I think at your deposition you said that you would possibly write it as reasonably likely today.
>
> A. Yes, I would. I feel that it's probably more reasonably likely.
>
> Q. Can you explain your reasoning for that?
>
> A. Yeah. It's right there with -- well, yeah, maybe I can. I don't know. I'll try. I just think it's more reasonably likely than highly likely. I think it's a good chance that it would happen, but highly likely to me means, you know, it's going to happen. I think it's possible that it wouldn't happen, but I think it's reasonably likely that it would, if that makes any sense.
>
> The Court: How come you didn't write it as reasonably likely to begin with?
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> The Witness: I'm going to lay it off on my inexperience at the time in that

area. That's what I think.

The Court: Did the fact that it was an ANFO truck factor into your highly likely [designation]?

The Witness: Yes, sir.

The Court: Go ahead, Mr. Motzny.

Q. [Mr. Motzny] How did that factor in?

A. Well, you know, it had approximately nine ton of ANFO on it, you know? And if that thing catches on fire and an explosion was to happen, I think that debris is going to go all over the place.

Tr. I, 58; see also Tr. I, 68 (where Fletcher conceded on cross examination that based on additional experience since issuing the citation, he would mark the gravity differently).

When asked why he designated the gravity of the type of injury that could reasonably be expected to occur as "fatal," Fletcher testified, "... if that thing caught on fire and an explosion occurred, I feel that it would probably be fatal." Tr. 60. He described possible injury scenarios to the driver of the truck as smoke inhalation from a fire, and death from burn injuries, entrapment, or an explosion. Tr. I, 60-62.

Two of Virginia Drilling's witnesses, Ralph Roark, maintenance supervisor for Austin Sales, and Anthony Kidd, a representative from VEDCO Holdings, parent company for Virginia Drilling and Austin Sales, testified that the leak was caused by a deteriorating "O-ring" inside the engine cylinder. Tr. II, 240-41. The O-ring seals the fuel line connection and helps return unused fuel back to the fuel tank (i.e., return fuel). When an O-ring deteriorates, it allows the return fuel to seep out from the connection between the fuel line and cylinder. Tr. II, 244-45. Roark conceded that the O-ring at issue could have deteriorated further, but opined that Respondent would have caught it and made a repair. Tr. II, 127.

To abate the citation, Virginia Drilling ordered two new fuel injector lines, O-rings, and a new seat. Tr. II, 84, 130-31; R. Ex. 1. Field mechanic, Aaron Pressley, made the repairs. Tr. II, 99. Pressley did not testify.

Roark did not observe the cited diesel fuel leak. Roark testified that he has encountered about 50 similar "small type of seeps" throughout his tenure. Tr. II, 99-100. Roark opined that such leaks are caused by deterioration of the O-ring on an injection line, which allows return fuel from the engine to seep out around the stem of the injection line where the nut meets the cylinder head, instead of returning to the fuel tank. Tr. II, 99-101, 126-27. On direct, Roark testified that there was no broken fuel line, which causes a different type of leak. Tr. II, 103. On cross, however, Roark conceded that he never determined whether there was a problem with the fuel line or with the O-ring and that he does not normally examine pre-operational records. Tr. II,

131, 135. Like the blaster helper, Roark did not know whether a pre-operational check had been done on the cited truck. Tr. II, 136.

Roark testified that the type of leak at issue can happen at any time, that it is typically discovered during a pre-operational check or a separate 250-mile maintenance check, and that it is fixed by taking the engine part, replacing the O-ring, and usually replacing the injection line, without any attention given to the turbocharger. Tr. II, 102-05. Roark further testified that the working temperature on the engine in these Mack trucks is about 180 degrees because there is a 180-degree thermostat, which opens and closes to control the antifreeze flowing through the motor to maintain the temperature. Further, there is a belt-driven water pump at the front of this engine, which pulls water from the radiator and pushes it through the block and head assembly and then back through the radiator again. Tr. II, 102.

Roark testified that he has done diagnostic testing with a heat gun to measure the temperature of an exhaust manifold on a similar shot truck, and most manifolds run around 200 to 250 degrees. Tr. II, 105. Roark testified that the operating range of this truck engine is about 500 RPMs to a maximum of 2100 RPMs, as regulated by a governor, which keeps the engine from over revving. Tr. II, 106, 132-33.

More specifically, Roark testified that after the citation was written, two of Respondent's witnesses (Roark and Kidd) started up a similar Mack truck with the same type of engine and "held the throttle down until we got the temperature up to an operating temperature." Tr. 108-09. They then measured the surface temperature of the exhaust manifold with a heat gun at 246 degrees Fahrenheit, while the truck was idle. Tr. II, 108-09; R. Ex. 3.[6] During this test, which lasted about 30 minutes, Respondent did not drive the truck around and Roark could not recall how long Kidd kept the throttle down. Tr. II, 110-12.

Two or three weeks before trial, Virginia Drilling personnel again tested the cited truck with a heat gun. Tr. II, 113-115. Respondent measured the temperature of the manifold surface at 30.9 degrees before the truck was started. Tr. II, 114-15; R. Ex. 4. Respondent then ran the engine to an operating temperature of 180 degrees and measured the surface temperature of the manifold with a heat gun at 232 degrees. Tr. II, 115-16; R. Ex. 5. Respondent then twice drove the truck with an estimated 3/4 load of powder from the magazine site down to the tipple and then back up the steepest grade (45 degree angle) and measured the surface temperature of the manifold after each run at about 409 degrees. Tr. II, 116-19; R. Ex. 6. Roark unconvincingly estimated the size of the load by tapping the side of the truck with his hand to determine the sound, but he did not load the truck. Tr. II, 120. Roark was unable to testify that these road tests were typical of a drive from the magazine site to the bench because the route is always different. Tr. II, 124. In fact, Roark was not employed at the mine when the citation was written and did not know the daily routes of the powder trucks to the bench. Tr. II, 125. Roark was unsure whether the temperature inside of the engine ever exceeded the auto-ignition temperature of the diesel fuel. Tr. II, 134.

[6] On cross examination, the Secretary's expert witness, James Louis Angel, agreed that such a temperature reading sounded about right, based on his experience. Tr. II, 10-11.

Roark testified that Respondent's powder trucks have had fuel leaks, but he is unaware of any powder trucks that have caught fire because of a fuel leak, and unaware of any Virginia Drilling or Austin Sales miner injured in a vehicle fire. Tr. II, 121-22. When asked by the undersigned why Respondent repaired such fuel leaks, Roark testified rather evasively that Respondent did not want any petroleum product to leak on the ground and cause a slipping hazard. Tr. II, 122-23. In Roark's opinion, the small amount of diesel return fuel that was leaking was unlikely to start a fire because the temperature of the engine block would not get hot enough to ignite the fuel. Tr. II, 123.

I find Respondent's testimony concerning the results of its field tests to be of little probative value in determining whether the cited fuel leak contributed to the reasonable likelihood of a fire hazard. These tests were performed in anticipation of litigation, after the citation was issued. The simulated conditions were executed with knowledge that temperature readings would be taken. This likely affected the operation of the vehicle, which was not the cited truck. No video evidence of the tests was submitted and the Secretary was not present during the test. Finally, the tests were conducted over a short period of time and did not reflect a typical work day involving continuous engine load.

C. Expert Testimony Regarding the Likelihood of a Fire Caused by the Fuel Leak

Whether this particular fuel leak was reasonably or highly likely to result in a fire turns on whether the engine manifold or turbo charger on the Mack ANFO truck could reach a temperature high enough to ignite the leaking diesel fuel. The Secretary and the Respondent presented expert witnesses on the fire hazard and possible ANFO explosion issues.

