Transboundary Gas Group Meeting

April 19 & 20, 2005
Best Western Edgewater Resort
Sandpoint, Idaho

1. Greetings and Introductions.

Mark Schneider welcomed everyone to today's Transboundary Gas Group meeting and the Edgewater Resort in Sandpoint, Idaho. The following is a summary (not a verbatim transcript) of the topics discussed and decisions made at today's meeting. Anyone with questions or comments about these minutes should contact Kathy Ceballos at 503/203-1284.

2. Cabinet Gorge TDG Abatement Project.

Joe DoSantos of Avista Corporation led this PowerPoint presentation. He noted that the Clark Fork River, with an average annual discharge of 22 Kcfs, is the largest tributary to Lake Pend Oreille, and is in fact the largest river in Montana. There are five hydro facilities above Cabinet Gorge – Hungry Horse, Mill Dam, Thompson Falls etc. He noted that the bypass tunnel facility started in 1996. Dos Santos touched on the following major topics:

- The history of the project
- Current status
- Future of the project
- The TDG issue – the TDG standard is 110%; Cabinet Gorge's hydraulic capacity is 36 Kcfs, and a fair amount of spill occurs. There is no separation of flow; powerhouse flow is "contaminated" by spillway flow. Persistent TDG levels of 150%+ have been recorded downstream of Cabinet Gorge in recent years. Avista is keenly aware of this problem, hence the bypass tunnel project.
- FERC license requirements – monitor TDG levels in Clark Fork – Lake Pend Oreille system, develop interim TDG abatement alternatives, conduct biological studies, conduct engineering study to determine default strategy, develop gas supersaturation control program (GSCP) in 2002
- Avista recognized that it will not resolve the TDG problem within the relicensing time-frame; instead, Avista was required to present a long-term resolution to the TDG abatement problem to FERC, IDEQ and the US Fish and Wildlife Service by

2002. The GSCP was this solution. It will include re-opening the two old diversion tunnels.

- Ultimately, it will not be possible to meet the 110% standard under all flow conditions, given the fact that forebay gas levels often exceed 120%. It may be possible to meet 120%, but the overall goal of the GSCP is to make Cabinet Gorge "TDG-benign." This plan has been approved by IDEQ, USFWS and FERC, and Avista has begun implementation.
- Program includes continued monitoring at Cabinet Gorge and Noxon. It also includes a $500,000 annual mitigation fund, because it will not be possible to meet the 110% standard in all water years. Projects are selected and funded through a management committee. The third component is the sequential re-opening of the two old diversion tunnels.

DoSantos then introduced Avista's Steve Fry, who described the engineering side of the GSCP. Fry touched on the following major topics:

- Where the tunnels are located.
- Capacity – the tunnels can handle up to 40 Kcfs of spill.
- Preliminary design (schematic) – tunnels originally built to divert the entire river flow during dam construction. High flow and pressure through the tunnels are major engineering concerns. The tunnel outlets will be submerged by up to 40 feet, depending on tailrace elevation.
- The tunnel project is unique – the project review team found no other similar diversion tunnel projects anywhere in North America
- Next steps: build a large-scale physical model of Cabinet Gorge and its tunnels, to prove the basic concept
- Following model studies, Avista will hire a design firm to develop the final design and numeric model. This contract should be in place in May.
- The schedule calls for one tunnel to be operational by 2010. At that point, a decision will be made as to whether or not a second tunnel is needed, or if increased mitigation will be sufficient.

