Transboundary Gas Group Meeting

April 17, 2006

1. Greetings and Introductions.

Mark Schneider welcomed everyone to today's session, explaining the role of the TGG. He introduced Don Weitcamp from Parametrix, who led a presentation titled "Total Dissolved Gas Historic Perspective." Among his topics:

- Ancient history – biological problems associated with TDG originated in the 1800s. Early reports were not related to dams.
- Dam-related TDG: Bonneville, Rock Island and Grand Coulee in the 1930s certainly produced supersaturation; in 1967, TDG supersaturation was recognized in the Columbia, when John Day Dam went in and, with the turbines absent, spilled the total river flow, producing adult fish kills on a significant scale. At that point, the problem was generally recognized.
- Spill was common 1-2 months each year; there were a lot of new dams on the tributaries as well.
- Nitrogen (TDG) monitoring: In the late '60s, there was intensive nitrogen monitoring, primarily by NMFS, via "grab samples."
- Dissolved gas analysis: DO by Winkler titration, Van Slyke gas analyzer for N2 and C2
- TDS monitoring mobile and fixed stations – the advent of continuous monitoring.
- Early biological research: focused on lab studies, most conducted in water 1 meter deep or less, produced severe GBD in short period at low levels of TDG
- Live cage bioassays: early attempts to evaluate biological effects in-river
- Started using multiple depth live cages (photo)
- Mobile live cage configuration (photo)
- Exopthalmia with bubbles (photo)
- Field sampling results – collected relatively small numbers, saw few fish with any signs of GBD, Unable to document occurrence of a biological problem in most cases
- Rare GBD signs in collected fish – fin bubbles etc. (photo)
- Operational remedy (in the 1970s)reduced spill, increased powerhouse flow
- Physical remedy developed – installation of spillway deflectors
- Fish transportation (photo)
- Spill for fish bypass began, along with high-flow years
- Many upstream projects have to spill a great deal of water, increasing upstream effects

- Where do we go from here? Is this really a major problem? Where will research take us?

How many dams have deflectors? asked one session participant. I'm not sure every dam has a full complement, Schneider replied; a number of dams do not have deflectors on their end-bays, for the purpose of attraction flow. Some dams, such as Wells, will not accept a deflector because of their design, Weitcamp said.

Were you associated with Parametrix's Noxon and Cabinet Gorge studies that saw TDG levels in excess of 130%? another participant asked. Yes, Weitcamp replied. Also, what about the correlation between TDG and the kokanee crash in Lake Pend Oreille? the participant asked. We did some live-cage, continuous and intermittent-exposure trials, and found no correlation between TDG and kokanee mortality, Weitcamp said. We did find some incidence of GBD, but no mortalities. Are they doing any gas abatement as a part of their FERC relicensing? the participant asked. Yes, but not flow deflectors, Weitcamp said. There was a Corps of Engineers study that was done a few years ago that identified 14 separate gas abatement measures, Schneider said – flow deflectors might help the gas problem, but they may also kill fish at this project, so it's a tradeoff.

Next up was Jim Adams of the Corps of Engineers, who led a presentation titled "Cascades Island TDG Off-Season Spill Characteristics." He noted that this gauge is located right in the spillway channel below Bonneville. Among the highlights:

- Percent TDG in Bonneville spillway channel – March/April (graph): in 2006, TDG levels approached 125% in the Bonneville spillway channel when the only thing that was happening was attraction flow from bays 1 and 15, and normal adult ladder operation. The TDG levels were significantly higher in 2006 than they were in 2005.
- When flow was turned off at night, TDG levels would raise; when flows were turned back on during the day, TDG levels would fall.
- USGS technicians verified the same pattern
- Why were these high values occurring? It's a mystery.
- In 2004, the Bonneville tailwater gauge was left in for a couple of weeks later than usual; the same phenomenon occurred, although not to the same level that has been seen in 2006.
- The Corps' 2002 transect study – April-August.
- Data from the various transects and ample periods. The bottom line: nighttime TDG levels continued to spike toward 120 percent, despite the fact that spill was no longer occurring. In general, the readings closest to the edges of the channel showed the highest values.
- Bonneville spillway and Cascades Island (diagram)
- Daytime spill occurs at bays 1 and 18 at 1.2 Kcfs. When that occurs, TDG levels actually drop. The Corps could not understand why that occurred.
- The Corps then installed TDG gauges in the fish ladders themselves, in a very limited study. TDG values of 107-130 percent were recorded. In other words, it

appears that the adult fish ladders are generating the TDG problems in the Bonneville spillway channel, because they are aspirating air. The flow from PH2 apparently isolates this water, from a hydraulic standpoint.

Those are our thoughts at this time, Adams said; we're going to pursue a more aggressive regimen of studies this year, to try to get definitively to the bottom of this situation. Why is the problem so much worse this year, given the fact that fish ladder operations are unchanged? Adams asked. No one knows, yet, but speculations include the installation of sea lion exclusion devices (SLEDS) at the bottom of the ladders and tailwater elevations.

Do other fish ladders in the system have the same structure, and create the same problems? one participant asked. I don't know, Adams replied, although we recently went to The Dalles, which has a different configuration than the ladders at Bonneville, and saw TDG levels of 107-108 percent – little difference from the forebay TDG levels. Tony Norris noted that the fish ladders at Bonneville are old in comparison to those at the most recent projects; designs have improved since the 1930s, he said.

