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MEMORANDUM

TO: FPAC

FROM: David A. Benner

DATE: February 14, 2005

RE: February 14, 2005 Addendum to the March 11, 2004 Joint Technical Staff Memorandum

In response to your request, the following outlines the methods and results of analyses focused on the relation between TDG at the Camas/Washougal (CWMW) fixed monitoring station (FMS) and spill at Bonneville Dam for 2004 and the relation between spill at Bonneville Dam and TDG BON TWP5-Cascade Island in 2002 and 2004. These analyses are meant to be an addendum to the March 11, 2004 Joint Technical Staff Letter addressed to the COE.

Hourly data was obtained from two sources 1) 2004 CWMW and Bonneville Dam spill data was obtained from the COE's online data query at <http://www.nwd-wc.usace.army.mil/cgi-bin/dataquery.pl> and 2) 2002 and 2004 BON TWP5 TDG data was obtained through COE as a separate data requests. Available hourly data for TDG at CWMW and BON TWP5 (Cascade Island) and spill at Bonneville Dam varied from year-to-year as did the start dates of spill, therefore the begin and end dates for each yearly dataset varied slightly. The following table lists the time span for each yearly dataset.

Table 1. Date ranges of yearly datasets.

Year	Date Range
2004	4-7-2004 to 8-31-2004
2002	4-11-2002 to 7-10-2002

Total Dissolved Gas (TDG) at BON TWP5 could be analyzed on a day-for-day basis without any significant lag time between the spillway at Bonneville Dam and the BON TWP5 TDG gauge. However, the lag time between spill at Bonneville Dam and the associated TDG from that spill at CWMW was significant and was accounted for in the same manner as described in the March 11, 2004 Letter.

Once all the CWMW data set was lagged, the 12-highest hours of TDG (lagged for CWMW datasets and non-lagged for BON TWP5) were averaged on a daily basis at BON TWP5 and CWMW. Additionally, for each day, the 12-hours of spill at Bonneville that corresponded to the highest hours of TDG at both respective locations were averaged. The resulting datasets contained daily averages of the 12-highest hours of TDG at CWMW and BON TWP5 and the 12-hours of spill at Bonneville that corresponded to the highest hours of TDG.

Linear regression was used to determine the relation between the 12-highest hours of TDG and corresponding spill at Bonneville for each year. Figure 1 displays the relationship at CMWM in 2004; Figures 2 through 4 display the relationship at BON TWP5 for 2002 and 2004. Over the 2004 season, the BON TWP5 gauge was relocated in the water column: from 4-7-04 to 6-3-04 the gauge was located in 25.8 to 37.6 feet of water, from 6-8-04 to 8-31-04 the gauge was located in 0.1 to 8.6 feet of water. Because of the change in gauge depth, relations between BON TWP5 and spill were divided into two time periods in 2004.

In 2004, the relation between the 12-highest hours of TDG at CWMW and spill at Bonneville Dam was very poor, similar to other below average water years. Table 3 displays the R^2 for each year's regression between TDG at CWMW and spill at Bonneville Dam as well as the Jan-July Runoff Volume as a percentage of average at The Dalles from 1995 to 2004.

Table 3. Squared Correlation Coefficient (R^2) for each year's regression between TDG at CWMW and spill at Bonneville Dam, as well as the Jan-July Runoff Volume as a percentage of average at The Dalles.

Year	Squared Correlation Coefficient R^2	Runoff Volume at TDA (% of average)
1995	0.1625	98
1996	0.7356	132
1997	0.9593	150
1998	0.4977	98
1999	0.3519	117
2000	0.2177	93
2001	0.7215	55
2002	0.5313	97
2003	0.3484	82
2004	0.1897	77

The R^2 for relationships between Bonneville Spill and TDG at BON TWP5 were 0.7093, 0.8582, and 0.8303 for the years of 2002 and the split year of 2004, respectively (Figures 2, 3, and 4). Both the BON TWP1 and BON TWP5 TDG gauges appear to yield similar relationships with spill at Bonneville Dam provided the gauge is not located in shallow water as was the case in the last half of the 2004 season. The relations between BON TWP1 TDG and BON TWP5 TDG with Bonneville Spill are generally strong and, more importantly, appear to be a much more reliable management tool for spill at Bonneville Dam.

