OAH 60-2004-37824

STATE OF MINNESOTA
OFFICE OF ADMINISTRATIVE HEARINGS

FOR THE DEPARTMENT OF NATURAL RESOURCES

In the Matter of the NorthMet Project Permit to Mine Application

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND RECOMMENDATION

This matter came before Administrative Law Judge James E. LaFave for an evidentiary hearing on March 27, 28, 29, 30 and 31, 2023. The record closed on September 22, 2023, upon the issuance of the Order Denying Motion for Leave to File a Response.

Jon W. Katchen and Bryson C. Smith, Holland & Hart, LLP, and Sherry Enzler General Counsel, represent the Minnesota Department of Natural Resources (Department or DNR).

Monte A. Mills, Aaron P. Knoll, and Farah N. Famouri, Greene Espel, PLLP, together with Jay C. Johnson and Kathryn A. Kusske Floyd, Venable, LLP, represent PolyMet Mining, Inc.[1] (PolyMet).

Melissa L. Lorentz, Joy R. Anderson, and Heidi M. Guenther, the Minnesota Center for Environmental Advocacy (MCEA), represent the Friends of the Boundary Waters Wilderness, Duluth for Clean Water, Center for Biological Diversity, Friends of the Cloquet Valley State Forest, Save Our Sky Blue Waters, and the Save Lake Superior Association (collectively, the Conservation Organizations).

Paula G. Maccabee, Just Change Law Offices, represents WaterLegacy.

Frank S. Holleman and Vanessa L. Ray-Hodge, Sonosky, Chambers, Sachse, Endreson & Perry, LLP, Sean W. Copeland and Ian R. Young, Legal Advisors, represent the Fond du Lac Band of Lake Superior Chippewa (the Band).

For the purposes of this report, the Conservation Organizations, WaterLegacy and the Band, will be referred to together as the Petitioners.

[1] PolyMet Mining, Inc., is now known as NewRange Copper Nickel LLC, which is a 50-50 joint venture of PolyMet US, Inc., and Tech America Incorporated. By agreement of the parties, this report will still refer to PolyMet Mining, Inc., as "PolyMet."

SUMMARY OF THE CASE

PolyMet seeks a permit to operate the NorthMet Project, Minnesota's first copper-nickel-platinum mine near Babbitt, Minnesota. PolyMet projects that its mine will produce 32,000 tons per day of ore and 42,000 tons per day of waste rock for 20 years. But this waste rock will be reactive, and it could release acid rock drainage that may seep into nearby surface or ground water. So PolyMet must handle the waste rock in compliance with Minnesota's Reactive Waste Rule.

To comply with the Reactive Waste Rule, PolyMet must either:

1. Store its mining waste in a manner such that the waste is no longer reactive; or

2. Upon closure, ensure that substantially all water is prevented from flowing over or through the waste.

PolyMet's plan to satisfy the Reactive Waste Rule relies on the use of bentonite. Bentonite is a clay that expands upon contact with moisture, limiting the amount of air and water that can pass through. PolyMet intends to store the waste rock in a tailings basin – essentially a lake. PolyMet plans to apply a layer of soil infused with bentonite to the tailing basin's side slope, beaches, and bottom. Then, PolyMet plans to grind the waste rock into sand and mix it with water to create a slurry, and store that slurry in the tailings basin. PolyMet proposes to limit the amount of oxygen and water that may react with its mine tailings by putting a layer of bentonite-infused soil on top of the tailings basin.

Considering an appeal to PolyMet's Permit to Mine, the Minnesota Supreme Court ordered the DNR to hold this contested case hearing, or trial.[2] The Department determined the scope of this proceeding based on the issue identified by the Supreme Court.[3] This proceeding only considers the effectiveness of the bentonite amendment in complying with the Reactive Waste Rule.

As more fully explained below, PolyMet is unable to meet either standard of the Reactive Waste Rule.

STATEMENT OF THE ISSUES

Is the proposed bentonite amendment a "practical and workable" reclamation technique pursuant to Minn. Stat. § 93.481, subd. 2 (2022), that will reduce infiltration of oxygen and water into the stored tailings and satisfy the Reactive Mine Waste Rule, Minn. R. 6132.2200, subp. 2(B) (2023)? This issue encompasses the following five specific fact disputes:

[2] *In re NorthMet Project Permit to Mine Application*, 959 N.W.2d 731, 754 (Minn. 2021).
[3] *Id.*

a. How would bentonite be applied to the tailings Basin sides, beaches, and pond bottom to ensure its effectiveness in reducing infiltration of oxygen and water into the stored tailings over time?

b. How should the application methods of the bentonite be evaluated or tested before application to ensure effectiveness in reducing infiltration of oxygen and water into the stored tailings?

c. Would the pond-bottom, bentonite-amended cover be effective in maintaining a permanent pond that acts as a water cover over the stored tailings?

d. Would any conditions in the pond result in a cation exchange that could reduce the effectiveness of the bentonite in reducing infiltration of oxygen and water into the stored tailings?

e. How would PolyMet ensure bentonite's effectiveness in reducing infiltration of oxygen and water into the stored tailings over time?

SUMMARY OF THE RECOMMENDATIONS

Based on a careful review of the record, the Administrative Law Judge respectfully recommends that the Commissioner find that:

- The bentonite amendment can be successfully applied to the Basin sides, beaches, and pond bottom.

- The bentonite-amended cover on the pond bottom would be effective in maintaining a permanent pond that acts as a water cover over the stored tailings.

- Cation exchange would not consequentially reduce the effectiveness of the bentonite in reducing infiltration of oxygen and water into the stored tailings.

- The bentonite amendment would be effective in reducing infiltration of oxygen and water into the stored tailings over time.

Despite those recommendations, the Administrative Law Judge also recommends that the Commissioner find:

- The bentonite amendment is not a practical and workable reclamation technique.

- The bentonite amendment would not help ensure that the tailings are stored in a manner that renders them non-reactive, as required by Minn. R. 6132.2200, subp. 2(B)(1) (2023).

- The bentonite amendment would not help ensure that the NorthMet Project permanently prevents substantially all water from moving through or over the reactive tailings as required by Minn. R. 6132.2200, subp. 2(B)(2) (2023).

Based upon these findings, and without passing judgment on other issues regarding the NorthMet Project that are pending before the DNR, the Administrative Law Judge recommends that the Commissioner **DENY** PolyMet's Permit to Mine application.

Alternatively, if the permit is granted, the Commissioner should impose the special conditions established in the original Permit to Mine (Nov. 1, 2018), along with additional or revised special conditions set forth by the DNR.

Based upon the evidentiary record herein, the Administrative Law Judge makes the following:

FINDINGS OF FACT

I. NorthMet Project Background

1. PolyMet's NorthMet Project would be Minnesota's first copper-nickel-platinum group elements mine.[4]

2. The NorthMet Project is located on Minnesota's Iron Range; the project consists of a mine site near Babbitt, Minnesota, and a site for mineral processing and tailings storage at the former LTV Plant near Hoyt Lakes, Minnesota.[5]

3. PolyMet projects that the NorthMet Project will require approximately 18 to 24 months of construction, followed by approximately 20 years of mining, after which the mine would undergo procedures for closure and reclamation.[6]

4. PolyMet proposes to conduct open-pit mining of ore at a previously undeveloped site. PolyMet will process of the ore at the LTV Plant, which is a former taconite plant that PolyMet will be refurbished to serve the NorthMet Project.[7]

[4] Exhibit (Ex.). 74 at 69-76.
[5] *Id.* at 65-67; Ex. 1.
[6] Ex. 219 (R.115526, ¶¶ 2,4).
[7] *Id.* (R. 115526, ¶ 3); Ex. 74, Radue Direct at 69-70.

5. PolyMet will mine the ore and then transport it, along with mine tailings, six miles by rail from the mine site to the LTV Plant, where the ore and tailings will be processed.[8]

6. After target minerals are extracted from the ore, the remaining materials are called "flotation tailings." PolyMet proposes to dispose of the flotation tailings within a special disposal area at the LTV Plant called the Flotation Tailings Basin (Basin).[9]

7. The NorthMet Project would yield an average daily production of 32,000 tons of ore and 42,000 tons of waste rock.[10] Over the proposed 20-year life of the mine, the NorthMet Project would generate 225 million tons of tailings.[11]

8. PolyMet intends to build the Basin on top of Cells 1E and 2E of the existing taconite tailings Basin at the LTV Plant[12] and, at closure, the Basin would be about the same height as Cell 2W.[13] As PolyMet deposits flotation tailings, it plans to construct a series of dams made from "borrowed" taconite tailings to contain its flotation tailings in the Basin above Cells 1E and 2E.[14]

9. The aerial view below shows the orientation of existing taconite tailing Basin Cells 2W, 1E, and 2E.[15]

[8] Ex. 74 at 69-70.
[9] Evidentiary Hearing Transcript Volume (Tr. Vol.) 1 at 61:18-19, 91:10-11 (Radue); Tr. Vol. 4 at 78:16-20 (Malusis); Ex. 74 at 83-87, 141-148; *see also* Ex. 40.
[10] Amended Notice and Order for Hearing at 4 (Feb. 14, 2022).
[11] Ex. 210 at R.0065580.
[12] Ex. 211, R.0715517.
[13] Tr. Vol. 2 at 10:16-20 (Radue).
[14] Ex. 210, R.0065585.
[15] Ex. 328. Fig. 3.2-22 (Nov. 2013).

10. The Basin has four key areas. First, the tailings dams and buttress contain the tailings. Second, the sides, beaches, and pond bottom are designed to limit oxygen and water infiltration to the underlying tailings. These areas are amended with bentonite as needed to improve sealing of these surfaces. Third, a seepage capture system surrounds the Basin to intercept and facilitate collection of seepage that occurs. Fourth, a wastewater treatment system treats the collected water gathered by the seepage capture system to a suitable quality for discharge to the environment in compliance with the NorthMet Project's National Pollutant Discharge Elimination System (NPDES) permit requirements.[16]

11. The Minnesota Pollution Control Agency (MPCA) issued PolyMet a final NPDES/SDS permit on December 20, 2018.[17] But, on August 2, 2023, the Minnesota Court of Appeals ruled that the MPCA's decision to grant the NPDES/SDS permit was "arbitrary and capricious under Minn. Stat. § 14.69(f)."[18] The Court of Appeals remanded the matter to the MPCA, which has that matter under advisement.[19]

12. An enhanced drawing of the tailings pond[20] is reproduced below.[21]

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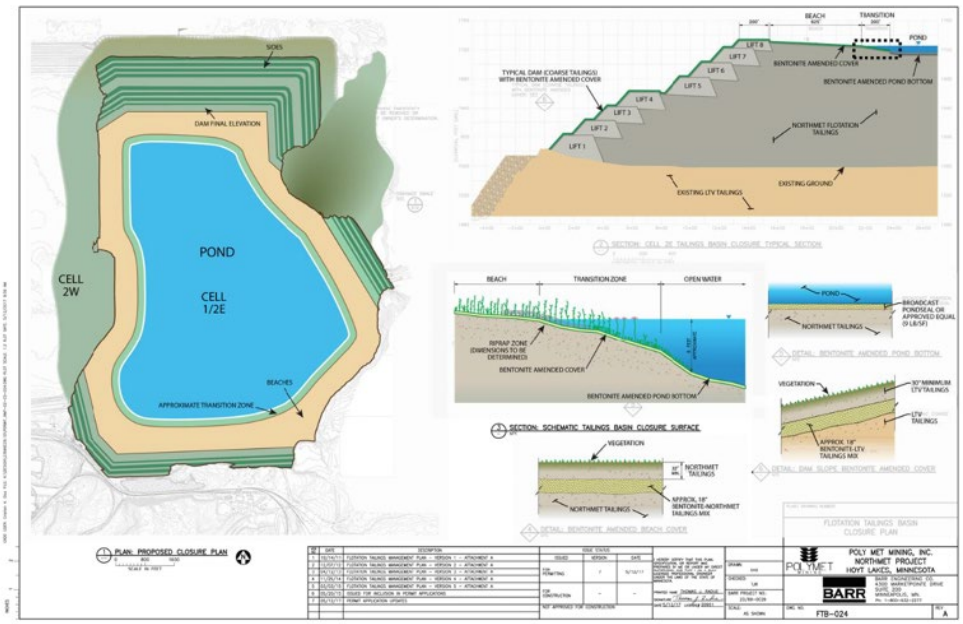
[16] Ex. 74 at 150-157.
[17] *ITM of the Denial of Contested Case Hearing* 2023 WL 4919533 at *5 (Minn. 2023). "Along with the NPDES program, the MPCA is tasked with administering the state disposal system (SDS) permit program under state law. Here, the MPCA issued a combined NPDS/SDS permit." (*Id.* at *4.).
[18] *Id.* at *13.
[19] *Id.* at *21.
[20] *See* Ex. 14.07.
[21] Ex. 14.07.



