

## Johnson, Bill H (DNR)

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**From:** Tina Pint <[REDACTED]>  
**Sent:** Tuesday, April 10, 2012 11:31 AM  
**To:** Carlson, Erik (DNR)  
**Cc:** Peter J. Hinck; Jim Scott ([REDACTED]) ([REDACTED])  
Cory D. Anderson  
**Subject:** FW: NorthMet QAPP

Erik-

I have some questions/concerns regarding the Specific Comments and Recommendations #1 from below.

- 1. Group B7: Calibration. First bullet. "acceptance criteria"** - Barr should present the acceptance criteria used to verify that the model is sufficiently calibrated. Barr should consider using quantitative metrics that assess the goodness of fit for purposes of model calibration.

The Mine Site QAPP discusses three different calibrations in Section 2.2; calibration of the MODFLOW model, calibration of the XP-SWMM model, and calibration of runoff water quality using the GoldSim model. At the Plant Site, there are again several different components or models that are calibrated, including the MODFLOW model, LTVSMC tailings release rates and surface runoff water quality within GoldSim, and evaporation and runoff rates from Cell 2W. The agencies seem to be requesting a change in the calibration methods for just the surface runoff water quality parameters. Is that correct?

Calibration of the runoff water quality was conducted in a quantitative manner, as was described in Plant Site calibration document Section 2.1 and in the Mine Site calibration document Section 3.0. The objective of calibration was to minimize the root mean square error (RMSE) between the measured and modeled concentrations at the 10<sup>th</sup>, 50<sup>th</sup> and 90<sup>th</sup> percentiles. Another way to do the calibration would be to set a target RMSE and then stop the calibration process once the target RMSE was met, even if it is not optimal solution. In our opinion, it is better to minimize the RMSE, as we had done. If the agencies are requesting that we switch to using a target RMSE, we need to discuss how this would be done, as it could be a bit arbitrary.

Thanks,  
Tina

Tina Pint, PG

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**From:** Peter J. Hinck  
**Sent:** Monday, April 09, 2012 1:46 PM  
**To:** Tina Pint  
**Subject:** FW: NorthMet QAPP

Peter J. Hinck, PE

Water Resources Engineer

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**From:** Carlson, Erik (DNR) [mailto:[REDACTED]]  
**Sent:** Thursday, March 29, 2012 3:42 PM  
**To:** Jim Scott; Liljegren, Michael W (DNR); Engstrom, Jennifer N (DNR); Kunz, Michael (DNR); David Blaha; Schwanz, Neil T MVP  
**Cc:** Peter J. Hinck; Cory D. Anderson; John Borovsky; Wenz, Zach (DNR)  
**Subject:** RE: NorthMet QAPP

Jim,  
Please see green.  
Erik

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**From:** Jim Scott [mailto:[REDACTED]]  
**Sent:** Thursday, March 29, 2012 12:49 PM  
**To:** Carlson, Erik (DNR); Liljegren, Michael W (DNR); Engstrom, Jennifer N (DNR); Kunz, Michael (DNR); David Blaha; Schwanz, Neil T MVP  
**Cc:** Hinck Peter; Cory D. Anderson; Borovsky John  
**Subject:** Re: NorthMet QAPP

Erik

I have discussed with Barr – please see embedded comments in blue bold

Note three items where I am seeking feedback (noted by [Please advise](#))

Overall path forward looks good

Jim

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**From:** [Carlson, Erik \(DNR\)](#)  
**Sent:** Thursday, March 29, 2012 10:04 AM  
**To:** [Jim Scott](#) ; [Liljegren, Michael W \(DNR\)](#) ; [Engstrom, Jennifer N \(DNR\)](#) ; [Kunz, Michael \(DNR\)](#) ; [David Blaha](#) ; [Schwanz, Neil T MVP](#)  
**Subject:** FW: NorthMet QAPP

Jim,  
ERM has completed their review of the EPA comments and the DNR has reviewed their comments.

For items under the red heading below, the DNR requests that Comment 1 be addressed by Barr/PolyMet. I recommend that this be done in updated Plant and Mine Site Calibration documents and not in a QAPP document. Establishing more robust acceptance criteria will need our review as will the resulting calibrations of the constituents, which may change. **[Barr: Calibration is currently performed to minimize the error between the observed and predicted values. This is a quantitative metric but is not a statistical test. We have not applied a statistical goodness-of-fit test, and believe this was an issue that was much discussed in the review of the calibration documents. [Please advise](#) if Lead Agencies want a different metric; agree that changing the metric would require re-calibration] The DNR would like to see a**

**quantitative assessment of the goodness of fit for each constituent and the acceptance criteria used to verify the model is sufficiently calibrated. The calibration could have been done well, we just need statistical verification.** I don't believe this is the only reason to update the calibrations. CDFs and new groundwater data at the mine site I believe would be triggers for a re-calibration. **[Barr: CDFs (XPSWMM and MODFLOW re-calibration) and new GW data at the Mine Site will trigger the need for re-calibration]** Also, the DNR is still not in agreement on the calibration of arsenic at the plant site. In January, Zach recommended a change to the arsenic calibration, but I am told his recommendation was not implemented. We need to re-visit this issue once more robust acceptance criteria have been applied to the calibrations. **[Barr: Understanding is that Zach's comment was addressed by Mike Liljegren internally, and the fact that it was not included in the comments submitted today (there were no outstanding comments) leads us to believe that it has been resolved. Please advise if this is not the case. This is not the case. The DNR decided to drop this issue in Jan. once we saw no change had been made to the calibration document in the way we requested and to come back to it during the MRC process. However, we will table this issue and review the goodness of fit assessment in hopes that the fit for arsenic shows it to be sufficient. Do not anticipate any CDFs or new data at the Plant Site that would necessitate re-calibration]** I see the re-calibrations happening prior to the DNR's comprehensive results review so we have a clear picture of model results prior to the application of mitigation. **[Understood]**