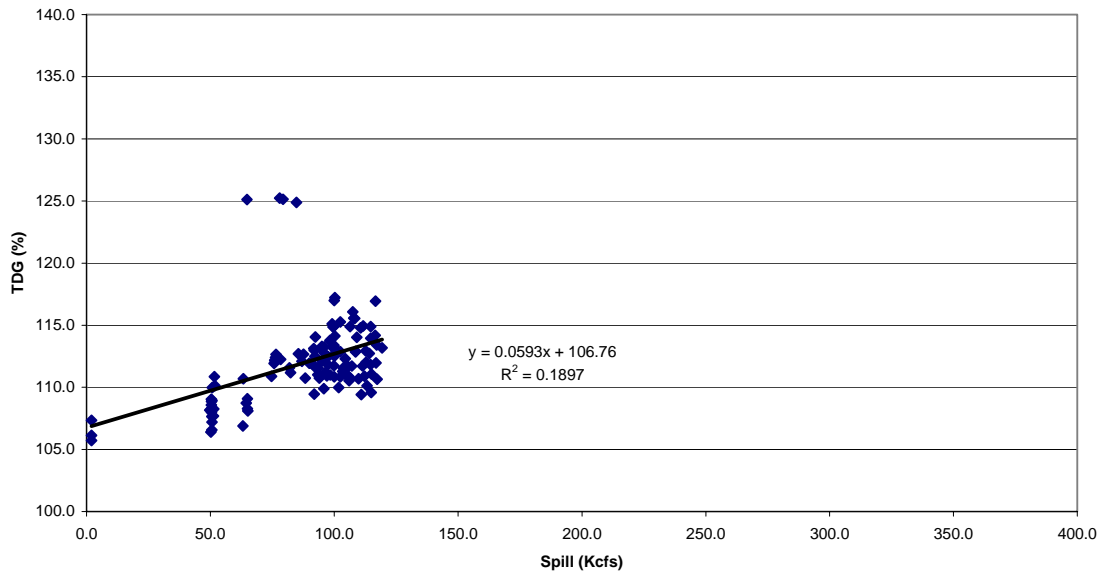


Figure 1. Relation between the average of the 12-highest hours of TDG at CWMW and the average spill at Bonneville over those hours (accounting for lag time) from April 7th, 2004 to August 31st, 2004.

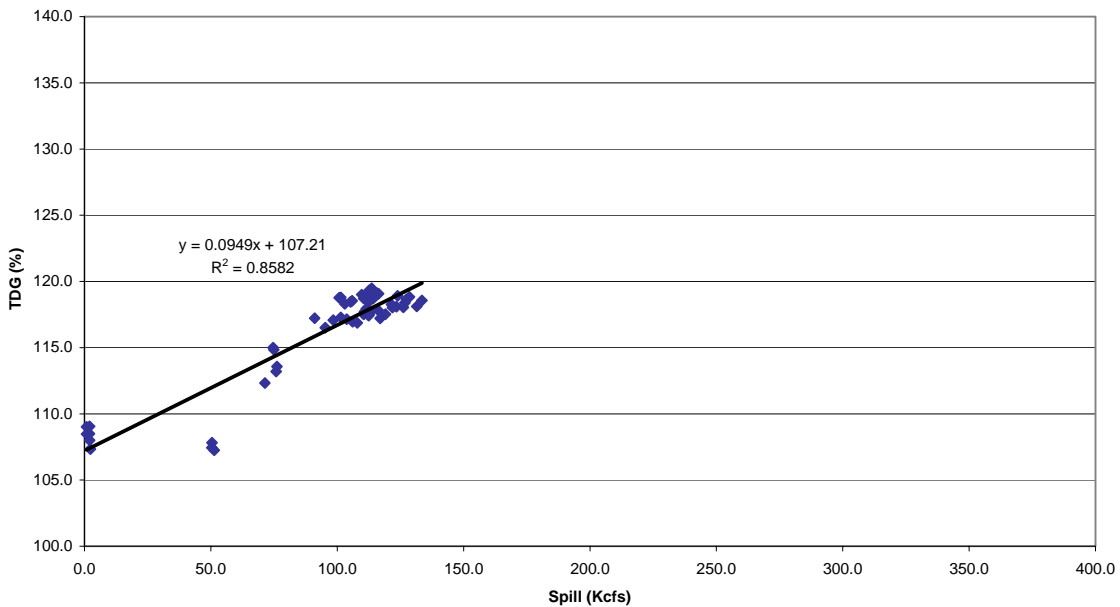


Figure 2. Relation between the average of the 12-highest hours of TDG at BON TWP5 and the average spill at Bonneville over the same hours from April 7th, 2004- June 3rd, 2004- depth of gauge between 25.8 and 37.6 feet.