13. PolyMet intends to use two types of tailings to construct the Basin: NorthMet flotation tailings and LTV coarse tailings. The flotation tailings will be present in the Basin, on the beach, and on the pond bottom. The flotation tailings are predominately silt and fine sand-sized material. The taconite coarse tailings are existing tailings generated in the past by operations of the now-closed taconite mine that PolyMet will use for Basin dam construction. The coarse tailings have a larger particle size distribution, ranging from silt to sand to fine gravel.[22]

14. PolyMet plans to amend the coarse taconite tailings on the dam sides and the flotation tailings on the beaches and pond bottom, if needed, with bentonite. Bentonite is a natural geologic clay material that swells when hydrated, thereby reducing the amount of oxygen and water that can enter the tailings.[23]

15. The application methods vary for each feature.[24] The purpose of the bentonite amendment is to reduce oxygen and water infiltration to the tailings and to maintain a wet cover over the tailings.[25]

16. Manufactured bentonite products come in various forms, including powdered, granulated, and pelletized.[26]

17. Bentonite has historically been used to reduce water infiltration in ponds, dams, landfills, and other facilities.[27] Although questions about bentonite's long-term

[22] Ex. 74 at 141-148; Ex. 2.
[23] Tr. Vol. 2 at 141:18-22 (Hull); Ex. 74, Radue Direct at 167-72, 235-38; Ex. 206, Benson Direct at 7:17-20.
[24] Ex. 74, Radue Direct at 276-300, 406-82.
[25] Ex. 74, Radue Direct at 152-53; Ex. 101, Engstrom Direct at 6:1-6.
[26] Ex. 11.01-11.03.

performance exist, bentonite has been used in covers of tailings and waste rock at several mining facilities, including in Minnesota.[28]

18. Bentonite is commonly used as a liner in ponds and landfills to prevent seepage. Bentonite is also used for making diaphragm walls, waterproofing below-grade walls, and forming other impermeable barriers. In addition, bentonite is commonly placed between synthetic materials to create geosynthetic clay liners (GCLs).[29] In light of bentonite's historical use, the properties and performance of bentonite to reduce oxygen and water infiltration are well understood and documented.[30]

19. Assessing the efficacy of the bentonite amendment at the NorthMet Project, requires consideration of the hydraulic conductivity of the bentonite-amended tailings layer. Hydraulic conductivity is a property of a porous medium representing the rate at which a fluid can travel through the pores. The porous medium at issue here is the bentonite-amended tailings layer, and the primary infiltrating fluids will be the Basin pond water and precipitation. The higher the hydraulic conductivity, the greater the rate at which fluid can pass through the bentonite-amended tailings.[31]

20. Percolation rate is the net amount of water measured in linear units that infiltrates and passes through a porous medium over time.[32]

21. The bentonite amendment is not designed to eliminate water and oxygen infiltration.[33] Rather, its purpose is to reduce water and oxygen infiltration enough to meet the modeled values for hydraulic conductivity and percolation.[34]

22. By decreasing oxygen and water infiltration, the bentonite amendment is designed to limit oxidation of the tailings, which would reduce the release of sulfate and metals.[35]

23. Other engineering controls, such as the seepage containment and wastewater treatment systems, are designed to capture and treat water that seeps from

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[27] *See, e.g.*, Ex. 76, Hull Direct at 263-312 (discussing use of AquaBlok bentonite product); Tr. Vol. 2 at 123:16–124:18 (Hull); Ex. 17 (listing dozens of instances where Wyo-Ben bentonite product has been used); Ex. 202.09 (publication about sealing ponds and lakes with bentonite); Ex. 74, Radue Direct at 172-76 (discussing use of clays like bentonite in the construction of Roman aqueducts).

[28] Ex. 66.14, Tr. Vol. 5 at 42:3-6 (Benson) (listing six mining facilities where soil-bentonite mixtures have been used to cover tailings and waste materials); Tr. Vol. 2 at 130:10-15 (Hull) (discussing use of bentonite to cover tailings at the Minorca mine in Minnesota); Ex. 206, Benson Direct at 14:1-8; Tr. Vol. 5 at 88:9-13 (Benson) (discussing soil-bentonite barrier at an Idaho mine).

[29] Ex. 74 at 191-204.

[30] Ex. 76, Hull Direct at 200-02.

[31] Ex. 105, Wenz Rebuttal at 2:10-13; Ex. 206, Benson Direct at 6:21-7:2.

[32] *See* Ex. 206, Benson Direct at 15:6-7.

[33] Ex. 74, Radue Direct at 290-96; Ex. 75, Radue Rebuttal at 1409-11.

[34] Ex. 75, Radue Rebuttal at 1409-11; Ex. 79, Diedrich Rebuttal at 106-10.

[35] Ex. 74, Radue Direct at 290-94; Tr. Vol. 4 at 108:2-5 (Malusis).

the tailings Basin. These engineering controls are beyond the scope of this proceeding.[36]

24. The water quality model for the NorthMet Project used certain inputs for hydraulic conductivity and percolation. The input for hydraulic conductivity for the bentonite-amended tailings on the dam sides and beaches was 5.56×10^{-6} cm/sec. The average modeled percolation rate for the bentonite-amended tailings on the pond bottom was 6.5 inches per year.[37]

25. A range of different hydraulic conductivities could meet the average modeled percolation rate of 6.5 inches per year.[38]

II. The Five Specific Fact Issues

A. Fact Issue No. 1: How Would Bentonite be Applied to the Tailings Basin, Sides, Beaches, and Pond Bottom to Ensure Its Effectiveness in Reducing Infiltration of Oxygen and Water into the Stored Tailings Over Time?

26. PolyMet plans to amend tailings with bentonite on three different features of the flotation tailings facility—the dam sides, beaches, and (if needed) pond bottom. The application methods vary for each feature.[39] Exhibit 14 depicts the three bentonite applications.

27. The bentonite amendments to the dam sides and beaches would be buried under a 30-inch layer of taconite tailings (dam sides) or flotation tailings (beaches). The bentonite amendment to the pond bottom would be covered by the pond.[40]

28. PolyMet would apply bentonite to the dam sides in stages during construction of the tailings Basin dam, while the applications to the beaches and pond bottom (if needed) would occur during closure.[41]

29. For each amendment, PolyMet tentatively plans to use a 3% bentonite mixture. PolyMet would conduct additional testing, however, to confirm the optimal dosage of bentonite.[42]

30. PolyMet has proposed compaction plans to account for potential differential settlement of the amended bentonite layer. Coarse taconite tailings have not

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[36] Ex. 103, Engstrom Rebuttal at 10:11-16; Amended Notice at ¶¶ 14, 17, 26.
[37] Tr. Vol. 1 at 46:4-12 (Radue); Tr. Vol. 2 at 43:14-20; 44:15-22 (Radue); Ex. 105 Wenz Rebuttal at 4:3-6.
[38] Tr. Vol. 3 at 33:4-34:14 (Diedrich); Tr. Vol. 2 at 112:19-113:34 (Radue); Tr. Vol. 2 at 51:14-19 (Radue); Tr. Vol. 3 at 202:18-20 (Wenz); Tr. Vol. 4 at 154:23-155:5 (Wenz).
[39] *See* Ex. 74, Radue Direct at 276-300, 406-82.
[40] Ex. 14.04-14.07.
[41] Ex. 219, R. 115626, ¶ 534.
[42] Ex. 74, Radue Direct at 696-97.

shown signs of differential settlement, and any differential settlement of flotation tailings is expected to be gradual instead of acute.[43]

i. Dam Sides

31. The taconite tailings on the dam sides would be amended with bentonite incrementally over 20 years of operations, as each lift in the dam is constructed.[44]

32. The process for amending the dam sides will include the three following components: (1) constructing dam side slopes and benches to subgrade elevation; (2) placing, mixing, and compacting a bentonite-amended tailings layer in thin lifts until a completed layer thickness of 18 inches is achieved; and (3) covering the bentonite-amended tailings with 30 inches of coarse taconite tailings and vegetation.[45]

33. The taconite tailings on the dam sides are to be amended with bentonite using conventional construction techniques on easily accessible, dry surfaces. As a result, there are no major challenges regarding this application.[46]

34. Bentonite has been used in a variety of applications similar to the proposed dam side application for the NorthMet Project.[47]

ii. Pond Bottom

35. PolyMet proposes using one of three methods to apply the bentonite amendment to the pond bottom. One method involves broadcasting granular bentonite or bentonite pellets, chips, or AquaBlok across the pond bottom. The bentonite may be broadcast on the pond bottom by barges controlled by global positioning systems (GPS).[48] AquaBlok has a proven track record when applied subaqueously through a water column to the bottom of a body of water via the broadcast method.[49]

36. Alternatively, the pond bottom may be amended by injecting granular, powdered, or slurry bentonite into the tailings using custom-made or modified agricultural injection equipment.[50]

37. The third method of amending the pond bottom is by placing a GCL across the pond bottom, overlapping adjacent GCL panels as needed to achieve uniform coverage.[51]

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[43] Ex. 75 Radue Rebuttal at 1077-1103.
[44] Ex. 74, Radue Direct at 407-09.
[45] *Id.* at 409-16.
[46] *See id.* at 406-16; Ex. 104 Ulrich Rebuttal at 3:18-4:4; Tr. Vol. 4 at 7:9-12 (Kuipers).
[47] Ex. 76, Hull Direct at 436-43 (describing use of bentonite in the construction and repair or trench dams, cofferdams, permanent dams, levees, and other water control structures.); Ex. 17 (Wyo-Ben brochure describing the application of bentonite products to a range of structures, including slurry cutoff trenches, landfills, and diaphragm walls).
[48] Ex. 74, Radue Direct at 457-59; Ex. 18.01.
[49] Ex. 76, Hull Direct at 263-312; Tr. Vol. 2 at 123:16-124:18, 135:16-23 (Hull).
[50] Ex. 74, Radue Direct at 461-64; Ex. 18.02.

