DEQ
Montana Department of Environmental Quality

# Memo

TO: HJ 37 Special Committee

FROM: The Department of Environmental Quality, Water Quality Division

DATE: March 9, 2022

SUBJECT: DEQ follow up to HJ 37 February 28 meeting requests

Following the WPIC/EQC HJ 37 committee meeting on February 28, 2022, legislative staff and the Department identified a number of follow-up items which are addressed here.

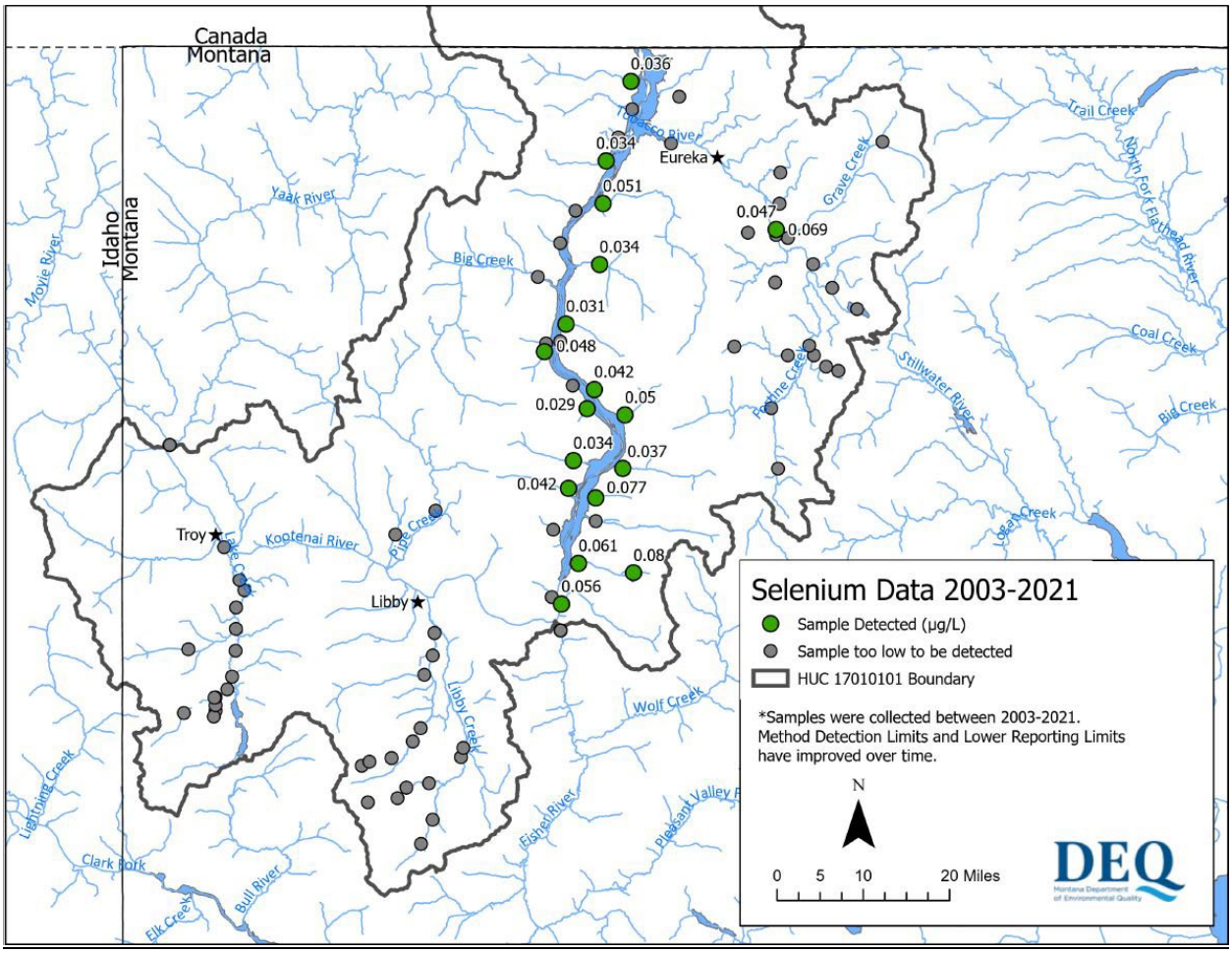
1) Response to Public Comment specific to comments regarding model validation and other technical modeling questions.
2) Cost of staff and laboratory analysis for the 2016 and 2021 Lake Koocanusa tributary sampling and map of selenium tributary results.
3) Written response to Dr. Luoma's testimony during the February 28, 2022, HJ 37 meeting.
4) Full statewide selenium dataset for lentic and lotic waterbodies from the Department's EQuIS database. As requested by Representative Gunderson.