1. Testimony from the Secretary's Expert, James Louis Angel

As noted, James Angel testified as an expert witness for the Secretary. Angel is a mechanical engineer in the mechanical engineering and safety division of MSHA's Approval and Certification Center, in Triadelphia, West Virginia. Tr. I, 107; Tr. II, 62. Angel works closely with the Center's diesel lab to review test information and procedures that primarily involve underground equipment, including tests of diesel engines on underground equipment. Tr. I, 112, 153; Tr. II, 56-57. Angel testified that the temperatures ranges for ignition tests on surface and underground equipment essentially would be the same. Tr. II, 57.

Angel has been employed by MSHA for over thirty years. *Id.* Before that, he spent two years working at Westinghouse Electric in Pittsburgh. Tr. I, 106. Angel earned a Bachelor's of Science degree in Mechanical Engineering from the University of Dayton, and holds an authorized representative card for technical assistance and accident investigation. Tr. I, 107, 152. Angel serves on several committees for the Society of Automotive Engineers, a national organization for consensus standards involving all forms of self-propelled vehicles. Tr. I, 111.

Angel's expert witness report (P. Ex. 3) was undertaken to determine whether the truck presented an acceptable safety risk because of the leak of the fuel injector. Angel was concerned with the risk of fire. Tr. I, 108. Angel testified that a fire risk exists when four elements are present: (1) a source of fuel, such as a flammable or combustible material; (2) oxygen (always

present in the atmosphere (Tr. 127); (3) a source of ignition energy; and (4) factors that bring the first three elements together. Tr. I, 108.

Angel testified that the fire risk associated with diesel fuel is typically based on the auto-ignition temperature of the combustible fuel. Tr. I, 109. Auto-ignition temperature is the lowest temperature at which a combustible material ignites in air without a flame or spark. P. Ex. 3, p. 4, n. 16. By contrast, the flash point is defined as the lowest temperature at which a liquid gives off vapors at a sufficient rate to support a momentary flame across its surface. P. Ex. 3, n. 14.

In order for diesel fuel to ignite, a competent heat source must reach the auto-ignition temperature and then contact the fuel or its vapors. Angel testified that a potential competent heat source could ignite the diesel fuel because the fuel was leaking onto the exhaust manifold below, and the turbo charger was close to the fuel leak. Tr. I, 114.

The auto-ignition temperature for fuel is determined in a laboratory setting by heating the fuel in an oven until it ignites into flame. Tr. I, 109. Angel testified that the auto-ignition temperature for diesel fuel generally ranges from 450 to 500 degrees Fahrenheit. Tr. I, 109. Petroleum Company No. 2 diesel fuel, the diesel fuel used at the time the citation was issued, has a published auto-ignition temperature of 500 degrees Fahrenheit, as listed on the manufacturer's Material Safety Data Sheet (MSDS). P. Ex. 3, n. 14; see also Tr. I, 109. Angel testified that many "real-world" environmental conditions may result in a much higher auto-ignition temperature. Tr. I, 110.

Based on National Fire Protection Article (NFPA) article 921, Angel testified that when an accident investigator tries to identify the most likely ignition sources for a fluid at an accident scene *after* a fire occurs, he looks for ignition sources at least 360 degrees higher than the auto-ignition temperature, although that it is not a hard and fast number. Tr. II, 27. That after-the-fact analysis, which Angel was hesitant to adopt, would put likely ignition at about 860 degrees Fahrenheit. Tr. II, 26.

Before a fire occurs, Angel testified that "you have to take a more conservative approach. . ." and "look at a range of temperatures where that fuel could possibly ignite. . ." Tr. II, 28. Based on a study testing droplets of diesel fuel on stainless steel materials, Angel testified that he would expect the droplets of diesel fuel in this case to ignite in the range of 750 to 1050 degrees Fahrenheit, and approaching 100% certainty at 1050 degrees Fahrenheit. Tr. I, 110; Tr. II, 28, 46; P. Ex. 3, p. 4, n. 17. Angel did not recall what the Mack truck's manifold was made of, although he testified that they are typically cast iron, which tends to be more porous than stainless steel, and would have a lower ignition temperature because the greater porosity would hold the fluid longer and generate more vapors that could ignite. Tr. II, 29, 55-56.

When asked whether the amount of fuel dripping on the manifold factored into his analysis, Angel testified it did not because any fuel leaking onto a hot surface presents a hazard of fire and the conditions of fire containment at that point become less important than the fact that there has been a loss of control in the development of a fire. Tr. I, 113; see also Tr. II, 65. Angel candidly conceded that in most cases, a fine mist or spraying leak provides more of a mechanism for ignition than droplets of fuel, although he alluded to research that shows the

opposite. Tr. I, 113; Tr. II, 23.[7] Based on experience, Angel testified that temperatures in the range of 700-800 degrees were a competent ignition source for hydraulic fuel, and he would look for higher temperatures for diesel fuel in the 750-1000 degree range, with temperatures approaching 1000 degrees Fahrenheit to have a 100% probability of ignition. Tr. II, 39.

Angel next identified the exhaust manifold and the turbo charger as two potential heat sources at the location of the fuel leak that could ignite the diesel fuel. Tr. I, 114. When asked why Angel considered the turbo charger in his heat source analysis, Angel testified that the vapors released from the drops of fuel on the exhaust manifold are ignited by hot surfaces. He testified that even if the temperature of the manifold was insufficient by itself to ignite those vapors, "...having a large amount of material in close proximity where those vapors could travel, it would be more likely that they could also be ignited by that much hotter surface." Tr. I, 118.[8]

Angel explained how a diesel engine functions as a compression-ignition engine. When diesel fuel is injected into the cylinder, the piston compresses the mixture of fuel and air, and heat from the compression causes the mixture to ignite and release thermal energy that turns the crankshaft and powers up engine output. Tr. I, 114. Angel explained that the manifold gets hot because the burnt fuel-air mixture exits the engine through the manifold and turbo charger and heats up both as it exits the exhaust system. Tr. I, 114. Angel further explained that the turbo charger uses energy from escaping hot exhaust gases to spin a turbine on the compressor side of the turbo charger, thereby forcing more air into the engine, which allows use of a greater amount of fuel and results in greater power. Tr. I, 115.

Angel expected gas temperatures exiting the engine to be at the high end of 1200 degrees Fahrenheit for turbo-charged diesel engines, regardless of engine design. Tr. I, 116. Angel testified that the exterior surface of the turbocharger and manifold would be slightly less than the exhaust-gas temperature, although he had not done any research comparing the variations in temperature. Tr. II, 58, 59. Angel further testified that the turbo charger could reach a maximum temperature of 1200 degrees Fahrenheit during normal operations, because the gases must exit the exhaust and make a loop around and constantly impinge upon the walls of the

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[7] On cross, Angel admitted that three of the four accident reports referenced in his expert report primarily involved sprayed hydraulic fuel, as opposed to a dripping fuel leak, and the other one involved a splash of diesel fuel, i.e., seven gallons of diesel fuel that was splashed on the turbocharger and manifold area while refueling a drill that was idling at 530 degrees Fahrenheit, after a five minute cool down from running at high load. Further, with regard to the splash of diesel fuel on the drill, MSHA considered whether the drill operator had been smoking a cigarette. Tr. II, 19-22, 60-61.

