OAH Docket No. 60-2004-37824

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

In the Matter of the NorthMet Project Permit to Mine Application	Conservation Organizations' Exceptions and Argument

INTRODUCTION

Poly Met Mining, Inc. ("PolyMet")[1] asks this Designee[2] to approve an unprecedented proposal for managing reactive mine waste.[3] To control reaction-inducing oxygen movement and reduce seepage, PolyMet would add a small percentage of bentonite to the flotation tailings basin ("FTB"), where the waste would be deposited. PolyMet claims that it can achieve a uniform "bentonite amendment" of tailings across thousands of acres. PolyMet also claims that the bentonite—a form of clay—would not materially degrade over the centuries-long life of the FTB.

In this hearing, Conservation Organizations ("COs") and other Petitioners demonstrated that this proposal would fail. The bentonite amendment would leave flotation tailings exposed to oxygen and allow hundreds of millions of gallons of polluted water to seep from the tailings every year. These problems would only worsen as the bentonite degrades over the years. Because the bentonite amendment would not be a practical and workable reclamation technique to comply with the reactive mine waste rule, the permit must be denied.

FACTUAL BACKGROUND

Processing NorthMet ore would produce "flotation tailings," a waste material.[4] Because the flotation tailings would react with oxygen and water to release sulfate and

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[1] Conservation Organizations reserve the right to raise arguments on the proper named permittee, an issue that the Commissioner has said would be addressed outside of the contested case. OAH Official Record, OAH 60-2004-37824, PolyMet Official Record ("OAH Record"), Hearing Notice, at p. 14969 ¶ 15.

[2] "Designee" refers to the decisionmaker in the contested case, and "Hearing Team" refers to DNR hearing participants.

[3] PolyMet's filings to this Designee state that PolyMet is reconsidering its proposal. Conservation Organizations maintain that PolyMet's statements during the hearing and to this Designee demonstrate that there is not a "complete" application, which is a prerequisite to this Designee's jurisdiction in the contested case, as well as jurisdiction to issue a permit to mine.

[4] *See* Ex. 219, R.0115587 n.9 (describing tailings).

metals, DNR found that the tailings would be "reactive mine waste" that must be carefully managed.[5] PolyMet proposes to manage the flotation tailings by depositing them on top of the two eastern cells of an existing LTV Steel Mining Company ("LTV") taconite tailings basin, using existing LTV tailings to construct a series of "dams."[6] The FTB would span over two square miles.[7]

During environmental review, the U.S. Environmental Protection Agency found that the FTB would release sulfate and metals into the Lake Superior watershed.[8] These pollutants would damage wetlands, kill wild rice, and increase mercury concentrations in fish tissue.[9] Because this seepage would continue for centuries, "the quality of that seepage is of critical importance and will largely determine the need for long-term operation, maintenance, and/or treatment."[10]

PolyMet and agency representatives subsequently formed a Tailings Basin Closure Cap Workgroup.[11] They identified oxidation and water percolation as "key drivers" of FTB performance.[12] To address this issue, they conducted a literature review to identify cover options.[13] One concept they developed was the "bentonite amendment," which would involve mixing a small amount of bentonite with the tailings.[14]

Workgroup members found a "paucity of studies" and "lack of demonstrated full-

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[5] Ex. 217, R.0034417; Ex. 220, R.0115742, ¶ 28b (requiring plans for "handling reactive mine waste).
[6] Ex. 210, R.0065585. *See also* Ex. 219, R.0115588 ¶ 293.
[7] Ex. 219, R.0115588 ¶ 294. *See also* Ex. 75 at 80:1536-38 (Radue).
[8] Ex. 227, R.0724748-49; Ex. 239, R.0744200.
[9] Ex. 227, R 0724747-49, R.0724751-54.
[10] Ex. 239, R.0744200. *See also* Ex. 243, R.0720832.
[11] Ex. 229, R.0744198; Ex. 239, R.0744200-01. *See also* Ex. 241, R.0720863-64.
[12] Ex. 239, R.0744208.
[13] Ex. 235, R.0744702-03; Ex. 243, R.0720832-33.
[14] Ex. 230; Ex. 239; Tr. Vol. 1 at 95:2-23 (Radue); Tr. Vol. 3 at 147:16-148:17 (Engstrom).

scale applications" of soil-bentonite covers.[15] PolyMet nonetheless opted for the bentonite amendment.[16] This would involve (1) adding bentonite to the LTV tailings on the dam sides as they are constructed, with LTV tailings covering the top of the bentonite layer; (2) doing the same with the flotation tailings on the beaches, but after closure; and (3) adding bentonite to the pond at closure.[17] PolyMet's water quality models were built on the assumption that the bentonite amendment would maintain specific levels of hydraulic conductivity (restricting water flow) and saturation (restricting oxygen diffusion).[18]

DNR consultants continued to criticize the bentonite proposal, calling it a "hail Mary" concept for mine-waste reclamation.[19] COs and other Petitioners requested a contested-case hearing.[20] DNR denied those petitions and granted a permit to mine with conditions that PolyMet conduct bentonite testing in the future to "confirm" its effectiveness.[21] The Minnesota Supreme Court reversed the permit decision, holding that a contested-case hearing was required "to determine whether the bentonite amendment, as proposed in the permit application, is a 'practical and workable' reclamation technique that will satisfy the DNR's reactive waste rule." *In re NorthMet Project Permit to Mine Application*, 959 N.W.2d 731, 754 (Minn. 2021). The court emphasized that a requirement to test in the future does not substitute for evidence supporting an agency decision. *Id.*

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[15] Ex. 238, R.0735831; Ex. 242, R.0743828. *See also* Ex. 234, R.0735738 (stating that this proposal would "require lab work and field demonstration").
[16] Ex. 239, R.0744201; Ex. 241, R.0720858.
[17] Ex. 241, R.0720858; *see* Ex. 202 at 31:3-18 (Kuipers) (time frame for beaches).
[18] Tr. Vol. 3 at 172:4-9 (Engstrom); Ex. 216, R.0741168, R.0741767; *see* Ex. 349A.
[19] Ex. 252; Ex. 250, R.0735799 ("I envision that PolyMet's reclamation plan could work for a while, but don't see how it will function forever without falling apart unless it is continuously maintained; which is a major leap of faith."); Ex. 261, R.0735730 ("I did not see detail demonstrating that there are effective methods to construct bentonite amended layer over the floatation tailings dams and beaches that will remain at a high enough saturation to permanently inhibit oxygen diffusion into the tailings."); Ex. 266; Ex. 281.
[20] Ex. 219, R.0115549.
[21] *Id.*, R.0115691.

In the contested case hearing that followed, Respondents did not produce any new testing.[22] PolyMet's evidence included advertising materials and examples of bentonite use in settings that did not involve the complications identified for the FTB.[23] PolyMet's examples included bentonite application to moist soils at a city park[24] and a "patch" to a sidewall that was partly underwater.[25]

Petitioners presented testimony by independent experts explaining that laboratory innovations and long-term field trials had created an even more sobering picture of bentonite degradation than previously thought.[26] A growing body of research shows that soil-bentonite amendments fail within several years.[27] When applied to the FTB, this research shows that PolyMet is unlikely to achieve a uniform bentonite amendment[28] and that the bentonite would further degrade and fail within several years.[29]

Even if the bentonite performed perfectly, however, the record shows that the bentonite amendment's design is fatally flawed. Because the bentonite itself requires a cover, PolyMet proposes to place one million cubic yards of flotation tailings, covering 427 acres, over the bentonite.[30] This reactive mine waste would be directly exposed to the elements. As for the rest of the flotation tailings, it is undisputed that oxygen diffusion and

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[22] *See* Ex. 103 at 4:13-6:17 (Engstrom) (describing the various testing that still has not been done); Tr. Vol. 1 at 64:18-20 (Radue).
[23] *See, e.g.*, Ex. 43 (product brochure).
[24] Tr. Vol. 2 at 188:12-14 (Hull).
[25] *Id*. at 187:19-25, 188:3 (Hull).
[26] *See, e.g.*, Ex. 205 at 11:8-12:14 (Thyne) (describing shortcomings in PolyMet's laboratory methods); Ex. 205.01 (describing advances in laboratory testing); Ex. 206 at 10:3-8, 14:1-21 (Benson); Ex. 206.03 (cation exchange in weak solutions); Tr. Vol. 5 at 14:21-24 (Benson) (describing long-term field research showing degradation).
[27] Ex. 206 at 25:9-12 (Benson) (citing Ex. 206.05; Ex. 206.09); Tr. Vol. 5 at 12:17-13:7 (Benson).
[28] Ex. 200 at 24:19-22 (Malusis); Ex. 202 at 33:22-34:5 (Kuipers).
[29] Ex. 206 at 25:6-9, 25:17-26:5 (Benson).
[30] Ex. 204 at 6:17-7:5 (Thyne). This calculation eliminates pore spaces. *Id. See also* Ex. 200 at 10:15-22 (Malusis).

water percolation will occur, causing reactions. Finally, the bentonite amendment would allow *at least* 298 million gallons of seepage per year from FTB.[31] As explained below, these facts show that even if the bentonite amendment could be perfectly applied and would not degrade, it would not be a " 'practical and workable' reclamation technique that will satisfy the DNR's reactive waste rule," *NorthMet*, 959 N.W.2d at 754; *see* Minn. Stat. § 93.481, subd. 2; Minn. R. 6132.2200.

ARGUMENT

The "bentonite amendment is 'practical and workable' if it is likely to achieve what is intended in the real-world situation contemplated for the NorthMet Project's tailings Basin."[32] The ALJ correctly found that the bentonite amendment would not be a practical and workable technique to ensure compliance with the reactive mine waste rule.[33] This would be true even if the bentonite performed as PolyMet claims. However, the evidence further shows that it would not. PolyMet's inapplicable examples only reinforce that the proposed bentonite amendment is untested and unverified.

I. The Bentonite Amendment Would Not Be a Practical and Workable Technique to Achieve Compliance with the Reactive Mine Waste Rule.

The ALJ correctly interpreted the reactive mine waste rule in accordance with the rule's plain meaning.[34] In considering the rule's meaning, this Designee should not afford any special deference to the Hearing Team, especially because the Hearing Team's arguments conflict with DNR's interpretation expressed in rulemaking. *J.D. Donovan, Inc. v. Minn. Dep't of Transp.*, 878 N.W.2d 1, 5 n.7 (Minn. 2016).

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[31] OAH Record, Findings of Fact, Conclusions of Law, and Recommendation ("ALJ Report"), at p. 42.
[32] *Id.* at pp. 31, 39.
[33] *Id.* at pp. 31.
[34] Other Petitioners provide additional explanation of these rules and responses to arguments raised by Respondents. COs agree with their analyses and limit the discussion here to avoid duplication.

The reactive mine waste rule provides three options for compliance: (1) modifying the reactive properties of the waste; (2) storing the waste so it does not interact with the constituents that cause it to react; or (3) preventing substantially all water from moving through or over the waste, and collecting and treating residual waters. Minn. R. 6132.2200, subp. 2. PolyMet does not plan to modify the waste itself, leaving the latter two options.

A. Subpart 2(B)(1): The Bentonite Amendment Would Not Store the Flotation Tailings in an Environment "Such that the Waste Is No Longer Reactive."

Subpart 2(B)(1) of the rule allows for a design that would "modify the physical or chemical characteristics of the mine waste, or store it in an environment, such that the waste is no longer reactive." Minn. R. 6132.2200, subp. 2(B)(1).