What's the elevation change from forebay to tailwater? Jim Adams asked. About 130 feet, Fry replied. And what uncertainty will you be evaluating once the first tunnel is available? Paul Pickett asked. The basic agreement calls for the first tunnel to have a capacity of 40 Kcfs, Fry replied; theoretically, if you have submerged intakes and outlets, the pressurized tunnel should not generate TDG. However, for project safety issues, it may be necessary to introduce some air at the intakes, so the whole thing doesn't blow apart. There are significant uncertainties about this approach, said Fry – one problem is that you can't physically model TDG, so we won't really know how the tunnel performs, with respect to TDG until it's built. Another real concern is the fact that, at some flows, velocities inside the tunnel could reach 40-50 feet per second. Will that produce a standing wave that will entrain TDG? Fry asked. At this point, we just don't know. In general, this is the design we felt would be the most benign, biologically, Fry said. The species of concern in the Clark Fork are West Slope cutthroat and bull trout,

added DoSantos; again, the effects of the tunnel discharge on downstream fish passage are unknown at this point, but the question is, what's worse, biologically – the tunnel discharge, or the extremely high TDG levels we're seeing, currently?

Have you looked at energy dissipation options for the lower end of the tunnel? Dave Zimmer asked. Yes – we are evaluating those, perhaps some sort of curve to the tunnel, for example, Fry replied.

3. Lake Pend Oreille Total Dissolved Gas Monitoring.

Kent Easthouse of the Corps of Engineers led this presentation. This is primarily an update, he said; we have reviewed our monitoring efforts at these meetings before. Easthouse touched on the following major topics:

- TDG and temperature monitoring – two seasonal monitoring sites (forebay and tailwater); sites calibrated every two weeks, equipment used
- The location of the study area in the Pend Oreille River (map)
- Fixed monitoring sites (aerial photograph)
- Pend Oreille River conditions, 2004 – 2004 flows less than historical average; peak inflow reached 63 Kcfs on May 30, while outflow peaked at 52 Kcfs on May 31
- 2004 daily inflows and outflows at Albeni Falls (graph)
- Data completeness (97.3% forebay, 83.6% tailwater, of hourly TDG data recorded and passing QA. Temperature data was 97.5% and 92.1% complete, respectively. Some of the problems included DCP malfunctions and programming problems, lightning strikes, tailwater station location issues and vandalism
- 2004 spill season results for Albeni Falls Dam – forebay and tailwater TDG levels exceeded 110% on only a few dates in late May and early June; the forebay and tailwater temperatures exceeded the IDEQ 22 degree C standard during July and August
- Albeni Falls forebay and tailwater TDG vs. flow in 2004 (graphs)
- Conclusions/recommendations for 2005 (TDG and temperature monitoring): relocate tailwater FMS etc.
- Planned Albeni Falls/Pend Oreille River water quality study, 2005

4. Albeni Falls.

Pickett provided a presentation on Pend Oreille River water quality monitoring. He touched on the following major topics:

- The location of the FMS associated with this study (map)
- TDG vs. Albeni Falls flow and spill over time (graph) – TDG never exceeded

110% in the Pend Oreille River near Ruby in 2004
- Box Canyon tailrace TDG vs. flow and spill over time, 2004 (graph)
- Temperature vs. TDG over time (May), Pend Oreille River near Ruby, 2004 – very close correlation between temperature and TDG (graph)

5***. Kootenay Tribe Fish Program and Nutrient Augmentation on the Kootenai River.***

Sue Ireland led this presentation, titled " An Overview of the Kootenai Tribal Fish and Wildlife Program." She noted that the Tribe recently hosted a meeting with the IJC and a local natural resources group, the tribe has a number of very interesting ongoing fish and wildlife programs. Among the highlights of her presentation:

- The Kootenai Basin is very large – nearly 9 million acres in two states and two countries – there are lots of habitat issues and many species in decline
- History/background – how the basin has changed since white settlers arrived – dam construction, the decline of various long-lived species, such as white sturgeon
- Species of concern: North Arm kokanee, burbot, white sturgeon, bull trout
- The tribal approach to fish and wildlife management and planning – holistic (watershed scale); defensible science and methodology, biologically and logistically feasible etc.
- Tribal fish and wildlife projects – Kootenai River white sturgeon studies, ecosystem improvements, including biomonitoring and nutrient rehabilitation, tributary habitat and kokanee restoration, burbot restoration etc.
- The Kootenai Valley Resource Initiative (KVRI) and Joint Powers Agreement between the City of Bonners Ferry, Boundary County and tribe
- The KVRI issue forum and subcommittee structure – subcommittees to address EIS/VARQ, TMDL, Healthy Forest Initiative, Wetland/riparian, subbasin planning, burbot
- The conservation strategies produced by these subcommittees, including burbot and wetlands/Riparian
- White sturgeon in the Kootenai/y River – no recruitment since the 1960s; any other species would have been extinct by now, but because of the long life os this species, are still 600-700 adults to work with. strategies include flow augmentation, conservation aquaculture
- Tribal program has spawned 40 females and 88 males from the wild sturgeon program since 1990; 50,000 juveniles from 88 families have been re-introduced to the system. Without this program, biologists estimate that white sturgeon will be extinct in the Kootenai by 2020.
- Other strategies: re-establish suitable habitat conditions, including Kootenai Lake fertilization and the Kootenai River nutrient enhancement experiment. Environment Canada has been very successful with their nutrient enhancement efforts in the North arm of Kootenai Lake, in terms of significantly-increased kokanee spawning.

Charlie Holderman of the Kootenai Tribe then described the tribe's Kootenai River nutrient augmentation efforts, touching on the following major topics:

- The problem – declining fisheries etc.
- The ecosystem approach – what is it? Basic research on water quality, nutrients, metals; aspects of river important to healthy fisheries – algae, aquatic insects, the present fish community and its aspects
- Results to date – found very low nutrient levels, poor development and production of algae and aquatic insects. Have yet to find a river in PNW literature as low as the Kootenai River
- Nutrient Summary – the Kootenai River above and below Libby Dam (graph)
- Kootenai River fish community – in poor shape, dominated by non-game fish such as pikeminnows and suckers; scant and mostly non-fishable populations of game fish
- How do we get back to a better, healthier river? Nutrient restoration is one idea – replace the nutrients retained behind Libby Dam by introducing liquid nutrients during the productive summer months.
- Nutrient injection site – near the Idaho/Montana border, about 50 kilometers downstream of Libby Dam, to introduce liquid nitrogen 28-0-0 and phosphorous 10-34-0
- Case studies – North Arm Kootenai Lake (increased kokanee spawners from 300,000 in 1990 to 2.1 million in 1998); Arrow Reservoir (1999-200 – dramatically increased kokanee spawning); Adams River, British Columbia (increased algae production 10-fold; bottom insects increased; trout densities doubled).
- Our perspective – nutrient addition is an experiment, not a silver bullet; however, this is needed to restore river productivity. Habitat improvements are also needed, as is a more normalized flow regime in the river.

In response to a question from Schneider, Holderman said the Tribe's nutrient augmentation program will begin this June, running through September, and will continue for five years. The Tribe will carefully monitor biological conditions in the river throughout this period. In response to another question, Holderman said it is the tribe's belief that the main cause of the Kootenai River's nutrient decline is the presence of Libby Dam, particularly for phosphorous. In response to a question from Pickett, Holderman said that, counterintuitively, the researchers have actually seen lower nutrient levels in the section of the river nearest the agricultural areas around Bonners Ferry.

7. Mica Dam Fish Flush TDG Study Proposal.

Gary Birch of BC Hydro led this presentation. He noted that he has no 2004 data to report, but would speak instead about BC Hydro's plans for 2005. One thing we're planning is the fish flush; we're also shifting over to a risk-driven approach for gas supersaturation. We're in the process of making that switch.

With respect to the Mica fish flush, Birch noted that Mica is the farthest dam up the system. Two of the units have synchronous condense capabilities. The dam discharges directly into Revelstoke Reservoir. In the mid-1990s, the operators began to notice fish kills in the Mica tailwater – mainly kokanee in the fall, and a variety of species in the spring. When field personnel went to collect samples, they found that some of the fish righted themselves and swam away; the fish that died showed evidence of gas bubble trauma. Field investigations then found TGP levels in excess of 160% downstream of Mica. The reason is Units 1 and 2, which run in synchronous condense. There are only two draft tubes for the entire facility; what was happening was that gas was accumulating during synchronous condense operations, especially when both Units 1 and 2 were operating. The project has historically operated in synchronous condense for days at a time, or even weeks, because Mica is very important to load stabilization for the rest of the BC Hydro system.