38. PolyMet plans to use standard construction technologies such as GPS and bathymetric surveys to ensure proper application to the pond bottom.[52]

39. There is a lack of academic literature establishing the ability to apply bentonite to the pond bottom.[53] Not all successful engineering methods, however, are reported in the literature.[54]

40. AquaBlok was applied subaqueously to the bottom of Machado Lake in California, which is around 45 acres in size. Exhibit 60 is a video recording of bentonite being applied subaqueously (via the broadcast method) to the bottom of Machado Lake in California. Machado Lake is approximately 45 acres in size.[55] AquaBlok was also successfully applied to the bottom of the Ottawa River in Ohio at a rate of several acres per day through the use of a Telebelt articulated/telescoping conveyor on a barge.[56] AquaBlok was applied through the water column at the East Branch of the Grand Calumet River in Indiana, the Middle River in Connecticut, the Grasse River in New York, a naval base in Virginia, and Pearl Harbor in Hawaii.[57]

41. Exhibits 42.01 to 42.10 depict various real-world applications of bentonite, including several subaqueous applications.

42. Bentonite has also been applied through at least 60 meters of seawater in Norway.[58]

43. Bentonite products have been applied under more difficult conditions than are presented by the NorthMet Project, including at depths much greater than the NorthMet Project's tailings pond and to water bodies with much higher ionic strength.[59]

44. All of these subaqueous bentonite applications satisfied their respective objectives.[60] Some of these examples were designed to cap contaminated sediments, and not to reduce water seepage through a pond bottom.[61] However, the same general principles apply to each use, as the purpose is to minimize the passage of free liquids from one side of the barrier to the other.[62]

45. Wyo-Ben, another brand of bentonite, makes a bentonite product intended to reduce the permeability of lagoons, ponds, and reservoirs. In situations where the

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[51] Ex. 74, Radue Direct at 474-77; Ex. 18.03.
[52] Radue Amended Declaration (Decl.) at ¶ 7. (On file with the Minn. Office of Admin. Hearings).
[53] Ex. 206, Benson Direct at 31:18-22.
[54] Ex. 75, Radue Rebuttal at 520-26; Tr. Vol. 4 at 33:14-34:10 (Kuipers); Radue Amended Decl. at ¶ 5.
[55] Ex. 76, Hull Direct at 267-71.
[56] *Id.* at 287-91.
[57] *Id.* at 272-85; Tr. Vol. 3 at 11:7-12:3 (Hull).
[58] Tr. Vol. 3 at 12:6-11 (Hull).
[59] Tr. Vol. 2 at 135:4-15 (Hull); Tr. Vol. 3 at 11:24-12:18, 17:10-17, 19:16-20 (Hull).
[60] Ex. 76, Hull Direct at 50-52; Tr. Vol. 2 at 126:11-16 (Hull).
[61] Tr. Vol. 2 at 193:5-9 (Hull).
[62] Hull Decl. at ¶¶ 4-5.

water is not removed before application of the bentonite, the product "is broadcast or poured across the surface of the water, then sinks to the bottom."[63]

46. Texas A&M University has published an article discussing the use of bentonite to seal ponds and lakes.[64] This publication states that seepage losses:

> [O]ften can be reduced or eliminated by using bentonite to seal the bottom of ponds. Bentonite is a natural clay with excellent swell characteristics. When wet, it expands to 10 to 12 times its dry size. When applied in sufficient volumes, bentonite can form a layer that is impervious to water. It is easy to apply with ordinary farm equipment and does not affect water quality.

The publication further discusses application methods of bentonite to pond bottoms, stating: "In situations where a pond cannot be drained, a sprinkle method may be used," by which "coarse particles are scattered on the surface of the water and then allowed to sink to the bottom." "As the bentonite swells, it forms a gel that is drawn into the more porous areas of the pond bottom," forming a "water-resistant layer" that "reduces the seepage from these areas."[65]

47. The NorthMet Project tailings Basin pond will be the largest known proposal to date for subaqueous application of bentonite.[66]

48. The scale of this application does not appear to be problematic.[67]

iii. Beaches

49. PolyMet expects the beach amendment will be the most challenging of the three applications due to the high moisture content and the difficulty in accessing this area.[68]

50. The process for amending the beaches with bentonite consists of the following steps: (1) peeling back several feet of taconite tailings from the beach surface; (2) drying those tailings to facilitate subsequent mixing with bentonite; (3) placing and mixing bentonite into the exposed upper 6-inch taconite tailings layer; (4) replacing the tailings that were peeled back in thin lifts by placing them, mixing in bentonite, and compacting them as needed to achieve a uniform and compacted 18-inch thick layer; and (5) covering the bentonite-amended tailings layer with 30 inches of flotation tailings and vegetation.[69]

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[63] Ex. 17 at 2-3.
[64] Ex. 202.09.
[65] *Id.* at 4, 6.
[66] Tr. Vol. 2 at 132:25-133:4 (Hull).
[67] Tr. Vol. 1 at 53:23-54:10 (Radue); Tr. Vol. 2 at 133:5-135:15 (Hull).
[68] Ex. 75, Radue Rebuttal at 567-70; Tr. Vol. 1 at 69:17-25 (Radue); Tr. Vol. 4 at 7:2-22 (Kuipers).
[69] Ex. 74, Radue Direct at 429-39.

51. PolyMet has not definitively specified the equipment it plans to use to complete the beach amendment. Examples of the types of equipment that could be considered include backhoes, dozers, rototillers, and agricultural equipment.[70]

52. PolyMet expects the tailings surface on the beaches to be nearly horizontal, and the tailings may need to be disced and dried in order to facilitate access.[71]

53. There are real-world examples of bentonite being applied to moist soils to reduce seepage and help retain water.[72]

54. Bentonite can be applied to the beaches, at least partially, using common equipment such as barges or telescoping conveyors, and through the use of mats to facilitate access.[73] Engineers have worked to apply bentonite in more challenging conditions than those posed by the tailings Basin beaches, including at coal ash facilities.[74]

55. 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.[75]

56. Because of the nature of mining operations (*i.e.*, the multiyear time frame of construction and operations, actual site conditions, and contingencies that arise during construction), specific details pertaining to the application of bentonite must be determined closer to the time of construction.[76]

B. Fact Issue No. 2: How Should the Application Methods of the Bentonite be Evaluated or Tested Before Application to Ensure Effectiveness in Reducing Infiltration of Oxygen and Water into the Stored Tailings?

57. A determination as to whether the bentonite amendment is a practical and workable reclamation technique that would satisfy the Reactive Mine Waste Rule[77] must be based on available evidence in the record. Future testing cannot form the basis of the determination at this time, however testing in the future could play an important role in confirming the effectiveness of the bentonite amendment.[78] Future testing may also

[70] Ex. 19 at 6-9; Tr. Vol. 1 at 147:18-23.
[71] Ex. 74 Radue Direct at 441-43.
[72] Tr. Vol. 2 at 132:12-24, 188:12-14 (Hull); Ex. 76 Hull Direct at 347-54; Ex. 42.09-10.
[73] Tr. Vol. 2 at 129:9-130:9, 174:11-22 (Hull).
[74] Tr. Vol. 2 at 101:5-102:5 (Radue); Ex. 68.
[75] Ex. 104, Ulrich Rebuttal at 5:4-8; Ex. 75, Radue Rebuttal 500-01.
[76] Ex. 75, Radue Rebuttal at 485-88, 703-12; Tr. Vol 2 at 154:5-19 (Hull); Tr. Vol 4 at 36:20-37:11 (Kuipers).
[77] *In re NorthMet Permit to Mine Application,* 959 N.W.2d at 754.
[78] Ex. 103, Engstrom Rebuttal at 4:6-6:21.

be important in determining certain variables like the optimal dose and type of bentonite.[79]

58. At this time, testing regarding the hydraulic conductivity for the bentonite-amended tailings is limited to a single laboratory test of coarse taconite tailings amended with 3% bentonite. This is a limited data set, and laboratory tests often do not reflect real-world variables.[80] Prior to the commencement of mining, it would be very difficult for PolyMet to obtain sufficient quantities of ore for field-scale testing.[81]

59. In January 2019, PolyMet submitted a work plan for bentonite amendment testing, as required by the permit's special conditions.[82] The work plan identifies a proposed protocol for lab testing, field testing, monitoring, and quality assurances and controls for construction.[83] Due to pending litigation, DNR has not completed a formal review of this work plan.

60. The DNR has various other tests, in addition to those contemplated in the 2019 work plan, that could potentially be conducted with respect to the bentonite amendment.[84]

61. Additional tests, including pilot and field-scale tests, could be used to collect a more robust data set and to account for the effects of real-world variables.[85]

62. The new testing plan should include quantifiable objectives.[86]

63. The new testing plan should evaluate different dosages, types, and forms of bentonite.[87]

64. The new testing plan should evaluate moisture retention, or saturation, of the bentonite-amended tailings.[88]

65. The new testing plan should incorporate field-scale tests to evaluate the effects of various sources of potential degradation of the bentonite-amended tailings layer.[89]

66. The new testing plan should incorporate a plan for post-construction monitoring to ensure that bentonite functions as anticipated. The plan should also

[79] Ex. 74, Radue Direct at 554-60.
[80] Ex. 103, Engstrom Rebuttal at 4:17-18.
[81] Ex. 75, Radue Rebuttal at 660-76, 754-60; Tr. Vol. 1 at 152:9-13 (Radue).
[82] Ex. 293.
[83] *Id.*
[84] Ex. 103, Engstrom Rebuttal at 4:6-6:21.
[85] *Id.* at 4:17-22.
[86] *Id.* at 5:10-15.
[87] *Id.* at 5:16-19.
[88] Tr. Vol. 4 at 108:8-16 (Malusis).
[89] Ex. 103, Engstrom Rebuttal at 6:3-14.

address adaptive management actions in the event monitoring reveals that bentonite is not functioning as anticipated.[90]

67. Minn. Stat. § 93.483, subd. 5 (2022), authorizes the DNR commissioner to "grant, with or without modifications or conditions, or deny the application after a contested case."

C. Fact Issue No. 3: Would the Pond-Bottom, Bentonite-Amended Cover be Effective in Maintaining a Permanent Pond that Acts as a Water Cover Over the Stored Tailings?

68. It is possible that the pond would be maintained even without a bentonite amendment.[91]

69. Existing cells 1E and 2E of the tailings Basin (where the pond would be located) already require the outward pumping of water, indicating ongoing water retention without the bentonite amendment.[92]

70. The tailings have a relatively low hydraulic conductivity even before being amended with bentonite, limiting the need for further reductions in hydraulic conductivity.[93]

71. After amendment with bentonite, the tailings on the pond bottom would swell, thereby filling voids and further reducing hydraulic conductivity. A reduction in hydraulic conductivity will further reduce water seepage through the pond bottom.[94]

72. The pond would maintain saturation of the underlying bentonite-amended tailings, providing protection against wet-dry cycling and creating a positive feedback loop that helps maintain the pond.[95]

73. Bentonite has a proven track record with subaqueous applications.[96] Bentonite has also been used to successfully reduce water leakage through a pond bottom.[97]

74. Bentonite has been successfully used in a partially subaqueous application at the Minorca mine in Minnesota.[98]

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[90] *Id.* at 6:18-21.
[91] Ex. 219 (R.115626 n.19) Ex. 74, Radue Direct at 868-73.
[92] Ex. 74, Radue Direct at 838-51; Tr. Vol. 2 at 22:6-12 (Radue).
[93] Ex. 25.
[94] Ex. 74, Radue Direct at 830-33, 890-95; Ex. 206, Benson Direct at 7:19-20; Ex. 105, Wenz Rebuttal at 2:10-11.
[95] Ex. 104, Ulrich Rebuttal at 5:10-6:7; Ex. 200, Malusis Direct at 30:13-15.
[96] Ex. 76 Hull, Direct at 263-312; Tr. Vol. 2 at 123:16-124:18 (Hull).
[97] Ex. 76, Hull Direct at 347-54; Ex. 42.09-10.
[98] Tr. Vol. 2 at 130:10-15 (Hull).