[8] Angel testified that the distance the vapors would travel was dependent on the amount of air flow around the engine, and as the gas expanded, it would take up volume along the manifold and turbo charger. Tr. 119. Although not specifically familiar with radiator fans on Mack engines, Angel testified that most radiator fans blow toward or over the engine, and such a fan would be a source of air that could dissipate some of the vapors and cool the engine's surface temperature. Tr. I, 119; Tr. II, 10; Tr. II, 51-52. If the engine is turned off, however, there is no fan ventilation to cool the engine or dissipate remaining vapors. Tr. I, 178.

turbine, whereas the manifold would reach temperatures slightly less. Tr. I, 118; Tr. II, 14; Tr. II, 58.[9]

When asked by the undersigned what "slightly less" meant, Angel testified that the flat area of the manifold near the fuel leak at the number two cylinder, would be around 900 degrees Fahrenheit when the truck was operating at full load. Tr. I, 121; Tr. II, 16. Angel testified that areas of the manifold at the end of the cylinders, such as the elbows, would reach about 1000 degrees Fahrenheit during normal operation at full load. Tr. I, 120; Tr. II, 15-16. Angel had no information from Respondent that there was any shielding or insulated material on the manifold to keep the outside surface of the manifold cooler. Tr. I, 125-26; see also Tr. II, 63-64.

When Angel used a dynamometer to test an idle engine running at about 600-800 RPM's, the engine temperature measured about 200 to 250 degrees Fahrenheit. Tr. I, 141. A dynamometer measures force torque or power by placing a simulated load on an engine. Tr. I, 141. The load is the force counteracting the force of burning fuel firing the pistons inside the cylinder. Tr. 141. Dynamometer tests are conducted in a laboratory setting for the purpose of checking engine power capability. Tr. II, 254. Many MSHA tests relied upon by Angel were executed using a dynamometer. Tr. II, 166.

Angel testified that engine load affects how hot engine components will become. As engine load increases, power demand also increases. If a truck operator presses the accelerator pedal, more fuel is injected into the engine, and the greater mass of fuel flowing within the engine is ". . . able to heat up the surfaces to a hotter area to overcome any cooling on the external surfaces." Tr. I, 121.

Angel testified that the engine load would have to reach 75 percent of the full torque value of the engine, such that the engine temperature would rise to *at least* 700 degrees or higher, in order to ignite the diesel fuel. Tr. I, 121-22, 140; Tr. II, 47. Angel testified that he would expect the engine temperature to reach this 75% threshold under normal mining operations. Tr. 1, 122.

> Q. Okay. Would you think that this red Mack ANFO truck would get under that much load during normal mining operations?
>
> A. I would expect the engine to be able to operate up to its full load. Mining conditions change. Steepness of the road, the load on the truck, all these factors play into an expectation that the trucks going to be used to reach its maximum power outlet that's controlled by the engine.

Tr. I, 122.

Angel testified that the truck would reach the 75 percent threshold when it was performing its maximum work traveling up steep hills with a heavy load at a high rate of speed. Tr. I, 140; Tr. II, 63. On cross examination, Angel testified that he would expect

[9] On cross, Angel recalled that this 1200 temperature reading was taken after underground testing on a Brookville locomotive. Tr. II, 14.

the truck to reach full capacity based on his knowledge of the mining industry and the heavy-duty use that such equipment endures: "The truck capabilities are typically fully used in mining applications. They're heavy duty use, so I would expect that in a mining application it would encounter conditions that would require full-power control. Tr. II, 17.

Angel was skeptical about the accuracy of Respondent's field tests to measure engine temperature under normal mining conditions.

> Q. Would it be difficult to test this engine – – to do a field test of an engine of this type?
>
> A. It would be difficult to control the load on the engine in the field. You could test the engine over some specific course, you would expect the mining conditions to change to require the engine to need to develop more power, therefore higher temperatures.
>
> It would be difficult to do one test of the engine over a specific mine road and say that it is applicable to the full range of operation of the truck.

Tr. I, 123-24.

In sum, Angel concluded that the requisite confluence of factors was present that would start a fire, i.e., leaking diesel fuel mixing with atmospheric oxygen on an engine component that can reach temperatures that will ignite the diesel fuel. Tr. I, 127. Angel opined that if the leaking fuel line were left unabated, "I would expect the vibration corrosion mechanical stresses to keep on degrading the system, causing the leak to increase." Tr. I, 127.

When asked whether or not the cited condition contributed to a fire risk, Angel testified that "... the hazard of a fire is a high likelihood and the consequence of a fire, injury to personnel who are - - that may report a possible explosion of the ANFO, presents an unacceptable safety risk to the person." Tr. I, 127. Angel testified that if a fire started in the engine compartment, the leaking diesel fuel would burn until it reached other combustible material present, such as rubber fuel lines lubricating the oil lines that go to the turbocharger or the hood, and generally as the fire spreads past the firewall of the engine, it consumes the entire vehicle, resulting in fatality for the driver trapped in the cab. Tr. I, 127-28. Angel recalled a loader accident that he had investigated in which a hydraulic fuel line ruptured and was most likely ignited by a hot engine manifold or turbo charger, which caused a large fire trapping the operator inside the cab. Tr. I, 128.

Addressing the issue of whether the ANFO was capable of exploding in the event of a fire on the truck, Angel testified that "... it's not generally accepted in the industry that ANFO can explode if it's subject to a fire. Most likely, it would burn, but under conditions where it's contained, the ammonium nitrate can heat up and become more sensitive to explosion and result in an explosion rather than just burn." Tr. I, 129.

When asked by the undersigned whether "an explosion here was highly likely to occur, or a fire was highly likely to occur, or both," Angel testified as follows:

> THE WITNESS: The hazard is the fire. I believe that that had a likelihood of occurrence. The possible consequences could have been injury or death of the single individual operating the vehicle, or in the worst case scenario, that fire could spread to the ANFO truck and result in a large explosion.
>
> That would have exposed people in a large area around the truck. So the overall risk estimate from the likelihood of the hazard to the possible consequences presents a high risk and an unacceptable safety condition.
>
> JUDGE McCARTHY: And why do you believe that the hazard of a fire was highly likely as opposed to reasonably likely?
>
> THE WITNESS: Because we have indications that all three -- or all four elements of the -- all three elements of the fire triangle are present. They're not only present, but they have been brought together, and that makes it highly likely for a fire -- presents a high likelihood that the fire will occur. If there was some separation of the fuel source from the ignition source, that would lower the likelihood. In this case, all of the elements had been brought together.

Tr.1, 129-130.

On cross examination, Angel confirmed that his report found a high likelihood of a fire occurring because all three legs of the fire triangle (fuel, competent ignition source, and oxygen) were brought together. Secondary factors, such as fire prevention, other flammable materials present, and the flow of air over the fire, can control or prevent the consequences of a fire, but a high likelihood of fire is reached once the three legs of the triangle are brought together. Tr. II, 43-46. Angel declined to comment on inspector Fletcher's gravity designation because he had not been trained in that, but for purposes of his risk evaluation, Angel testified that "for a reasonable expectation of a fire, there has to be a high likelihood or a high likelihood of a fire. Those are both the same." The high likelihood is reached when the three elements of the fire triangle conjoin. Tr. II, 49.

In support of his position, Angel's testimony and expert report relied on a 2006 draft report from his Center evaluating an emulsion truck explosion at ASARCO's Ray Open Pit Cooper Mine near Kearny, Arizona. P. Ex. 3, n. 18. Angel explained that the report was a draft because it was based on technical support findings to the district, and that only MSHA headquarters is responsible for issuing any final report. Tr. I, 132-33. The Secretary waived any deliberative process privilege concerning the contents of the draft report, and over Respondent's objection, I received the report into evidence, with concerns about weight to be given to the draft report, as opposed to its admissibility. See Tr. 1, 131-38; Tr. II, 66-67. On cross examination, Angel did not know why a final report was not published, although he testified that such a result was not unusual for non-fatal accident reports. Tr. I, 29-31.