We now operate Units 1 and 2 in synchronous condense for no more than 12 hours at a time, Birch said; following that operation, we operate one unit at 300 MW for about 15 minutes to flush out the tube. This works well, but it costs about $12,000 each time we do it.

BC Hydro is in the process of gathering up all of the data associated with synchronous condense operations at Mica, said Birch; we need to study TGP levels in the tailrace following the fish flush. We will study that this spring. We're also going to look at varying levels and durations of flush in an effort to discover the operation that produces the lowest gas levels at the least cost, he explained. Birch said he will provide a further update as more information becomes available. In response to a comment, Birch said he has heard that one measurement, taken inside the draft tube at Mica, measured 200% – I didn't think that was physically possible, he said.

8. Temperature TMDL Agreement Between EPA, WDOE, IDEQ and the Kalispel Tribe.

Christine Psyk of the U.S. EPA said this update is primarily informational in nature. I wanted to let you know that we do have listings for temperature and TDG on the Pend Oreille from Long Bridge to the border, she said; there was a lot of interest in EPA's coordinating among the various jurisdictions – IDEQ, WDOE and the Kalispel Tribe, as well as Seattle City Light, which operates Boundary Dam. We have come to an agreement that we think will set the framework to allow that agreement to go forward. That agreement has been signed by EPA, but is awaiting signatures from other parties. Psyk distributed copies of this agreement. She added that this process will cover both temperature and TDG.

Pickett noted that, in terms of approach, it is hoped that the temperature TMDL will cover all of the relevant waters. With gas, we felt that, because it does not depend on natural processes to the same extent as temperature, it made more sense to do the

TDG TMDL on more of a project-by-project basis, he said. IDEQ has told me, however, that it will take some years before they can produce a TDG TMDL for their piece of the system. WDOE is proceeding with the development of an allocation for its portion of the system; the Idaho portion will be incorporated later, said Pickett. The Clark Fork will be covered under a separate process, Psyk added.

9. Tri-State Council History and Monitoring Project.

Ruth Watkins of the Tri-State Council led this presentation. She began by describing the history of the Tri-State Water Quality Council, noting that the group, like the TGG, meets twice yearly. The Clark Fork/Pend Oreille watershed covers 16,000 square miles, she explained; we deal with three states, 14 counties and three tribes. Citizens in the watershed raised serious concerns about the growth of algae in Lake Pend Oreille; this led to a paragraph in the rewritten Clean Water Act directing EPA to study the sources of pollution in this watershed. Congress then appropriated finding for this study. This was back in the early '90s, she added, and led to the development of a water management plan, which was presented to Congress. The first identified priority was to found a stakeholder group that would take this ball and run with it; thus the Tri-State Council was established, 12 years ago this October.

Watkins described the Council's membership – three hydro utilities, most of the major cities in the watershed, counties, industry representatives, businesses, conservation districts, state water quality agencies, three federal agencies, three tribes, environmental groups and private citizens – and accomplishments. These include projects to reduce nutrient pollution, clean up heavy metals pollution in the first 200 miles of the Clark Fork, and develop a TMDL for Lake Pend Oreille for phosphorous. We are beginning to work with the states of Idaho and Washington to develop a TMDL for the Pend Oreille River, Watkins said.

With respect to the Council's monitoring program, Watkins said the monitoring program is focused on nutrients and heavy metals in the Clark Fork/Pend Oreile watershed. She noted that, until now, there has been considerable duplication of effort among the state water quality agencies. The Council then turned its efforts to the development of a single, coordinated monitoring plan; that's what we've done, she said. We have taken over the State of Montana's long-term monitoring program in the Clark Fork; we're also monitoring in Lake Pend Oreille and at Cabinet Gorge. Every year, we have monitoring going; every five years, we put all that data together to see where the trends are going. The program also includes an annual monitoring report, but every five years, we go through an intensive analytical process, said Watkins.