**Item 1**

For responses to public comment related to modeling, see Comment Nos. 160-178, 181.
https://rules.mt.gov/gateway/ShowNoticeFile.asp?TID=10178

**Item 2**

| | *Year 2016* | *Year 2021* |
|---|---|---|
| Two field crew - salaries including benefits | $672.00 | $918.00 |
| Laboratory Analyses Cost | $1,897.50 | $2,240.00 |
| **Total Per Year** | **$2,569.50** | **$3,158.00** |




**Item 3**

*During the February 28, 2022, HJ 37 Legislative Committee meeting, Vicki Marquis and Dr. Luoma made the following points or asked the following questions during their testimony under the Teck Resources agenda item. The Department committed to reviewing these points and has taken the time to respond.*

**Teck's assertions regarding model validation and peer review**

RESPONSE: While the Department's work is not required to be peer reviewed, in this case, the development of a site-specific water quality standard for Lake Koocanusa implements a peer-reviewed and science-based approach for ascertaining a protective water quality standard for Lake Koocanusa. Different levels of peer-review were included throughout the process. Items peer-reviewed include the USGS Modeling Framework for Lake Koocanusa (Jenni et al. 2017), Lake Koocanusa Modeling report (Presser and Naftz, 2020), and four peer reviewed databases. The peer-reviewed Presser and Naftz (2020) report utilized the Presser and Luoma (2010) ecosystem model and calibrated it to the Lake Koocanusa ecosystem. The Department worked with this scientifically peer-reviewed and published model and utilized modeling parameters recommended by the Selenium Technical Subcommittee and provided by the USGS in association with the Presser and Naftz (2020) modeling report.

USGS provided the Department with 13 different modeling scenarios in a support document titled, "Results of Ecosystem Scale Selenium Modeling in Support of Site-Specific Guidelines Development for

lake Koocanusa, Montana, U.S.A., and British Columbia, Canada, 2020". The Department reviewed the modeling results, reviewed the recommendations from the Selenium Technical Subcommittee, and then selected the "W6. TFM w/ TL 3 100% AqIns" model from this support document. This model provided to the Department by USGS provided a range of values (0.56-9.86 ug/L). From this range, the Department made a risk decision within the authority of the Department, by selecting at the 75$^{th}$ percentile of the Kd distribution. This corresponds to a protective dissolved selenium concentration of 0.8 ug/L. Calibration and validation of the model was performed by the USGS and was included in the peer-reviewed process.

The model validation is clearly described in Presser and Naftz (2020). The model calibrates a peer-reviewed global model to local conditions by modifying the global model parameter values (in this case, the trophic transfer factors through the bioavailability factor and then using site-specific Kd data based on repeat field-observations over multiple years). As described in Presser and Naftz (2020), the Lake Koocanusa model overpredicted selenium concentrations in zooplankton and invertebrates relative to the concentrations seen in Lake Koocanusa. Thus, the model was calibrated to improve predictions on the local level, using a 60 percent bioavailability to address unmeasured local factors causing over prediction. The 60 percent bioavailability model has been calibrated to be accurate to local conditions informed by the zooplankton and aquatic insect tissue concentrations.