Thereafter, Angel testified, over Respondent's hearsay objection, to a discussion with the report's drafter, Mr. Lob, a purported expert in explosives, which Angel was not. Angel was told by Lob that the cited scenario at Virginia Drilling and the situation involving the Ray Open Pit "were analogous, that there were conditions where the ammonium nitrate on both trucks could become sensitized by fire and result in an explosion." Tr. I, 139; Tr. II, 33-34. On questioning from the undersigned, Angel admitted that he brought the Ray Open Pit incident to Lob's attention, not vice versa. Tr. II, 37. On cross, Angel testified that MSHA had concluded that a spraying hydraulic fuel leak was the fuel source for the Ray Open Pit fire and that hydraulic fuel would ignite in the 700-800 degree range, whereas diesel fuel would ignite at a higher temperature range, but approach 100% probability at 1000 degrees. Tr. II, 40-41. The ignition range would vary based on the type of hot-surface material, the way the fuel is deposited on the hot surface, and the way the vapors are dissipated. Tr. II, 41-42. Angel testified that the vapors can move several inches, and within several inches, you find the turbocharger at a higher temperature. Tr. II, 43.

Angel testified to his understanding that the blending or mixing of the ammonium nitrate and fuel oil occurred on board the cited Mack ANFO truck, and the mixture was then discharged. The record establishes that this understanding was based on what Lob told Angel based on what Angel told Lob. Tr. II. 34-36. On this issue, I find more reliable the testimony of maintenance supervisor Roark. Roark testified that the truck does not have a mechanism to mix the fuel and powder. Rather, the ANFO is mixed in a delivery truck in the powder bin before being loaded on the shot truck. Tr. II, 86-87.

Although Angel never tested the specific type of Mack engine at issue, he testified that the combustion of diesel fuel is the same across engines, and that manufacturers generally want to achieve the maximum power out of the engine, so they regulate the fuel to get that power. Tr. I, 124. On cross, however, Angel conceded that diesel engines can run different (hotter or cooler) depending on the size and type of equipment and its function. Tr. II, 23.

Respondent's cross examination attempted to chip away at the competency of Angel's testimony. Respondent established that Angel has never personally tested or designed a diesel engine or participated in any heat tests done on the engine components or exhaust air temperatures of a Mack truck. Tr. I, 112, 153; Tr. II, 9; see also Tr. II, 56. Angel has never heard of a fuel leak on a Mack truck manifold that caused a fire. Tr. II, 11. Angel is not a mechanic and has never repaired a Mack engine or turbocharger. Tr.. I, 154-55. He does not have a commercial driver's license and has never driven a commercial vehicle or a Mack truck. Tr. I, 152-53. None of the testimony Angel provided regarding engine temperature had anything to do with a Mack truck on a diesel engine. Tr. I, 153. His temperature range estimates were based on what he had learned about MSHA tests on underground equipment. Tr. II, 8-9, 11. Further, Angel is not a certified fire or explosives investigator. He has no formal education or courses in fire sciences, explosives, or thermodynamics, other than mechanical engineering courses, although he has had a lot of experience and interaction on fire protection issues. Tr. I, 153-54.

Angel conceded that in the event of an ignition, he would expect the diesel fuel to burn and smoke, and that one would be able to smell it. He testified that the absence of these

conditions at the time of the citation would indicate that the temperature was below the competent ignition-source threshold. Tr. II, 11-12. In fact, if the truck was stopped and idling on the bench while powder was being augured, Angel would not expect such auxiliary functions to tax the engine to a level high enough to cause an ignition. Tr. II, 12-13. Rather, Angel testified that the engine is designed to operate at its full range of power and if it reached that level, the fuel leak could cause surface temperatures to ignite. Tr. II, 13.

2. Testimony from Respondent's Expert, Lon Dimitrios Santis

Lon Dimitrios Santis testified as an expert witness for Virginia Drilling. Santis is a consultant with Explosives Risk Managers, LLC. Tr. II, 314. At hearing, Santis had about 20 hours invested in this case. Tr. II, 395.

Santis has a Bachelor's and Master's degree in Mining Engineering from the University of Pittsburgh. Tr. II, 315. He has worked in the explosives industry since 1986, including a 12-year stint with the U.S. Bureau of Mines and time spent at the National Institute of Occupational Safety and Health (NIOSH). Tr. II, 317. Thereafter, he became manager of technical services for the transportation, distribution and security of explosives at the Institute of Makers of Explosives (IME). Tr. II, 317-18. He is chairman of the technical committee on explosives at the NFPA, a nationally recognized organization that establishes fire safety standards. Santis serves on the NFPA's lightning and electrical committees. Tr. II, 323-24.

Santis has testified before Congress as a representative for the explosives industry regarding bulk transport of explosives equipment in a hearing about the DOT special-permit process, and he testified on another occasion regarding the need for MSHA to update explosives regulations. Tr. II, 319-21. Santis has published 40 articles on a wide variety of explosives topics. Tr. II, 322. He holds secret clearance from the Department of Homeland Security (DHS) for classified information concerning explosive threats to the homeland. Tr. I, 322-23.

Santis was retained by Respondent to evaluate the citation issued and to provide an expert opinion on whether a violation of the cited standard occurred, and the appropriateness of inspector Fletcher's assessment of gravity. Tr. II, 315. Santis prepared an expert report and supplemental report, R. Exs. 7 and 8, respectively. Tr. II, 314. Santis has never testified in an MSHA case before, and he could only recall reading one Commission case, which involved storage of explosives in a magazine. Tr. II, 334-35, 341.

Santis has never been involved in a case concerning a similar type of diesel fuel leak, although he understood such leaks to be a common occurrence with diesel engines. Tr. II, 325-26. Santis testified that there were no photographs of the leak, and based on Fletcher's testimony, Santis perceived the leak to be very small. Tr. II, 325.

Santis characterized ANFO as a blasting agent, a less sensitive form of explosive that required a stronger stimulus and both a detonator and booster to cause an explosion. Tr. II, 331-32; R. Ex. 7, p. 6. He testified that ANFO is on the low end of the explosives sensitivity scale, and to detonate, the amount of heat input into the explosive by the fire must exceed the amount of heat that can be given off by the explosive. Tr. II, 352; R. Ex. 7, p. 9.

Santis opined that a violation of section 77.404(a) did not occur because in order for equipment to be unsafe, there has to be a reasonable probability of harm, and there was no reasonable probability that a fire could occur from the diesel leak. Tr. II, 333, 366-67. Santis explained that the temperature measurements made on the manifold of the vehicle "came nowhere near approaching the temperatures necessary to cause ignition of the diesel fuel and also the amount of fuel that was leaking was so small." Tr. II, 336, 399.[10] Santis favorably cited Angel's stainless-steel, diesel-fuel drop laboratory study in which diesel fuel did not ignite below 752 degrees Fahrenheit. Tr. II, 355; R. Ex 8, p. 6, referencing P. Ex. 3, n. 17. Santis testified on cross examination that engine temperatures would have to approach 750 to 800 degrees Fahrenheit before he considered the diesel leak unsafe due to the probability of fire, and that a larger volume of fuel would make the fire more dangerous. Tr. II, 396-97.

Given the location of the radiator fan blowing ventilation over the area while the engine was running, Santis could not see any way that an ignition could occur under such conditions. Tr. II, 336. Santis noted that Angel's report was based on vapor igniting and not on the ignition of the actual liquid that had dropped on the surface. He further testified that the ventilation fan blowing across the manifold would quickly disperse any vapors off the manifold before they could accumulate to the point of ignition. Tr. 361. Santis testified that ignition was dependent upon the volume and surface area of the leak and the length of time that the vapors were exposed to the ignition temperature, which time was reduced by the movement of air by the radiator fan across the manifold. Tr. II, 361-62. Santis further testified that had the small amount of dripping fuel ignited, it would have been readily extinguished, and unlikely to have spread quickly or resulted in a conflagration. Tr. II, 363. On cross, however, Santis had no knowledge of how quickly a leak like this would be caught and repaired by Respondent, nor whether most leaks are caught before the truck is put in service. Tr. II, 390-91.