D. Fact Issue No. 4: Would Any Conditions in the Pond Result in Cation Exchange that Could Reduce the Effectiveness of the Bentonite in Reducing Infiltration of Oxygen and Water into the Stored Tailings?

75. An ion is an atom or molecule with a different number of negatively charged electrons than positively charged protons. When the number of protons exceeds the number of electrons, the ion has a positive charge and is called a cation. Common cations include sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), and magnesium (Mg^{2+}).[99]

76. Montmorillonite, the mineral that makes up bentonite clay, has a crystal structure with interlayered cations.[100]

77. Cation exchange is an electrochemical process in which cations replace one another between the solid and liquid boundary. With respect to the proposed bentonite amendment, cation exchange would typically entail a sodium cation on the bentonite surface being replaced with a calcium or magnesium cation from the pond water or pore water in the flotation tailings.[101]

78. When hydrated with deionized water (water lacking ions), bentonite swells abundantly and is highly impermeable. As the ionic strength (*i.e.*, concentration of ions) of the hydrating solution increases, bentonite's swelling capacity is reduced.[102]

79. Bentonite swells most readily when the interlayer cations within the bentonite are dominated by sodium (Na^+), which is a monovalent cation given its charge of +1. The sodium cations, however, can be replaced through cation exchange with polyvalent cations (with a charge of more than +1), such as calcium (Ca^{2+}) or magnesium (Mg^{2+}), that reduce the bentonite's swelling capacity.[103]

80. Calcium bentonites have less swelling capacity than sodium bentonites and therefore are more permeable in amendment applications.[104] But, bentonite swells to some extent regardless of its cation composition.[105] Thus, bentonite will swell and maintain some amount of expanded mass even if subject to a large amount of cation exchange.[106]

81. Cation exchange is primarily driven by two variables—the composition of the surrounding fluid (i.e., the types of ions present) and the ionic strength of the surrounding fluid (i.e., the concentration of ions). All else being equal, fluid with a higher

[99] Ex. 74, Radue Direct at 945-50.
[100] Ex. 78 Diedrich Direct at 337-71; Ex. 206, Benson Direct at 8:6.
[101] Ex. 105, Wenz Rebuttal at 2:14-18; Ex. 206, Benson Direct at 32:13-16.
[102] Ex. 206, Benson Direct at 10:9-15.
[103] Ex. 78, Diedrich Direct at 371-75; Ex. 206, Benson Direct at 9:19-10:5.
[104] Ex. 10; Ex. 201, Malusis Rebuttal at 8:8-9; Tr. Vol. 3 at 32:6-9, 67:17-20 (Diedrich).
[105] Ex. 78 Diedrich Direct at 375-77.
[106] Tr. Vol. 3 at 31:10-16 (Diedrich).

ionic strength would cause more cation exchange, with a greater adverse effect on bentonite's swelling capacity.[107]

82. It is undisputed that some cation exchange would occur within the bentonite-amended tailings for the NorthMet Project.[108]

83. The fact that cation exchange tends to reduce the swelling capacity of the bentonite-amended tailings means that it likely would result in increased hydraulic conductivity.

84. The combination of cation exchange and wet-dry cycling would significantly increase the hydraulic conductivity of the bentonite-amended tailings.[109] 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.[110]

85. Testing cation exchange within low-ionic-strength solutions requires a significant amount of time.[111] As a result, there is little scientific or technical literature addressing cation exchange within such solutions.[112]

86. Modeling forecasts specific to the NorthMet Project indicate that the tailings' pond water would have a relatively low ionic strength, and that it will be reduced further over time, such that it is not anticipated to result in consequential levels of cation exchange.[113]

87. Likewise, PolyMet expects that water contacting the bentonite amendment on the beaches and dam sides—mainly in the form of precipitation and pore water—will have low ionic strength in the near surface.[114]

88. The pond itself will saturate the pond bottom, essentially eliminating wet-dry cycling on the pond bottom and limiting the consequences of any cation exchange.[115] Air intrusion should be minimal beneath the water-covered portion (i.e., the pond area), provided that the pond is maintained as a permanent feature.[116]

89. The dam sides and beaches likely will experience some wet-dry cycling.[117] PolyMet expects that the bentonite-amended tailings on the beaches will

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[107] Ex. 78, Diedrich Direct at 380-87; Tr. Vol at 35:9-12 (Diedrich).
[108] Ex. 206, Benson Direct at 25:17-20; Tr. Vol. 3 at 32:19-24 (Diedrich).
[109] Tr. Vol. 5 93:4-7, 96:17-97:2 (Benson); Tr. Vol. 4 at 50:21-51:10 (Malusis); Ex. 200, Malusis Direct at 29:15-21.
[110] Tr. Vol. 5 at 96:17-97:2, 93:2-10, (Malusis); Ex. 200, Malusis Direct at 29:15-21.
[111] Tr. Vol. 4 at 116:3-19 (Wenz).
[112] Tr. Vol. 4 at 116:3-19 (Wenz).
[113] Ex. 78, Diedrich Direct 93-96, 388-90; Tr. Vol. 3 at 34:15-35:19 (Diedrich).
[114] Ex. 79, Diedrich Rebuttal at 228-63; Tr. Vol. 3 at 44:15-45:4 (Diedrich).
[115] *See* Tr. Vol. 4 at 95:14-18 (Malusis) Ex. 104, Ulrich Rebuttal at 5:10-6:7; Ex. 200 Malusis Direct at 30:13-15.
[116] Ex. 200 Malusis Direct at 7:10-11.
[117] Tr. Vol. 5 at 119:9-15 (Benson).

wick water from the pond, helping to maintain saturation and limit wet-dry cycling.[118] The annual average precipitation at the tailings Basin exceeds annual average evapotranspiration and runoff, which is also likely to limit wet-dry cycling.[119] In addition, because PolyMet intends to bury the bentonite amendments on the beaches and dam sides under a 30-inch layer of vegetated tailings, that additional cover will help limit wet-dry cycling.[120]

90. Although some wet-dry cycling will occur on the beaches and dam sides, the low ionic strength of the water contacting the bentonite in those areas will result in limited cation exchange.[121]

E. Fact Issue No. 5: How Would PolyMet Ensure Bentonite's Effectiveness in Reducing Infiltration of Oxygen and Water Over Time?

91. It is undisputed that bentonite would reduce water and oxygen infiltration to some extent.[122] The critical question is whether such reduction would remain sufficient over time, despite potential sources of degradation.

92. Tests at the existing tailings Basin indicate oxygen concentrations decline as vertical depth from the surface increases, suggesting that oxygen infiltration could be limited even without the bentonite amendment.[123]

93. Modeling for the NorthMet Project indicates that water quality standards would be met at an average hydraulic conductivity of 5.56×10^{-6} cm/sec for the dam sides and beaches and an average percolation rate of 6.5 inches per year for the pond bottom.[124]

i. Initial Hydraulic Conductivity Prior to Potential Degradation

94. Lab testing indicates that the 3% bentonite-amended taconite tailings have a hydraulic conductivity of 1.8×10^{-7} cm/sec.[125] The data, however, were derived from a single test. In addition, that test was run in a laboratory and does not account for potential sources of degradation in the field, such as cation exchange, wet-dry cycling, root penetration, and animal burrowing. More confirmation testing data, including from field tests, would provide increased confidence that the results are reliable.[126] Despite

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[118] Ex. 77, Hull Rebuttal at 416-20; Tr. Vol. 2 at 182:14-20, 184:4-10 (Hull).
[119] Ex. 77, Hull Rebuttal at 386-97; Ex. 75, Radue Rebuttal at 1039-43.
[120] Ex. 77, Hull Rebuttal at 416-20.
[121] Ex. 79, Diedrich Rebuttal at 228-63; Tr. Vol. 3 at 44:15-45:4 (Diedrich); Tr. Vol. 5 at 93:2-10, 96:17-97:2 (Benson) (discussing the integrated effect of wet-dry cycling and cation exchange); Ex. 200, Malusis Direct at 29:15-21.
[122] Ex. 74, Radue Direct at 235-38; Ex. 206, Benson Direct at 7:17-20.
[123] Ex. 74, Radue Direct at 1106-13; Exs. 33-34.
[124] Tr. Vol. 1 at 46:4-12 (Radue); Tr. Vol. 2 at 43:14-20, 44:15-22 (Radue); Ex. 105 Wenz Rebuttal at 4:3-6.
[125] Tr. Vol. 1 at 63:3-6 (Radue); Ex. 16.
[126] *See* Ex. 103, Engstrom Rebuttal at 4:17-5:9; Tr. Vol. 4 at 122:9-17 (Malusis); Ex. 203, Kuipers Rebuttal at 24:15-20.

these shortcomings, the test is relevant to determining the anticipated initial hydraulic conductivity of the bentonite-amended tailings.

95. The NorthMet tailings (on the beaches and pond bottom) will have a finer size gradation than the lab-tested LTV tailings. As a result, PolyMet expects that the NorthMet tailings will have an even lower hydraulic conductivity than 1.8×10^{-7} cm/sec when amended with 3% bentonite.[127]

96. The AquaBlok bentonite product, which has been used at another Minnesota mining facility,[128] has achieved a hydraulic conductivity of 1×10^{-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.[129] AquaBlok's low hydraulic conductivity has been tested in both freshwater and saltwater applications.[130]

97. Given that the hydraulic conductivity of amended materials can be engineered to be substantially less than the modeled values, the bentonite-amended tailings layers could degrade quite a bit and still maintain a hydraulic conductivity or percolation rate below the modeled values.[131]

ii. Potential Degradation Over Time

98. The bentonite-amended tailings layers in the NorthMet Project's tailing Basin would be protected—by the pond in the case of the pond bottom amendment and by the 30-inch burial with vegetation in the case of the dam sides and beach amendments.[132]

99. Nonetheless, the bentonite-amended tailings layers likely would degrade to some extent over time due to pedogenic effects, which occur when near-surface earthen materials undergo natural stresses. The degradation would particularly impact the dam sides and beaches. Such degradation may result in increased hydraulic conductivity and percolation.[133]

100. Root penetration is unlikely to be a significant problem on the pond bottom given the presence of the pond itself.[134] As for the dam sides and beaches, PolyMet evaluated root depths at the existing tailings Basin and discovered that the maximum root penetration depth was 26 inches. As noted above, the bentonite-amended tailings layer on the dam sides and beaches would be buried under 30 inches of cover. Thus,

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[127] Tr. Vol. 1 at 39:12-40:13, 64:7-17 (Radue).
[128] Tr. Vol. 2 at 130:10-15 (Hull).
[129] Ex. 43; Ex. 77, Hull Rebuttal at 655-59.
[130] Ex. 77, Hull Rebuttal at 644-64.
[131] Tr. Vol. 1 at 39:12-40:13, 64:7-17 (Radue); Ex. 43; Ex. 77, Radue Rebuttal at 655-59 (indicating low initial hydraulic conductivity).
[132] Ex. 14.04-14.07.
[133] Ex. 77, Hull Rebuttal at 760-62; Ex. 206, Benson Direct at 10:3-15, 25:17-20; Tr. Vol. 5 at 89:15-20, 118:12:119:15 (Benson).
[134] Ex. 104, Ulrich Rebuttal at 5:19-6:1.

current vegetative patterns suggest that root penetration is unlikely to be a significant problem on the dam sides and beaches.[135]

101. Some risk exists that the increased moisture in the bentonite-amended tailings layer could cause roots to penetrate more deeply than has been historically observed.[136]

102. PolyMet does not expect that freeze-thaw cycling or animal burrowing will materially degrade the amendment.[137] To the extent some animal burrowing occurs, PolyMet expects such burrowing to be minimal and anticipates it can be remedied.[138]

103. PolyMet also expects that wave action should not cause significant degradation, but some maintenance, including the installation of riprap, may be required.[139]

104. If necessary, PolyMet could mitigate the impacts of degradation through application of supplemental bentonite.[140] In addition, PolyMet could adjust the mix and amount of bentonite applied to provide a range of hydraulic conductivity or percolation rates.[141]

iii. Studies of Bentonite Degradation at Other Facilities

105. Studies at other facilities have shown that degradation commonly occurs in near-surface earthen soil covers, due to pedogenesis, resulting in hydraulic conductivities above the modeled values for the NorthMet Project.[142] Based on these studies, earthen soil (including bentonite) barriers tend to reach an equilibrium hydraulic conductivity in the range of to 1 x 10^{-5} cm/sec to 5 x 10^{-4} cm/sec, which is above the modeled values for the NorthMet Project.[143] This is not, however, a universal rule. Some studies indicate it is possible that a soil cover could provide hydraulic conductivity less than the modeled values for the NorthMet Project.[144] The range of hydraulic conductivities in available studies underscores the importance of considering site-specific factors.

