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Mr. Randy Landolt
Managing Director
Pacificorp Energy
825 NE Multnoma, Suite 1500
Portland, Oregon 97232

Re: Information Related to the Occurrence of Microcystin in the Tissues of Klamath River Biota

Dear Mr. Landolt:

Thank you for your letter of May 13, 2008, regarding the occurance of microcystin in the tissue of Klamath River biota. The Office of Environmental Health Hazard Assessment (OEHHA) is under a contract with the State Water Resources Control Board (SWRCB) to develop scientifically based health-protective reference doses (RfD) for four microcystin variants (-LR, -RR, -YR and –LA), cylindrospermopsin, and anatoxin-a. These RfDs are maximum safe daily intakes of these cyanotoxins, normalized to body weight. The technical document and the cyanotoxin RfDs will provide a basis for developing Advisory Tissue Levels (ATLs) for fish or shellfish consumption, but will not, itself, contain any ATLs.

Your letter notes that because all microcystins may not be equally toxic and they may not be equally well absorbed in the intestinal tract, it may not be appropriate to combine the measured microcystin congener concentrations in fish tissue, until the assumption that they are all as toxic as microcystin-LR (MC-LR). However, that begs the question as to what should be done with regard to other congeners. While OEHHA agrees that the toxicity of microcystin congeners other than MC-LR is uncertain, until subchronic toxicity data for the other congeners become available, OEHHA recommends applying the MC-LR RfD to the sum of all microcystin congeners, since ignoring congeners other than MC-LR, would have the effect of assuming that they are non-toxic. As noted in Dr. Kann's memorandum, included as one of your attachments, acute toxicity values for various microcystin congeners fall within a fairly narrow range.

You question whether the microcystin analysis techniques used by the Department of Fish and Game (DFG) Water Pollution Control Laboratory (WPCL) measured all microcystin in the tissue or only the non-bound microcystin. We have reviewed the 2007 microcystin data and Quality Control (QC) results from the WPCL included in the memorandum.

WPCL used certified standards for six microcystin congeners and quantitated demethlylated variants as their parent analogs. This is a standard procedure when certified standards are not available. We also verified, through personal communication with David Crane at WPCL, that the methodology used for the analysis only measures the unbound (bioavailable) fraction. We are satisfied that these are high quality results and can be used in risk assessment. You have also questioned Dr. Kann's analysis with respect to potential health risk from consumption of fish and mussels based on tissue levels found in 2007. While OEHHA employs slightly different methodology, we would support Dr Kann's implied conclusion that the 2007 mussels and perch fillets contain levels of cyanotoxins that could potentially reach a toxic dose if eaten frequently, as shown in the following discussion.

Because the OEHHA technical document is currently in development, and not expected to be finished in time to address this year's cyanobacterial blooms, we had previously provided guidance to the North Coast Regional Water Quality Control Board in the form of a memorandum to Elmer Dudik dated July 2, 2008. This memorandum (enclosed) provides guidance regarding the use of the provisional guidelines by the World Health Organization (WHO, 1999) as a basis for fish consumption recommendations.

Since that memorandum, we have concluded that the 2006 U.S. Environmental Protection Agency (U.S. EPA) draft Toxicological Review of Cyanobacterial Toxins (which is still under revision at U.S. EPA and is subject to change) (EPA, 2006) can be used as a preferred alternative to the WHO guidelines in order to determine the risk from consumption of microcystin-contaminated fresh water mussel and yellow perch. This change is primarily based on our ongoing review of the toxicity of the blue-green algae toxins and the fact that the U.S. EPA value is based on newer information than the WHO document. We had used the WHO guidelines for the July 2, 2008, memorandum in order to be consistent with earlier use of the guidelines for posting certain areas around the two reservoirs and along the Klamath River.

The U.S. EPA draft proposes a RfD for short-term (up to 30 days) and subchronic (up to 10% of a person's lifetime) exposure of 6×10^{-6} mg/kg/day based on hepatotoxicity in rats (Heinze 1999). U.S. EPA also proposes a draft RfD for chronic (lifetime) exposure duration of 3×10^{-6} mg/kg/day based on hepatotoxicity in mice (Ueno et al., 1999). Each of these RfDs is based on microcystin-LR and each incorporates a cumulative uncertainty factor of 1000.

In order to determine the risk from consumption of fresh water mussel and yellow perch we have averaged the 2007 microcystin concentrations for each species and each water body. The average total microsystin concentration (sum of all congeners) in mussels from Klamath River sites was approximately 554 ng/g. The average total microsystin concentrations in yellow perch fillets from Iron Gate and Copco Reservoirs were approximately 42 ng/g and 169 ng/g, respectively. Using the draft U.S. EPA RfD for short-term and subchronic exposure

(6×10^{-6} mg/kg/day), we calculated ATLs using the methodology and assumptions described in (Klasing and Brodberg, 2008). OEHHA recognizes that consuming fish and shellfish is beneficial to health, but benefits from consumption need to be balanced against risk from chemical and microbial toxins. When consumers can NOT consume one serving a week of a particular fish or shellfish due to toxin levels, OEHHA recommends against any consumption. The upper bound of the ATL range for the one serving (8 oz uncooked fish, 6 oz. cooked, equal to 32 g/day) per week category is 26 ng total microcystins/g. Based on this ATL and the 2007 data, OEHHA would have recommended against consuming mussels from the affected sections of the Klamath River, and yellow perch from Iron Gate and Copco Reservoirs because their average concentrations exceeded 26 ng/g.

Your last issue concerned tissue samples from salmon and steelhead from the Iron Gate Hatchery and from points along the Klamath River. We do not have any comments on these findings because for the most part they were non detectable levels of cyanotoxins. If there is no toxin in the edible tissue of fish that would be eaten, there should be no risk. This of course is caveated with the provision that the detection limit of the analytical method would have to be below the tissue level that is potential harmful.

I hope you find this letter helpful and responsive to your concerns. If you have any question please call me at (510) 622-3200.

Sincerely,

George V. Alexeeff, Ph.D, DABT
Deputy Director for Scientific Affairs

Enclosure

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References

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