Mine waste is determined "reactive" based on the chemical and physical properties of the waste. Minn. Rs. 6132.0100, subp. 28, .1000, subp. 2. A natural reading of Subpart 2(B)(1) is that those reactive properties determine (1) what modifications should be made to the waste or (2) what constituents should be prevented from contacting the waste. Here, the flotation tailings would react when interacting with oxygen.[35] Accordingly, under Subpart 2(B)(1), PolyMet could either (1) directly modify the characteristics of the tailings or (2) isolate the tailings from oxygen so that their reactive properties do not manifest.

Respondents offer interpretations that are much less straightforward. The Hearing Team argues that mine waste is no longer "reactive" if modeling shows that the facility design would not violate water quality standards.[36] This interpretation overlooks the reference to "characterization studies" in the definition of "reactive mine waste," Minn. R. 6132.0100, subp. 28, and skips over to the phrase "unacceptable impacts" in the definition of "adversely impact natural resources," *id.* subp. 3. It also contradicts what DNR said

[35] Ex. 200 at 7:4-5 (Malusis).

[36] DNR Exceptions, at 15 (arguing that Subpart 2(B)(1) would be satisfied because PolyMet's modeling indicates that water quality standards would be met outside the tailings basin).

during rulemaking, which is that Subpart 2(B)(1) was intended "to prevent the *formation* of unacceptable substances."[37] The option to control reactivity via the storage environment would accomplish this by "changing the environment in which the chemical finds itself" so it "is unable to react because it doesn't have any other oxygen source."[38]

Respondents also rely on a proposed seepage capture system that would surround the FTB.[39] The efficacy of that system is disputed, and because Respondents sought to exclude that issue from this hearing, it would be fundamentally unfair to rely on any evidence regarding seepage capture.[40] *See* Minn. Stat. § 93.483, subd. 5 (requiring hearing to be conducted in accordance with due process and fundamental fairness.) Even so, collection of seepage *from the waste* is not storage *of the waste*. The plain meaning of "store" is "to leave or deposit in a . . . place for keeping, preservation, or disposal."[41] The seepage capture system would not store the *waste* at all. Rather, it is intended to capture the polluted water that seeps out the bottom of the FTB and send it to the tailings processing plant or to treatment.[42]

PolyMet claims that use of the word "environment" in Subpart 2(B)(1) means that other systems in and around the FTB can be considered in determining whether the waste itself is reactive.[43] This argument requires splitting the words of the rule apart so that they lose their context. The full phrase is "stored in an environment, such that the waste is no longer reactive." Minn. R. 6132.2200, subp. 2(B)(1). This context shows that

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[37] Ex. 336, R.0730374.
[38] Ex. 107, R.0234395.
[39] PolyMet Exceptions, at 29; DNR Exceptions, at 12-13.
[40] *See* OAH Record, Memorandum in Support of Motion to Include Evidence, at p. 14665; Amended Notice and Order for Hearing, at pp. 14345, 14349; Petitioners' Joint Memorandum in Support of Motion to Nullify or Vacate the Amended Order, at pp. 14123-46.
[41] *Webster's Third New Int'l Dictionary* 2252 (2002).
[42] Ex. 210, R.0065583-84.
[43] PolyMet Exceptions, at 29.

"environment" here refers to conditions of the storage location.[44] The chemical environment of the storage location is what causes the waste to react or not react.[45]

It is undisputed that the bentonite amendment would allow oxygen diffusion into the tailings. Accordingly, PolyMet's proposal would not comply with Subpart 2(B)(1).

B. The Denied, Reversed, And Remanded Water-Quality Permits Demonstrate that the Hearing Team's Interpretation of the Rule Is Not Viable.

By relying on modeled compliance with water quality standards, the Hearing Team conflates its jurisdiction with that of other agencies and steps out of DNR's area of expertise. COs maintain that DNR must protect *all* natural resources, as directed by the Legislature and DNR's own rules. Minn. Stat. § 93.47; Minn. Rs. 6132.0100, subp. 21 (defining "natural resources), .2200, subp. 1. DNR may not, and should not, issue permits solely based on standards charged to another agency.

Nonetheless, the bentonite amendment fails even the Hearing Team's flawed interpretation. After the parties filed posthearing briefs offering their interpretations of the rule, federal and state water permits were struck down based on predicted violations of water quality standards.[46] Among other rulings, the Minnesota Supreme Court conclusively decided that FTB seepage would violate a groundwater standard. *In re Denial of Contested Case Hearing Requests*, 993 N.W.2d 627, 664-65 (Minn. 2023). The Hearing Team claims that the violation of this standard would be "acceptable" due to the seepage capture

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[44] *See Webster's* at 760 (defining environment as "the surrounding conditions, influences, or forces that influence or modify").
[45] Ex. 107, R.0234395.
[46] OAH Record, ALJ Report, at pp. 39-44. *See also* OAH Record, Army Corps Decision, at p. 1276. The Fond du Lac Band of Lake Superior Chippewa explains the meaning and impact of the denial of the federal permit in their brief, and both the Band and WaterLegacy discuss the Minnesota Supreme Court's remand of PolyMet's state surface water permit. COs agree with their analyses and will not expound on the same points here.

system.[47] But the supreme court specifically held that the seepage capture system would *not* assure compliance with the groundwater rule, even if the system works as PolyMet claims. 993 N.W.2d at 664-65. This decision was based on the language of the rule, which was promulgated pursuant to MPCA's groundwater expertise in notice-and-comment rulemaking.[48] *Id.*; Minn. R. 7060.0600, subpart 2 (groundwater rule). *See also* Minn. R. 7060.0200 ("[U]nderground water constitutes a natural resource of immeasurable value which must be protected as nearly as possible in its natural condition.").

These recent decisions demonstrate that, even accepting the Hearing Team's erroneous interpretation, the bentonite amendment would not ensure compliance with Subpart 2(B)(1). The ALJ correctly found, based on the hearing record, that the bentonite plan could not comply with Subpart 2(B)(1) even under Respondents' narrow view of what is required.[49]

C. Subpart 2(B)(2): The Bentonite Amendment Would Not Prevent "Substantially All Water" From Moving Through Or Over the Mine Waste, And It Would Not Preclude All But "Residual Waters" From Seeping "From the Mine Waste."

Where it is not possible to prevent reactions from occurring, the reactive mine waste rule provides another option.[50] Subpart 2(B)(2) would require PolyMet to:

> during construction to the extent practicable, and at closure, *permanently prevent substantially all water* from moving through or over the mine waste and provide for the collection and disposal of *any* remaining *residual waters* that drain *from the mine waste* in compliance with federal and state standards.

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[47] DNR Exceptions, at 20-21.

[48] The court did not analyze whether the seepage capture system would work as expected or how much of the seepage would be collected by the system, as those issues were not necessary to the court's decision. *See* 993 N.W.2d at 664-65 (stating that it was undisputed that there would be polluted water in the containment systems, and therefore the permit would not comply with the standard). Those issues remain disputed.

[49] OAH Record, ALJ Report, at pp. 40-42.

[50] Ex. 336, R.0730374 (rulemaking SONAR).

Minn. R. 6132.2200, subp. 2(B)(2) (emphasis added).

The ALJ found that the bentonite amendment would allow 298 million gallons of water to move "through and over" the mine waste every year.[51] In fact, it would be more accurate to say that this is the amount of water that would drain "from the mine waste." More would move "through and over" the waste from precipitation and runoff over exposed tailings[52] and water circulating within the basin. Either way, the record shows that the bentonite would not be sufficient to ensure compliance with Subpart 2(B)(2).[53]

The Hearing Team argues that the meaning of "substantially all" should be guided by tax cases.[54] But "substantially all" has a special meaning in tax law, which was developed through rulemaking. *Cont'l Can Co., Inc. v. Chicago Truck Drivers, Helpers & Warehouse Workers Union (Indep.) Pension Fund*, 916 F.2d 1154, 1158 (7th Cir. 1990). None of the cases cited by Respondents consider the plain meaning of "substantially all."

In Subpart 2(B)(2), the word "substantially" modifies the word "all," which means "the complete amount" or "the whole."[55] Effect must also be given to the rule's second directive: to collect and dispose of "any remaining residual waters that drain from the mine waste." Minn. R. 6132.2200, subd. 2(B)(2). The word "residual" means "remaining after most of something has gone."[56] When referring to liquid or substances, "residue" is

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[51] OAH Record, ALJ Report, at p. 42.

[52] As explained below in the exceptions portion of this brief, flotation tailings themselves will cover the bentonite on the beaches to protect the bentonite from degrading, which means that 427 acres of flotation tailings will be exposed to precipitation.

[53] Other Petitioners explain the record evidence supporting this determination in detail. COs agree with their analyses and will not repeat the same points here.

[54] DNR Exceptions, at 24-30.

[55] "All," *Cambridge Dictionary*, https://dictionary.cambridge.org/us/dictionary/english/all. *See also Webster's* at 54 ("the whole amount or quantity of").

[56] "Residual," *Cambridge Dictionary*, https://dictionary.cambridge.org/us/dictionary/english/residual. *See also Webster's* at 1931 ("of, relating, or constituting a residue").

commonly used to refer to trace amounts.[57] *See e.g.*, *State v. Rodgers*, No. C8-01-1864, 2002 WL 31013685, at *1 (Minn. App. Sept. 10, 2002). This means that only a slight amount of water may eventually seep out "from" the mine waste. Hundreds of millions of gallons per year could not be considered a "residual" amount of water.

Because undisputed facts in the record establish that the bentonite would not prevent "substantially all" water from moving through or over the mine waste, this Designee should adopt ALJ's finding and conclusion that the bentonite amendment would not ensure compliance with Subpart 2(B)(2).[58] This conclusion could be bolstered by observing that 298 million gallons of water cannot be considered "residual."

D. The ALJ Was Required to Consider the Rule's Meaning.

PolyMet claims that the ALJ should not have considered the requirements of the reactive mine waste rule at all.[59] But the supreme court specifically ordered this hearing on the issue of whether the bentonite amendment would be a practical and workable technique to achieve compliance with the rule. *NorthMet*, 959 N.W.2d at 754. That cannot be done without considering what the rule requires.

PolyMet argues that the permit-to-mine statute does not allow for making legal conclusions in a contested case.[60] But the cited provision governs the issue of *whether* to grant a hearing in the first place. Minn. Stat. § 93.483, subd. 3; *NorthMet*, 959 N.W.2d at 745. Once a hearing is granted, it "must be conducted in accordance with sections 14.57 to 14.62." Minn. Stat. § 93.483, subd. 5. Those statutes require the ALJ and agency decisionmaker to issue both "findings" and "conclusions." Minn. Stat. § 14.62, subd. 1.[61]

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[57] *See id.* (providing an example: "The scanner checks travel documents for residual traces of explosives.").
[58] OAH Record, ALJ Report, at pp. 42-44.
[59] PolyMet Exceptions, at 21.
[60] *Id.*
[61] The case PolyMet cites also involved the threshold issue of whether the petitioners were

PolyMet also argues that the reactive mine waste rule is only relevant to whether the proposal "complies with lawful requirements."[62] But multiple "lawful requirements" apply to any mining permit, including those of other agencies or jurisdictions. Determining whether a technique is practical and workable to meet reclamation standards does not render any portion of the statute ineffective.

In ordering this contested case, the supreme court offered PolyMet and the Hearing Team an opportunity to produce evidence showing that the bentonite amendment would achieve compliance with the reactive mine waste rule, even as Petitioners produced evidence that it would not. *See* 959 N.W.2d at 754. PolyMet cannot now complain that the ALJ evaluated the evidence in light of the rule's requirements.

II. The Bentonite Proposal Is Unlikely to Achieve PolyMet's Hydraulic Conductivity And Saturation Goals.

PolyMet and the Hearing Team claim that that it is sufficient for the bentonite amendment to "reduce" oxygen and water infiltration into the tailings.[63] The bentonite amendment would not be a practical and workable method to achieve these goals either. In this hearing, independent expert testimony supported by peer-reviewed research demonstrated that the bentonite amendment would fail, invalidating the assumptions in PolyMet's modeling.