A wide range of Kd values were measured in situ, and it is known to be affected by hydrologic factors such as residence time and selenium speciation. Thus, for the Lake Koocanusa model, the USGS applied a modeling approach utilizing all observed pairs of dissolved: Particulate Se (Kd) to create scenarios accounting for the full range of the observed dataset (full uncertainty). The USGS provided the Department with different food web models from which the Department selected the "W6. TFM w/ TL 3 100% AqIns" model, reviewed the full range of results provided by the USGS (0.56-9.86 ug/L) and selected at the 75$^{th}$ percentile of the Kd distribution. This level of protection meets the protection goals defined at the conception of this work and protects the aquatic life beneficial use.

**The goal of the model is to provide a range of guidelines that any jurisdiction might use that is specific to the environment of interest, in this case Lake Koocanusa.**
RESPONSE: The Department agrees with this statement. This is exactly what was done for Lake Koocanusa. The USGS provided the Department different food web models to consider. The Department selected the "W6. TFM w/ TL 3 100% AqIns" model. This is a USGS calibrated model using the 60% bioavailability as described in the peer-reviewed modeling report (Presser and Naftz, 2020) and validated to site specific conditions using the zooplankton and aquatic insect data. The only additional step the Department performed was to review the range of guidelines provided (0.56-9.86 ug/L) and select a protective dissolved selenium concentration for Lake Koocanusa. In this case, that value was selected based upon the 75$^{th}$ percentile of the Kd distribution.

> "*The overall goal of this work is to provide an ecosystem-scale model that illustrates the site-specific range of potential selenium exposure and bioaccumulation that can inform the basis for regulatory decision-making by the State and the Province.*" Page 2 Presser and Naftz (2020).

**The key step in the model is calibration to environment of interest.**
RESPONSE: The Department agrees with this statement. This work was performed by the USGS and detailed in the peer-reviewed modeling report (Presser and Naftz, 2020). The calibration was done using a 60% bioavailability and validated to the site-specific zooplankton and aquatic insect data. The Department reviewed the food web models prepared by the USGS and selected the "W6. TFM w/ TL 3

100% AqIns" model. This model was calibrated to the environment of interest and the calibration and validation step went through the peer-review process.

**The first run of the model at 100% overpredicts. 30% is the appropriate bioavailability for Lake Koocanusa.**

RESPONSE: The Department agrees the 100% percent bioavailability model overpredicts. The USGS also recognized this, therefore describing in detail in the peer-reviewed Presser and Naftz (2020) modeling report their calibration step using the 60% bioavailability. Dr. Luoma suggests 30% bioavailability is an appropriate fit, however, the Department disagrees with this statement. While the Department respects Dr. Luoma's professional opinion, it is not clear why Dr. Luoma only chose to calibrate the 30% bioavailability scenario only to zooplankton when the USGS calibrated also to fish. Dr. Luoma is not applying the bioavailability to each trophic level. Furthermore, it is unclear which food web and diet model Dr. Luoma selected. If Dr. Luoma only selected the Invertebrate to Fish Model (IFM) at 100% zooplankton, this not only represents a model with nearly no bioaccumulation occurring, but it would not meet the protection goals for the reservoir.

Of the 13 food web modeling scenarios the USGS provided, the Department selected the Trophic-level (predator to forage) Fish Model (TFM) assuming prey fish were consuming a 100% aquatic insect diet. This is a piscivorous model with the 60% bioavailability applied to it. It would be more comparable if Dr. Luoma had selected this model for his example. Lastly, Dr. Luoma's statement that he thinks the 30% bioavailability is more appropriate to be applied has not gone through peer-review as did the 60% bioavailability application described in Presser and Naftz (2020). This is simply Dr. Luoma's professional opinion. Dr. Luoma was not part of the Selenium Technical Subcommittee, Teck had a different consultant on that committee, and Dr. Luoma did not submit comments on this during the public comment period.