Based on his experience and research, Santis was not aware of a fire starting in a vehicle based on the cited conditions and he found no hazard. Tr. II, 336-37, 390. Based on assumption piled on assumption, Santis estimated that a vehicle fire from all causes would occur about every 4 million vehicle days. Tr. II, 353-54. Santis acknowledged, however, that a hydraulic leak was alleged to have caused the vehicle fire in the "Ray pit" case relied on by Angel. Tr. II, 338. Santis testified that there was a much lower likelihood of injury in the current case than in the incidents cited in Angel's report, which involved either a spray of high-pressure hydraulic fluid, or a spill of a large volume of fuel during a refueling activity. Tr. II, 364-65.

Based on the MSDS, Santis testified that at 360 degrees Fahrenheit, 5% of the diesel fuel would have started to vaporize. Santis noted that Fletcher did not see any smoke or vapors coming off the manifold. Tr. II. 339-40. Santis testified that well before temperatures became high enough to cause an ignition, smoke and vapors would be visible. Tr. II, 339.

Santis further opined that it was extremely unlikely that the cited condition would lead to a fatality because three improbable events had to occur: a fire; loss of control of the fire, and the detonation of explosives actually harming people. Tr. II, 343. In fairly leading testimony on direct, Santis testified that even in the unlikely event that a fire occurred, the fire was unlikely to

[10] Santis testified that the leak was only a couple of ounces per hour. Tr. II, 342.

detonate the ANFO, although detonation was a possibility, as evidenced by a Canadian incident in which a tractor-trailer carrying a mixed load of explosives rolled over, burned and detonated. Tr. II, 345, see also Tr. II, 393 (instant ANFO mixture could undergo a DDT and detonate in 30 minutes). Santis also emphasized that Virginia Drilling had evacuation procedures and had trained their employees on how to respond to a vehicle fire. Tr. II, 347. On cross, however, Santis conceded that 9 tons of burning ANFO would give off some fumes, even if it did not explode, and one would want to stay upwind from the burning ANFO. Tr. II, 392.

Santis attempted to distinguish the Ray pit incident cited by Angel because that case involved a batch mixer for ammonium nitrate, slurry, fuel, a sensitizer and perhaps other chemicals, whereas Respondent used just ammonium nitrate and diesel fuel, which were premixed. Tr. II 349-50, 394; R. Ex. 8, last page, figure 2. Santis opined that only the material in the batch mixer detonated at the Ray pit, and there was ammonium nitrate prell and portions of the truck that did not detonate. Tr. II, 351. Further, no one was hurt. Tr. II, 352.

Santis was rather evasive on initial cross. Tr. II, 367-71, 384, 386-87. Santis has never tested diesel engines or measured engine temperatures when a radiator fan is on and off. Tr. II, 372. 378. Santis never measured the truck's exhaust manifold temperatures or the turbo charger temperature, although he purportedly gave Respondent some email instructions about conducting its tests once the truck reached its steady temperature. Tr. II, 373-74, 376-77, 379. Those instructions were not offered into evidence.

Santis relied on Respondent's measurements and Respondent's design of the tests. Tr. II, 373, 382. The temperatures cited in his report were based on those measurements and Santis played no role in gathering the data. Tr. II, 378, 380. Santis testified that he knew that Respondent measured multiple points on the manifold because, "That's what I told them to do, and that's what they did. Tr. II, 379. Santis recommended that Kidd measure the temperature on the manifold in operating condition. Tr. 400. Santis did not recommend that Respondent have independent testing performed, or that Respondent use a dynamometer during testing. Tr. II, 400.

Santis did not observe the tests, but was told by Respondent that they ran the truck up a hill for 10 minutes during the second test. Tr. II, 374, 376. Santis conceded that he did not know whether the test course would elicit the hottest temperature that the manifold would reach, but he testified that the load would be greater than that needed to move around a shot bench and unload ANFO with an auger. Tr. II, 377-78. More importantly, Santis conceded on cross examination that in rendering his expert opinion, he did not consider what would happen to the leaking fuel line under continued normal mining conditions. Tr. II, 395. Rather, his opinion was confined to the condition of the truck as found on the bench by Fletcher. *Id.*

3. Limited Rebuttal Testimony from Angel

In an effort to rebut Kidd's testimony that the source of the leak was from return fuel, Angel testified that he had no information about whether the source of the leak other than the fact that the citation indicated that the leak came from the diesel fuel injector line, which meant

that the supply of fuel to the cylinder was escaping and would degrade the system and increase over time. Tr. II, 403-08.

IV. Analysis and Disposition

A. The Violation of Section 77.404(a)

Section 77.404(a) imposes two duties upon a mine operator: (1) to maintain both mobile and stationary machinery and equipment in safe operating condition, and (2) to remove unsafe equipment from service immediately. The Commission has held that derogation from either duty violates the standard. *Peabody Coal Co.*, 1 FMSHRC 1494, 1495 (Oct. 1979).

The Mack ANFO truck cited by inspector Fletcher was mobile equipment. It is undisputed that such mobile equipment was in service when cited. The dispute is whether the truck was maintained in safe operating condition. I find that the truck was not maintained in safe operating condition because of the fuel leak, and was not removed from service. Accordingly, Respondent derogated both duties. I find the violation.

Equipment is in unsafe operating condition under section 77.404(a) when a reasonably prudent person familiar with the factual circumstances surrounding the alleged hazardous condition, including any facts peculiar to the mining industry, would recognize a hazard warranting corrective action within the purview of the applicable regulation. *Ambrosia Coal & Construction Company*, 18 FMSHRC 1552, 1557 (Sept. 1996) (citing *Alabama By-Products Corp.*, 4 FMSHRC 2128, 2129 (Dec. 1982). Applying this test, I find that a reasonably prudent person familiar with driving a loaded Mack ANFO truck up and down 15-20% graded mine terrain would recognize that a diesel fuel line leaking fuel onto the exhaust manifold in close proximity to the turbo-charged engine constitutes failure to maintain the truck in safe operating condition, free from hazards that require corrective action. Accordingly, I find that the Secretary has proven by a preponderance of the evidence that Respondent violated Section 77.404(a) by failing to maintain the Mack ANFO truck in safe operating condition, and by failing to remove it from service.

B. The Fuel Leak Violation of Section 77.404(a) was Significant and Substantial

1. Legal Principles

The Mine Act describes an S&S violation as one "of such nature as could significantly and substantially contribute to the cause and effect of a coal or other mine safety or health hazard." 30 U.S.C. § 814(d)(1). The Commission has held that a violation is S&S "if, based on the particular facts surrounding the violation, there exists a reasonable likelihood that the hazard contributed to will result in an injury or illness of a reasonably serious nature." *Cement Div., Nat'l Gypsum Co.*, 3 FMSHRC 822, 825 (Apr. 1981). Consistent with the language of section 104(d)(1), it is the contribution of a violation to the cause and effect of a hazard that must be significant and substantial. *U.S. Steel Mining Co.*, 6 FMSHRC at 1575. "The fact that injury [or a condition likely to cause injury] has been avoided in the past or in connection with a particular violation may be 'fortunate, but not determinative.'" *U.S. Steel IV*, *supra*, 18 FMSHRC at 867,

quoting Ozark-Mahoning Co., 8 FMSHRC 190, 192 (Feb. 1986). *See also Elk Run Coal Co.*, 27 FMSHRC 899, 906-07 (Dec. 2005); *Blue Bayou Sand & Gravel, Inc.*, 18 FMSHRC 853, 857 (June 1996).