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[135] Ex. 30 (showing result of a study); Ex. 75, Radue Rebuttal at 1052-59; *see also,* Ex. 104, Ulrich Rebuttal at 5:19-6:1 (explaining that root penetration and freeze-thaw cycling are unlikely to be material problems).
[136] Ex. 206, Benson Direct at 27:1-11.
[137] Tr. Vol. 4 at 70:11-12 (Malusis); Ex. 61.13, 61.18 (Benson memos re freeze-thaw cycling); Tr. Vol. 5 at 104:1-12 (Benson) (Benson reaffirming position taken in memos); *see also,* Ex. 74 Radue Direct at 1263-67.
[138] Ex. 74, Radue Direct at 1258-67.
[139] Tr. Vol. 2 at 133:24-134:20 (Hull); Ex. 74, Radue Direct at 1268-72.
[140] Ex. 76, Hull Direct at 174-76; Tr. Vol. 2 at 143:12-17(Hull); Tr. Vol. 3 at 21:1-14 (Hull); Ex. 74 Radue Direct at 1296-99.
[141] Tr. Vol. 2 at 139-11-140-10, 179:1-13 (Hull).
[142] Exs. 352-53; Tr. Vol. 5 at 12:17-22, 18:9-13, 23:2-5 (Benson).
[143] Exs. 352-53; Tr. Vol. 5 at 16:8-18:7.
[144] Exs. 352-53.

106. One study assessed a sand-bentonite waste cover at the Whistle Mine in Ontario. Given differences in construction design, environmental setting, and material properties between that facility and the NorthMet Project Basin, it is difficult to draw direct comparisons.[145] For example, the mixture at the Whistle Mine consisted of sand and bentonite, whereas the mixture at the NorthMet Project Basin would be made of tailings and bentonite, which is expected to result in lower permeability.[146] In addition, the mixture at the Whistle Mine contained 8% bentonite, but PolyMet proposes a mixture with 3% bentonite for the NorthMet Project Basin.[147] Despite the differences, the Whistle Mine study indicates that bentonite can reduce precipitation infiltration, as measurements indicated a percolation rate of 56.4% through the uncovered control rock pile versus 20% through the sand-bentonite cover.[148] The study also demonstrated a 65% degree of saturation and improved water quality despite various shortcomings in testing.[149]

III. Additional Background - The Environmental Review Process

107. Before PolyMet began the permitting process, the NorthMet Project underwent an environmental review process required by the National Environmental Policy Act (NEPA) and the Minnesota Environmental Policy Act (MEPA). The U.S. Army Corps of Engineers (USACE) led the NEPA review, while the DNR conducted the state process.[150]

108. The DNR and USACE initiated a joint federal-state environmental review process for the NorthMet Project in 2004. The DNR and USACE were co-lead agencies for the review, and the U.S. Forest Service later joined in as a co-lead agency. DNR and USACE issued a notice of preparation of a Draft Environmental Impact Statement in April 2006. DNR and USACE then issued the Draft Environmental Impact Statement in October 2009, which triggered a 90-day public comment period. In February 2010, the U.S. Environmental Protection Agency submitted comments on the Draft Environmental Impact Statement and assigned it a rating of EU-3 (Environmentally Unsatisfactory – Inadequate Information).[151]

109. PolyMet substantially modified the NorthMet Project after its prior plan received the unsatisfactory rating, including by making changes to the proposed mine pits and tailings Basin. After revising the Draft Environmental Impact Statement to address the modifications and the comments received, the co-lead agencies issued a Supplemental Draft Environmental Impact Statement in December 2013. The Supplemental Draft Environmental Impact Statement was also subject to a 90-day comment period, during which over 58,000 comments were submitted. As a result of

[145] Ex. 105, Wentz Rebuttal at 4:17-5:1; Ex. 206, Benson Direct at 28:14-15.
[146] Ex. 200 Malusis Direct at 12:13-16; Ex. 75, Radue Rebuttal at 1561-64; Tr. Vol. 1 at 58:24-59:5 (Radue).
[147] Ex. 200 Malusis Direct at 12:13-16, Ex. 75, Radue Rebuttal at 1561-64.
[148] Ex. 105, Wenz Rebuttal at 4:17-5:6.
[149] Tr. Vol. 2 at 105:16-106:6 (Radue).
[150] Ex. 101, Engstrom Direct at 2:15-19.
[151] *Id.* at 2:19-3:6.

those comments, PolyMet made additional minor modifications to the NorthMet Project.[152]

110. As part of the environmental review process, DNR and its consultants evaluated PolyMet's proposed bentonite amendments.[153]

111. After further revisions to the document to address the changes and comments, the co-lead agencies issued the Final Environmental Impact Statement in November 2015. The Final Environmental Impact Statement included responses to all comments received during review of the Draft Environmental Impact Statement and Supplemental Draft Environmental Impact Statement.[154]

112. DNR also issued a Record of Decision determining the Final Statement to be adequate in March 2016. The Record of Decision was not challenged.[155]

113. The environmental review process is further described in the findings issued by the DNR contemporaneously with the Permit to Mine.[156]

IV. The Permitting Process

114. After the DNR issued the Record of Decision, PolyMet submitted an application for various permits to the DNR and other state and federal agencies, including USACE and the MPCA. With respect to DNR, PolyMet submitted applications for a Permit to Mine, dam safety permits for the flotation tailings Basin and hydrometallurgical residue facility, several water appropriation permits, a public waters work permit, and a permit to take endangered or threatened species.[157]

115. The DNR's Permit to Mine is the Permit at issue in this proceeding.[158]

116. PolyMet submitted its initial application for the Permit in November 2016. The application started an iterative process during which PolyMet submitted a series of revised applications based on the DNR's comments on each respective application. PolyMet submitted Version 2 in August 2017, Version 3 in November 2017, and Version 3.1 in December 2017. PolyMet made additional changes to the NorthMet Project in the revised applications, such as adding additional buttressing to the tailings Basin dam to further enhance dam safety and combining two wastewater treatment plants into one plant. After PolyMet submitted Version 3.1, the final version, the DNR developed numerous special conditions regarding the operation and reclamation of the NorthMet Project. The DNR noticed a draft permit in January 2018, after which DNR held a 60-day public comment period, held two public meetings, and engaged in tribal outreach. The DNR received over 14,000 comments, and the Petitioners in this

[152] *Id.* at 3:7-14.
[153] Tr. Vol. 1 at 64:21-65:7 (Radue); Tr. Vol. 4 at 156:15-157:17 (Wenz).
[154] Ex. 101, Engstrom Direct at 3:15-19.
[155] *Id.* at 3:20-21.
[156] Ex. 219 (R. 115529-34).
[157] Ex. 101, Engstrom Direct at 4:4-8.
[158] *Id.* at 4:13-15.

proceeding filed two petitions for a contested case hearing, to which PolyMet filed a response.[159]

117. As part of the application submitted during the permitting process, PolyMet proposed to apply bentonite to: 1) the side slopes of the flotation tailings Basin dams during construction and operations; 2) the beaches of the flotation tailings Basin pond at closure; and 3) the pond bottom, if needed, at closure.[160]

118. The DNR retained consultants to assist it in reviewing the application, including as to mine planning, water management, tailings and waste rock management and storage, mine waste characterization, closure, and financial assurance. The DNR's review also relied upon the expertise of over a dozen internal agency staff.[161]

119. After carefully reviewing the comments on the draft Permit and petitions for contested case hearing, and making various permit revisions in response to these comments, the DNR denied the petitions and issued the Permit on November 1, 2018.[162] In conjunction with its decision, DNR also issued a set of findings and conclusions.[163]

120. DNR included special conditions in the Permit prescribing various requirements for pilot and field scale testing of the bentonite amendment. The special conditions required that PolyMet submit to the DNR, within 90 days after Permit issuance, a work plan for pilot and field scale testing of the bentonite amendment. PolyMet submitted this work plan in January 2019.[164]

121. The special conditions also required testing of the bentonite amendment to the dam sides before construction, and testing of the bentonite amendment to the beaches and pond bottom was required before the third year of tailings deposition.[165]

V. Litigation

122. In December 2018, Petitioners filed certiorari petitions in the Minnesota Court of Appeals challenging the DNR's denial of a contested case hearing and its issuance of the Permit and two dam safety permits. These various challenges were consolidated into a single action.

123. The Court of Appeals issued its decision on January 13, 2020.[166] The Court held that the DNR was required to hold a contested case hearing on a number of

[159] *Id.* at 4:17-5:7.
[160] *Id.* at 6:1-3.
[161] *Id.* at 5:14-20.
[162] *Id.* at 5:7-9; Ex. 220 (Permit).
[163] Ex. 219.
[164] Ex. 101, Engstrom Direct at 6:7-18; Ex. 293 (work plan).
[165] Ex. 220 (R. 115753-54, Special Conditions 89, 89b, 89e).
[166] *In the Matter of NorthMet Project Permit to Mine Application Dated December 2017,* 940 N.W.2d 216 (Minn. Ct. App. 2020).

issues regarding the NorthMet Project, including but not limited to, the proposed bentonite amendment.[167]

124. The DNR and PolyMet appealed the Court of Appeals' decision to the Minnesota Supreme Court.

125. Following briefing and oral argument, the Minnesota Supreme Court issued its decision on April 28, 2021.[168] The Court largely reversed the Court of Appeals, holding that there was substantial evidence in the record supporting the DNR's decision to deny a contested case hearing on all but one issue—"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, Minn. R. 6132.2200, subp. 2(B)(2)."[169] The Court held that a contested case hearing was not required regarding any other issue, including the "tailings basin dam," "waste storage and seepage containment technologies," "alternatives to wet closure," "financial assurances," and the "adequacy of the permit."[170] The Court also held that the Permit must contain a fixed numeric term. The DNR's decision regarding the Permit term is currently pending and is beyond the scope of this proceeding.

126. Any Finding of Fact contained in the following Memorandum is hereby adopted as such.

127. Any Conclusion of Law more properly considered to be a Finding of Fact is incorporated herein.

Based on these Findings of Fact, the Administrative Law Judge makes the following:

CONCLUSIONS OF LAW

1. The Minnesota Supreme Court directed that this contested case hearing be held "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."[171] The DNR "has the authority to identify the issues and the scope of the contested case hearing."[172]

2. The Commissioner of the DNR and the Administrative Law Judge have jurisdiction to consider the issue presented and the five specific facts disputes pursuant to Minn. Stat. §§ 93.483, 14.50, .57-.62 (2022), and Minn. R. 1400.5010-.8500 (2023).

