

Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement for the Columbia and Snake Rivers

Department of Ecology's Frequently Asked Questions

Ecology decided not to change its 115% total dissolved gas (TDG) forebay water quality criterion for the Columbia and Snake Rivers. This decision is based on the information provided in the *Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers – Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement*. This paper is available on our website at <http://www.ecy.wa.gov/programs/wq/tmdl/ColumbiaRvr/ColumbiaTDG.html>.

Q: What is total dissolved gas?

A: Spilling water over dams increases the level of total dissolved gas (TDG) in the river. Water plunging from a spill entrains air and carries it to a depth where the pressure forces the gas into solution. TDG levels above 110% of saturation can cause gas bubble trauma in fish. Gas bubble trauma is caused by gas bubbles forming in the cardiovascular system of aquatic species. These bubbles block the flow of blood and respiratory gas exchange.

Q: What are the current criteria for TDG?

A: Ecology's statewide total dissolved gas criterion in the water quality standards is 110%. This criterion is designed to fully protect salmon and all other aquatic life. In the 1990s, Ecology added a specific exemption for the Columbia and Snake Rivers for higher TDG levels to allow additional spill of water over the dams to aid salmon migration. Ecology allows TDG up to 120% in the tailrace immediately below the dam and 115% in the forebays behind the dams. While this level of gas is less protective than our statewide criterion, it does allow for additional spill that benefits salmon.

Q: Why is there a TDG criterion in the dam forebays?

A: TDG levels in the tailrace are typically higher just after the water plunges over the dam. However, most aquatic life spends more of their time in the forebays. The 115% forebay criterion provides an additional margin of safety for chronic protection against gas bubble trauma in all aquatic life.

Q: What were Ecology’s scientific findings?

A: 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 at shallow depths when TDG approaches 120%. The detrimental effects ranged from behavior changes to high levels of mortality after a few days. There were fewer effects on aquatic life at 115% TDG. This information is explained in more depth in *Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers – Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement*, available on-line.

Q: How are Water Quality Standards changed?

A: Changing the water quality criterion would trigger additional administrative procedure requirements. In Washington, rule changes must include a cost benefit analysis and a small business economic impact statement to determine the effects of rule changes on the public and businesses in the state. The benefits of the rule change must outweigh the costs in order to be adopted into rule. A State Environmental Policy Act (SEPA) determination would be needed. Based on that determination, there might be a requirement for an environmental impact statement if the proposed rule change was determined to significantly impact the environment. Given in the information in the *Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement*, Ecology does not believe the overall benefits of additional spill versus additional risk of gas bubble trauma are clear and are sufficient for a rule revision.

Q: Since Ecology is not changing the standard, what does Ecology want?

A: Ecology strongly encourages implementing actions that increase salmonid survival without further increasing total dissolved gas. We need to increase fish survival without increasing the risk of gas bubble trauma.

Q: How did Ecology make its decision?

A: ODEQ and Ecology convened an “Adaptive Management Team” (AMT) to provide information on the 115% forebay requirement. The AMT was co-chaired by Oregon and Washington and consisted of TDG experts from federal agencies, tribes, public utility districts, Save Our Wild Salmon, and NW River Partners. Ecology and ODEQ held monthly meetings from November 2007 through September 2008 to gather, share, discuss, and synthesize technical information. Meeting notes and all of the technical information is available on Ecology’s website at <http://www.ecy.wa.gov/programs/wq/tmdl/ColumbiaRvr/ColumbiaTDG.html>. Ecology and ODEQ

gathered information on the effects of removing the 115% TDG requirement on spill volumes and how that spill would harm and/or benefit salmon and other aquatic life.

Q: Oregon decided to change their requirement. Why is Ecology doing something different?

A: ODEQ and Ecology reached different conclusions regarding the 115% forebay requirement. ODEQ and Ecology do not disagree on the fundamental technical findings in this report. There are important differences in the TDG requirements in the two states; ODEQ issues a waiver with 115% forebay requirements while Ecology's forebay requirements are part of the water quality standards. Changing water quality standards is more difficult than changing a waiver. Further, ODEQ has a 105% shallow water TDG criterion while Ecology does not. Ecology's 115% requirements apply to dams on the Lower Columbia, Middle Columbia, and Lower Snake Rivers while ODEQ's requirement only applies to the Lower Columbia River.

Q: Oregon has regulated shallow water TDG below Bonneville dams because of fish concerns. If Ecology is concerned about shallow water TDG, where are those areas that we are concerned about and why haven't we raised the issue in the past?

A: Ecology is concerned about the top meter of the water. The term "shallow water" was replaced with "near the surface" in the paper for clarity. When TDG exceeds 110%, aquatic life residing in the top one meter of water starts to suffer from gas bubble trauma. With a 10% depth compensation for each meter below the surface, a TDG level of 120% would mean all aquatic life below one meter would have a depth compensated TDG equivalent to 110% (and aquatic life below two meters would have a depth compensated TDG equivalent to 100%). While all aquatic life near the surface is susceptible to gas bubble trauma, aquatic life in habitats where no depth compensation is available (shallow waters where the water is never deeper than one meter) is especially vulnerable. Oregon's 105% criterion is designed to protect these especially vulnerable areas. The paper's primary focus is on all the water near the surface. Ecology has always been concerned about the TDG near the surface, which was also the focus of the Ecology literature review.

Q: The AMT process said it would review both the 115% forebays and location of tail races. The report does not address the location of tailraces as being appropriate.

A: When the AMT was formed, Ecology and ODEQ decided to address the need for the 115% forebay requirement first, then the location of the forebay and tailrace monitors. This paper only addresses the first issue, the need for the 115% forebay requirement.

MORE INFORMATION

For more information, please see the complete record of the Adaptive Management Team on the web at: <http://www.ecy.wa.gov/programs/wq/tmdl/ColumbiaRvr/ColumbiaTDG.html>).

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