

MEMO FOR: Andrew Kolosseus (WDOE), AMT Co-chair
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FROM: Laura Hamilton (Corps of Engineers)

SUBJECT: Corps comments on GBT Presentation by the Fish Passage Center.

The Fish Passage Center (FPC) gave a presentation at the May 13, 2008 Adaptive Management Team (AMT) meeting in which they promoted the idea that the TDG levels in the project tailwater at the next project upstream were high but resulted in low incidences of Gas Bubble Trauma (GBT) in juvenile salmon and steelhead. The presentation included a figure showing these data combined among years and project to assert that elevated tailwater TDG levels at upstream projects resulted in minimal incidences of GBT.

When discussing GBT, it is important to ask whether the observed GBT is caused by short term exposure to spillway TDG which persist for only a short period of time or by longer term exposure to mixed river TDG levels that persist in the miles of river reach that can be represented by the forebay gage TDG levels. The FPC's figure and presentation suggested that the observed GBT was from short term exposure to spillway TDG levels.

This is not consistent with other FPC data. Their June 8, 2007 memo on Steelhead and GBT at Little Goose and Lower Monumental dams includes data for June through July 2007 sampling for GBT at Little Goose and Lower Monumental dams. The FPC found elevated GBT levels ranging from 15 to 67% of Steelhead at Little Goose with an average of 36% for the June-July period. They also reported elevated GBT levels at Lower Monumental ranging from 0 to 100% of Steelhead with an average of 36% for the June-July period. The FPC provided the daily GBT data for Little Goose and Lower Monumental in their Gas Bubble Trauma Monitoring and Data Reporting for 2007, which are Tables 1 and 2 in their memo (shown below). The data show that the GBT levels at Little Goose and Lower Monumental persisted at high levels for Steelhead in June and July 2007 when flows are typically low. It is important to note that these elevated GBT levels occurred when TDG levels were mostly below 115%.

TABLE 1
Observation of GBT
In yearling Chinook, steelhead, and sub-yearling Chinook
At Little Goose Dam in 2007

Date	Yearling Chinook		Steelhead		Subyearling Chinook		All Species % GBT	Percent TDG	
	# Exam.	% GBT	# Exam.	% GBT	# Exam.	% GBT		LGS-FB	LGR-TW
5-Jun	6	0.0	94	15%	0	N/A	14%	112.8	112.9
8-Jun	2	0.5	92	39%	6	0%	37%	108.2	112.2
10-Jun	0	N/A	50	26%	100	3%	11%	110.9	113.6
12-Jun	2	0.0	50	22%	98	5%	11%	109.3	111.8
19-Jun	2	0.0	61	56%	14	7%	46%	109.6	115.7
26-Jun	1	0.0	2	50%	99	3%	4%	109.3	114.8
3-Jul	3	0.0	4	25%	97	2%	3%	110.3	113.6
10-Jul	0	N/A	12	67%	90	6%	13%	109.2	113.6
24-Jul	0	N/A	82	28%	16	0%	24%	107.5	111

TABLE 2
Observation of GBT
In yearling Chinook, steelhead, and sub-yearling Chinook
At Lower Monumental Dam in 2007

Date	Yearling Chinook		Steelhead		Subyearling Chinook		All Species % GBT	Percent TDG	
	Exam.	% GBT	# Exam.	% GBT	# Exam.	% GBT		LMN-FB	LGS-TW
4-Jun	2	0%	64	19%	0	N/A	18%	114.3	113.8
7-Jun	4	0%	18	28%	0	N/A	23%	109.0	112.2
11-Jun	3	33%	33	49%	5	0%	42%	110.2	109.4
25-Jun	0	N/A	1	0%	0	N/A	0%	106.9	108.3
1-Jul	0	N/A	2	50%	23	0%	4%	107.0	107.8
8-Jul	0	N/A	1	100%	3	0%	25%	107.6	109.3
22-Jul	0	N/A	3	0%	3	0%	0%	105.0	107.6
29-Jul	0	N/A	5	40%	3	0%	25%	106.3	107.9

The FPC’s June 8, 2007 memo states, “Maule et al. (1997) observed that incidence and severity is a function of TDG level and exposure time.” The memo suggests that it was the exposure time causing the high levels of GBT when they wrote in their memo, “It is likely that the long travel time is causing an increased exposure time and causing the fish to show the signs of GBT. There are also other factors that may be contributing to these long travel times. In addition to flow, there could be a delay in the forebays of the projects that might be a function of the present spill patterns, or spill amounts that are being provided at both Little Goose and Lower Monumental dams.” This indicates that long exposure times, low TDG levels and delays in the forebays of the projects attributed to the elevated GBT levels. Since the tailwater TDG levels are the high end of TDG levels for a project and the forebay gage TDG levels is the low end of the TDG levels for a project, it is logical to conclude that the TDG levels that caused these elevated GBT incidents is associated with mixed river conditions where TDG levels would be somewhere in between these extremes. Linking GBT incidents solely to tailwater gage TDG levels does not fully represent TDG conditions.