The evidence brought forth by PolyMet and cited by the ALJ includes advertising materials and examples of bentonite use in completely different contexts. The advertising materials and examples provided by PolyMet would support a finding that bentonite is an "available technology"—a separate prong of the permit-to-mine statute. *See* Minn. Stat. § 93.481, subd. 2. The ALJ's findings on PolyMet's examples should be reviewed in light of

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entitled to a contested-case hearing in the first instance. *In re Max Schwartzman & Sons, Inc.*, 670 N.W.2d 746, 757 (Minn. App. 2003). Additionally, the discussion there was dicta, as the petition was untimely filed. *See id.*

[62] PolyMet Exceptions, at 22-23.

[63] *See id.* at 14; DNR Exceptions, at 2.

that distinction.

A. Evidence that Bentonite Has Been Used in Different Contexts Shows that the Bentonite Is an "Available Technology."

The permit-to-mine statute contains two distinct prongs relevant here: (1) the bentonite must be an "available technology," *NorthMet*, 959 N.W.2d at 752-53, and (2) the bentonite must be a " 'practical and workable' reclamation technique," *id.* at 753. The supreme court distinguished these two phrases, concluding that a technology is "available" if it "exists and is ready for use." *Id.* at 752 n.17. Because the record showed that " 'bentonite *has been used* for many years in a variety of applications,' including mine tailings facilities," the court concluded that "bentonite, as a technology, exists and is commonly used as a barrier for reducing oxygen and water infiltration." *Id.* at 752-53 (emphasis added).

The court then turned to the "practical and workable" prong. Although bentonite is "available" and "commonly used," there was no evidence that "the bentonite amendment *proposed by PolyMet*" (1) had ever "been tested" or (2) would be "effective." *Id.* at 753 (emphasis added). The court rejected conclusory statements in the record that were not supported by studies. *Id.* The court also rejected reliance on special conditions that required post-construction testing, holding that future testing is not substantial evidence. *Id.* at 754.

B. Petitioners' Evidence Shows that this Bentonite Amendment Would Not Be "Practical And Workable," Whereas PolyMet's Examples Show that Bentonite Is an "Available Technology."

The court emphasized the uniqueness of the bentonite amendment "proposed by PolyMet." *Id.* at 753-54. This is because DNR consultants identified the proposal as unprecedented. *See id.* at 753. The hearing confirmed this fact.[64] There are no known

[64] *See, e.g.*, Tr. Vol. 5 at 12:2-14:4 (Benson); Ex. 202 at 23:22-24 (Kuipers); Ex. 200 at 37:8-9 (Malusis).

examples of a cover system in which bentonite is mixed with mine tailings.[65] PolyMet additionally plans to mix bentonite directly into the host material on-site, an approach that is novel and not supported by literature.[66] These and other factors complicate PolyMet's proposal, creating uncertainty that compels testing before the bentonite amendment could be approved.[67]

The scientific literature available on bentonite casts serious doubt on PolyMet's proposal. That research shows that PolyMet's application methods would leave defects and that the bentonite would degrade over time. Petitioners presented expert testimony at the hearing explaining this research and applying it to predicted site conditions.[68] Their analyses demonstrated that the bentonite amendment here would fail.

By contrast, PolyMet presented more of the same evidence that bentonite is an "available technology." PolyMet offers examples of bentonite applications at a much smaller scale, without the complications that experts have identified in PolyMet's proposal, and without specification as to the degree of saturation or hydraulic conductivity achieved. None of PolyMet's examples were reviewed for the long-term degradation issues identified here, and none of them establish that this bentonite amendment would be effective.[69]

C. Some Findings Merely Demonstrate an "Available Technology."

Based on PolyMet's evidence, the ALJ made some findings stating that bentonite has been used in other applications. Not all of these findings are erroneous per se, if taken

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[65] *See* Tr. Vol. 2 at 131:18-132:1 (Hull) (naming only the Whistle Mine as an example); Ex. 206 at 28:16 (Benson) (stating that Whistle Mine, or "Song and Yanful," study involved a "sand-bentonite barrier"); Ex. 206.15 (Song & Yanful); Tr. Vol. 4 at 7:2-8 (Kuipers) (noting no other known examples in hard rock mining); Ex. 66.14 (listing examples and saying that none of them involved blending bentonite directly into tailings).
[66] Ex. 238, R.0735831; Ex. 244, R.0720854; Ex. 202 at 28:19-14 (Kuipers).
[67] Ex. 200 at 25:11-17 (Malusis); Ex. 202 at 28:2-3 (Kuipers); *see* Ex. 103 at 5:16-6:17 (Engstrom) (describing conditions that should be tested).
[68] *See, e.g.*, Ex. 200 at 17:15-18:16 (Malusis); Tr. Vol. 5 at 119:9-120:15 (Benson).
[69] *See* Ex. 104 at 8:16-9:4 (Ulrich).

for the simple proposition that bentonite is "available." But in applying the "practical and workable" standard to any of the evidence, it is important to keep in mind that evidence showing bentonite "has been used" (i.e., "available") does not, by itself, show that bentonite has been *successful* in a similar application (i.e., "practical and workable").

FOF 17, 18, 40-42, 45, 46, 53, 73, and 74 are based on such evidence. At most, these findings stand for the proposition that bentonite has been used in some construction applications and is an "available technology." They do not demonstrate that a uniform, large-scale bentonite amendment of reactive tailings has been accomplished, let alone that such a proposal would be effective for centuries. And they do not demonstrate compliance with the rule.

The record shows that the bentonite amendment still has not been tested and that there has never been a similar bentonite amendment. This evidence reinforces the ALJ's finding that the bentonite proposal would not be a practical and workable reclamation technique.[70]

Additionally, a growing body of research on other types of bentonite covers demonstrates that PolyMet's proposed bentonite amendment is likely to fail. That research only further compels the conclusion that the bentonite amendment cannot be approved. The ALJ's findings did not fully account for the record evidence on that research, and those findings should be corrected.

EXCEPTIONS

The evidence shows that the bentonite amendment would not comply with the reactive mine waste rule, and no analysis under the subissues in the Amended Order for Hearing can change that fact. Even so, Petitioners presented compelling evidence under each of the subissues that reinforces the bentonite amendment's failure as a reclamation technique. Some of the ALJ's findings overlooked this evidence and testimony. This

[70] OAH Record, ALJ Report, at pp. 9, 31.

Designee should address Petitioners' evidence and correct the findings.

I. Some ALJ Findings Do Not Meet Evidentiary Standards.

A. Conflicting Testimony Must Be Addressed.

For findings to be legally sufficient in a contested case, the ALJ must (1) "make [] express credibility determination[s]," (2) "set forth the inconsistencies in the record," (3) "demonstrate that all relevant evidence was considered and evaluated," and (4) "detail the reasons for discrediting pertinent testimony." *Carter v. Olmsted Cnty. Hous. & Redevelopment Auth.*, 574 N.W.2d 725, 729-30 (Minn. App. 1998). This Designee should modify or add to findings that fail to discuss Petitioners' testimony and evidence.

B. Expert Testimony Should Be Given More Weight When It Is Supported By the Record And Less Weight When a Witness May Financially Benefit From the Outcome.

When resolving conflicts between testimony, the factfinder should evaluate the quality of the testimony and weigh the credibility of witnesses. Expert testimony is unreliable and lacks foundation when "(1) the opinion does not include the facts and/or data upon which the expert relied in forming the opinion, (2) it does not explain the basis for the opinion, or (3) the facts assumed by the expert in rendering an opinion are not supported by the evidence." *Kedrowski v. Lycoming Engines*, 933 N.W.2d 45, 56 (Minn. 2019). Some of the testimony the ALJ cited was conclusory and lacked foundation. Such testimony should not be credited.

To assess credibility, the factfinder should consider whether a witness will experience gain or loss if the case is decided a certain way and whether the testimony is reasonable compared with other evidence. *Ywswf v. Teleplan Wireless Servs., Inc.*, 726 N.W.2d 525, 533 (Minn. App. 2007). Here, PolyMet's witnesses are under contract for the NorthMet project and would experience financial gain if the permit were granted.[71] And

[71] Tr. Vol. 1 at 83:3-7 (Radue); Tr. Vol. 2 at 146:16-147:9, 191:12-21 (Hull); Tr. Vol. 3 at 47:4-10 (Diedrich); Tr. Vol. 3 at 119:19-23 (Donahue).

the Hearing Team's witnesses are not entitled to any deference, as they participated in the context of litigation. *In re Excess Surplus Status of Blue Cross & Blue Shield of Minn.*, 624 N.W.2d 264, 278 (Minn. 2001). This Designee should also consider the qualifications, expertise, and background of all witnesses, which are described in Joint Petitioners' Findings of Fact ("JPFOF") ¶¶ 76-94.[72]

C. PolyMet Bears the Burden of Proof.

There is currently no permit to mine. Because PolyMet is "[t]he party proposing that certain action be taken"—approval of the bentonite plan—PolyMet bears the burden of proof in this proceeding. *See* Minn. R. 1400.7300, subd. 5. Accordingly, Cos request modification of **Conclusion 4**, which makes an error of law in stating that Petitioners bear the burden of proof.[73]

II. Subissue 1: The Bentonite Amendment Is Ineffectively Designed, And PolyMet Would Not Achieve a Uniform Mixture.

The problems with the proposed bentonite amendment begin with its application to the FTB. PolyMet proposes novel construction methods including mixing bentonite directly into the flotation tailings on site, rather than incorporating the materials under controlled conditions.[74] PolyMet would also attempt to achieve uniform distribution over 905 acres using blind installation through a water column.[75] These methods are not supported by literature or experience.[76] Overall, the evidence shows that PolyMet's application methods would not ensure an effective or long-lasting bentonite amendment.

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[72] OAH Record, Petitioners' Joint Proposed Findings, at pp. 1556-60.
[73] A more detailed analysis is presented in other Petitioners' briefs. *See also* OAH Record, Petitioners' Joint Prehearing Statement, at pp. 14848-49.
[74] Ex. 200 at 15:23-18:16 (Malusis); Ex. 202 at 28:19-29:10 (Kuipers); Ex. 206 at 29:20-30:18 (Benson); Tr. Vol. 4 at 7:2-8 (Kuipers). *See also* Ex. 244, R.0720854.
[75] Ex. 206 at 32:1-12 (Benson); Ex. 74 at 9:133-135 (Radue) (describing pond); Tr. Vol. 2 at 69:2-5 (Radue).
[76] Ex. 200 at 22:9-12, 24:7-8, 25:11-12 (Malusis); Ex. 202 at 22:12-24:4, 24:8-11 (Kuipers); Ex. 206 at 31:18-22 (Benson).

A. Exposed Flotation Tailings Would Cover the Bentonite on the Beaches.

First, the ALJ overlooked an issue raised by Cos.[77] An inherent challenge of using bentonite is that it degrades when exposed to natural forces.[78] In an attempt to protect the bentonite, PolyMet would cover the bentonite itself with tailings.[79] There is a significant flaw in this design—the cover for the beach amendment would consist of the *flotation tailings* themselves.[80] This means that close to one million cubic yards of reactive mine waste, covering 427 acres, would be exposed to air and water.[81] These tailings would continue to react and generate pollutants.[82] They would neither be "stored" so that they are "no longer reactive" pursuant to Subdivision 2(B)(1), nor protected from "substantially all water," pursuant to Subdivision 2(B)(2).