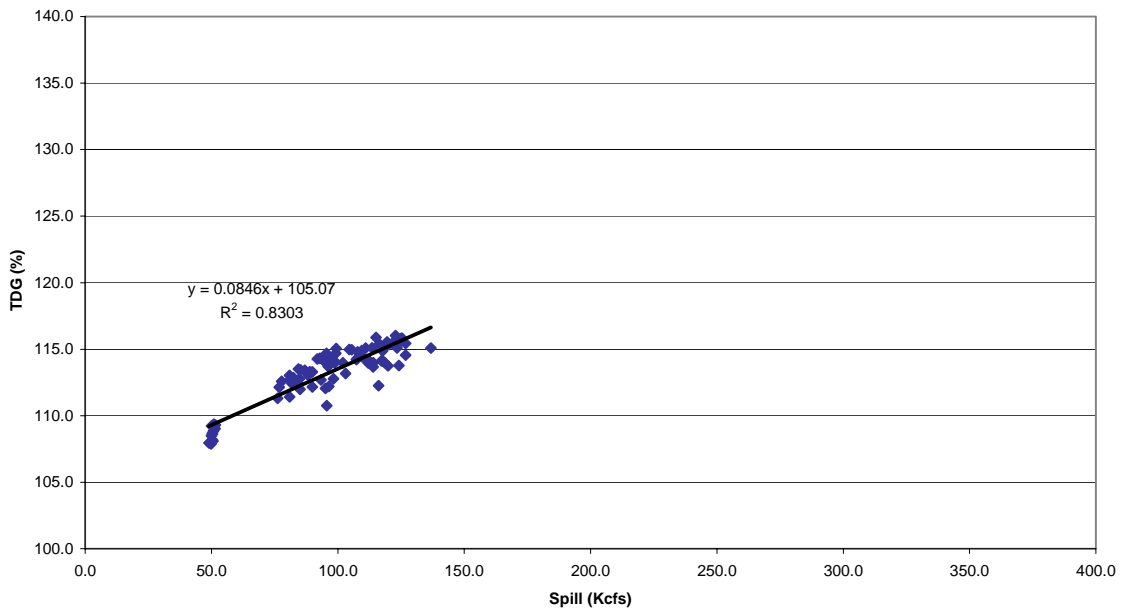


Figure 3. Relation between the average of the 12-highest hours of TDG at BON TWP5 and the average spill at Bonneville over the same hours from June 8th, 2004 to August 31st, 2004- depth of gauge between 0.1 and 8.6 feet.

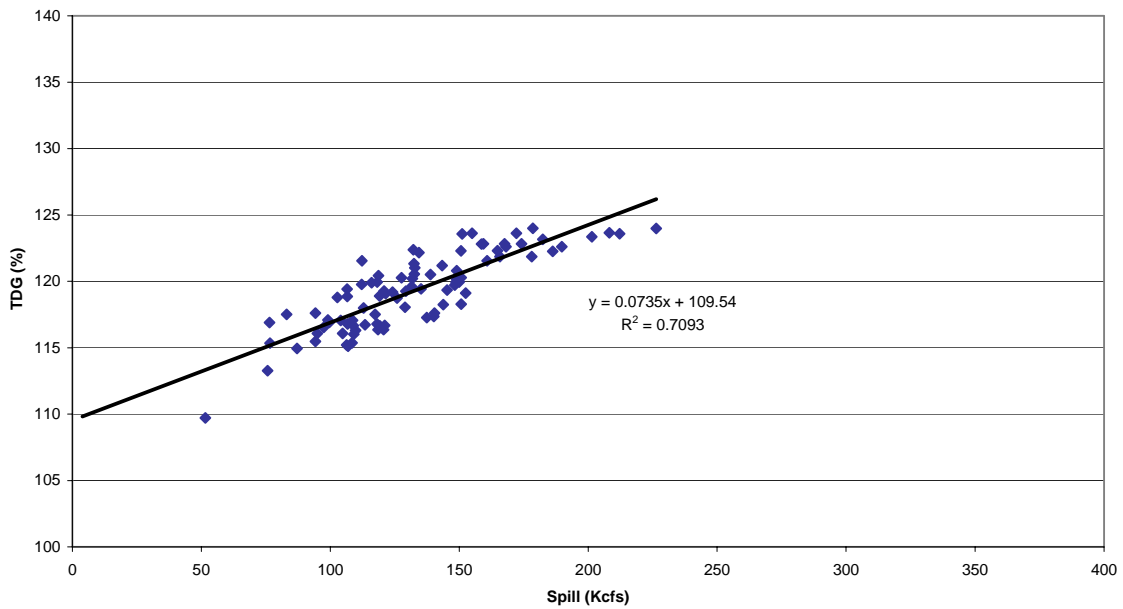


Figure 4. Relation between the average of the 12-highest hours of TDG at BON TWP5 and the average spill at Bonneville over the same hours from April 11th, 2002 to July 10th, 2002- average depth of gauge 15.4 feet