> "*The results of our analysis and illustrated modeling scenarios show that at least 78 percent of predictions are <1.5 ug/L and at least 46 percent of predictions are <1 ug/L for protection of this community of core benthic feeders. The percentages are based on exposure through a 100-percent chironomid diet and two choices of bioavailability (100 percent and 60 percent for SPM); hence, these scenarios represent conservative, but realistic, choices with the set of 12 categorized fish species*" page 34 Presser and Naftz (2020).
>
> "In sum, this subset of modeling variables, species, and attributes appears to meet the specific goals set out at the beginning, which also impinge on operational interests. These considerations connect to specific scenarios and supporting rationales to represent the system." Page 35 Presser and Naftz (2020).

**The DEQ guidance document used the 60% and 100% bioavailability but the Department did not calibrate all the way down to the tightest calibration of 30%.**

RESPONSE: The Department did not use the 100% bioavailability model, and it is not in the Department's technical support document as a model the Department selected. The Department used the "W6. TFM w/ TL 3 100% AqIns" model utilizing the 60% bioavailability. This work was validated to local conditions using zooplankton and aquatic insect data and is described in detail in Presser and Naftz (2020). As described in the comments above, the only additional step the Department took was to select at the 75$^{th}$ percentile of the Kd distribution.

**A different range of choices is available whether you select the 60%, 45%, or 30% bioavailability. The 60% showed most results between 0.5 and 1.5 ug/L, 45% showed most results between 1-2 ug/L, while the 30% bioavailability application showed most results were between 1.5- 3 ug/L. The most tightly calibrated model is 30% which showed different results than the model the Department used that was not calibrated.**

RESPONSE: The Selenium Technical Subcommittee provided technical input throughout a multi-year process from which the USGS incorporated the input in their work which then went through a peer review process. The Department agrees that a different range of choices is the result of utilizing different bioavailability percentages. The range of choices additionally depends on the food web (IFM or TFM) and diet selected. The Department used a peer-reviewed model whereby the calibration of 60% also has been peer reviewed.

**DEQ errored when it tested the difference between the whole body 8.5 and 5.6 mg/kg dw. If you want to test the difference of the sensitivity of the model between two choices then you use the same model, put it all the way through the model and see what the outcome is. In this case, despite the difference in the beginning point (the fish tissue) you get the same outcome. The way the Department did that is by juggling parameters. This is not best practice. Juggling coefficients to achieve a desired outcome is not standard scientific methodology and it is not best practice in modeling. This is his cause of concern on how the Department arrived at the 0.8 ug/L standard.**

RESPONSE: The Department disagrees with this interpretation of how the Department arrived at 0.8 ug/L as a protective water quality standard for Lake Koocanusa. The derivation of the 0.8 ug/L water column standard is explained in the comments above. DEQ disagrees with the notion that the 0.8 ug/L was derived by juggling modeling parameters. It must be clarified that the Department worked closely with the British Columbia Ministry of Environment throughout the standard setting process and that British Columbia has fish tissue guidelines in place that are lower than those in the U.S. As part of the long-term goal of this multi-year binational effort to adopt the same water column concentration for Montana and British Columbia, British Columbia and the Department jointly reviewed modeling scenarios that considered the British Columbia whole body value of 5.6 mg/kg dw. The modeling scenario utilizing the 5.6 mg/kg whole body value, a bioavailability of 45% and a Kd selection at the 50% percentile was very much guided by the British Columbia of Ministry of Environment to meet their regulatory requirements, which differ from the regulatory requirements in Montana. However, it must be made clear that the Department proposed adoption of 8.5 mg/kg dw as the whole body standard not 5.6 mg/kg dw, and that EPA acted on the Department's water column translation approach utilizing the EPA whole body criterion of 8.5 mg/kg dw, applying a 60% bioavailability and selecting at the 75$^{th}$ percentile of the Kd distribution.

**A site-specific model must be calibrated to the site of interest.**

RESPONSE: The Department agrees with this comment. This work was completed by the USGS and is described in the Department's comments above. Additional details on the calibration can be found in Presser and Naftz (2020).

