STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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May 7, 2010

(See Distribution List)

RE: PETITION TO AMEND WAC 173-201A-200(1)(F)(II) – WATER QUALITY STANDARDS

The Washington State Department of Ecology (Ecology) received your petition for rule making on March 8, 2010. The petition requests a change or removal of a portion of the total dissolved gas (TDG) criteria in the Washington State Water Quality Standards regarding the fish passage exemption for the Snake and Columbia Rivers, WAC 173-201A-200(1)(f)(ii). The petition contends that the 115% forebay TDG criterion is unduly restrictive, at odds with sound science, and contrary to federal and state law.

The evidence presented in Ecology's literature review [1] shows the potential for a small increase in harm to aquatic life. Ecology continues to assert that federal and state law require Ecology to maintain and protect all designated and existing uses in waters of the state. The current TDG standard for maintaining and protecting designated uses is in fact 110% of saturation. The special fish passage exemption was placed into rule in 1997 after a careful balancing of the benefits of aiding fish over the dams with the risk of increased impacts from high TDG. At that time, the forebay sites were established as a measure of TDG in mixed waters and to represent the long-term exposure levels of migrants throughout the migration corridor. Ecology maintains that the 115% forebay criteria adjustment allows increased spill for fish while also providing a margin of safety for other organisms shown to be harmed by prolonged exposure to TDG levels above 115% of saturation.

Ecology is denying the petition to change the Washington State Water Quality Standards based on the results of a thorough review conducted in 2007-2009. This review was conducted in response to previous concerns raised in 2007 about the 115% forebay TDG criterion. Details of the review are available at http://www.ecy.wa.gov/programs/wq/tmdl/ColumbiaRvr/ColumbiaTDG.html. Ecology's analysis of the 115% forebay TDG criterion can be found in *Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers – Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement* (AMT Evaluation). Ecology and the Oregon

[1] Maynard, C., 2008. Evaluation of Total Dissolved Gas Criteria (TDG) Biological Effects Research: A literature review. Washington State Department of Ecology, Olympia, WA. Publication No. 08-10-059.

Department of Environmental Quality (ODEQ) gathered all the technical information from experts who supported and opposed the 115% forebay criterion. In this document, Ecology made the following conclusion:

> Ecology determined that there would be a potential for a small benefit to salmon related to fish spill if the 115% forebay criterion was eliminated, but there would also be the potential for a small increase in harm from increased gas bubble trauma. The weight of all the evidence from available scientific studies clearly points to detrimental effects on aquatic life near the surface when TDG approaches 120%.

Based on the information in this evaluation, Ecology does not believe the overall benefits of additional spill versus detrimental effects to other aquatic life are clear or sufficient for a rule revision.

The petition identifies five main issues that support the rule change request. A more detailed response to these five issues is attached. If you have questions, please contact Chad Brown in our Water Quality Program, at chad.brown@ecy.wa.gov / (360) 407-6128.

Sincerely,

Ted Sturdevant
Director

Attachment

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ATTACHMENT

Petition Issue I
Spill is a vital salmon and steelhead protective measure.

Ecology agrees that spill is an important measure to decrease mortality of migrating salmon and steelhead. Washington's Water Quality Standards currently allow exemptions to the statewide 110% TDG criterion for the Columbia and Snake Rivers in order to aid in fish passage over the dams. These criteria adjustments are designed to provide spill for fish passage greater than would be allowed by the 110% criterion. We also agree that the resulting increased fish passage, as well as favorable ocean conditions, have contributed to increased salmon returns. Ecology's rule allowance of the adjustments to the 110% TDG criterion were done in the interest of meeting the goals of the Endangered Species Act by reducing fish passage mortality. However, it should also be noted that Ecology is not under any specific legal obligation to balance fish spill with the increased risks of gas bubble trauma (GBT).