The ALJ did not address the exposed flotation tailings on the beaches. Because a cover is required for a bentonite layer, this is a material issue to whether the bentonite amendment is a practical and workable method to achieve compliance with the reactive mine waste rule. Accordingly, COs recommend adopting Petitioners' Joint Proposed Findings of Fact ("PJFOF") 145-49.[83]

B. In-Situ Mixing Would Create Gaps in the Bentonite Layer, on Both the Sides And the Beaches.

The ALJ also erroneously stated that the bentonite amendment to the dam sides was

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[77] OAH Record, Posthearing Brief of Conservation Organizations, at pp. 1618-19.
[78] Ex. 233, R.0735746 ("Most earthen layers used in covers tend to become damaged over relatively short time frames unless they are covered with a geomembrane or are very deep (meters)."); Ex. 234, R.0735738 ("Barr had a layer of tailings above the bentonite amended soil in their schematics to keep this soil damp (prevent desiccation cracking) and avoid root penetration.").
[79] As discussed below under Subissue 5, a thirty-inch cover would not be adequate to protect the bentonite from degradation. However, it is undisputed that a cover is necessary.
[80] Ex. 200 at 10:15-16 (Malusis); Ex. 204 at 6:17-7:5 (Thyne).
[81] Ex. 204 at 6:23-7:5 (Thyne). This calculation eliminates pore spaces. *Id.*
[82] *Id*. at 7:4-5.
[83] OAH Record, Petitioners Joint Proposed Findings of Fact, at pp. 1567-68.

undisputed.[84] Due to their potential for oxygen diffusion and water infiltration,[85] the dam sides are potentially a "primary source of key pollutant load."[86] Bentonite was proposed to address these reactions and resulting pollutants.[87] But DNR staff and external experts were skeptical that a uniform bentonite mixture could be achieved on either the sides or the beaches.[88]

Uniform mixing of bentonite into the host material is essential to achieve its goal of reducing hydraulic conductivity, or permeability to water.[89] When bentonite is unevenly applied, "windows" form where there is little or no bentonite coverage.[90] This was one of the problems identified at the Whistle Mine, where researchers were unable to achieve a uniform sand-bentonite mixture across the site in field trials.[91] The bentonite proposal for the Whistle Mine was abandoned because its effectiveness could not be confirmed.[92]

Dr. Michael Malusis, a professor of civil and environmental engineering,[93] testified that PolyMet's proposed "in-situ" methods (i.e., mixing bentonite in the field rather than mixing before application) have been shown to yield an uneven application of bentonite.[94] His testimony is supported by peer-reviewed studies in the record.[95] Mr. Kuipers, an engineer with over 40 years of experience constructing and evaluating tailings storage

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[84] OAH Record, ALJ Report, at p. 16, FOF 33.
[85] Ex. 229, R.0744198.
[86] Ex. 239, R.0744208.
[87] *See id*. at R.0744200-02.
[88] Ex. 261; Ex. 233, R. 0735744; Ex. 236, R. 0735791.
[89] Ex. 200.20, at 65; Ex. 244, R.0720855 ("A key question is whether the bentonite can be applied with sufficiently uniform mixing to achieve the oxygen diffusion and water infiltration reductions predicted and at sufficient depth to protect it . . . .").
[90] Ex. 200 at 18:3-4 (Malusis).
[91] *Id*. at 17:7-13 (Malusis). *See also* Ex. 200.06; Ex. 200.24.
[92] Ex. 202 at 24:8-25:8 (Kuipers).
[93] Ex. 200 at 1:10-2:14 (Malusis); Ex. 200.01.
[94] Ex. 200 at 15:23-16:17, 20:8-10 (Malusis).
[95] Ex. 200.05; Ex. 200.06; Ex. 200.07; Ex. 200.11; Ex. 200.24; Ex. 276, R.0266950.

facilities,[96] testified that pilot testing is needed to determine whether the mixing methods to the sides would be effective.[97]

Yet, **FOF 33** erroneously states that "there are no major challenges regarding this application" because the "dam sides are to be amended with bentonite using conventional construction techniques on easily accessible, dry surfaces."[98] This finding mischaracterizes the testimony and the issues raised.[99] It also overlooks testimony and evidence that uniform mixing *failed* at the Whistle Mine. Instead, this FOF relies on bare conclusions in PolyMet's testimony that lacked any support or analysis.[100] This finding should be rejected.

FOF 34 erroneously states: "Bentonite has been used in a variety of applications similar to the proposed dam side application for the NorthMet Project."[101] This finding should be rejected because it is unsupported, contrary to evidence in the record, and overlooks conflicting testimony. The ALJ relied on testimony by Mr. Hull of Aquablok,[102] the company that sells a bentonite product PolyMet may use on the pond bottom.[103] Mr. Hull stated generally that bentonite products "have been successfully used" in water control

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[96] Ex. 202 at 1:1-5:2 (Kuipers); Ex. 202.01.
[97] Ex. 202 at 28:1-30:2 (Kuipers).
[98] OAH Record, ALJ Report, at p. 16.
[99] The ALJ's sole citation to Petitioners' testimony refers to a statement by Kuipers that the side slopes would be *less* problematic than the beaches. Kuipers also testified that pilot testing would be needed to validate the mixing methods, but the ALJ did not consider that testimony. Ex. 202 at 28:2-8 (Kuipers).
[100] Mr. Radue's cited testimony merely states what PolyMet plans to do and claims these are "standard construction processes" without explanation. Ex. 74 at 27:406-16 (Radue). Mr. Ulrich claimed that the application is "straightforward" without providing any analysis or support, then inaccurately said that "Petitioners' witnesses seem to agree." Ex. 104 at 3:18-4:4 (Ulrich). Petitioners' referenced testimony actually said that a detailed assessment was impossible because PolyMet's construction specifications are unknown, and that the performance of the constructed bentonite layer would be "questionable." Ex. 200 at 15:5-10 (Malusis); Ex. 202 at 28:1-30:2 (Kuipers).
[101] OAH Record, ALJ Report, at p. 16.
[102] Tr. Vol. 2 at 123:10-12, 191:12-21 (Hull).
[103] *Id.* at 54:6 (Radue); *id*. at 123:10-12 (Hull).

structures, including in landfills and "applications similar to the proposed use," without providing specific information about those projects.[104] The exhibits cited by the ALJ and Mr. Hull are advertising materials for Mr. Hull's patented Aquablok.[105]

On cross-examination, Mr. Hull could not provide details about his examples.[106] The only example he could cite in which bentonite had been mixed in-situ with tailings was the Whistle Mine[107]—where the bentonite amendment was abandoned following unsuccessful trials.[108]

The ALJ ultimately did not make specific findings addressing whether uniform mixing could be accomplished on the dam sides using the in-situ methods PolyMet proposes. COs respectfully refer this Designee to JPFOF ¶¶ 164-74 for recommended findings supported by the record.[109]

C. Uniform Mixing Would Be Even Less Achievable on the Beaches.

PolyMet would face even greater challenges achieving uniform mixing with on the beaches, because the flotation tailings there would contain finer silts, clays, and slimes.[110] Additionally, the higher moisture content of the beaches would make it difficult, and potentially unsafe, to access with the heavy equipment that PolyMet is considering for the bentonite application.[111]

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[104] Ex. 76 at 26:438-43 (Hull).
[105] Ex. 17; Ex. 76 at 27:462-68 (Hull) (citing Ex. 42.17 as support); Ex. 42.17.
[106] Tr. Vol. 2 at 131:7-15 (Hull).
[107] *Id*. at 131:18-132:1 (Hull).
[108] Ex. 200 at 17:7-16 (Malusis); Ex. 200.06 at 496; Ex. 200.24, R.0735855; Ex. 202 at 25:6-8 (Kuipers).
[109] OAH Record, Petitioners Joint Proposed Findings of Fact, at pp. 1570-71.
[110] Ex. 202 at 29:16-30:2 (Kuipers); Ex. 203 at 4:17-5:4 (Kuipers) (quoting Ex. 38); Ex. 244, R.0720855 (noting that "this could be the most difficult area").
[111] Ex. 203 at 13:23-28 (Kuipers) (discussing equipment shown in Ex. 19). *See also* Ex. 202 at 31:11-18 (Kuipers); Tr. Vol. 1 at 69:17-25 (Radue). Mr. Kuipers also testified that PolyMet's proposal to "peel back" the top thirty inches of flotation tailings before placing the bentonite would be complicated by the presence of water at the shallow edge of the pond. Ex. 202 at 31:7-11 (Kuipers).

PolyMet has not decided what equipment it proposes to use.[112] However, none of the equipment PolyMet has identified would be capable of accomplishing a uniform mixture.[113] Use of that equipment to create a barrier layer is unsupported by industry and government guidance, or even product materials.[114] Mr. Kuipers had never seen this equipment used to successfully achieve mixing or create an effective barrier.[115]

The record contains no examples of a beach amendment at a hard rock mining facility.[116] Mr. Ulrich, a geotechnical engineer who consulted with DNR during environmental review, testified: "PolyMet has not offered real-world examples of bentonite being applied to tailings beaches."[117] Mr. Radue, PolyMet's project engineer, admitted he was unaware of any examples in which bentonite was applied to a material with the moisture content of the beaches.[118] Given the lack of specifications, testing, and real-world examples, any finding that a uniform bentonite amendment could be safely accomplished on the 427-acre beaches would be based on speculation.

FOF 53 states: "There are real-world examples of bentonite being applied to moist soils to reduce seepage and help retain water."[119] The cited testimony discusses a city park with "very moist soils" and "kind of a regular surface"[120] and mentions a sediment capping project.[121] Mr. Hull did not provide project specifications or evidence of effectiveness, and

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[112] Ex. 104 at 4:18-22 (Ulrich).
[113] Ex. 203 at 13:23-28 (Kuipers) (discussing equipment shown in PolyMet's Ex. 19).
[114] Ex. 202 at 29:8-14 (Kuipers); *see* Ex. 202.12 ("MudMaster" description cited by Kuipers).
[115] Ex. 202 at 28:19-29:10 (Kuipers).
[116] Tr. Vol. 4 at 7:2-8 (Kuipers).
[117] Ex. 104 at 4:21-5:2 (Ulrich).
[118] Tr. Vol. 1 at 70:1-4 (Radue).
[119] OAH Record, ALJ Report, at p. 19.
[120] *Id.* n.72; Tr. Vol. 2 at 188:12-14 (Hull); Ex. 76 at 21: 347-54 (Hull).
[121] OAH Record, ALJ Report, at p. 19, n.72; Tr. Vol. 2 at 132:12-24 (Hull); Ex. 42.09-10. *See also* Ex. 350, at 3, 4 (photographs of park project).

he admitted that these projects were much smaller applications than the FTB.[122] Even so, these small-scale examples do not demonstrate a uniform bentonite amendment can be achieved on the 427-acre FTB beaches. The examples do not support a practical-and-workable finding.

FOF 54 incorrectly states: "Engineers have worked to apply bentonite in more challenging conditions" than the proposed beaches, "including at coal ash facilities."[123] The cited examples do not even involve bentonite, no details about the cited facilities were provided, and there is no demonstration that a uniform mixture was achieved.[124] The only record evidence concerning the project consists of images showing equipment and mud.[125] Mr. Radue admitted that he knew of no examples of bentonite applied to a material with the moisture content of the beaches.[126] FOF 54 should be rejected.

FOF 55 erroneously states: "To the extent that the bentonite layer is not uniformly applied to the beaches, PolyMet can address this issue by making multiple passes in different directions."[127] But the cited testimony does not support this finding. Mr. Ulrich testified that bentonite performance "*might be improved*" with multiple passes.[128] And multiple passes would not address the issues raised by Mr. Kuipers, who questioned whether this technique could be even accomplished on the beaches.[129] Because this finding is unsupported and relies on speculation, it should be rejected.