We were monitoring 24 sites on the Clark Fork, but found that to be prohibitively expensive, Watkins continued. On the off-years, we are now monitoring only at key sites, although every five years we also monitor at all the historic sites for five heavy metals, phosphorous and nitrogen. Like the TGG, we meet twice a year, in April and October. In response to a request from Watkins, Schneider said he will provide a brief

written description of the TGG and its ongoing projects for inclusion in the Council's water quality plan.

Have the voluntary nutrient discharge targets been met by your membership? Psyk asked. Some have been met; some of our other stakeholders are still working on it, Watkins replied; for example, Deer Lodge has met its target, while the City of Butte still has some challenges to overcome. Pickett noted that the Council has an incredible website – www.tristatecouncil.org – to which the TGG may want to link. Birch added that phosphorous is becoming quite expensive to buy; he said he knows of several universities in the US that are experimenting with ways of extracting phosphorous from sewage for agricultural use.

10. Rock Island Gas Abatement Plan for 2005.

We just wrapped up Rock Island's over/under spill test, but the only data available is very preliminary, said Waikele Hampton. The upstream gate slot is equipped with a notched gate, which is good for fish passage but produces a lot of TDG. We decided to add submerged discharge at our downstream gate. The numbers look promising, and hopefully, by the time of the TG's October meeting, I'll have more information to share.

11. Lower Columbia River Toxics Study.

Pickett led this presentation, titled "Monitoring 303(d) Listed Pesticides, PCBs and PAHs in the Lower Columbia River Using Passive Samplers." Among the highlights:

- Background – interagency Columbia River Toxics Group formed; decision made to break the river into three sections, reviewed existing data; EPA grant secured for a one-year monitoring program; semi-permeable membrane devices selected as the technology medium; supplemental EPA funding secured for PCB congener analysis
- Washington and Oregon 303(d) organics listings in the Lower Columbia (charts)
- Study objectives – measure ambient concentrations and estimate loadings of 303(d) listed organic compounds; 13 sites sampled between Bonneville Dam and Beaver Army Terminal etc.
- Study design – SPMDs deployed at 5 mainstem and 8 tributary sites; compounds measured in parts per quadrillion etc.
- List of sampling sites, from above Bonneville (RM 147) to just below Longview (RM 52)
- Map of SPMD locations
- Flow during the 2003-2004 study, Columbia and Willamette Rivers (graph)
- Analysis – SPMDs, flow
- What are SPMDs? (passive sampling devices, which sequester OC pesticides, PCBs, PAH, PCDDs/PCDFs, other compounds)
- SPMD function (diagram)

- SPMD components (photos)
- SPMD deployments – yield both time-weighted concentrations and bio-available concentrations of the various elements included in the study
- Bottom and shore deployment (photos)
- Permeability reference compounds
- Observations – highest T-DDT and Dieldren numbers are present at Bonneville, decrease as you move downstream; pesticide levels highest in winter and lowest in fall; PCB levels increase as you move downstream; Columbia Slough, the Willamette River and Multnomah Channel are sources of T-DDT, Dieldrin and T-PCBs; Multnomah Channel showed the highest concentrations of T-DDT and Dieldrin; Columbia Slough highest for T-PCBs and T-HMW-PAH)
- Summary of human health exceedences (graphs) – 14% of the DDE samples were above the human health limit; 10% of DDD; 3% of total PAH samples. For Dieldrin, 53% of the samples were above the human health threshold, 100% of the PCB samples were above the threshold.
- Comparison of USGS (1999) and Ecology (2003-2004) HMW-PAH data (table)
- Predicted vs. measured fish tissue concentrations for common carp, sucker and white sturgeon (table)
- Change in concentrations based on loadings (table)
- T-DDT simulation in Lower Columbia (graph) – actual numbers were lower than predicted, which indicates that the pollution sources are located above Bonneville Dam
- T-PCB simulation in the Lower Columbia – model indicates that the sources of pollution are located below Bonneville
- High flow tributary inputs for T-DDT (graph) – Multnomah Channel far higher than other tributaries
- Conclusions – human health criteria are regularly exceeded for PCBs and Dieldrin in the Lower Columbia; PCBs exceeded human health criteria due to sources above Bonneville, but additional important sources are also present in the Lower Columbia; major sources of DDT and Dieldrin are located above Bonneville Dam; the Willamette River and Multnomah Channel are significant sources for all of these compounds etc.
- Next steps: CRTW will meet in May to review the results of this study and decide what to do next. The report can be downloaded at http://www.ecy.wa.gov/biblio/0503006.html