> The petitioners assert that "State and federal laws require Ecology to set TDG limits that maximize salmon survival by balancing the benefits of spill with the risk of GBT [Gas Bubble Trauma]. [2]

This statement is inaccurate. State regulations require Ecology to maintain and protect all designated and existing uses in waters of the state (WAC 173-201A-310). In addition, federal regulations require Ecology to maintain and protect all existing uses (40CFR131.12. (a)). The designated uses for the Columbia and Snake Rivers include the key species uses of salmon spawning, rearing and migration, as well as the following requirement: *It is required that all indigenous fish and nonfish aquatic species be protected in waters of the state in addition to the key species described below* (WAC 173-201A-200(1)).

> The petitioner also argues that, "It is here – when balancing risks and benefits to aquatic biota – that Ecology's decision errs." [3]

Since Ecology's federal and state legal obligation is to maintain and protect designated uses, Ecology's decision to include protection for aquatic organisms other than salmonids is not in error and is not a violation of federal and state laws. On the contrary, the water quality standards clearly state that all indigenous biota are part of the designated aquatic life uses, and must be maintained and protected. Therefore, Ecology believes that the current fish passage exemptions for TDG balance the needs of spill for fish passage with a margin of safety for other aquatic organisms that utilize the upper portion of the water column above the TDG hydrostatic compensation depth.[4]

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[2] Save Our Wild Salmon, March 8, 2010. Petition to Amend WAC 173-201a-200(1) (f) (ii), p. 4.
[3] *Id.* at 4.
[4] Hydrostatic pressure of water compensates for approximately 10% of supersaturation per meter of water depth. Therefore, the hydrostatic compensation depth is the depth below which organisms will not experience effects of TDG supersaturation. This depth varies, depending upon the level of supersaturation.

Petition Issue II
The 115 percent forebay TDG limit is not grounded in science.

The petitioners argue that the 115% criterion is not grounded in science.

Ecology disagrees with this assertion. The effects on aquatic life at 115% versus 120% are detailed in the AMT Evaluation in the section titled "Gas Bubble Trauma Impacts." Further information on the effects of chronic exposure to TDG supersaturation is also described in Ecology's literature review. [5]

We do not consider the current 115% criteria adjustment to be too restrictive just because data and studies show there is only limited gas bubble trauma exhibited at that level. The goal of the water quality standards is to set criteria that fully maintain and protect aquatic life uses, which would usually mean setting a level that results in no gas bubble trauma or other harmful effects. Indeed, most criteria in our water quality standards are set at a far more protective (i.e., more strict) level. After further evaluation of the 115% limit, we continue to believe the current 115/120/125 percent criteria[6] adjustments achieve the best balance between increased spill for salmon migration and the protection of aquatic life that have shown lethal and sublethal effects due to prolonged exposure to TDG supersaturation.

The petitioners argue that Ecology overstated the potential for harm to aquatic biota by omitting and misrepresenting studies in the literature review.

We reviewed the studies that were identified in the petition—all of which were referenced in Ecology's literature review. [7] We agree that Ecology can clarify some result summaries to include information provided in the petition. However, we do not agree that these studies were misrepresented in Ecology's review. Some of the studies identified in the petition were not intended to analyze the effect to aquatic organism below 120% TDG levels. Therefore, Ecology did not necessarily consider them in the "weight of evidence" that the petitioners describe. However, it is important to note that studies identified in Ecology's literature review point to key studies not mentioned by the petitioners that showed lethal and sublethal effects to some aquatic organisms. Scientific evidence shows detrimental effects to some aquatic organisms (see the section under "Petition Issue IV" for details). These effects cannot be deemed negligible by Ecology in determining the appropriate water quality standards required to maintain and protect all aquatic life uses.