Petitioners presented detailed testimony explaining that uniform mixing is essential to bentonite's effectiveness and that conditions on the beaches would make application

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[122] Tr. Vol. 2 at 133:1-4.
[123] OAH Record, ALJ Report, at 19.
[124] Tr. Vol. 2 at 7:22-8:20 (Radue).
[125] Ex. 68; Ex. 69.
[126] Tr. Vol. 1 at 70:1-4 (Radue).
[127] OAH Record, ALJ Report, at 19.
[128] Ex. 104 at 5:4-8 (Ulrich) (emphasis added).
[129] Tr. Vol. 4 at 26:8-28:5 (Kuipers).

more difficult. PolyMet provided only vague anecdotes, conclusory statements of "confidence," and promises to test later. PJFOF 156-163 accurately summarizes the testimony regarding the beaches.[130]

II. The Pond-Bottom Application Methods Would Leave Defects.

The permit-to-mine application described different methods for applying bentonite to the 905-acre pond through its eight-foot water column.[131] PolyMet's preferred method is to broadcast Aquablok from a remote-controlled barge.[132] PolyMet claims that it can achieve a uniform layer of bentonite two to three inches thick using this method.[133]

Dr. Benson, an engineer and professor who has published hundreds of papers on waste covers and liners including soil-bentonite amendments,[134] testified that an effective liner requires "extreme care and constant visual inspection during construction,"[135] and it is "almost impossible" to achieve subaqueous deposition without defects.[136] PolyMet's proposed application methods are unsupported by studies or field-scale demonstrations.[137]

PolyMet's evidence includes photographs and videos that lack documentation as to project specifics,[138] and a marketing brochure that does not describe any subaqueous applications.[139] PolyMet cites examples listed by Mr. Hull.[140] But Mr. Hull did not provide details about these projects, and on cross examination he was not able to describe their size,

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[130] OAH Record, Petitioners Joint Proposed Findings of Fact, at pp. 1569-70.
[131] OAH Record, ALJ Report, at p. 16, FOF 35.
[132] PolyMet Exceptions, at 9; Ex. 74 at 30:451-31:459 (Radue).
[133] PolyMet Exceptions, at 9; Tr. Vol. 2 at 54:6 (Radue) (describing thickness of layer).
[134] Ex. 206 at 1:8-12, 2:21-3:10, 3:15-23 (Benson); Ex. 206.01.
[135] Ex. 206 at 32:1-4 (Benson).
[136] Tr. Vol. 5 at 13:8-21 (Benson). *See also* Ex. 206 at 32:4-12 (Benson); PFDNR20211203, 0265917, at p. 2 (Malusis discussing pond bottom applications as "untested" and "unproven").
[137] Ex. 200 at 22:6-12, 24:7-8 (Malusis); Ex. 206 at 31:18-22 (Benson).
[138] Ex. 42; Ex. 60.
[139] Ex. 17; *see* Tr. Vol. 2 at 78:21-79:6 (Radue).
[140] PolyMet Exceptions, at 9.

purpose, or specifications.[141] Mr. Radue knew even less about the projects, as he relied on Mr. Hull to provide these examples.[142]

Even based on the scant detail provided, however, the examples cited are vastly different from the proposed FTB in scale, materials, and purpose. For example, the Minorca Mine example was merely a "patch" to a sidewall that was partly underwater.[143] One example was described as a "marine application" in Norway.[144] Mr. Hull stated that this was a "pilot to ascertain could the material get to the bottom. We found it at the bottom."[145] The pilot was deemed "successful" simply because the Aquablok reached the bottom, not because it resulted in a uniform or effective cover.[146] Every example PolyMet has provided lacks support that demonstrates uniform application and actual performance, especially in the long term.[147] There is no documentation of any testing, percolation rates, or other measures that would be applicable to the FTB.

All of the projects were of a significantly smaller scale than the FTB[148]—whereas the FTB "pond" would cover 905 acres, all of PolyMet's examples were a fraction of that size.[149] PolyMet's largest example involved a 45-acre pond, and some were as small as one acre.[150] Mr. Hull himself testified that practical and workable techniques "do not rely on tolerances or performances that are not regularly achievable at full scale applications."[151] Here, the scale would be hundreds of acres, and uniform distribution across that entire area would be necessary for PolyMet's modeling to be accurate. None of PolyMet's examples

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[141] Ex. 203 at 2:3-20, 23:5-25 (Kuipers); *see, e.g.*, Tr. Vol. 2 at 131:7-15 (Hull).
[142] Tr. Vol. 2 at 69:6-9 (Radue).
[143] *Id.* at 187:19-25, 188:3 (Hull).
[144] Tr. Vol. 3 at 12:6-9 (Hull).
[145] *Id.* at 12:16-18 (Hull).
[146] *Id.*
[147] Ex. 203 at 27:8-9 (Kuipers); Ex. 104 at 8:16-9:4 (Ulrich).
[148] Ex. 203 at 25:24-26:1 (Kuipers).
[149] Tr. Vol. 2 at 132:25-133:4 (Hull); Ex. 350.
[150] Ex. 76 at 15:267-270, 18:299-301 (Hull).
[151] Ex. 77 at 4:66-70 (Hull); *accord* Ex. 203 at 25:18-19 (Kuipers).

demonstrate that this feat is achievable.

FOF 35 erroneously states that AquaBlok "has a proven track record when applied subaqueously."[152] This portion of the finding should be rejected, because Mr. Hull's testimony lacked foundation and the examples provided are not similar to PolyMet's plan.

FOF 39 states: "Not all successful engineering methods, however, are reported in the literature."[153] Speculation that there *could* be unreported examples is not evidence that can support a finding that a method is "practical and workable." Indeed, the Minnesota Supreme Court remanded the bentonite issue *because* the record did not contain literature, field trials, or any examples demonstrating that PolyMet's proposed bentonite amendment would work. *NorthMet*, 959 N.W.2d at 753-54. Accordingly, this Designee should reject the final sentence of FOF 39.

FOF 40-43 discuss Mr. Hull's examples,[154] but at most the examples provided illustrate an "available technology," not that the sprinkle method would achieve uniform and effective application through a water column spanning hundreds of acres.[155]

FOF 44 states: "All of these subaqueous bentonite applications satisfied their respective objectives."[156] This finding should be rejected. There is no evidence in the record to support the stated proposition except unsupported testimony by Mr. Radue and Mr. Hull. Both lacked specific knowledge about the cited bentonite applications. PJFOF 179-81, 187, and 188 accurately describe the record and should be adopted instead.[157]

FOF 45 describes a promotional brochure but does not address testimony explaining why the brochure is not helpful evidence.[158] PJFOF 176 and 182 describe that testimony

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[152] OAH Record, ALJ Report, at p. 16.
[153] *Id*. at p. 17.
[154] *Id*.
[155] *See* Tr. Vol. 2 at 135:4-15 (Hull); Tr. Vol. 3 at 11:24-12:18, 17:10-17, 19:16-20 (Hull).
[156] OAH Record, ALJ Report, at p. 17.
[157] OAH Record, Petitioners' Joint Proposed Findings of Fact, at pp. 1572-73.
[158] OAH Record, ALJ Report, at pp. 17-18.

and should be adopted.[159]

FOF 46 cites the Texas A&M University Extension article,[160] but it should quote the source in full, which states: "[t]he sprinkle method is less effective than other methods" and "[a]ccurate, uniform placement of bentonite is difficult to accomplish."[161] There should also be a finding that this is an Extension Service article that does not discuss large-scale mine-waste disposal applications.

FOF 48 is contrary to testimony in the record: "The scale of this application does not appear to be problematic."[162] This finding cites statements by Mr. Radue and Mr. Hull that discuss economies of scale.[163] The testimony does not address the technical challenges of large-scale projects raised by Petitioners' witnesses. And Mr. Mr. Hull contradicted his own earlier testimony that scale is important.[164] This finding should be rejected.

When the entire record is considered, the weight of the evidence shows that PolyMet's design and construction methods would not create an effective bentonite amendment. The bentonite itself requires a cover, and that cover would be constructed of reactive mine waste. Because uniform in-situ mixing is unlikely to be achieved over the hundreds of acres required, there would be defects allowing oxygen and water to leak through. Accordingly, this Designee should reject **Conclusion 10**.[165] Instead, this Designee should find that the application methods described at the hearing are unlikely to ensure bentonite's effectiveness in reducing infiltration of oxygen and water into the stored tailings over time.

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[159] OAH Record, Petitioners' Joint Proposed Findings of Fact, at pp. 1572-73.
[160] OAH Record, ALJ Report, at p. 18.
[161] Ex. 202.09, at 6.
[162] OAH Record, ALJ Report, at p. 18.
[163] *See* Tr. Vol. 1 at 53:23-54:10 (Radue); Tr. Vol. 2 at 133:13-18 (Hull).
[164] Ex. 77 at 4:66-70 (Hull).
[165] OAH Record, ALJ Report, at p. 32.

III. Subissue 2: Special Conditions for Post-Permit Testing Are Not Evidence of Bentonite's Effectiveness.

PolyMet's modeling relies on the assumption that the bentonite amendment would achieve specific hydraulic conductivity and saturation levels.[166] Yet, those inputs were not validated with testing.[167] The Minnesota Supreme Court concluded that a promise to test in the future is not substantial evidence. 959 N.W.2d at 754. The Hearing Team's proposed Special Conditions for testing cannot be used to support permit issuance.

A. PolyMet's Single Laboratory Test Does Not Establish the Hydraulic Conductivity of the Amended Tailings.

The only bentonite testing PolyMet has ever conducted was a single, small-scale laboratory test of bentonite mixed with LTV tailings in 2015.[168] There is no documentation as to how the sample was collected, how the mixture was created, or how the test specimen was prepared.[169] There were no replicate tests or backup documentation.[170] Dr. Malusis testified that it was impossible to assess the test's quality, or the accuracy of PolyMet's calculations, based on the information provided.[171] PolyMet has not explained why it could not conduct further tests or provide foundational documentation.

Even if the test was supported by proper foundation, it would provide little information about the actual hydraulic conductivity that could be expected in the field.[172] A single test is not statistically significant, and there is no way to know whether PolyMet's

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[166] *See* Ex. 349A; Tr. Vol. 3 at 209:3-6 (Wenz) (stating that if bad information goes into a model, the model will not be accurate).
[167] Tr. Vol. 4 at 115:5-18 (Malusis); Tr. Vol. 1 at 118:2-12 (Radue) (noting only one test has been completed with bentonite and it was with LTV tailings).
[168] Ex. 200 at 18:23-19:3 (Malusis); Ex. 200.27; Ex. 103 at 5:16-19 (Engstrom).
[169] Ex. 200 at 19:3-4 (Malusis).
[170] *Id.* at 19:4-8 (Malusis).
[171] *Id.* at 19:8-9 (Malusis). *See also* Tr. Vol. 4 at 109:6-19 (Malusis).
[172] Ex. 202 at 6:1-15 (Kuipers).

result was an outlier.[173] This test is not a reliable metric for the hydraulic conductivity of the bentonite-amended tailings, and it should not be relied upon in this Designee's findings.

