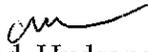


April 2, 2008

TO: Columbia and Snake River Dam Spill Operators

FROM:  Chris Maynard, Hydropower Coordinator, Washington State Department of Ecology

RE: Method for averaging 12 consecutive daily average high IDG readings in any one day

I have been asked to clarify how Ecology expects operators to measure TDG during fish passage spill on the Columbia and Snake Rivers.

Washington's previous 1997 total dissolved gas (TDG) Water Quality Standards (WQS) for fish spill on the Snake and Columbia Rivers required TDG measurements to be taken at least hourly and the 12 highest measurements averaged over the course of a day. A day was assumed to be a 24 hours period although the start and end time were never clearly defined. The operators averaged measurements and reported based on a calendar day, starting at 12: a.m. and ending at 12 am. The term 'day' did not need to be defined because averaging any high TDG from midnight to midnight captured all high IDG readings. Often the high readings for tailraces would occur during the early hours after midnight and in the evening hours with a period of lower readings in between during the day. This is because fish spill often occurs more at night.

The revised 2006 Washington WQS require measuring the average of the 12 highest *consecutive* hours in any one day. This is because at 120% TDG or less, studies have shown that aquatic organisms experience the most TDG harm from consecutive exposure, not intermittent exposure throughout a 24 hour period. High TDG and corresponding spills tend to occur during consecutive blocks of time. Measuring midnight to midnight breaks up the consecutive period of nightly high TDG.

Beginning during the 2008 spill season, the operators should use the following method to average and report the 12 consecutive hourly high TDG reading in a day:

*Method:* Use a rolling average to measure 12 consecutive hours. The highest 12 hour average in 24 hours is reported on the calendar day (ending at midnight) of the final measurement.

- The first averaging period of each calendar day begins with the first hourly measurement at 1:00 a.m. This hour is averaged with the previous day's last 11 hourly measurements.
- Each subsequent hourly measure is averaged with the previous 11 hours until there are 24 averages for the day.
- From the 24 hour averages, the highest average is reported for the calendar day.
- Round 12 hour average to nearest whole number.

*Rationale for the rolling average:* The standards say "in any one day", but a day need not be a calendar day. Defining a day as starting at a set hour (like midnight) and ending 24 hours later leaves only twelve 12-hour blocks to average within 24 hours. If a period ends at midnight, night spill TDG measurements would be cut off during the middle of the night and the consecutive readings of the highest spill period would not be averaged since the period from 12 midnight on would not be counted with the previous day. So a rolling 12-hour average makes the most sense. This method best captures consecutive hours of high IDG not only below dams that spill at night, but also for dams that vary their hours of spill from nighttime. It also captures consecutive forebay reading which measure TDG from the upstream dam hours later.

The accompanying table shows an example of how the TDG should be tracked and averaged as a rolling average. It shows what hours will be reported for a day: the highlighted green and blue hours are those that are averaged each hour to report as May 19<sup>th</sup>. The first period evaluated for May 19<sup>th</sup> reporting begins with the first hour's measurements of the day. Since the previous 12 hour measurements are needed for a consecutive average, eleven of those hours (in the first highlighted column) will necessarily occur on May 18<sup>th</sup>. The next hour's measurement is then evaluated with the eleven hours previous, and so on through the day until the last measurement at midnight. There are now twenty-four averaging periods, and the highest average (ending at 2: a.m. May 19<sup>th</sup>) is chosen to report for May 19<sup>th</sup>.

Cc: Agnes Lut, ODEQ  
Margaret Filardo, FPC  
WQT  
Pat Irle, Ecology  
Marcie Mangold, Ecology