To establish an S&S violation under *National Gypsum*, the Secretary must prove the four elements of the Commission's subsequent *Mathies* test: (1) the underlying violation of a mandatory safety standard; (2) a discrete safety hazard – that is, a measure of danger to safety – contributed to by the violation; (3) a reasonable likelihood that the hazard contributed to will result in an injury; and (4) a reasonable likelihood that the injury in question will be of a reasonably serious nature. *See Mathies Coal Co.*, 6 FMSHRC 1, 3-4 (Jan. 1984) (footnote omitted); *accord Buck Creek Coal, supra,* 52 F.3d 133, 135 (7th Cir. 1995) (recognizing wide acceptance of *Mathies* criteria); *Austin Power, Inc. v. Sec'y of Labor*, 861 F.2d 99, 103 (5th Cir. 1988) (approving use of *Mathies* criteria). An S&S determination must be based on the particular facts surrounding the violation and in the context of continued normal mining operations. *Texasgulf, Inc.,* 10 FMSHRC 498, 500 (Apr. 1988) (quoting *U.S. Steel Mining Co.,* 6 FMSHRC 1573, 1574 (July 1984)).

Often, it is the third element of the S&S test that is difficult to apply. This element is established if the Secretary proves "a reasonable likelihood the hazard contributed to will result in an event in which there is an injury." *U.S. Steel Mining Co.*, 7 FMSHRC 1125, 1129 (Aug. 1985). "The Secretary need not prove a reasonable likelihood that the violation itself will cause injury." *Cumberland Coal Res., LP*, 33 FMSHRC 2357, 2365 (Oct. 2011) (quoting *Musser Engineering, Inc. & PBS Coals, Inc.*, 32 FMSHRC 1257, 1280-81 (Oct. 2010). Moreover, the Secretary is not required to prove that the hazard contributed to will actually result in an injury causing event. *Youghioghemy & Ohio Coal Co.*, 9 FMSHRC 673, 678 (April 1987).

Rather, "[t]he third element of the *Mathies* test 'requires that the Secretary establish a *reasonable likelihood* that the hazard contributed to will result in an event in which there is an injury.'" *Ziegler Coal Co.,* 15 FMSHRC 949, 953 (June 1993), quoting *U.S. Steel Mining Co.,* 6 FMSHRC 1834, 1836 (Aug. 1984)(emphasis in original); *but see Peabody Midwest Mining, LLC, v. FMSHRC*, 762 F.3d 611, 616 (7th Cir. 2014)(shortcutting S&S analysis and holding that question is not whether it is likely that the hazard would have occurred, but only if the hazard occurred, regardless of likelihood, it was reasonably likely that a reasonably serious injury would result). When examining the third element of the *Mathies* test for those violations that involve hazards of fire, ignition, or explosion, the Commission has held that the Secretary must prove that such a hazard is reasonably likely to occur, in addition to proving that the hazard is reasonably likely to result in an injury. *Ziegler Coal,* 15 FMSHRC at 953, *citing Texasgulf, Inc.,* 10 FMSHRC 498, 501 (April 1988); *see also Eastern Assoc. Coal Corp.*, 13 FMSHRC 178, 184 (Feb. 1991). That is, when evaluating the reasonable likelihood of a fire, ignition, or explosion, the Commission has examined whether the requisite "confluence of factors" is present based on the particular facts surrounding the violation. *Enlow Fork Mining Co.,* 5 FMSHRC 5, 9 (Jan. 1997), citing *Texasgulf, Inc.*, 10 FMSHRC 498, 501 (April 1988).

2. S&S Analysis

I conclude that the violation of § 77.404(a) was significant and substantial. The violation contributed to a discrete fire hazard that was reasonably likely to result in injury, and the injury was reasonably likely to be of a serious nature.

For the reasons explained above, I have found the underlying violation of mandatory safety standard 77.404(a).

With regard to the second *Mathies* factor, the violation created a discrete fire hazard and discrete explosion hazard, both measures of danger to safety. My finding of a violation *a fortiori* requires a finding of a discrete measure of danger to safety as the standard violated requires a failure to maintain mobile equipment (the Mack ANFO truck) in safe operating condition, free from hazards that require corrective action. Ergo, if the truck is not maintained in safe operating condition there is necessarily a discrete measure of danger to safety.

Furthermore, under the second *Mathies* prong, the Secretary need only identify a safety hazard associated with the putative S&S violation. *Highland Mining Co.*, 34 FMSHRC 3434, n. 5 (Dec. 2012). The record evidence establishes that the diesel fuel leaking onto the exhaust manifold in close proximity to the turbo-charged engine created a discrete fire hazard, and because the violation contributed to a fire hazard and the truck was loaded with ANFO, the violation also contributed to a separate explosion hazard if the ANFO exploded because of the fire. Both fire, and explosion because of fire, were hazards that were measures of danger to safety for the driver of the truck.

The record establishes that that diesel fuel is capable of catching fire at a certain temperature point and that the manifold and turbo charger in question can reach high temperatures, during continued normal mining operations. Whether they could reach temperatures high enough to ignite the diesel fuel is discussed below under the third prong of *Mathies.* The record testimony of the experts, however, is in apparent conflict as to whether the ANFO is capable of exploding in the event of a fire on the truck.

Angel testified that "... it's not generally accepted in the industry that ANFO can explode if it's subject to a fire. Most likely, it would burn, but under conditions where it's contained, the ammonium nitrate can heat up and become more sensitive to explosion and result in an explosion rather than just burn." Tr. I, 129. To support his position, Angel's expert report relied on a 2006 draft report from his Center evaluating an emulsion truck explosion at ASARCO's Ray Open Pit Cooper Mine near Kearny, Arizona. P. Ex. 3, n. 18. Over Respondent's objection, I received the report into evidence, with concerns about weight to be given to the draft report, as opposed to its admissibility. Tr. I, 131-38. Based on a hearsay discussion with the report's drafter, an expert in explosives, which Angel was not, Angel was told that the cited scenario at Virginia Drilling and the situation involving the Ray Open Pit "were analogous, that there were conditions where the ammonium nitrate on both trucks could become sensitized by fire and result in an explosion." Tr. I, 139.

On the other hand, Santis, Respondent's expert, testified that ANFO had a very low probability of detonating by fire based on testing done at Department of Transportation (DOT) laboratories concerning transportation quantities of ANFO. Tr. II, 3443-44. Based on the definition of "blasting agent" provided in one of his reports (R. Ex. 7, p. 6), Santis testified that ANFO was a less sensitive form of explosive than other forms of explosives that are transported, which means that "it takes a stronger stimulus to cause a reaction." Tr. II, p. 331. Santis testified that "[a] detonator should not initiate a blasting agent." Tr. II, p. 332.

Santis then explained how ANFO is detonated by Respondent. Respondent places a detonator inside a booster, either a stick powder or cast booster, made of cast pentolite, a mixture of PETN and PNT. The detonator sets off the booster, and then the booster sets off the ANFO. Tr. II, 332. In his report (R. Ex. 7, p. 9), Santis states, "ANFO is on the low end of the explosive sensitivity scale. It is one of the least likely of all explosives to undergo a deflagration to detonation transition (DDT)." Santis explained that DDT "is the mechanism that causes an explosive to detonate from fire. Essentially, what happens is that the amount of heat input into the explosive exceeds the amount of heat that can be given off by the explosive. You develop a heat feedback loop that keeps putting more heat into the material. Eventually, that can be enough energy to start a detonation." Tr. II, 352.

Santis distinguished incidents involving other trucks or trailers carrying a "mixed load of explosives" that caught fire, burned, and detonated. Tr. II, 345-347. With regard to the Ray Open Pit incident relied on by Angel, Santis testified that it involved a truck with a batch mixture of ammonium nitrate, slurry, fuel, a sensitizer, and perhaps other chemicals, and the ammonium nitrate prell did not detonate when the batch mixer detonated; rather, it "just got thrown all over the place." Tr. II, 349-51. Santis testified that the ANFO truck used by Respondent involved just two pre-mixed components, ammonium nitrate and fuel oil, which in his opinion, as noted, was unlikely to detonate. Tr. II, 350.