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[167] *Id.* at 232-37.
[168] *In re NorthMet Permit to Mine Application,* 959 N.W.2d at 754.
[169] *Id.*
[170] *Id.* at n. 11; *Id. at* 751-52; 754.
[171] *In re NorthMet Permit to Mine Application,* 959 N.W.2d at 754.
[172] *Id.* at 738 n. 4.

3. The DNR has complied with all relevant procedural requirements of statute and rule and this matter is properly before the Administrative Law Judge and the Commissioner.

4. The Petitioners bear the burden of proving, by a preponderance of the evidence, that the issue and the five specific fact disputes should be resolved against PolyMet and the DNR.[173]

5. 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.

I. Compliance with the Reactive Mine Waste Rule

6. The Reactive Mine Waste Rule requires, among other things, that the mining operation must be designed to meet at least one of two standards. An applicant for a permit to mine must either:

(1) modify the physical or chemical characteristics of the mine waste, or store it in an environment, such that the waste is no longer reactive; or

(2) 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.[174]

7. The bentonite amendment would not help ensure that the tailings are stored in an environment such that the waste is no longer reactive, so the NorthMet Project does not comply with Minn. R. 6132.2200, subp. 2(B)(1).

8. The bentonite amendment would not help ensure that the NorthMet Project will permanently prevent substantially all the water from moving through or over the mine waste, so the NorthMet Project does not comply with Minn. R. 6132.2200, subp. 2(B)(2).

9. Therefore, the bentonite amendment is not a "practical and workable" reclamation technique that will satisfy the Reactive Mine Waste Rule.

[173] Minn. R. 1400.7300, subp. 5; Order on Motions at 10-11 (July 29, 2022).
[174] Minn. R. 6132.2200.

II. The Five Fact Issues

A. Fact Issue No. 1: How Would the Bentonite Amendment be Applied to the Tailings Basin, Sides, Beaches, and Pond Bottom to Ensure its Effectiveness in Reducing Infiltration of Oxygen and Water into the Stored Tailings Over Time?

10. The bentonite amendment can be effectively applied to the dam sides, pond bottom, and beaches.

B. Fact Issue No. 2: How Should the Application Methods of the Bentonite Amendment be Evaluated or Tested Before Application to Ensure Effectiveness in Reducing Infiltration of Oxygen and Water into the Stored Tailings?

11. The Commissioner may "grant, with or without modifications or conditions, or deny the application after a contested case," pursuant to Minn. Stat. § 93.483, subd. 5 (2022).

12. If the Permit to Mine is reissued, it should be subject to the special conditions in the original Permit to Mine (Nov. 1, 2018) and the Department's additional or revised special conditions set forth in the Department's Proposed Findings of Fact, and Recommendations.

C. Fact Issue No. 3: Would the Pond-Bottom, Bentonite-Amended Cover be Effective in Maintaining a Permanent Pond that Acts as a Water Cover Over the Stored Tailings?

13. Applying the bentonite amendment to the pond bottom would be effective maintaining a permanent pond bottom.

D. Fact Issue No. 4: Would Any Conditions in the Pond Result in Cation Exchange that Could Reduce the Effectiveness of the Bentonite in Reducing Infiltration of Oxygen and Water into the Stored Tailings?

14. The cation exchange would not consequentially impact the effectiveness of the bentonite amendment in reducing the infiltration of oxygen and water into the stored tailings.

E. Fact Issue No. 5: How Would PolyMet Ensure Bentonite's Effectiveness in Reducing Infiltration of Oxygen and Water Over Time?

15. The bentonite amendment would be effective over the long term and would not suffer degradation to the extent that hydraulic conductivity increases above the modeled values. The bentonite amendment is likely to achieve modeled values for hydraulic conductivity and percolation over time.

16. Any Finding of Fact more properly considered to be a Conclusion of Law is adopted herein.

17. Any portion of the accompanying Memorandum that is more properly considered to be a Conclusion of Law is adopted herein.

Based upon these Conclusions of Law, and for the reasons explained in the accompanying Memorandum, which is incorporated herein, the Administrative Law Judge makes the following:

RECOMMENDATION

1. The Commissioner should determine that:

   a. The bentonite amendment can be successfully applied to the dam sides, beaches, and pond bottom.

   b. The bentonite-amended cover on the pond bottom would be effective in maintaining a permanent pond that acts as a water cover over the stored tailings.

   c. Cation exchange would not consequentially reduce the effectiveness of the bentonite in reducing infiltration of oxygen and water into the stored tailings.

   d. The bentonite amendment would be effective in reducing infiltration of oxygen and water into the stored tailings over time.

   e. The bentonite amendment is not a practical and workable reclamation technique.

2. The bentonite amendment does not comply with Minn. R. 6132.2200, subp. 2(B)(1), because it would not help ensure that the tailings are stored in an environment such that they are not reactive.

3. The bentonite amendment does not comply with Minn. R. 6132.2200, subp. 2(B)(2), because it would not help ensure that the NorthMet facility permanently prevents substantially all water from moving through or over the tailings, and provides for the collection and disposal of any remaining residual waters that drain from the tailings in compliance with federal and state standards.

4. If the Commissioner reissues the Permit to Mine, the Commissioner should require further evaluation and testing before application to confirm the effectiveness of bentonite in reducing infiltration of oxygen and water into the stored tailings. Specifically, any reissued Permit should include the special conditions established in the original Permit to Mine (Nov. 1, 2018) together with the additional conditions set forth by the DNR.

5. With respect to the bentonite amendment, and without passing judgment on the other issues regarding the NorthMet Project that are pending before DNR, the Administrative Law Judge recommends that PolyMet's Permit to Mine application be **DENIED.** If, however, the permit is granted, it should be granted subject to both the special conditions in the original Permit to Mine (Nov. 1, 2018), and the additional or revised special conditions set forth by the DNR.

Dated: November 28, 2023

JAMES E. LAFAVE
Administrative Law Judge

Reported: Shaddix & Associates
Five Volumes

NOTICE

This Order is a recommendation, not a final order. The Commissioner of the Department of Natural Resources (Commissioner) will make the final decision after a review of the record. Under Minn. Stat. § 14.61 (2022), the Commissioner shall not make a final decision until this Order has been made available to the parties for at least ten calendar days. The parties may file exceptions to this Order and the Commissioner must consider the exceptions in making a final decision. Parties should contact Commissioner, 500 Lafayette Road, St. Paul, MN 55155, to learn the procedure for filing exceptions or presenting argument.

The record closes upon the filing of exceptions to the Order and the presentation of argument to the Commissioner, or upon the expiration of the deadline for doing so. The Commissioner must notify the parties and Administrative Law Judge of the date the record closes. If the Commissioner fails to issue a final decision within 90 days of the close of the record, this Order will constitute the final agency decision under Minn. Stat. § 14.62, subd. 2a (2022).

Under Minn. Stat. § 14.62, subd. 1 (2022), the Commissioner is required to serve the final decision upon each party and the Administrative Law Judge by first class mail or as otherwise provided by law.

MEMORANDUM

I. Introduction

PolyMet seeks to build Minnesota's first copper-nickel-platinum group elements mine.[175] As the Minnesota Supreme Court noted, "Minnesota has a long history of

[175] Ex. 74 at 69-76.

regulating iron and taconite mining. Although years of study have been underway to prepare for copper-nickel mining, this is the first permit to mine of its kind."[176]

In 1993, the Minnesota Legislature unequivocally declared that "[i]t is the policy of the state to provide for the diversification of the state's natural mineral economy through long-term support of mineral exploration, evaluation, environmental research, development, production, and commercialization."[177] But the Legislature also realized that mineral exploration and production must be tempered by respect for, and preservation of, the environment. To that end, Minnesota law requires land that has been mined to undergo reclamation in order to preserve natural resources.[178]

The Minnesota Supreme Court recognized this balancing act when it previously considered issues related to the Permit, observing that:

> [T]he proposed NorthMet Project brings with it potential environmental impacts … In particular, the mine waste generated by extracting and processing sulfide ore has the potential to release acid rock drainage, … that could seep into nearby surface waters and groundwaters. As a result, the NorthMet Project has generated significant public interest and controversary.[179]
>
> …
>
> The permitting process allows the State to balance its interests in limiting the "possible adverse environmental effects of mining" and preserving natural resources, against its interests in encouraging "the orderly development of mining," "good mining practices," and the beneficial aspects of mining.[180]

This matter came before the Administrative Law Judge for consideration of a particular issue and surrounding factual questions in order to create a factual record for the Commissioner's decision on the permit application.[181] This Memorandum will address the legal framework for mining in Minnesota, the key factual issue remanded for a contested case proceeding by the Minnesota Supreme Court, and the five other factual disputes identified by the DNR.

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[176] *In re NorthMet Project Permit to Mine Application* 959 N.W.2d at 738.
[177] Minn. Stat. § 93.001 (2022); 1993 Laws Minn. Ch. 113, Art. 2, § 1.
[178] *See* Minn. Stat. § 93.44 (2022).
[179] *In re NorthMet Permit to Mine Application,* 959 N.W.2d at 738-39.
[180] *Id.* at 739 (citations omitted).
[181] *See* Minn. Stat. § 14.62, subd. 1 (2022) ("Every decision and order rendered by an agency in a contested case shall be in writing, shall be based on the record and shall include the agency's finding of fact and conclusions on all material issues.").

II. Legal Framework for Nonferrous Metallic Mineral Mining

Minnesota's Mineral Lands Statute,[182] governs the administration of mining in Minnesota. As noted above, Minnesota seeks to support and encourage responsible mining in the State tempered by respect for and preservation of the environment.

Specifically, Minn. Stat. § 93.481, subd. 2, provides in part:

> The commissioner in granting a permit with or without modifications shall determine that the reclamation or restoration planned for the operation complies with lawful requirements and can be accomplished under available technology and that a proposed reclamation or restoration technique is practical and workable under available technology.

Further, the "final decision by the commissioner to grant, with or without conditions, or deny the application after a contested case hearing shall constitute a final order …"[183]

The DNR also promulgated the Nonferrous Metallic Mineral Mining Rules.[184] The purpose of those rules "[i]s to implement Minnesota Statues, sections 93.44 to 93.51," to control possible adverse environmental effects of nonferrous metallic mineral mining, to preserve natural resources, and to encourage both good mining practices and the orderly development of nonferrous metallic mineral mining.[185]

A. Flexible and Site-Specific Reviews

Chapter 6132 establishes an outcome-based regulatory framework rather than detailing specific performance standards for mining operations.[186] The text of the rules, and the rulemaking record, show that the rules allow for a case-by-case, site-specific review of applications for non-ferrous metallic mineral permits to mine.[187] To that end, Minn. R. 6132.0200 provides in relevant part:

> [I]t is the policy of the Department of Natural Resources that mining be conducted in a manner that will reduce impacts to the extent practicable, mitigate unavoidable impacts, and ensure that the mining area is left in a condition that protects natural resources and minimizes to the extent practicable the need for maintenance. This shall be accomplished according to parts 6132.0100 to 6132.5300 through the use of mining, mine waste management, and passive reclamation methods that maximize physical, chemical, and biological stabilization of areas disturbed by mining, as opposed to the use of ongoing active treatment

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[182] Minn. Stat. §§ 93.001-.61 (2022).
[183] Minn. Stat. § 93.483, subd. 5.
[184] Minn. R. 6132.0100-53.00 (2023).
[185] Minn. R. 6132.0200.
[186] *Minnesota Center for Environmental Advocacy v. Minnesota Center for Environmental Advocacy,* 2019 WL 35458339 at *18-22 (Minn. Ct. App. Aug. 5, 2019).
[187] *Id.*

> technologies. The department recognizes that in some cases passive treatment alone will not entirely meet all reclamation goals. In these cases, active treatment technologies may be necessary and provisions for continued maintenance of the treatments will be required.[188]

The Rule further recognizes that "[b]ecause of the unique character of each mining operation and the extreme diversity of the possible types and sizes of operations, specific permit requirements shall be established within the framework" provided by Chapter 6132.[189]

Like the rules themselves, the underlying Statement of Need and Reasonableness (SONAR) filed in support of this Rule emphasized the flexibility of the DNR's regulatory approach:

> [T]he rules are designed to act as a framework within which specific permit requirements are to be developed to address the unique problems anticipated to exist at each individual mine site. The actual reclamation, conducted at a given mine, will have to be custom designed to account for each site and operation's uniquely specific characteristics. In order to make the proposed rules workable, it is necessary and reasonable to build in enough flexibility, while still providing basic direction on how reclamation can be achieved.[190]

Moreover, during the rulemaking hearing conducted related to the rules, a DNR witness explained the flexibility of the framework in discussing the various reclamation standards within Chapter 6132:

> [E]ach section starts off with a section called goals. And these goals are targets that we want the mining companies, the operators, permittees to be aiming at when they do the reclamation. And we have established these targets and use them in the development of the specific requirements under each of these various different sections.
>
> We think the targets are important because they sort of establish a policy for each section. We recognize the fact that these goals may not be attainable, but we feel that they are at least targets that one should shoot for. One will not be considered to be out of compliance if the goal is not met, but the specific requirements that have been developed will be the things that we will be looking at to determine compliance.[191]

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[188] Minn. R. 6132.0200.
[189] *Id.*
[190] Ex. 336 R.730360 (SONAR at 8).
[191] Ex. 338 at 124:13-125:2.

