

Hells Canyon Complex Total Dissolved Gas Study (E.2.2-4)

John W. Anderson
AFS Certified Fisheries Scientist
Cold Stream Consulting, P.O. Box 575 Baker City, OR 97814
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I. Introduction

“The states of Idaho, Oregon and Washington have set a limit of 110% TDG (total [nitrogen] dissolved gas) saturation to protect aquatic resources, particularly juvenile salmonids. The study described in this report addressed supersaturation within and downstream of the Hells Canyon Complex (HCC).”....“The effects of hydroelectric operations on TDG levels are well documented (Weitkamp and Katz 1980). Gas supersaturation downstream of a dam typically occurs when air becomes entrained in water that is released over a spillway and plunges deep into a stilling basin. The hydrostatic pressure at depth causes entrained atmospheric gases to be absorbed into solution.”.... “Rivers with extensive hydroelectric development can become supersaturated during periods of high runoff when inflowing water exceeds the hydraulic capacity of these projects and must be released over the spillways.” (Page 1, Paragraph 1 and 2)

II. Conclusions

1. *“Spilling water at any of the three projects within the HCC can increase TDG to supersaturation levels that exceed the 110% protective standard. Measured levels in Brownlee and Oxbow tailraces generally range from 120% to 125% saturation during spill episodes at those two projects.” (Page 13, Paragraph 1)*

Response: The BLM agrees with this finding.

2. *“In the Hells Canyon Dam tailwater, measured levels peak around 136% saturation. Supersaturation declines in the Snake River as water flows downstream of Hells Canyon Dam. However, levels in excess of 110% saturation can persist downstream to the confluence with the Salmon River.” (Page 13, Paragraph 1)*

Response: The BLM agrees with this finding.

3. *“This study did not include biological sampling to evaluate the site-specific effects of the elevated TDG levels on biota downstream of the dams. However, juvenile fall chinook surveys conducted within a time frame similar to the one used in this study failed to identify symptoms related to elevated TDG (R. Waitt, US. Fish and Wildlife Service, pers. Comm.).” (Page 13, Paragraph 2)*

Response: The BLM believes that the findings of the unrelated study conducted by R.Wait, USFWS, cited in this report can only be considered as antidotal information. If the applicant believes that TDG is not having an adverse affect on fish, is should conduct comprehensive studies that are scientifically based. However, the numerous studies at the Columbia River dams have already definitively proven that elevated TDG adversely affects fish. Therefore, the applicant should accept this fact.

4. *“Adult steelhead and chinook captured at Hells Canyon Dam have exhibited symptoms of gas bubble disease (Burton 1988a, b; Bertellatti and Young 1990; Snider 1993). However, it could not be determined whether the symptoms resulted from exposure to elevated TDG levels immediately downstream of Hells Canyon Dam or exposure to elevated TDG levels produced by the federal lower Snake River projects located further downstream (P. Abbott, the applicant, per. comm.).” (Page 13, Paragraph 2)*

Response: This conclusion is a failure to acknowledge the applicant’s non-compliance with TDG standards. The BLM agrees that gas bubble disease in adult steelhead and chinook captured at Hells Canyon Dam may be from either the Columbia River Dams or the HCC, possibly both. However, the levels of TDG produced by the HCC are in excess of the 110% standard. These higher levels of TDG are proven to be harmful to salmon and steelhead. Therefore, the applicant should accept the fact that their facility needs to be modified to reduce TDG.

5. *“The potential for detrimental biological effects downstream of Brownlee and Oxbow dams (in Oxbow and Hells Canyon reservoirs) is logically lower than the potential downstream of Hells Canyon Dam. Not only are TDG levels generally lower downstream of Brownlee and Oxbow dams than those downstream of Hells Canyon Dam, but deeper areas within the impoundments provide more potential refuge areas. Organisms in areas of depth greater than 2[meters] would not be exposed to the effects of supersaturation, even under the worst-case spill scenario.” (Page 13, Paragraph 2)*

Response: The BLM finds that although this statement may be generally true, it does not change the fact that Oxbow and Brownlee dams’ TDG levels are out of compliance with state standards and that they do pose a potential for harm to fish in the reservoirs.

6. *“Spilling water from the upper spill gates at Brownlee Dam rather than the lower spill gates appears to minimize TDG levels in the Brownlee Dam tailwater. Although levels still exceed 110% it might be possible to keep them below 120% saturation by releasing water only from the upper spill gates.” (Page 13, Paragraph 3)*

Response: The BLM agrees with this statement. However, the problem of elevated TDG is not fully resolved by changing spill gates. Furthermore, there is no indication in the study that the applicant intends to modify either Oxbow or Brownlee dam to reduce TDG levels to meet the 110% standard.

7. *“Selective spill gate operation does not effect super saturation below Hells Canyon Dam. However, installing the flow deflectors designed by IIHR might reduce supersaturation below Hells Canyon Dam. We are not able to predict actual TDG levels or the amount of reduction if the deflectors are installed. However, the physical model qualitatively indicates that improvement over current conditions might be possible by preventing the entrained air bubbles from plunging to depth and supersaturating the water. Also, the physical model shows that the flow deflectors on Hells Canyon Dam would be ineffective at spills greater than 30,000 cfs. At that flow rate, the deflectors could not keep the entrained air from plunging to depth in the stilling basin. However, the IIHR design appears to be effective for approximately 98% of recorded flow occurrences at the project. We are unable to identify any measures that would guarantee complete compliance with the 110% saturation standard.” (Page 13, Paragraph 2)*

Response: The BLM agrees with this finding. The BLM believes that the applicant should implement measures that will reduce TDG to the maximum extent possible. The applicant should consult with NMFS and US ACOE to determine whether the IIHR design is the best possible modification that can be installed to reduce TDG.

III. Study Adequacy

The study appears to be adequate to document the source levels of TDG at each of the three HCC dams. It provides potential partial solutions to the TDG caused by spilling. It does not provide information that documents the biological impacts of TDG on Snake River aquatic life.

IV. BLM Conclusions and Recommendations

Conclusions

1. The study documents that TDG levels produced by each of the HCC dams exceed state standards and levels known to be harmful to fish when spilling occurs.
2. TDG in the tailwaters of Hells Canyon Dam measured as high as 135% saturation, with resulting in-river levels in excess of 110% saturation for up to 60 miles downstream.
3. Based on modeling of the Hells Canyon Dam, the level of TDG may be reduced to meet the 110% standard during 98% of the flows of record.
4. The applicant studies indicated elevated TDG in the tailwaters of both Brownlee and Oxbow dams.
5. The Applicant's did not present modeled results for reducing TDG at Brownlee or Oxbow reservoirs. They indicated the biological effects would be lower in the reservoirs because only the upper 2 meters would be exposed to the TDG. The study did not indicate that the applicant intends to modify either Oxbow or Brownlee dams to reduce TDG to meet state standards.

Recommendations

1. The BLM should recommend that the applicant modify the Hells Canyon, Oxbow, and Brownlee dams to meet the 110% state standard.

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2. The BLM should recommend that the applicant present their plan for modification of each of the dams in the Draft Application.