Despite this apparent conflict is testimony, the second prong of the *Mathies* test does not require a "reasonable likelihood" analysis. *Musser Eng'g, Inc.*, 32 FMSHRC 1257, 1280 (Oct. 2010). Accordingly, I need not resolve the conflict of whether a fire or an explosion was reasonably likely to occur when discussing the second prong of *Mathies.* Santis' testimony did not rule out the possibility that an explosion, albeit it unlikely, could occur if the ANFO detonated as a result of a truck fire. Consequently, I find that the violation contributed to two discrete hazards. First, a fire hazard if the engine manifold or turbocharger reached a temperature sufficient to ignite the diesel fuel. Second, an explosion hazard if the fire detonated the ANFO. Accordingly, I find that the second *Mathies* factor is satisfied by either hazard.

Regarding the third *Mathies* factor, the Secretary need not prove that the violation itself is reasonably likely to cause injury. The test under the third element is whether there is a reasonable likelihood that the hazard(s) contributed to by the violation will result in injury. *Musser Eng'g,* 32 FMSHRC at 1281. In this case there was one violation and two hazards, fire if the leaking diesel fuel ignited, and explosion if any fire detonated the ANFO. Through the expert testimony of Angel, the Secretary demonstrated a reasonable likelihood that the fire hazard contributed to by the leaking diesel fuel violation would result in an injury, during continued mining operations.

All the elements of the fire triangle sufficient to establish the confluence of factors necessary to start a fire were present. Diesel fuel, which ignites under sufficient heat, was leaking onto the engine manifold near the turbocharger, both sources of ignition energy. If left uncorrected, vehicle vibration, mechanical stress, and corrosion would degrade the fuel line and augment the leak. Tr. I, 127. There was oxygen present in the atmosphere near the diesel fuel leak. The essential issue in dispute with regard to the fire hazard is whether the exhaust manifold or turbocharger were heat sources that could reach a temperature hot enough that it was reasonably likely that the leaking diesel fuel would ignite and cause a fire that would result in an injury, under continued normal mining operations.

Angel credibly testified that the auto-ignition temperature for diesel fuel can range from 450 to 500 degrees Fahrenheit. Tr. I, 109. The Petroleum Company No. 2 diesel fuel at issue has a published auto-ignition temperature of 500 degrees Fahrenheit, as listed on the manufacturer's MSDS. P. Ex. 3, n. 14; Tr. I, 109. Santis testified that before reaching a temperature high enough to cause ignition, there would be visible smoke and vapors, and that five percent of the diesel fuel would have started to vaporize at 360 degrees Fahrenheit, the boiling point listed on the MSDS. Tr. II, 338-39. Although Angel also testified that environmental or "real-world" factors may result in a much higher auto-ignition temperature, he explained that testing of the auto-ignition temperature of diesel fuel droplets on stainless steel at MSHA's diesel lab established that the fuel would ignite at 750 to 1050 degrees Fahrenheit. Tr. I, 110; P. Ex. 3, n. 17.

Angel credibly testified that the load the engine is under will affect how hot the engine components will become and that the engine load would have to be about 75 percent of the full torque value of the engine, for the engine components to reach *at least* 700 degrees Fahrenheit and get hot enough to ignite the diesel fuel. Tr. I, 121-22. Angel further credibly testified that he would expect the engine to be able to operate up to its full load potential during normal mining operations. Tr. I, 122. Angel explained that mining conditions change, and the steepness of the road, the load on the truck, and other operating conditions, factor into his expectation that the Mack ANFO truck would be used to reach its maximum engine potential. Tr. I, 122. By contrast, Santis relied on Respondent's test data, the probative value of which I have discounted, and unlike Angel, he did not consider the violation in the context of continued normal mining operations. Tr. II, 373, 382, 395.

The record establishes a reasonable likelihood that both the engine manifold and turbocharger could reach a temperature of 750 to 1050 degrees Fahrenheit near the area where the diesel fuel was leaking, which would be sufficient to ignite the diesel fuel during continued normal mining operations. Angel credibly testified that the flat area of the manifold near the fuel leak at the number two cylinder would reach about 900 degrees Fahrenheit. Tr. I, 121. Angel also credibly testified that areas of the manifold at the end of the cylinders, such as the elbows, would reach about 1000 degrees Fahrenheit. Tr. I, 120. In addition, Angel credibly testified that the gas temperatures exiting the turbo-charged engine could reach 1200 degrees Fahrenheit, a temperature higher than the manifold itself. Tr. I, 117-18.

Although the radiator fan would dissipate some of the vapors around the manifold and cool it down, once the engine was turned off, the fan would no longer provide ventilation to cool the engine and dissipate the vapors. Tr. I, 118-20, 178-81. Prior to such cooling, the exhaust manifold and turbocharger would still be hot enough to ignite the leaking diesel fuel after a heavy load above 75 percent of engine potential. Tr. 178-81. Angel credibly testified that the engine can reach that potential, depending on the steepness of the road, the load on the truck, and other varying conditions. Tr. I, 122.

Finally, Angel persuasively testified that if a fire were to start in the engine compartment, leaking diesel fuel would burn until it reached other combustible material and ultimately consume the entire vehicle, which was reasonably likely to result in entrapment of the operator inside the cab and death or other injury (burns, smoke inhalation) to the truck operator. Tr. I, 128. Given this record evidence and confluence of factors, I find that the Secretary established both that a fire was reasonably likely to occur under normal mining operations if the violation was left unabated, and that the fire hazard contributed to by the violation was reasonably likely to result in an injury.[11] Accordingly, I find that the third prong of the *Mathies* test has been satisfied with respect to the fire hazard.[12]

With regard to the fourth *Mathies* factor, I find a reasonable likelihood that the injury resulting from the fire would be of a reasonably serious nature and likely fatal. The type of injury that would likely result from a fire on the Mack ANFO truck would be operator burns,

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[11] The Secretary litigated this case as a fire hazard case and not an explosion hazard case, or both. Accordingly, I find it unnecessary to resolve the conflict in expert testimony as to whether it was reasonably likely that the ANFO would explode in the event of a fire under the third prong of *Mathies*.

[12] Respondent and its expert argue that it is unlikely that a fire will occur from the fuel leak on the ANFO truck because there have been only a few fires reported for bulk-explosive transport trucks over the past 50 years and none at Virginia Drilling. See Tr. II, 337; Resp. Ex. 7. These arguments are not persuasive. The Secretary need not produce quantitative evidence of the frequency of a hazard to show that it was reasonably likely under the circumstances. *Knox Creek Coal Corp.*, 36 FMSHRC 1128, 1132-33 (May 2014) (requiring the Secretary to essentially prove a statistical frequency of a hazard occurring would impose an unwarranted standard that extends beyond reasonable likelihood). Further, although Kidd testified that Virginia Drilling has never had an ignition from this type of condition (Tr. II, 263), the fact that a fuel leak ignition or fire has not occurred at Virginia Drilling in the past, does not mean that it cannot or will not happen when the requisite confluence of factors is present making such occurrence reasonably likely. *Ambrosia Coal & Construction Company*, 18 FMSHRC 1552, 1560 (Sept. 1996). *See also Elk Run Coal Company,* 27 FMSHRC 899 (Dec. 2005); *Buffalo Crushed Stone, Inc.,* 19 FMSHRC 231, 238 (Feb. 1997) (the absence of previous instances of over travel does not establish that an accident would not be reasonably likely to occur, given the nature of the hazards presented); *Blue Bayou Sand and Gravel, Inc.*, 18 FMSHRC 853, 857 (June 1996)(assertions that the operator had no history of accidents, and that the truck had been operated in the cited condition for many months without incident, are not dispositive of a finding that the third *Mathies* element has not been established).

smoke inhalation, and/or death. *Cf., Buck Creek, supra*, 16 FMSHRC at 542-43 (ALJ) (finding that "smoke and gas inhalation" would cause a reasonably serious injury "requiring medical attention" for S&S purposes), *aff'd* 52 F.3d at 135-36 (7th Cir. 1995). The Commission has recognized that auto ignitions and explosions are major causes of death and injury to miners. *Black Diamond Coal Mining Co.*, 7 FMSHRC 1117, 1120 (Aug. 1985). Accordingly, because it was at least reasonably likely that the occupant of the truck would sustain a reasonably serious or fatal injury as a result of a fire contributed to by the leaking fuel violation, I find that the fourth element of the *Mathies* test has been established.