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[5] Maynard, C., 2008. Evaluation of Total Dissolved Gas Criteria (TDG) Biological Effects Research: A literature review. Washington State Department of Ecology, Olympia, WA. Publication No. 08-10-059. See pp. 2-3.
[6] WAC 173-201A-200(1)(f)(ii) states that spill to aid fish passage may exceed the 110% criterion providing that "TDG must not exceed an average of 115% as measured in the forebays of the next downstream dams and must not exceed an average of 120% as measured in the tailraces of each dam (these averages are measured as an average of the 12 highest consecutive hourly readings in any one day, relative to atmospheric pressure) [and] [a] maximum TDG one hour average of 125% must not be exceeded during spillage for fish passage."
[7] Maynard, C., 2008. Evaluation of Total Dissolved Gas Criteria (TDG) Biological Effects Research: A literature review. Washington State Department of Ecology, Olympia, WA. Publication No. 08-10-059.

Ecology agrees that minimal effects are seen in many invertebrates, but other studies cited in Ecology's literature review show harmful affects to other indigenous species. Federal and state laws do not allow Ecology to disregard the aquatic life use requirements of some species over another. Ecology must consider effects on aquatic organisms other than salmonids that, in this case, utilize the upper water column for all or portions of their life stages.

> The petitioners cite C.F.R. § 131.11(s)(1) that a state's water quality "must be based on sound scientific rationale..." and RCW 90.48.580(2)(c) which requires the use of "credible data" for agency decisions involving Clean Water Act (CWA) rules. The petitioners argue that the "exclusive reliance on experimental studies...led Ecology to substantially overestimate the risk of GBT to aquatic life."

Data and information from experimental studies are routinely used by EPA and the states to develop water quality standards. Experimental studies that show harmful effects to aquatic life due to TDG approaching 120% are valid and necessary for developing criteria that maintain and protect all designated and existing uses.

> The petitioners' second issue also included further information showing that Ecology had ignored the benefits of spill to Pacific Lamprey.

We are encouraged that the current spill allowed by the criteria adjustment is beneficial to the Pacific Lamprey, as well as salmonids. It is important to remember that keeping Ecology's 115% criteria will not "further harm" the Pacific Lamprey. Since Ecology is retaining the current adjustment criteria for spill, there is no further or increased harm or benefit from the current situation. Ecology also supports the current studies being undertaken by the USACE to research and evaluate the migration of Pacific Lamprey. [8]

Petition Issue III

Forebay monitors do not provide credible data necessary for monitoring compliance with water quality standards.

Ecology recognizes the challenges in collecting forebay TDG data. As stated in Ecology's August 10, 2009, letter to the petitioners, [9] difficulty in monitoring is not a valid reason to eliminate a criterion in the water quality standards.

> The petitioners argue that "[w]hile this may be an appropriate general rule, it does not apply here" [10] because forebay monitoring is used to determine allowable spill for fish at the upstream dam.

While Ecology continues to work with stakeholders to improve the quality of TDG monitoring, we also assert that the criteria is necessary to maintain and protect designated aquatic life uses. These criteria are independent of the difficulty to monitor. Furthermore, Ecology disagrees with the analysis method [11] that the Fish Passage Center (FPC) used to conclude that measures taken

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[8] The U.S. Army Corps of Engineers has funded projects to evaluate adult lamprey migration and use of passage structures. Future studies are proposed for the FCRPS dams.

[9] Department of Ecology. August 10th, 2009. Response to Petition for Rulemaking – Chapter 173-201a WAC – Water Quality Standards.

[10] Save Our Wild Salmon, March 8th, 2010. Petition to Amend WAC 173-201a-200(1) (f) (ii), p. 15.

[11] Fish Passage Center, spring Spill 2006 Memorandum (Sept. 29, 2006).

as part of reasonable and prudent alternative (RPA) 132[12] did not achieve the objective. The Fish Passage Study did not adequately assess the effects of relocating forebay-monitoring locations as part of RPA 132.