B. Features of Minnesota's Reactive Mine Waste Rule

The DNR's application of Minnesota's Reactive Mine Waste Rule lies at the heart of the Minnesota Supreme Court's remand for a contested case proceeding.[192] The goal of this Rule is to ensure that "[r]eactive mine waste shall be mined, disposed of, and reclaimed to prevent the release of substances that result in the adverse impacts on naturel resources."[193] In relevant part, the Rule provides the following requirements:

> Subpart 1. Goals. Reactive mine waste shall be mined, disposed of, and reclaimed to prevent the release of substances that result in the adverse impacts on natural resources.
>
> Subpart 2. Requirements. A mining operation must meet the requirements in items A to D.
>
> …
>
> B. A reactive mine waste storage facility must be designed by professional engineers registered in Minnesota proficient in the design, construction, operation, and reclamation of facilities for the storage of reactive mine waste, to either:
>
> (1) modify the physical or chemical characteristics of the mine waste, or store it in an environment, such that the waste is no longer reactive; or
>
> (2) 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.
>
> …

Therefore, to satisfy Minnesota's Reactive Mine Waste Rule, PolyMet must meet the criteria of either Subpart 1 or Subpart 2. PolyMet argues it meets both criteria. The Petitioners maintain PolyMet meets neither standard.

III. Analysis

The scope of this proceeding was defined by the Minnesota Supreme Court. Based on the Court's direction, this matter concerns "[w]hether 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."[194] To answer

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[192] Minn. R. 6132.2200 (2023); *see In re NorthMet Permit to Mine Application,* 959 N.W.2d at 754.
[193] Minn. R. 6132.2200, subp. 1.
[194] *In re NorthMet Permit to Mine Application,* 959 N.W.2d at 754.

that question, the Commissioner must determine what the phrase "practical and workable" means in the context of Minn. R. 6132.2200. As in statutory interpretation, when a rule is unambiguous, "[w]e construe the rule according to the common and approved usage or the words and phrases, and do not disregard the rule's plain meaning to pursue its spirit."[195]

A. Practical and Workable

Neither "practical" or "workable" are defined by Minn. Stat. Ch. 93 or Minn. R. Ch. 6132. The Legislature has provided canons of interpretation to guide courts in determining the meaning of words that are undefined, and in such cases, the words must be given their ordinary meaning.[196]

The ordinary meaning of practical is "relating to, or manifested in practice or action: not theoretical or ideal."[197] The ordinary meaning of workable is "practicable, feasible"[198] or "likely to do or achieve what is intended."[199] Reading those definitions together, the bentonite amendment is "practical" and "workable" if it is likely to achieve the intended purpose of the NorthMet Project's tailings Basin while complying with Minnesota's Reactive Mine Waste Rule.

B. The Dual Criteria of Minnesota's Reactive Mine Waste Rule

i. Minnesota Rule 6132.2200, Subpart 2(B)(1)

Subpart 2(B)(1) of the Reactive Waste Rule is satisfied if the waste facility is designed to "[m]odify the physical or chemical characteristics of the mine waste, or store it in an environment, such that the waste is no longer reactive…." "Reactive mine waste" is "[w]aste that is shown through characterization studies to release substances that adversely impact natural resources."[200] The Rule further defines the terms "adversely impacts natural resources" as "an unacceptable level of impact on natural resources as determined by the commissioner based on an evaluation which considers the value of the resources and the degree of impact."[201]

The DNR interprets an impact to be "unacceptable" if it results in a violation of environmental standards.[202] The DNR maintains that when the applicable rules are read together, mine waste is reactive if substances flow out from the waste and cause

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[195] *J.D. Donovan, Inc. v. Minnesota Department of Transportation,* 878 N.W.2d 1, 5-6 (Minn. 2016).
[196] Minn. Stat. § 645.08(1) (2022); *see In re NorthMet Permit to Mine Application,* 959 N.W.2d at 744; Ex. 336 (R.730356, SONAR at 4 ("When a word to term is used in the proposed rules, and does not appear in this section, it shall be assumed to have the definition that is found in commonly used dictionaries.").
[197] Merriam-Webster's Collegiate Dictionary 972 (11th ed 2012).
[198] *Id.* at 1443.
[199] "Workable" *Cambridge Dictionary,* https://dictionary.cambridge.org/us/dictionary/english/workable.
[200] Minn. R. 6132.0100, subp. 28.
[201] *Id.* at subp. 3.
[202] *See* R.730350, SONAR at 7 (explaining that "reactive mine waste" is defined "because nonferrous metallic mining often generates mine waste that can cause water that might contact such waste to assume an unacceptable quality due to contamination.").

violations of environmental standards; particularly water quality standards, given that water is the medium by which the seepage may be released into the environment. The DNR notes that this reading of the regulations is consistent with the regulatory goal of ensuring that "[r]eactive mine waste shall be mined, disposed of, and reclaimed to prevent the release of substances that result in the adverse impacts on natural resources."[203]

The Petitioners argue this analysis is flawed for several reasons. First, they argue that such a reading puts the DNR in the position of enforcing water quality standards; a duty that belongs to the MPCA. Petitioners note the DNR's obligation to protect the waters of the State are defined in other statues and are independent from the MPCA's authority to enforce water quality standards.[204]

Second, Petitioners assert that the DNR's interpretation is inconsistent with the plain language of Subpart 2(B)(1). This Rule states that waste must be stored "such that the waste is no longer reactive." Waste is "reactive" if it "releases substances that adversely impact natural resources."[205]

The Administrative Law Judge agrees. The regulatory definitions in Chapter 6132 define "natural resources" to include "[a]ll mineral, animal, botanical, air, water, land, timber, soil, quietude, recreational, historical, scenic, and aesthetic resources in accordance with Minnesota Statutes, section 116.02, subdivision 4."[206] The natural resources to be protected are not limited to Minnesota's waters. Notably, Subpart 2(B)(1) does not incorporate water quality standards, nor does it reference compliance with such standards. In contrast, Subpart 2(B)(2) expressly does so, requiring that the disposal of seepage water must be done "in compliance with federal and state standards."[207] Thus, reading the Reactive Waste Rule alongside the regulatory definitions, a waste is no longer reactive if, as a result of its storage, it ceases to release the substances that made it reactive in the first place into natural resources. Petitioner's interpretation finds additional support in the remainder of Minn. R. Ch. 6132. Other sections of the Nonferrous Metallic Mineral Mining Rules[208] incorporate other regulatory standards to give the environmental performance requirements of the mining rules meaning.[209]

But even if the DNR's interpretation is correct, and only compliance with water quality standards is required under Subpart 2(B)(1), there is serious doubt as to whether PolyMet's proposal meets that narrower standard. On June 6, 2023, the USACE

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[203] Minn. R. 6132.2200, subp. 1.
[204] *See White Bear Lake Restoration Ass'n exrel. State v. Minn. DNR,* 946 N.W.2d 373, 386 (Minn. 2020) (discussing the Department's obligations to protect water resources codified in Minn. Stat. chs. 103A-114B).
[205] Minn. R. 6132.0100, subp. 28 (2023).
[206] *Id.* at subp. 21.
[207] Minn. R. 6132.2200, subp. 2(B)(2).
[208] Minn. R. 6132.0100 - .5300 (2023).
[209] *See e.g.,* Minn. R. 6132.5300, subp. 1 (incorporating the wetland conservation rules of Minn. R. ch. 8420); Minn. R. 6132.2000, subp. 6 (incorporating Minn. Stat. § 103G.005, subd. 19); Minn. R. 6132.0100, subp. 21 (incorporating Minn. Stat. § 116B.02, subd. 4).

revoked the Section 404 permit it issued in March of 2019.[210] The Section 404 permit authorized discharges of dredged and fill material into 901 acres of wetlands, and indirect loss of an additional 27 acres of wetlands, in association with the construction and development of the NorthMet Project.[211] The Band objected to the granting of the permit, claiming that the project would violate the Band's water quality standards.[212] The USACE held a public hearing, received public comments, and the U.S. Environmental Protection Agency (EPA) submitted its evaluations and recommendations.[213] The EPA agreed with the Band and recommended that the Section 404 permit be revoked.[214] After a considerable review, the USACE found that the discharges from the NorthMet Project would violate the Band's downstream water quality standards and so revoked the Section 404 permit.

Next, on August 2, 2023, the Minnesota Supreme Court issued a decision *In the Matter of the Denial of Contested Case Hearing Requests and Issuance of National Pollutant Discharge Elimination System / State Disposal System Permit No. MN0071013 for the Proposed NorthMet Project St. Louis County Hoyt Lakes and Babbitt Minnesota.*[215] The appeals considered in that case involved "the plans of PolyMet for the collection and treatment of wastewater."[216] The Supreme Court held that the MPCA's decision to issue a combined NPDES/SDS permit was arbitrary and capricious. The NPDES/SDS permit would regulate the point source discharges of wastewater within the Lake Superior watershed.[217]

Those rulings indicate that seepage from the NorthMet Project would not meet water quality standards. Accordingly, regardless of whether Subpart 2(B)(1) is accorded a broad interpretation or a narrower reading, the PolyMet application fails to meet the regulatory standard.