Respondent contends that because the truck has fire extinguishers and there is an emergency plan in place, there is no risk of fatality in the event of a fire. R. Br. 23; see also Tr. II, 305. I reject these arguments. The presence of fire-fighting equipment and other precautions does not lessen the risk or severity of injury or death to a miner due to a truck fire caused by a leaking fuel line. *Buck Creek*, 52 F.3d at 136 (in the event of a fire, the mere presence of . . . firefighting equipment does not mean that fires do not pose a serious safety risk to miners); *Eagle Nest, Inc.*, 14 FMSHRC 1119, 1123 (July 1992) (for purposes of analyzing whether a violation is S&S, a hazard continues to exist regardless of whether caution is exercised). Furthermore, even with an emergency plan in place, there is no guarantee that a miner will respond appropriately under the stress of emergency conditions. Likewise, there is no guarantee that an endangered truck operator will be able to access the fire-fighting equipment and use it effectively. As I have previously noted, the Commission interprets safety standards to take into consideration "ordinary human carelessness." *Beckley Crane & Constr., Inc.*, 33 FMSHRC 372, 382 (Feb. 2011) (ALJ), quoting *Thompson Bros. Coal Co.*, 6 FMSHRC 2094, 2097 (Sept. 1984).

A. Respondent's Negligence was Properly Designated as Moderate

The Respondent contends that the citation's negligence designation should be classified as low, rather than moderate. The Act defines negligence as "conduct, either by commission or omission, which falls below a standard of care established under the Mine Act to protect miners against the risk of harm." 30 C.F.R. § 100.3 (d). An operator is required to "take steps necessary to correct or prevent hazardous conditions or practices." *Id.* In order for a citation to be designated as moderate negligence it must be determined that "the operator knew, or should have known of the violative condition or practice, but there are mitigating circumstances." 30 C.F.R. §100.3 Table X. On the other hand, for a citation to be properly designated as low negligence there must be considerable mitigating circumstances present. *Id.* A mitigating circumstance may include actions taken to prevent or correct hazardous conditions. 30 C.F. R. §100.3(d).

The Respondent should have known that there was a fuel leak on the vehicle's engine manifold. Respondent should have insured that a pre-operational check was performed on the truck in question prior to operation. Mack's maintenance manual for this particular truck requires that as part of the driver's daily schedule, the driver check for "signs of leaking, fuel, oil or coolant" as well as inspect under the hood for "oil, fuel and air leaks." The manual further states that the driver should "make sure any problem is corrected before using the vehicle." P. Ex. 3, Ref. 6, p. 2. Respondent's safety director, Anthony Kidd, did not know whether a pre-operational check of the vehicle had been performed. Tr.II, 276. At the very least, such

ignorance paints a picture of lax enforcement of a pre-operational inspection policy and imprecise recordkeeping on the part of the Respondent.

To support its contention that the negligence should be lowered from moderate negligence to low negligence, Respondent argues that the location of the leak is a mitigating factor. While the leak is under the hood and not visible without lifting the hood of the truck, I have found that the Mack maintenance manual requires checking under the truck's hood for fuel leaks prior to daily use. Although inspector Fletcher conceded that this type of leak could occur after a driver does a pre-shift examination (Tr. I, 76), Respondent failed to establish that one was done. Moreover, the Commission has held that the execution of a pre-operational inspection does not relieve the operator of its duty to maintain equipment in safe operating equipment, and to hold otherwise would run counter to the strict liability nature and safety objectives of the Mine Act. *Wake Stone Corp.*, 36 FMSHRC 825, 829 (April 2014).

Furthermore, the Respondent's argument that Austin Sales maintains the truck and is responsible for pre-operational inspections, does not relieve Respondent from its duty to maintain vehicles in safe working condition as required by the mandatory safety standard. Finally, Respondent's argument that the blaster helper operating the truck at the time of the citation was not an agent of Respondent is not a mitigating circumstance. Respondent should have a vigilantly monitored system in place to ensure that pre-operational checks have been completed and that mobile equipment is maintained in safe operating condition.

Accordingly, I find no mitigating circumstances that would justify reducing the negligence designation from moderate to low. Respondent should have known of the violative condition and its negligence was properly designated as moderate.

B. Civil Penalty

The Act requires that when evaluating a civil monetary penalty the Commission shall consider six statutory penalty criteria: 1) the operator's history of previous violations; 2) the appropriateness of the penalty to the size of the business; 3) the operator's negligence; 4) the operator's ability to stay in business; 5) the gravity of the violation; and 6) any good faith compliance after notice of the violation. *Douglas R. Rushford Trucking,* 22 FMSHRC 598, 600 (May 2000). The Commission is not required to give equal weight to each of the criteria, but must provide an explanation for a substantial divergence from the proposed penalty under the criteria. *Spartan Mining Co.,* 30 FMSHRC 699. 723 (Aug. 2008).

As I discussed in my final *Big Ridge* decision, in an effort to avoid the appearance of arbitrariness, I look to the Secretary's assessment formula as a reference point. *Big Ridge Inc.*, 36 FMSHRC 1677, 1681-82 (July 19, 2014) (ALJ). This formula is not binding, but operates as a lodestar, since factors involved in a violation, such as the level of negligence, may fall on a continuum rather than fit neatly into one of five gradations. Further, unique aggravating or mitigating circumstances may call for higher or lower penalties, and will be taken into account.

When assessing the gravity of this violation under section 110(i) criteria in light of the penalty principles outlined above, I credit and find persuasive inspector Fletcher's testimony at

hearing that the citation was more appropriately written as reasonably likely to result in an injury, rather than highly likely to result in an injury. Tr. I, 58; see also Tr. I, 68. In essence, Fletcher candidly reassessed his analysis after additional experience on the job. The gravity was very serious, however, given the reasonable likelihood of a fire and the potential for a fire to result in explosion. To the Respondent's credit, the violation was quickly abated in good faith when Respondent ordered parts for the truck and had a mechanic from Austin Sales promptly repair the vehicle. R. Ex. 1. The parties stipulated to this prior to hearing. Jt. Ex. 1. Accordingly, applying the remaining section 110(i) criteria to my findings set forth herein, I assess a civil penalty of $37,416 against Respondent for the instant violation of section 77.404(a).

V. Order

WHEREFORE, the motion for approval of settlements is **GRANTED.**

The contest of Citation No. 8262897 is **DISMISSED**

It is further **ORDERED** that Citation No. 8262897 be modified to reduce the likelihood of injury or illness from "highly likely" to "reasonably likely."

To the extent Respondent has not already done so, within 40 days of the date of this decision, Respondent, Virginia Drilling, Inc., is **ORDERED TO PAY** a total civil penalty of $44,164, i.e., $37,416 for the litigated citation and $6,748 for the settled citations.[15]

Thomas P. McCarthy

Thomas P. McCarthy
Administrative Law Judge

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[15] Payment should be sent to: Mine Safety & Health Administration, U.S. Department of Labor, Payment Office, P.O. Box 790390, St. Louis, MO 63179-0390.