The FPC study compared the maximum, minimum, and mean for pre-spill data in six different years. The seasonal maximum, minimum, and mean TDG values are not necessarily comparable between years because these TDG values can be affected by flow and other conditions that vary by year. A comparison of the absolute change in non-spill TDG data from tailrace to forebay in years before and after the monitoring relocations would give a clearer assessment of the success of the RPA 132 actions.

Ecology agrees there is evidence that primary production is a problem affecting the forebay TDG measurement. The extent to which this affects the monitoring values is not clearly known. Ecology encourages further study to collect more representative forebay TDG data, but notes that the challenges in measuring compliance with water quality criteria remain independent of determining water quality standards.

> The petitioners state that an alternative to changing the 115% forebay criterion is to remove the forebay criterion altogether.

Ecology disagrees with removing the forebay criteria. Generally, the fishery management agencies have sought spill quantities that result in TDG values close to the 120% tailrace adjustment criterion. This maximizes the fish passage and survival, but any small change in conditions of the downstream reach that influence TDG – such as change in barometric pressure, water temperature, degassing rates, incoming gas, total river flow, or tailwater elevation – may cause an increase in TDG above 120%. [13] Forebay limits provide a margin of safety to ensure that these changes in condition do not result in an increase of TDG above 120% and help to limit chronic exposure to harmful TDG levels within the reach.

Petition Issue IV

The 115% forebay TDG limit does not protect the most sensitive designated use of the Snake and Columbia Rivers: salmonid habitat.

From review of TDG studies and information, Ecology is not convinced that salmon are the most sensitive aquatic life in terms of effects from high TDG. These key species are important in this system and is the reason Ecology has provided an exemption of the 110% TDG criterion for fish spill. However, all aquatic life must be protected by the water quality standards, including all indigenous fish and nonfish aquatic species. A description of the effects of TDG on aquatic life is available in the AMT Evaluation and the three literature reviews cited by the evaluation. [14]

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[12] BiOp Measure 132 Final Report, December 2004: "Total Dissolved Gas Forebay Fixed Monitoring Station Review and Evaluation for Lower Snake River Projects and McNary Dam, 2003-2004".

[13] Pickett, P.J., R. Harding, 2002. Total Maximum Daily Load for Lower Columbia River Total Dissolved Gas. Washington Dept. of Ecology, Olympia, WA. p. 17. Publication No. 02-03-004.

[14] The reviews include those produced by NOAA Fisheries, Parametrix, and WA Dept of Ecology.

> While the petitioners argue that Ecology did not perform a proper literature review, the petition does not dispute that some studies show harmful effects to aquatic life such as frogs,[15][16] sturgeon larvae,[17] and juvenile steelhead trout[18] between 115 and 120% of saturation.
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> The petitioners again assert that Ecology is considering and protecting for power generation as a designated use.

As stated in our previous denial of petition, power generation is not a designated use for Washington's surface water quality standards. The reason that Ecology retains and does not increase the 115% forebay criterion adjustment is due to the designated aquatic life uses described in this letter.

> The petitioners also argue that "the forebay gas caps play a dominant role in reducing spill for salmon survival."

Our evaluation did not find that forebay TDG limits were a primary limiting factor for spill. The BPA and USACE analyses found that spill could increase 1-4% if the forebay TDG limits were removed. The FPC analysis found that spill could increase 2% (scenario B, average of 2003, 2005, 2006, and 2007) to 10% (scenario C, average of same years) if the forebay TDG limits were removed. Only if spill was not limited by planned operations (scenario D) would the forebay gas caps play a dominant role in reducing spill. The spill volumes are detailed in the AMT Evaluation in the section titled "Spill Volume Analysis: With and Without the 115 Percent TDG Limit."