FOF 58 appears to recognize that the test has some shortcomings but does not address the issues raised in Petitioners' testimony.[174] PJFOF 210-217 fully describe the evidence regarding the lab test.[175]

B. The Record Contradicts PolyMet's Claim that Testing Cannot Be Conducted Until Mining Begins.

PolyMet could test bentonite-amended tailings now. PolyMet has ready access to LTV tailings, and PolyMet could also construct test pads on site.[176] In addition, PolyMet obtained 43 tons of flotation tailings for waste characterization.[177] But PolyMet has not even attempted to reproduce the single laboratory test discussed above. When asked why PolyMet had not conducted *any* testing of pilot plant tailings mixed with bentonite, Mr. Radue testified: "Simply didn't do it. No specific reason."[178]

C. Post-Permit Testing Is Not Evidence that Can Support A "Practical and Workable" Finding.

PolyMet and the Hearing Team claim that this testing is only needed "confirm" the effectiveness of the bentonite amendment.[179] But testing cannot "confirm" the effectiveness of a novel technique that has not been proven in the first place.[180] And confirmatory testing is not relevant to whether there is evidence now showing that the

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[173] Ex. 203 at 24:18-20 (Kuipers). *See also* Tr. Vol. 4 at 122:11-17 (Malusis); Tr. Vol. 3 at 213:1-6 (Wenz) (stating that "a minimum of three" would allow "a bare minimum statistics of the variability").
[174] OAH Record, ALJ Report, at p. 20.
[175] OAH Record, Petitioners' Joint Proposed Findings, at pp. 1577-78.
[176] Ex. 202 at 37:3-8 (Kuipers); Tr. Vol. 3 at 166:17-168:20 (Engstrom); Tr. Vol. 4 at 44:3-4 (Kuipers).
[177] Ex. 218, R.0253850-51; Tr. Vol. 2 at 165:7-15 (Hull); Ex. 103 at 4:22-6:6 (Engstrom); Ex. 202 at 37:5-8 (Kuipers); Tr. Vol. 1 at 63:16-21 (Radue).
[178] Tr. Vol. 1 at 64:18-20 (Radue).
[179] Ex. 74 at 40:615-45:712 (Radue); DNR Exceptions, at 3, 31-33.
[180] Tr. Vol. 4 at 30:16-22 (Kuipers).

bentonite amendment is practical and workable. *NorthMet*, 959 N.W.2d at 754.

FOF 57 states: "[T]esting in the future could play an important role in confirming the effectiveness of the bentonite amendment. Future testing may also be important in determining certain variables like the optimal dose and type of bentonite."[181] This portion of the finding should be rejected, because it is irrelevant to the issue of whether there is enough evidence now to support issuing the permit.

Testing in the future is not current evidence demonstrating effectiveness. To the contrary, the Hearing Team's Special Conditions reinforce the need for further study. They do not provide a basis for approving the bentonite amendment.

IV. Subissue 3: The Pond-Bottom Amendment Would Not Maintain a Permanent Pond.

The pond is intended to serve as a "wet cover" over a portion of the tailings to limit oxygen exposure.[182] The pond-bottom bentonite amendment was proposed to maintain that wet cover and reduce seepage.[183] But defects in the pond-bottom amendment are likely to occur, and the bentonite would be prone to further degradation.[184] Mr. Radue calculated that if there are defects in just 5% of the pond bottom, percolation would more than double.[185] According to Dr. Benson, this amount of percolation would drain the pond.[186] It would also invalidate the model—which assumes bentonite would reduce seepage to 6.5 inches per year[187]—increasing seepage from the mine waste and further violating the

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[181] OAH Record, ALJ Report, at pp. 19-20.
[182] Ex. 101 at 6:5-6 (Engstrom); Ex. 244, R.0720854. Whether a wet cover is a viable reclamation method is not at issue in this proceeding. COs reserve the right to raise issues regarding the wet-cover method in any future proceedings.
[183] Ex. 219, R.0115527; *see* Ex. 244, R.0720854 (describing concept to workgroup).
[184] Ex. 206 at 36:14-37:7 (Benson).
[185] OAH Record, Amended Declaration of Tom Radue, at p. 1637.
[186] *See* Tr. Vol. 5 at 117:1-23 (Benson) (testifying that at percolation rate of 10 inches per year, natural hydrology would be unable to keep up).
[187] Tr. Vol. 1 at 171:23-24 (Radue).

reactive mine waste rule.[188] The ALJ never addressed this testimony.

Instead, **FOF 68-70** speculate as to whether the pond-bottom bentonite would be needed to maintain the pond.[189] This speculation is contradicted by the record, which shows that water is pumped in and out of the existing LTV pond to maintain pond levels there.[190] And testing has not established that the hydraulic conductivity, or permeability, of the FTB pond bottom would be lower than the LTV pond bottom.[191] Because these findings are not supported by the evidence, they should be rejected.

FOF 73 and 74 describe Mr. Hull's examples discussed under Subissue 1.[192] FOF 74 says bentonite was "successfully used" at the Minorca Mine[193] but there is no documentation in the record or explanation of what "success" means. Mr. Hull did not even know why Aquablok was used and thought "may have been . . . a patch" to a "partially" underwater sidewall.[194] This is far from a large-scale permanent pond.[195] Because these findings are based on testimony that lacks foundation and inapplicable examples, they should be rejected. At most, the examples describe an "available technology."

The ALJ ultimately found that the bentonite amendment would "reduce" the hydraulic conductivity of the pond bottom, causing a "reduction of water seepage through the pond bottom."[196] These propositions do not support a finding that pond levels would be permanently maintained. The ALJ entirely overlooked the evidence that the pond-bottom proposal is unique and untested, that even a small percentage of defects—which

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[188] *See id.*
[189] OAH Record, ALJ Report, at p. 21.
[190] Ex. 103 at 8:11-16 (Engstrom).
[191] *See* Ex. 25 (showing variability in tailings' permeability).
[192] OAH Record, ALJ Report, at p. 21 & n.97; Ex. 76 at 21:347-54 (Hull).
[193] OAH Record, ALJ Report, at p. 21.
[194] Tr. Vol. 2 at 131:7-8, 187:19-25, 188:5-7 (Hull).
[195] *See id.*at 132:25-133:4 (Hull) (admitting that the examples he provided were much smaller than the FTB pond).
[196] OAH Record, ALJ Report, at p. 45.

are very likely—would double percolation rates from the pond, and that these percolation rates would eventually drain the pond. PJFOF 233-44 address the evidence and testimony in detail.[197] Because the record shows that the pond-bottom bentonite would fail, this Designee should modify **Conclusion 13** and find that the bentonite amendment would be unlikely to maintain a permanent pond.[198]

V. Subissue 4: Cation Exchange Would Degrade the Bentonite.

Bentonite's performance depends on its ability to swell and plug voids. This swelling is compromised when bentonite is exposed to multivalent cations, such as calcium or magnesium,[199] that would be present in the tailings, pond water, and pore water in the bentonite layer.[200] The bentonite would lose its ability to retain saturation, making it less effective as an oxygen barrier on the sides and beaches.[201] For the same reasons, the hydraulic conductivity would increase, making the bentonite more permeable to water.[202] Field research shows that bentonite barriers are 1,000 to 10,000 times more permeable after cation exchange.[203] Based on his long-term field research, Dr. Benson predicted that the bentonite amendment proposed here would become ineffective at controlling water and oxygen movement within several years.[204]

A. Cation Exchange Is Not Dependent on Wet-Dry Cycling.

Because cation exchange compromises bentonite's ability to attract and hold water,

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[197] OAH Record, Petitioners' Joint Proposed Findings, at pp. 1580-82.
[198] *See* OAH Record, ALJ Report, at p. 32, COL 13.
[199] Ex. 200 at 28:1-11 (Malusis); Ex. 206 at 10:3-15 (Benson); Tr. Vol. 3 at 30:13-31:2, 32:6-9 (Diedrich).
[200] Ex. 4.01; Ex. 205 at 2:26-32 (Thyne) (explaining pore water concept); Ex. 200 at 11:4-9, 18:6-9, 28:20-29:3 (Malusis); Ex. 201 at 2:7-19, 3:15-18 (Malusis); Ex. 246; Ex. 247.
[201] Ex. 200 at 32:8-14 (Malusis).
[202] Ex. 206 at 11:12-13 (Benson).
[203] Ex. 206.06, at 814; Ex. 206.10; Ex. 206.02.
[204] Ex. 206 at 26:2-5 (Benson).

its impacts on bentonite performance are observed when bentonite undergoes hydration.[205] Thus, it affects bentonite's initial swell when it is first mixed with the tailings or added to the pond bottom—*and* when the bentonite rehydrates following wet-and-dry cycles.[206]

FOF 84 overlooks the effects that occur upon initial hydration of the bentonite, erroneously stating: "So, cation exchange and wet-dry cycling are interconnected because the decreased swelling capacity triggered by cation exchange does not create greater hydraulic conductivity unless the bentonite layer is dried and rehydrated."[207] This statement is not supported by the testimony cited[208] or the record as a whole. Because PolyMet does not plan to pre-hydrate the bentonite, cation exchange may also affect the bentonite's ability to swell upon *initial* application.[209] The Designee should reject this portion of the finding and acknowledge that cation exchange affects initial swelling.

B. Cation Exchange Renders Bentonite Ineffective Even in Weak Ionic Solutions.

Findings 85-87 minimize the effects of cation exchange, relying on PolyMet's claim that the solution hydrating the cations would be relatively weak.[210] But cation exchange is known to occur in weak solutions, including those with the ionic strength predicted at the FTB.[211] Long-term field testing has demonstrated that while this process occurs more slowly where there is a lower concentration of cations, in the long term it still

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[205] Ex. 200 at 30:4-17 (Malusis); Ex. 201 at 3:15-18 (Malusis); Ex. 204 at 6:2-5 (Thyne); Ex. 203 at 5:6-18 (Kuipers) (quoting Ex. 38, at 3, 4).
[206] Ex. 200 at 11:4-9, 28:20-29:3 (Malusis); Ex. 205 at 2:24-3:14 (Thyne).
[207] OAH Record, ALJ Report, at p. 23.
[208] Tr. Vol. 5 at 96:17-97:2, 93:2-10 (Benson); Ex. 200 at 29:15-21 (Malusis).
[209] Ex. 200 at 11:4-9, 28:20-29:3 (Malusis); Ex. 205 at 2:24-3:14 (Thyne). *See also* Ex. 103 at 5:20-6:1 (Engstrom) (stating that testing should account for cation exchange that could occur when the bentonite is initially mixed with the tailings).
[210] OAH Record, ALJ Report, at p. 23.
[211] Ex. 200 at 30:23-31:18 (Malusis); Tr. Vol. 5 at 122:12-25; 123: 9-21 (Benson). *See also* Tr. Vol. 3 at 34:20-35:1 (Diedrich); Tr. Vol. 4 at 149:11-15 (Wenz); Ex. 247, R.0735777 (stating that any cation exchange would occur if any water containing calcium or magnesium contacts the bentonite).

causes bentonite layers to lose their function.[212]

Petitioners' experts applied the findings from this research to PolyMet's forecasted FTB conditions. Dr. Malusis explained that the pond water in Mine Year 20 would be similar to a solution that caused geosynthetic clay liner ("GCL") specimens to become ten times more permeable (i.e., one order of magnitude) in the long term.[213] Dr. Thyne, a geochemist,[214] calculated that the predicted pond water cation levels would cause swelling to decrease by 30 to 50 percent and reduce hydraulic conductivity by one to one-and-a-half orders of magnitude.[215]

By contrast, PolyMet's witnesses presented opinions that lack record support. For example, Dr. Diedrich cited a figure in one of Dr. Benson's articles that showed the hydraulic conductivities of GCLs following cation exchange.[216] As Dr. Malusis explained, however, GCLs start with a lower hydraulic conductivity than soil-bentonite barriers in the first place. Consequently, when comparing GCLs to a bentonite amendment, the *degree* of change in hydraulic conductivity is a more relevant method than the end hydraulic conductivity.[217] Dr. Diedrich ultimately conceded that other studies presented by petitioners showed increases in hydraulic conductivity even in weak solutions and that cation exchange could increase the hydraulic conductivity of the pond bottom ten-fold.[218]

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[212] Ex. 206 at 13:3-8 (Benson); Tr. Vol. 5 at 14:21-15:7 (Benson).
[213] Ex. 200 at 31:8-18 (Malusis) (5 mM); Ex. 200.14 (Jo, Benson et al. 2005). Diedrich testified that "all of these numbers are reasonably dilute solutions in the neighborhood of the 5 mM/liter," indicating that both the Jo 2005 study and the water contacting the LTV tailings would have similar concentrations of calcium. Tr. Vol. 3 at 95:1-4 (Diedrich).
[214] Ex. 204 at 1:3-22 (Thyne); Ex. 204.01.
[215] Tr. Vol. 4 at 213:1-18, 214:11-14 (Thyne). In other words, it would become one to one-and-a-half times more permeable.
[216] Ex. 78 at 23:384-90 (Diedrich); Tr. Vol. 3 at 106:2-19 (Diedrich) (citing Ex. 200.17, R.0737124 (Fig. 10)).
[217] Tr. Vol. 4 at 79:15-80:1 (Malusis).
[218] *See* Tr. Vol. 3 at 70:9-16, 83:18-84:7, 84:20-85:12; 93:19-95:4 (Diedrich); Ex. 206.03. *See also* OAH Record, Petitioners' Joint Proposed Findings, at p. 1587, FOF 281 (describing testimony).