PolyMet has pledged to obtain the required Section 404 and the NPDES/SDS permits.[218] If it does so, the analysis of this issue could change. But those events have not occurred and are not found in the current hearing record. The Administrative Law Judge cannot conclude that PolyMet can store residual mining waste "[i]n an

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[210] Letter from Eric R. Swenson, Colonel, Corps of Engineers, District Commander to Ms. Christie Kearney, NewRange Copper Nickel Mining, LLC (Jun. 6, 2023) (on file with the Minn. Office of Admin. Hearings).
[211] *Id.* at 3.
[212] *Id.* at 1.
[213] *Id.*
[214] *Id.*
[215] 2023 WL 4919533 (Minn. Aug. 2, 2023).
[216] *Id.* at *3.
[217] The record in this case was reopened after the June 6, 2023, ruling by the U.S. Army Corps of Engineers and after the August 2, 2023, ruling by the Minnesota Supreme Court to allow the parties to discuss the effect of the rulings on this proceeding and to address whether the rulings mooted this proceeding. (*See* Second Post-Hearing Order (Jun. 12, 2023) and Fourth Post-Hearing Order (Aug. 8, 2023)).
[218] *See* PolyMet Mining, Inc.'s Statement in Response to Fourth Post-Hearing Order at 3 (Aug. 15, 2023) ("PolyMet intends to move forward with the NorthMet Project. That means acquiring its permits one at a time.").

environment … such that the waste is no longer reactive."[219] Therefore, as of today, the NorthMet Project does not meet the plain requirements of Subpart 2(B)(1).

ii. Minnesota Rule 6132.2200, Subpart 2(B)(2)

A permit applicant may satisfy Subpart 2(B)(2) of the Reactive Mine Waste Rule if its facility is designed to "[p]ermanently prevent substantially all water from moving through or over the mine waste and provide for the collection and disposal if any remaining residual waters that drain from the mine waste in compliance with federal and state standards."[220] "Substantially all" is not defined in the rules, but the ordinary meaning of "substantial" is "considerable in quantity: significantly great."[221]

It is undisputed that water seepage will occur after closure. PolyMet estimates that:

- 160 million gallons per year will seep from the pond;
- 73 million gallons per year will seep through the beaches; and
- 65 million gallons per year will seep from the dams.[222]

This means that, by design, 298 million gallons of water will move through or over the tailings every year.

PolyMet and the DNR argue that 298 million gallons is a small fraction of the overall 32.1 billion gallons of water in the Basin, and that when compared to that total, the standard in Subpart 2(B)(2) is satisfied. PolyMet acknowledges that 160 million gallons of water per year will seep out of the pond at closure,[223] but points out that the pond will store approximately 2,170 million gallons of water, and 32,180 million gallons will be stored in the Basin below the pond.[224] Though seepage will also occur from the beaches and dams, in the combined amount of 138 million gallons per year, 2,030 million gallons will be stored in the beaches and dams.[225] PolyMet reasons that 99.56% of the water will stay in the Basin while just .044% will seep out of the pond. The DNR and PolyMet assert that at these levels the seepage containment and wastewater treatment systems would "provide for the collection and disposal of any remaining residue waters that drain form the mine waste in compliance with state and federal standards."[226] They maintain that the design permanently prevents "substantially all" the water from moving over or through the mine waste, thereby satisfying the Reactive Mine Waste Rule.

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[219] Minn. R. 6132.2200, subp. 2(B)(2).
[220] *Id.*
[221] Merriam-Webster's Collegiate Dictionary 1245 (11th ed 2012).
[222] Tr. Vol. 2 at 113:21-117:5 (Radue); Ex. 81.
[223] *See* Tr. Vol. 2 at 113:21-114:19 (Radue).
[224] *Id.* at 116:12-24.
[225] *Id.*
[226] Minn. R. 6132.2200, subp. 2(b)(2).

Petitioners vigorously disagree. They argue, in essence, that the critical issue is the total amount of water going over or though the mine waste – not the percentage of the total stored water that will seep from containment. Petitioners maintain that focusing on the percentage of stored water that will seep from the Basin obscures the real issue, which is the total amount of water that will go over or through the mine waste. There is no dispute that 298 million gallons of water will flow through the waste each year, 160 million gallons through the pond bottom alone. Petitioners maintain that whatever the term "substantially all" means, that is not it. The Administrative Law Judge agrees.

Subpart 2(B)(2) of the Reactive Mine Waste Rule mandates that the facility must be designed to prevent *substantially all* water from moving over or through the waste. 298 million gallons is an enormous amount of impaired water. Some context is helpful in understanding the scope of this number. For example, if 298 million gallons were measured in Olympic-sized swimming pools, the water would fill 451 pools. Lined up end-to-end, the pools would stretch for a distance of nearly 14 miles.

If a hauler wanted to transport 298 million gallons of water by truck, using 53-foot long large capacity tankers that carry 11,000 gallons, it would take 27,091 trucks to carry the water. If those trucks were lined up bumper-to-bumper, the convoy would stretch 271 miles – approximately the distance between St. Paul and Grand Marais.

Subpart 2(B)(2) requires a mine permit applicant to restrict the movement of water over and through mine tailings. The record here shows that water will move within the reactive mine waste in the Basin, becoming impaired. Water that seeps through the Basin pond bottom, beaches, and dams will move through or over those reactive tailings and then out of these areas to emerge at the Basin dam toe. 298 million gallons will flow though the tailings every year, a substantial sum on an annual basis. But PolyMet's model runs for 500 years after PolyMet begins mining operations, which is approximately 475 years after closure of the mine.[227] Over that entire time span, approximately 408.975 billion gallons will move through and out of the Basin. PolyMet will not be preventing substantially all of the water from moving over and through the tailings. That is contrary to the Reactive Mine Waste Rule.

C. The Five Fact Issues

In the Amended Notice and Order for Hearing, the Department identified "five specific fact disputes" that that must be resolved in this contested case.[228] For the reasons outlined below, consideration of the five sub-issues does not change the conclusion that the bentonite amendment fails to comply with the Reactive Mine Waste Rule.

i. How Would the Bentonite Amendment be Applied to the Tailings Basin Sides, Beaches, and Pond- Bottom to Ensure its Effectiveness in Reducing Infiltration of Oxygen and Water into the Stored Tailings Over Time?

Bentonite is a natural geologic material that swells when hydrated, thereby restricting the amount of oxygen and water that can infiltrate the stored tailings.[229] PolyMet plans to amend tailings with bentonite on the dam sides, beaches, and if necessary, the pond bottom.[230] The application methods vary for each feature.[231] The timing of the bentonite application would vary as well. The dam side application would occur at stages during construction of the tailings dam Basin, while the bentonite applications to the beaches and pond bottom (if necessary) would occur at closure.[232]

Based on a totality of the evidence, the bentonite can be effectively applied to the dam sides, pond bottom, and to the beaches. Yet, even if PolyMet can eliminate infiltration of oxygen and water into the tailings, the bentonite amendment will not satisfy the Reactive Mine Waste Rule for the reasons explained above.

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[227] Tr. Vol. 3 at 182:18-22 (Engstrom).
[228] Amended Notice and Order for Hearing at ¶ 26 (Feb. 14, 2022); *see also* Minn. Stat. § 116B.02 (2022).
[229] Tr. Vol. 2 at 141:18-22 (Hull); Ex. 74 Radue Direct at 235-38; Ex. 206 Benson Direct at 7:17-20.
[230] Ex. 74 Radue Direct at 276-300; Ex. 101, Engstrom Direct at 6:1-6.
[231] *See* Radue Direct at 406-82.
[232] Ex. 219 (R. 115626, ¶ 534).

ii. How Should the Application Methods of the Bentonite Amendment be Evaluated or Tested Before Application to Ensure Effectiveness in Reducing Infiltration of Oxygen and Water into the Stored Tailings?

The Department recommends that future testing of any bentonite application is warranted, and the parties proposed the use of various tests.[233] The Department proposes that any reissued Permit to Mine must include special conditions requiring a more robust testing plan that is contemplated by PolyMet before mining commences and - while operations are underway.

This sub-issue, as articulated by the Department, presupposes the bentonite amendment will meet the requirements of the Reactive Mine Waste Rule. If the Permit to Mine is reissued, the special conditions in the original Permit to Mine and the special conditions recommend by the DNR should be included. But, as described above, the proposed bentonite amendment will not comply with the Rule and the Administrative Law Judge has recommended denial of the permit, which would moot this issue.

iii. Would the Pond-Bottom, Bentonite-Amended Cover be Effective in Maintaining a Permanent Pond that Acts as a Water Cover Over Stored Tailings?

It is possible that the pond would be permanently maintained even without a bentonite amendment.[234] If a bentonite amendment were needed, the bentonite amendment would increase swelling of the tailings on the pond bottom, thereby filling voids and further reducing hydraulic conductivity This reduction in hydraulic conductivity would result in a further reduction of water seepage through the pond bottom.[235]

While that is all true, the waste in the pond would still be reactive in violation of Subpart 2(B)(1). Also, by design, 160 million gallons of water would seep through the mine waste[236] in the pond every year, in violation of Subpart 2(B)(2). For these reasons, regardless of whether the bentonite amendment would be effective in maintaining a permanent pond cover, PolyMet's proposal would not meet the requirements of the Reactive Mine Waste Rule.

iv. Would Any Conditions in the Pond Result in a Cation Exchange that Could Reduce the Effectiveness of the Bentonite in Reducing Infiltration of Oxygen and Water into the Stored Tailings?

Cation exchange is an electrochemical process whereby cations – positively charged ions – are exchanged between a solid and a liquid. Here, a cation exchange

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[233] *See* Ex. 103, Engstrom Rebuttal at 4:6-21.
[234] Ex. 74 Radue Direct at 868-73; Ex. 219 (R.115626 n.19).
[235] Ex. 74, Radue Direct at 830-33, 890-95; Ex. 206, Benson Direct at 7:19-20; Ex. 105, Wentz Rebuttal at 2:10-11.
[236] Tr. Vol. 2 at 113:21-117:5 (Radue); Ex. 81.

involves a sodium cation on the bentonite surface being replaced with a calcium or magnesium cation from the pond water or pour water in the flotation tailings.[237]

Cation exchanges will take place within the bentonite-amended tailings.[238] And, it is undisputed that cation exchanges tend to reduce swelling capacity of the bentonite, which could lead to increase in hydraulic conductivity.[239] Based on the record, however, the cation exchange would not meaningfully change the effectiveness of the bentonite amendment in reducing oxygen and water infiltration into the stored tailings. Even so, notwithstanding whether PolyMet can eliminate infiltration of oxygen and water into the tailings, the bentonite amendment will not satisfy the Reactive Mine Waste Rule's terms.

v. How Would PolyMet Ensure Bentonite's Effectiveness in Reducing Infiltration of Oxygen and Water into the Stored Tailings Over Time?

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.[240] The degradation could be caused by cation exchange, wet-dry cycling, root penetration, freeze-thaw cycling, or animal burrowing. The evidence in the record, however, shows that PolyMet can mitigate the impacts of degradation by applying supplemental bentonite applications.[241]

Even assuming the bentonite amendment will retain its effectiveness over time, the proposed bentonite amendment is still not a 'practical and workable' reclamation technique that will satisfy the DNR's Reactive Mine Waste Rule. That is because, as described above, the amount of water flowing over or through the mine waste will violate the Rule.

IV. Conclusion

Based on the foregoing, the Commissioner should find that PolyMet's proposed bentonite amendment is not a workable practical reclamation technique and does not satisfy the requirements of Minnesota's Reactive Waste Rule. As a result, the Commissioner should **DENY** a permit for the NorthMet Project.

J. E. L.

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[237] Ex. 105, Wenz Rebuttal at 2:14-18; Ex. 206, Benson Direct at 32:13-16.
[238] Ex. 206, Benson Direct at 25:17-21; Tr. Vol. 3 at 32:19-24 (Diedrich).
[239] Ex. 206, Benson Direct at 10:3-16, 11:12-13; TR. Vol. 3 at 30:19-31, 31:17-32:19 (Diedrich).
[240] Ex. 206, Benson Direct at 10:3-15, 25:17-20; Tr. Vol. 5 at 89:15-20, 119:9-15 (Benson); Ex. 77, Hull Rebuttal at 76-62.
[241] Ex. 76, Hull Direct at 174-76; Tr. Vol. 2 at 143:12-17 (Hull); Tr. Vol. 3 at 21:1-14 (Hull); Ex. 74, Radue Direct at 1296-99.