**It is inappropriate to suggest the choice of a standard was supported by the selenium bioaccumulation model, as was implied by the model's prominent position in the DEQ guidance document.**

RESPONSE: The Department respects Dr. Luoma's professional opinion. In this case, the USGS utilized the Presser and Luoma (2010) model and calibrated it to the Lake Koocanusa ecosystem using a 60% bioavailability and validating that model to the site using zooplankton and aquatic insect data. The USGS has stated in testimony that the Department utilized the model as intended.

"*The overall goal of this work is to provide an ecosystem-scale model that illustrates the site-specific range of potential selenium exposure and bioaccumulation that can inform the basis for regulatory decision-making by the State and the Province."* Page 2 Presser and Naftz (2020).

*"In sum, this subset of modeling variables, species, and attributes appears to meet the specific goals set out at the beginning, which also impinge on operational interests. These considerations connect to specific scenarios and supporting rationales to represent the system."* Page 35 Presser and Naftz (2020).

**CONCLUSION**

The derivation of the 0.8 ug/L water column standard for Lake Koocanusa included a sound scientific process with input over several years by leading experts in the field of selenium toxicology. The modeling work was completed by the USGS which resulted in a peer reviewed scientific modeling report (Presser and Naftz, 2020). The Department has the discretion to make the risk decisions that were made in selecting the "W6. TFM w/ TL 3 100% AqIns" model and selecting the Kd value at the 75$^{th}$ percentile of the distribution. This decision was informed by the recommendations by those on the Selenium Technical Subcommittee, Lake Koocanusa Monitoring and Research Working Group members, public comment, and the specific protection goals for Lake Koocanusa defined at the beginning of the process.

For reference, the previously defined protection goals for Lake Koocanusa are listed below:

- consideration of ecologically significant species and those important to stakeholders;
- protection of 100% of the fish species in the reservoir assuming a reproductive endpoint from reproductively mature females that are feeding in an ecosystem that functions as a lentic reservoir;
- long-term protection for fish in all parts of the reservoir during all phases of reservoir operation, all selenium loading profiles, and all water years;
- protection of ecosystems during maximum dietary selenium exposure (that is, feeding within a benthic food web); and
- protection of downstream uses including protection of endangered Kootenai River White Sturgeon

As stated above, it is unclear which food web model and diet Dr. Luoma used in his examples for his calibration using 30% bioavailability and why he did not select a piscivorous model, therefore calibrating to fish. It is also unclear why he used only zooplankton and did not use the aquatic insect data for his validation. His comments have not been peer reviewed and he did not submit comments during the public comment period, nor did he participate or request to participate as a member of the MRC during the six year process. Dr. Luoma was not the Teck consultant on the Selenium Technical Subcommittee. As such, he was not part of the more than 25 Selenium Technical Subcommittee meetings where details of the modeling and ecosystem were discussed at length. The model calibration using the 60% bioavailability and validation to the zooplankton and aquatic insect data was included in the peer-reviewed process and is detailed in the modeling report by Presser and Naftz (2020).

As the state of the science evolves with any pollutant and the known impacts on beneficial uses (aquatic life, human health, agriculture, etc.), water quality standards are updated to reflect that science. Both state and federal law require water quality standards be reviewed at least every three years. If the review identifies new information that indicate new or revised water quality standards are needed, DEQ

would conduct rulemaking and submit any new or revised water quality standards to EPA for review and action under the Clean Water Act.

**Item 4**

Attached is a spreadsheet of all selenium data for lentic and lotic waterbodies found in the Department's EQuIS database. There are two tabs, the first tab is the full dataset and the second tab is the detected samples only per the request from Representative Gunderson. The Department uploads all data from EQuIS into the public National Water Quality Portal Website https://www.waterqualitydata.us/

/s/ Amy Steinmetz 3/9/22

Water Quality Division Administrator,
Amy Steinmetz Date