Hearing Team witness Dr. Wenz confirmed that Dr. Diedrich's testimony was "inconsistent with the existing body of information, which shows cation exchange will occur and potentially change the bentonite hydraulic conductivity."[219]

FOF 85 is incomplete: "Testing cation exchange within low-ionic-strength solutions requires a significant amount of time. As a result, there is little scientific or technical literature addressing cation exchange within such solutions."[220] The cited testimony stated that "it's not easy to find a lot of studies" of specific hydraulic conductivity ranges.[221] Petitioners nonetheless presented literature on cation exchange in weak solutions and explained how that literature applies to PolyMet's proposal. This finding should be modified to confirm that literature shows significant bentonite degradation even in weak solutions, and that field trials demonstrate a significant reduction in the hydraulic conductivity following these processes.

FOF 86 compounds this error by stating that pond water with low ionic strength "is not anticipated to result in consequential levels of cation exchange."[222] This finding should be rejected because it relies on PolyMet's conclusory testimony and does not consider contrary testimony offered by Petitioners and the Hearing Team—including evidence that improvements in testing methods have documented that even weak ionic solutions significantly increase bentonite's hydraulic conductivity. The finding also overlooks Petitioners' testimony that cations in the pore water, and those collected by precipitation as it percolates through the overlying tailings, would affect the bentonite.[223] PJFOF 265-

[219] Ex. 105 at 10:7-12 (Wenz).
[220] OAH Record, ALJ Report, at p. 23.
[221] *See id.* n.111 & 112; Tr. Vol. 4 at 116:9-10 (Malusis). Dr. Malusis emphasized that the difficulty in finding literature underscores the importance of conducting testing here. *Id.* at 117:2-3. *See also* Tr. Vol. 4 at 115:1-19 (Malusis).
[222] OAH Record, ALJ Report, at p. 23.
[223] Ex. 205 at 2:26-3:10, 7:2-8:11, 10:14 -11:6 (Thyne).

67 and 273-74 addresses these other sources of cations.[224] FOF 86 should be modified to reflect the different sources of cations that would affect the bentonite and the research showing that the bentonite degrades and loses its function even in weak solutions.

C. The Water Contacting the Bentonite Would Likely Have a Higher Ionic Strength than PolyMet Predicts.

Further, PolyMet underestimates the ionic strength of the water that would contact the bentonite. PolyMet relies on humidity cell testing of the tailings to predict the pond water's ionic strength.[225] As Dr. Thyne explained, however, many researchers are skeptical that humidity-cell testing accurately predicts field behavior. His testimony is supported by literature in the record.[226] Even Dr. Diedrich admitted that these laboratory values are not necessarily the same as the flushing that would result under field conditions.[227] And she admitted that a study in the record involving a solution similar to the pond water showed an increase in hydraulic conductivity by an order of magnitude (i.e., tenfold).[228]

FOF 86 and 87 state that water contacting the bentonite would have "low ionic strength."[229] These findings should be modified or rejected, because they overlook studies and testimony offered by Petitioners and the Hearing Team, rely on PolyMet's conclusory testimony, and fail to account for Dr. Diedrich's admissions.

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[224] OAH Record, Petitioners' Joint Proposed Findings of Fact, at pp. 1584-86.
[225] *See* PolyMet Exceptions, at 12; Ex. 78 at 10:174-77; 13:234-14:242 (Diedrich) (stating that water model used outcomes from humidity cell testing).
[226] Ex. 205 at 11:12-12:14 (Thyne) (citing Ex. 205.01 (Pieretti 2022) and studies referenced therein); Ex. 205.01, at 12-14.
[227] Tr. Vol. 3 at 38:12-25 (Diedrich). Dr. Thyne testified that using actual water quality data from the LTV tailings seepage and ponded water would provide a more reliable estimate of FTB leachate chemistry than the humidity cell testing, with the caveat that the flotation tailings will have a higher concentration of sulfate, nickel, and other solute compared to the LTV tailings. Ex. 205 at 12:1-14 (Thyne).
[228] Tr. Vol. 3 at 83:18-84:7; 94:5-95:4 (Diedrich). *See also* Ex. 206.03.
[229] OAH Record, ALJ Report, at p. 23.

D. Wet-Dry Cycling Would Compromise the Bentonite Amendment.

Dr. Benson and Mr. Hull testified that wet-dry cycling would be "inevitable" on the sides and beaches.[230] Cycles of drying and rehydrating exacerbate the effects of cation exchange, because if the bentonite is not able to regain its swell, its effectiveness as a water and oxygen barrier decreases.[231] This is a concern in Minnesota, where wet springs are followed by summers that can dry the soil at a depth of over 40 inches, especially during drought.[232] The record shows that the thirty-inch cover of tailings above the bentonite would not be adequate to protect it from wet-dry cycling.[233] In fact, a cover of similar thickness was ineffective in the Whistle Mine trials.[234]

FOF 89 correctly states that the dam sides and beaches likely will experience wet-dry cycling.[235] But the following sentences of the finding mischaracterize the record and should be rejected. First, the ALJ cited PolyMet's expectation that the tailings on the beaches will wick water from the pond, helping to maintain saturation.[236] But Dr. Diedrich contradicted the cited testimony by Mr. Hull. Dr. Diedrich testified that pond water chemistry would not interact with the beaches.[237] Second, the ALJ stated that "annual average precipitation at the tailings Basin exceeds annual average evapotranspiration and runoff."[238] But Dr. Benson maintained that wet-dry cycling would still be "inevitable" even if precipitation exceeds evapotranspiration in average years.[239] And Mr. Radue admitted that dry summer months could cause drying into the soil notwithstanding yearly

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[230] Tr. Vol. 5 at 119:9-15 (Benson); Ex. 77 at 20:386-87 (Hull).
[231] Ex. 200 at 11:5-9 (Malusis); Tr. Vol. 5 at 92:21-93:10 (Benson).
[232] Tr. Vol. 5 at 118:15-122:4 (Benson).
[233] Ex. 200 at 11:17-12:8, 34:16-35:4 (Malusis); Ex. 233, R.0735746.
[234] Ex. 200 at 34:21-35:6 (Malusis).
[235] OAH Record, ALJ Report, at pp. 23-24.
[236] *Id.*
[237] Ex. 78 at 19:300-03 (Diedrich).
[238] OAH Record, ALJ Report, at p. 24.
[239] Ex. 206 at 27:18-28:2 (Benson); Tr. Vol. 5 at 119:14-15 (Benson).

averages.[240] Finally, the ALJ stated that the thirty inches of tailings covering the bentonite on the sides and beaches protect it from drying.[241] But the thirty-inch cover in the Whistle Mine study failed to protect that cover from degradation.[242]

Overall, the testimony and evidence in the record compels the conclusion that cation exchange would significantly affect the bentonite amendment. **Conclusion 14**[243] should be modified to state that cation exchange is likely to render the bentonite ineffective as an oxygen barrier and increase hydraulic conductivity of the bentonite at least tenfold.

VI. Subissue 5: Natural Forces Would Degrade the Bentonite, Rendering It Ineffective As a Water And Oxygen Barrier.

The flotation tailings would remain reactive for thousands of years.[244] This means that the bentonite amendment must function for centuries. Even assuming the bentonite amendment would be effective in the first place, the record shows that it is likely to degrade due to natural stressors as weather fluctuates and ecosystems function.

The ALJ correctly found: "Evidence in the record establishes that the bentonite-amended tailings layer *is likely to degrade over time and that such degradation may result in increased hydraulic conductivity and percolation*. The degradation could be caused by cation exchange, wet-dry cycling, root penetration, freeze-thaw cycling, or animal burrowing."[245] This proposition is supported by the record.[246] However, there are errors in some findings under this subissue.

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[240] Tr. Vol. 2 at 39:8-14 (Radue).
[241] OAH Record, ALJ Report, at p. 24.
[242] Ex. 200 at 34:16-35:6 (Malusis). *See also* Ex. 233, R.0735744, R.0735746.
[243] OAH Record, ALJ Report, at p. 32.
[244] Ex. 204 at 14:9-15:10 (Thyne).
[245] OAH Record, ALJ Report, at 46 (emphasis added.).
[246] *See, e.g.*, Ex. 200 at 34:6-14 (Malusis); Ex. 200.10, at 6-1; Ex. 206 at 25:17-26:5 (Benson); Tr. Vol. 5 at 89:15-20, 119:9-15 (Benson).

A. The Bentonite Amendment's Initial Hydraulic Conductivity Would Be Higher than PolyMet Predicts.

Under this subissue, the ALJ made findings about the hydraulic conductivity of the bentonite-amended tailings when they are first constructed. But the initial hydraulic conductivity of the bentonite-amended tailings has not been tested or verified.

FOF 94 describes the laboratory test discussed under Subissue 2, then states: "the test is relevant to determining the anticipated initial hydraulic conductivity of the bentonite-amended tailings."[247] But that test lacked foundation and statistical significance.[248] It is not a reliable data source. Further, results in the field are almost never the same as in the laboratory.[249] COs recommend adopting PJFOF 210-18,[250] which describes the laboratory test in detail, as well as PJFOF 199 and 214,[251] which describe testimony stating that laboratory testing does not establish field performance.

FOF 95 relies on Mr. Radue's testimony for the proposition that the bentonite-amended flotation tailings would have a low hydraulic conductivity value, and **FOF 97** therefore states that "the bentonite-amended tailings layers could degrade quite a bit and still maintain a hydraulic conductivity or percolation rate below the modeled values."[252] Mr. Radue relied on PolyMet's unreliable laboratory test[253] and speculated that the flotation tailings would perform better than the LTV tailings.[254] The record contradicts that statement. The hydraulic conductivity of both the LTV tailings and flotation tailings would

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[247] OAH Record, ALJ Report, at pp. 24-25.
[248] *See supra*, at 28-29.
[249] *See* Ex. 103 at 4:17-18 (Engstrom); Ex. 200 at 5:24-26:1 (Malusis); Ex. 202 at 35:16-19 (Kuipers). *See also* Ex. 77 at 2:35-36 (Hull) ("Laboratory conditions can almost never perform exactly as large-scale field implementation.").
[250] OAH Record, Petitioners' Joint Proposed Findings, at pp. 1577-78.
[251] *Id.* at pp. 1575, 1577.
[252] OAH Record, ALJ Report, at p. 25.
[253] Tr. Vol. 1 at 39:12-16, 63:3-6 (Radue).
[254] *Id.* at 39:20-24, 64:15-17 (Radue).

vary, and some of the flotation tailings would actually exhibit greater hydraulic conductivity than some of the LTV tailings.[255] And the cited Aquablok brochure does not establish the hydraulic conductivity of the bentonite-*amended tailings* at issue here.[256] These findings should be rejected.