Ecology agrees with the salmon distribution information presented in the petition. The AMT Evaluation included 15 studies on aquatic life distribution from the Ecology literature review. The conclusion of these studies was that the mean depth of the fish was always deeper than one meter, and usually deeper than two meters. The amount of time spent at depths less than one meter was usually (but not always) less than the amount of time where significant detrimental effects were found. Aquatic organisms in the top meter of water are the most vulnerable to gas bubble trauma and other sublethal effects due to a lack of hydrostatic pressure to keep gas in solution. Ecology does not agree that the abilities of some organism to sense and avoid water quality limited areas should be used as the only basis to ensure that protections required under the Clean Water Act are met. Furthermore, the effects to other aquatic organisms that cannot detect or otherwise avoid this water quality limited area should not be disregarded.

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[15] Colt, J., K. Orwicz, & D. Brooks, 1984. Effects of gas-supersaturated water on *Rana catesbeiana* tadpoles. Aquaculture 38(2): 127-136.

[16] Colt, J., K. Orwicz, & D. L. Brooks, 1987. Gas Bubble Trauma in the Bullfrog *Rana catesbeiana*. Journal of the World Aquaculture Society 18(4):229-236.

[17] The effects of dissolved gas supersaturation on white sturgeon larvae. Transactions of the America Fisheries Society 127:316-322.

[18] Nebeker, A.V., J. D. Andros, J. K. McCrady, & D. G. Stevens, 1978. Survival of steelhead trout (*Salmo gairdneri*) eggs, embryos, and fry in air-supersaturated water. Journal of the Fisheries Research Board of Canada 35:261-264.

Petition Issue V

Ecology should amend WAC 173-210A-200(1) (f) (ii) to remedy its violations of federal and state law.

> The petitioners argue that there is no risk to aquatic life near the surface when TDG approaches 120%.

Ecology disagrees with this conclusion. The specific evidence that led Ecology to determine there were detrimental effects on aquatic life near the surface when TDG approaches 120% is detailed in the Gas Bubble Trauma Impacts section of the AMT Evaluation. The Ecology literature review found sublethal and lethal effects on aquatic life (not just salmon) at 120%.

> The petitioners assert that Ecology's rationale to not remove the forebay TDG criteria is not grounded in science, but rather is based on the "complexity of the process" and that "administrative convenience" [19] is part of Ecology's decision to modify a rule.

The petitioners are misrepresenting Ecology's statement in the AMT Evaluation that "rule changes must include a cost benefit analysis and a small business economic statement." Although this is a step in Ecology's rule-making process, it is not a determining factor whether or not to begin rule development. Rather, the requirement to maintain and protect aquatic life uses determines whether a water quality standard rule change is necessary.

> The petitioners argue, "Ecology's refusal to revise its standards also threatens to undermine ODEQ's more protective waiver that eliminates the forebay monitoring requirement." [20]

Ecology recognizes that ODEQ decided to eliminate their 115% waiver limit, and that the dam operators will need to continue to meet the 115% limit based on Washington's adjusted criteria during spill for fish. Ecology also acknowledges that the analyses show that a removal of the 115% forebay requirement would allow a small percentage increase in fish passing over the dams. However, Ecology does not agree that Oregon's removal of the waiver is "more protective" when all aquatic organisms are considered. Furthermore, data shows that the 115% forebay requirement is most limiting of spill at Bonneville, Little Goose, and Lower Monumental Dams. Ecology and ODEQ both previously eliminated the 115% limit below Bonneville Dam. Therefore, both states have the same TDG criterion (120% of saturation in the tailrace) that limit spill at Bonneville Dam. Additionally, Little Goose and Lower Monumental Dams are entirely in Washington's jurisdiction on the Snake River, so Oregon's waiver limit does not affect them. We also note that the Oregon and Washington TDG standards are not directly comparable. Oregon maintains a 105% TDG criterion (outside of the waiver for fish spill) for shallow waters, which provides further protection for aquatic organisms above the TDG hydrostatic compensation depth. Washington does not currently have a criterion specifically for the protection of aquatic organisms in shallow water.

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[19] Save Our Wild Salmon, March 8, 2010. Petition to Amend WAC 173-201a-200(1) (f) (ii), p. 19.

[20] *Id.* at 20.