Comment #2, the DNR requests that this change be made to the Mine Site QAPP and a final version of this document be issued for our files. We recommend that the Plant Site QAPP be improved in the same way if the same issue exists. Once this change has been made to the Plant Site QAPP, please issue it to me for Co-lead review. **[Barr: Propose a "road map" table identifying all sources (document, section, table-figure) of data. Please advise if this is acceptable] Yes this sounds like a good approach.**

Comments 3 &4 will be handled in the Co-lead Phase II QA/QC.

Please let me know if this path forward seems off the mark to you.

-Erik

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**From:** David Blaha [<mailto:> [REDACTED]]  
**Sent:** Sunday, March 25, 2012 4:49 PM  
**To:** Liljegren, Michael W (DNR); Carlson, Erik (DNR)  
**Cc:** Al Trippel; Deb McGovern; Fred Marinelli; Houston Kempton  
**Subject:** NorthMet QAPP

Erik/Mike

Per your request, ERM has reviewed USEPA's revised comments dated January 4, 2012 regarding the NorthMet Mine Site Water Quality Model Quality Assurance Project Plan (QAPP). USEPA used a "Checklist for QA Project Plan Elements for Modeling" from *Guidance for Quality Assurance Project Plans for Modeling* (EPA QA/G-5M Appendix C) to "audit" the Mine Site QAPP. USEPA suggests in their letter that the Co-Lead Agencies consider the checklist items marked as missing as possible improvements to the Mine Site QAPP. It should be noted, however, that the USEPA guidance is generic and acknowledges that not all checklist items are relevant to every QAPP.

ERM was asked by the Co-Lead agencies to determine whether any of the items which USEPA identified as missing or only partially included would strengthen the Mine Site QAPP. ERM (Blaha, Adams, Kempton) reviewed both the Mine Site QAPP and USEPA's comments. We offer the following general comments on the USEPA letter and specific recommendations for strengthening the Mine Site QAPP and the future Plant Site QAPP:

### ***General Comments and Observations***

- As USEPA notes, Barr mistakenly references the EPAQA/R-2 (*EPA Requirements for Quality Management Plans*), rather than EPA QA/G-5M (*Guidance for Quality Assurance Project Plans for Modeling*). Barr should use the correct USEPA guidance for the Plant Site QAPP.
- Many of the missing or partially included items identified by USEPA have in fact been done, but are simply not documented in the Mine Site QAPP, rather are found in other NorthMet documents (e.g., IAP memos, Work Plans, Data Packages), such as “conflicts or uncertainties that will be resolved by this project”, “summary of all work to be performed, products to be produced, and the schedule for implementation”. Although there is some value in having all of these items in a single document, they are not critical to achieve the objectives of the QAPP – cross-referencing other documents would be valuable in some cases to provide a trail to the information.
- **Group A: Project Management** – much of this Group’s items are generally valuable, especially for reviewers who have not been involved in the model development process at all, but are not critical to the QAPP’s primary function as a quality assurance plan.
- **Group C: Assessment and Oversight** – ERM’s Model Evaluation Review will address most of the missing items from this Group, including items such as assessments, code verification, checking for programming errors, correct insertion of model equations, code linkage to analysis of uncertainty, and hardware/software configuration tests.
- **Group C1: Plans for Science and Product Peer Review** – the Co-Leads Model Results Check process is essentially addressing these missing items.
- **Group D: Data Validation and Usability** – ERM’s Model Evaluation Review will address most of the missing items from this Group, including review of model input data and model outputs.

### **Specific Comments and Recommendations**

1. **Group B7: Calibration. First bullet. "acceptance criteria"** - Barr should present the acceptance criteria used to verify that the model is sufficiently calibrated. Barr should consider using quantitative metrics that assess the goodness of fit for purposes of model calibration.
2. **Group B9: Non-direct Measurements. Third bullet. "Method(s) of identifying and acquiring data"** - Should be more specific in identifying the references for acquired data. In addition to the report citation, should provide page, table, and or figure numbers. If the data are dispersed within and between reports, should produce an appendix with all issue-specific data compiled in one place.
3. **Group B10: Requirements Documentation** - The Mine Site Data Package contains many of the equations used in the GoldSim model, but it is not complete. Conditional programming ("if this, then that") is commonly described verbally, but not mathematically. It is in our interests for Barr to present all of the equations and conditionals used in GoldSim programming. This will allow every line in the program to be traceable to a technical document.
4. **Group B10: Hardware/Software Configuration – Source Code** - The complete source code for the model should be provided to the Co-Leads.

I hope this review is helpful. If you have any questions please do not hesitate to contact us.

Take care

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**From:** Liljegren, Michael W (DNR) [<mailto:> [REDACTED]]  
**Sent:** Friday, January 13, 2012 9:18 AM  
**To:** Fred Marinelli; David Blaha