FOF 96 states that Aquablok "has achieved a hydraulic conductivity of 1 x 10^{-8} cm/sec, or lower. This result is orders of magnitude less than the modeled values for the NorthMet Project, and even those modeled values would allow the NorthMet Project to meet water quality standards."[257] This finding relies on Mr. Hull's inapplicable examples, a product brochure, and short-term Aquablok tests that did not involve tailings.[258] Further, the record shows that the project would *not* meet water quality standards, even if the bentonite worked.[259] This finding should be rejected.

B. PolyMet's Root Penetration Study Does Not Demonstrate that the Thirty-Inch Cover Would Protect the Bentonite From Damage

Over the long-term, research shows that bentonite is vulnerable to natural forces, including vegetative growth.[260] Root penetration and water uptake affect the structure of

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[255] *See* Exhibit 25; Ex. 218, R.0253852 (Geotechnical Data Package) (stating "the average Flotation Tailings permeability is greater than the maximum permeability testing results on LTVSMC bulk tailings" and describing variability); R.0253853 ("Additional permeability testing is recommended for both [floatation tailings and LTV tailings] . . . ."). *See also* Ex. 200 at 21:13-19 (Malusis) (explaining that the tailings would not be of uniform composition when deposited); Ex. 202 at 29:16-18 (Kuipers) (same).

[256] Ex. 43. *See* OAH Record, ALJ Report, at p. 25, FOF 95, n.129; *id.* FOF 97, n.131.

[257] OAH Record, ALJ Report, at p. 25.

[258] *Id.* n.128. *See* Tr. Vol. 2 at 187:24 (Hull) (discussing Minorca Mine "patch"); Ex. 43 (brochure); Ex. 77 at 36:658 (Hull) (stating that tests lasted only 15 days).

[259] *See* OAH Record, ALJ Report, at p. 40-41.

[260] Ex. 200 at 34:6-14 (Malusis); Ex. 206 at 25:12-28:6, 30:20-31:8 (Benson). *See e.g.*, Ex. 206.09 at 7-22 (discussing cover damage from plant roots, as well as associated insect burrowing and desiccation).

an earthen cover,[261] creating paths for water and oxygen to leak through.[262] Plant transpiration also contributes to the wet-dry cycling discussed under Subissue 4.[263] Recent research by Dr. Benson and the federal government document this phenomenon damaging soil-bentonite barriers.[264]

Upper Midwest vegetation, including forbs and grasses, grow roots deeper than the thirty inches that would cover the bentonite on the sides and beaches.[265] The moisture in the bentonite amendment would attract these plant roots, causing them to extend deeper and draw moisture, especially during dry periods.[266] Plants are expected to grow not only on the sides and beaches, but also in the shallow areas of the pond, making the pond edge more permeable too.[267]

PolyMet's limited sampling of the LTV basin does not provide reassurance. Mr. Radue, who presented the study, has never performed a root penetration study and did not claim expertise regarding such studies.[268] The sampling locations did not account for the range of vegetation present—PolyMet dug test holes only in areas of low herbaceous vegetation,[269] overlooked vegetative growth around the LTV pond,[270] and did not measure root depths near shrubs and trees that are visible in site photographs.[271] Nonetheless, PolyMet still found root depths up to 26 inches—only a few inches short of the proposed

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[261] Ex. 206.09, at 7-1.
[262] Ex. 200 at 11:10-12 (Malusis) (discussing preferential pathways); Ex. 200.10, at 6-1; Ex. 206.09, at 7-22; Tr. Vol. 5 at 118:15-119:8 (Benson).
[263] Ex. 206 at 25:13-14, 27:1-11, 34:13-17 (Benson); Tr. Vol. 5 at 120:18-121:3 (Benson).
[264] *See* Ex. 206.09, at iii.
[265] Ex. 206 at 26:16-22 (Benson).
[266] *Id.* at 27:2-8 (Benson); Tr. Vol. 5 at 120:4-7 (Benson).
[267] Ex. 206 at 30:23-31:4 (Benson); Tr. Vol. 5 at 121:8-122:4 (Benson); Ex. 14.07 (depicting vegetation growing into the pond).
[268] Tr. Vol. 2 at 90:12-13, 94:9-12 (Radue).
[269] Ex. 30, at 2-9 (photographs of test holes).
[270] *See* Ex. 19, photograph 6 (depicting existing LTV beach).
[271] *See id.* at 4. Ex. 203 at 28:25-29:1 (Kuipers).

bentonite depth on the sides and beaches.[272]

Even if PolyMet initially plants preferable vegetation, maintenance would be required in perpetuity to prevent deep-rooted species from becoming established.[273] PolyMet contends that it will monitor the beaches.[274] But it would not be practical and workable to manage vegetation on the FTB for centuries.

FOF 100 erroneously describes the evidence on root penetration.[275] The finding relies on the root study and the conclusory testimony of Mr. Ulrich, stating that limited oxygen at the deepest part of the pond would limit plant growth.[276] The ALJ did not consider conflicting testimony, the shortcomings in PolyMet's study, or government research that compel a different conclusion. And in stating that there would be no issue on the pond bottom, the ALJ failed to consider that there will be a gradient into the pond where PolyMet expects vegetation. FOF 100 should be rejected, and JPFOF 293-95 and 299-303 should be adopted.[277]

C. A Thirty-Inch Cover Is Not Adequate to Protect the Bentonite Amendment.

FOF 98 states that the bentonite layer would be protected by the pond and by the 30-inch cover above the bentonite on the sides and beaches.[278] But the record shows that this cover is not adequate to protect a bentonite amendment.[279] This is reinforced by the Whistle Mine study, which found bentonite degradation under a thirty-inch cover.[280] This

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[272] Ex. 30, at 1.
[273] Ex. 206 at 26:18-22 (Benson).
[274] PolyMet Exceptions, at 18.
[275] OAH Record, ALJ Report, at pp. 25-26.
[276] Ex. 104 at 5:19-6:1 (Ulrich).
[277] OAH Record, Petitioners' Joint Proposed Findings, at pp. 1589-1590.
[278] OAH Record, ALJ Report, at p. 25.
[279] Ex. 200 at 11:17-12:8, 34:16-35:4 (Malusis); Ex. 233, R.0735746 ("Most earthen layers used in covers tend to become damaged over relatively short time frames unless they are covered with a geomembrane or are very deep (meters).").
[280] Ex. 200 at 34:21-35:6 (Malusis).

finding should be rejected because it is not supported by evidence and does not consider conflicting testimony.[281] The findings should reflect the evidence showing that natural forces would affect soils beyond the proposed cover depth, and within at least the shallow areas of the pond.[282]

D. PolyMet Does Not Present Any Concrete Or Workable Mitigation Proposal.

FOF 104 erroneously states that PolyMet could mitigate the impacts of degradation by applying supplemental bentonite.[283] But defects in buried soil-bentonite layers are often not visible in field inspections,[284] and PolyMet has not presented any concrete plan as to how it would detect and repair leaks.[285] Further, based on his long-term research Dr. Benson testified that adjusting the amount of bentonite would not prevent defects.[286]

Speculation that damage could be mitigated is not evidence of bentonite's effectiveness. And a plan that requires active inspection and repair for centuries is not practical or workable. Accordingly, this finding should be rejected.

E. Studies at Other Facilities Show that the Bentonite Would Fail.

Research on soil-bentonite barriers documents degradation and failure. **FOF 105** describes government research presented by WaterLegacy's expert witness, Dr. Benson,[287] and COs recommend adopting WaterLegacy's analysis on that finding.

FOF 106 notes differences between the failed Whistle Mine studies and PolyMet's

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[281] The finding cites PolyMet's design drawings. Ex. 14.04-14.07.
[282] Ex. 206 at 30:23-31:4 (Benson); Tr. Vol. 5 at 121:8-122:4 (Benson).
[283] OAH Record, ALJ Report, at p. 26.
[284] Ex. 200.20, at 3 ("These processes may be occurring but develop at a rate at which they are not obvious from field inspections, yet may still have a negative effect on performance over the operating life of a cover system."); *see* Tr. Vol. 5 at 71:14-72:3 (Benson) (describing site that appeared to be in good condition but bentonite was failing).
[285] *See* Ex. 200 at 36:1-3 (Malusis). The repair process would also allow further air and water intrusion. *Id.* at 35:20-22.
[286] Ex. 206 at 26:2-5 (Benson).
[287] OAH Record, ALJ Report, at p. 26.

proposal.[288] But testimony establishes important similarities between the two.[289] And the differences witnesses noted would actually cause the bentonite to perform *worse* than the Whistle Mine studies, not better.[290] Those witnesses emphasized that the Whistle Mine studies are cause for concern.[291] Accordingly, this finding misstates the record and should be rejected. PJFOF 167-73, 202, 229, and 275 describe the studies' applicability here.[292]

Overall, **Conclusion 15**, which states that bentonite would be effective in the long term, is erroneous.[293] The ALJ overlooked research demonstrating degradation of bentonite covers, instead relying on PolyMet's unreliable testing and speculation that defects could be repaired. This Designee should instead find that the bentonite amendments are likely to degrade and fail, especially over the centuries-long life of the FTB.

VII. The Efficacy of the Seepage Collection System, and Other Excluded Issues, Remain Disputed.

The courts never addressed whether substantial evidence supported denial of a contested case on the seepage collection system. Instead, the core issue addressed on appeal was the correct standard for granting a hearing. *See NorthMet*, 959 N.W.2d at 745-49. The courts considered five of the issues raised in the petitions, and the bentonite issue was sufficient to warrant a remand to DNR.[294]

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[288] *Id*. at p. 27.
[289] The similarities include the depth of the cover over the bentonite and the thickness of the bentonite layer. Ex. 200 at 17:15-20 (Malusis).
[290] *Id.* at 18:1-11 (Malusis); Ex. 206 at 28:16-23 (Benson) (stating that vegetation was not present at the Whistle Mine); *id.* at 27:1-11 (testifying that vegetation would cause degradation at the FTB).
[291] Ex. 206 at 29:9-17 (Benson). *See also id.* at 28:20-23 (observing that study was too short to document long term results).
[292] OAH Record, Petitioners' Joint Proposed Findings, at pp. 1570-71, 1576, 1580, 1586.
[293] OAH Record, ALJ Report, at p. 32.
[294] *NorthMet*, 959 N.W.2d at 750 & n.13. ("The court of appeals noted that 'numerous factual issues' were raised in the contested case hearing petitions, 'including' the five issues specifically addressed in the opinion. Consistent with that decision and with the parties' arguments to our court, we address these same five specific issues.").

FOF 125 erroneously states: "The Court held that a contested case hearing was not required regarding any other issue . . . ."[295] This finding is incorrect and should be rejected. COs offered evidence showing why this and other aspects of PolyMet's proposal would fail.[296] Petitioners also contested the validity of the Hearing Team's Amended Order that purported to restrict the scope of the hearing.[297] COs reserve the right to contest the Amended Order and exclusion of issues from the hearing.

CONCLUSION

This Designee should adopt the ALJ's findings that the bentonite amendment would not be a practical and workable technique to achieve compliance with the reactive mine waste rule. The record as a whole further establishes that the bentonite amendment would not meet PolyMet's hydraulic conductivity and saturation goals, and that it would degrade and fail early in the life of the FTB. PolyMet's permit application should be denied.

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[295] OAH Record, ALJ Report, at p. 30.
[296] The memoranda supporting COs' motions are in the OAH Record, at pp. 14636, 14665. The offers of proof were transmitted as CCH Petitioners' Exhibits.
[297] OAH Record, Petitioners' Joint Memorandum in Support of Motion to Nullify or Vacate the Amended Order, at p. 14123.

Lake Superior Association, and Save Our Sky Blue Waters