Next, Rick Klinge of Douglas PUD described the Mid-Columbia PUDs' experience with voluntary spill and TDG. Among the main topics of his presentation:

- Geographic area of the mid-Columbia: 148 river-miles from the tailrace of Priest Rapids to Chief Joseph Dam.
- Hydraulic conditions – records kept since 1917; the maximum daily average flow was 692.6 Kcfs in 1948, compared to an annual average high flow of 448 Kcfs.
- History of the Mid-C projects, from Rock Island, constructed in 1933, to Wells Dam, constructed in 1967.Other dams: Priest Rapids, Rocky Reach, Wanapum.
- Anadromous populations include spring chinook, summer/fall chinook, sockeye, steelhead and coho. At Wells, the uppermost project that anadromous fish can pass, about 7.2 million juvenile fish pass each year.
- Juvenile passage – details. A 93 percent juvenile passage survival is required at Wells, Rocky Reach and Rock Island.
- Juvenile passage at Wells – bypass made from modified spill gates, five gates operate with paired generating units, beginning in April.
- Juvenile passage at Rocky Reach – elaborate juvenile bypass system/surface collector with a large opening and dewatering system. Juvenile passage starts April 1 and ends on August 31. Spill is used to supplement the JBS, but both subyearling chinook and juvenile sockeye have a difficult time passing the project.
- Juvenile passage at Rock Island: begins April 17, ends at the 95% passage point for the summer chinook migration. The project spills 20 percent of total river flow during this period; generally, the 95 percent passage point occurs during the second or third week in August.
- Juvenile passage at Wanapum: top spill of 22 Kcfs; start spill season when 5% of the spring migration has passed and end it when the 95% of the summer migration has passed.

- Juvenile passage at Priest Rapids: spill 60 percent of daily average flow, 22 gates operate, start when 5% of the spring migration has passed and end when 95% of the summer migration has passed.
- Actions to reduce TDG: Ongoing testing and studies at Wells; JBS development at Rocky Reach; gate entrance configurations tested at Rock Island to improve fish guidance per volume of spill. Wanapum has construct3ed flow deflectors in all spill bays and is constructing a new top spill fish passage. At Priest Rapids, studies are ongoing, including TDG and turbine passage survival studies.

The 60 percent spill at Priest Rapids occurs to achieve the 93 percent survival target? one participant asked. Correct, Klinge replied.

Next up was Laura Orr of the Corps' Seattle District, who discussed the Corps' System Flood Control Review for the Columbia River. She touched on the following major topics:

- Project authority
- Study purpose: to analyze the modification of the current system flood control operations on the Columbia to... [missed that]
- Study process: conduct reconnaissance-level report (comments still being accepted); develop project management plan, conduct phased feasibility study; implement actions.
- Reconnaissance report purpose
- Reconnaissance report results: identified various actions that might provide additional water to benefit fish, including improved use and reliability of seasonal runoff volume forecasts, a change in systemwide storage regulation etc. Corps management believes a feasibility study is warranted.
- Study process: first, a project management plan is needed; the pathway for the feasibility study, Regional input is needed.
- The project management plan will then feed into the feasibility study/analysis, which will identify and evaluate recommended, implementable solutions.
- The phases of the feasibility study, 1-4.
- Project issues: assumed biological benefits associated with increased flow for fish, increased flood damage risk, expense (an estimated $30 million, in direct competition with other CRFM projects), length of time to conduct (6 years).
- Next steps: compile, respond to and append regional comments, submit recon report with appendices to Corps HQ, develop project management plan.

This study is just in its infancy, Orr said; she asked anyone with questions or comments to contact her at laura.a.orr@usace.army.mil, or at 206/764-3575.

Will you be coordinating flows with the Mid-C projects? one participant asked. Definitely, Orr replied; the more comments you send in, the better. Second, said the participant, fish are very sensitive to temperature – are you considering that as well? Yes – we have a team looking at what would be beneficial to fish, including potential means to lower temperature, Orr replied. That's one of the reasons the study is so expensive – it will be very detailed and comprehensive.

The final speaker of the session was Kevin Crum of the Corps, who addressed the group on the removable spillway weir at Ice Harbor Dam. Among the highlights of his presentation:

- This technology had its origins when engineers and scientists noticed that Wells Dam was very efficient at passing fish
- The RSW concept: a modification to a spillway to facilitate juvenile passage, bypassing juveniles safely in-river via modified spillway. Surface flow offers better attraction because juvenile fish are surface-oriented.
- The advantages of surface bypass: reduced forebay residence time, faster passage, increased power generation, reduced dissolved gas, improved water quality
- The RSW design (diagrams and photos)
- Fabrication, transportation and installation of the Ice Harbor RSW cost about $13 million.
- Ice Harbor RSW 2005 data – fish passage, survival probability, forebay delay, % fish to flow, TDG levels for bulk spill vs. RSW (less spill). The bottom line: the RSW yields similar passage survival and efficiency results with far less spill and TDG
- Lower Granite RSW 2003 data
- Next RSW will be installed at Lower Monumental in 2007; the Little Goose RSW will be operational by 2009. RSWs will also be installed at McNary and John Day by 2012.

No questions were offered at the close of Crum's presentation. With that, today's session was adjourned.