12. Lower Granite and Ice Harbor Dams Removable Spillway Weirs.

Steve Juul of the Corps of Engineers provided an overview of the removable spillway weir programs at Lower granite and Ice Harbor dams. His presentation touched on the following major topics:

- Background information on RSWs
- RSW in operating position (diagram)
- Typical spillway without RSW (diagram and AVI)

- Typical spillway with RSW (diagram and AVI)
- The RSW is designed to better attract surface-migrating fish than is a typical spillway
- Summary of anticipated RSW benefits – same or better fish passage with less flow, shorter forebay residence time, increased power production, less downstream TDG
- The project delivery team
- RSW installation sites – Lower Granite and Ice Harbor now installed; Lower Monumental scheduled for 2007. Little Goose, McNary and John Day Dams are under consideration for future RSW installation; no decision has been made as to which project will be the next to receive an RSW. The cost of the Ice Harbor RSW was about $12.5 million.
- Photos of the Ice Harbor RSW under construction and en route to the dam
- Lower Granite RSW location (diagram)
- Lower Granite RSW installed (photo)
- Lower Granite RSW test conditions – 2002 (TDG and biological) and 2003 (biological only)
- Lower Granite RSW provides greater fish passage efficiency at 20.8 Kcfs spill (14 Kcfs training spill + RSW spill) than does BiOp spill up to the gas cap (about 45 Kcfs). At RSW +14 Kcfs training spill, dissolved gas averaged 109.8% TDG. In 2003, the RSW passed 58-69% of juvenile steelhead and chinook, significantly higher than BiOp spill. Fish passage efficiency was at least 5 times higher under the RSW compared to BiOp spill. In addition, passage time was 2.2-3.8 times greater, in both 2002 and 2003, when the project spills to iOp spill volumes compared to RSW operation. Survival through the RSW has averaged 98%.
- Ice Harbor RSW location (spill bay 2)
- Spill through the Ice Harbor RSW will be 8 Kcfs, compared to 6.8 Kcfs for the Lower Granite RSW.
- Biological testing will take place from April-August 2005.
- Ice Harbor RSW economic benefits – the bottom line is that the anticipated reduction in spill operation costs will be $13-22 million per year at Ice Harbor.

Juul invited anyone who would like more information about RSW technology to contact Kevin Crum at the Corps' Walla Walla District (Kevin.F.Crum@usace.army.mil). Does operation of the RSW steer more fish away from the powerhouse, and toward the RSW? Jim Adams asked. There is some evidence that that is the case, Juul replied; with the RSW and the behavioral guidance system in place, we are seeing fewer fish through the powerhouse. Have you seen any problems with injury, due to fish striking the RSW's flow deflector? another participant asked. Nothing out of the ordinary, Juul replied. Are they looking at using strobe lights to guide fish toward the RSWs, rather than training spill? Jim Irish asked. I'm not sure – I can't answer that, Juul replied.

13. Operational Experience and Investigations on Advanced Turbine Designs – Juvenile Fish Survival Studies at Wanapum and Priest Rapids Dams.

This topic was not addressed at today's meeting.

14. Other.

Llewellyn Matthews noted that his organization is still hoping to obtain a letter of endorsement from the TGG for the second 435 MW powerhouse at Waneta; we're still developing the preliminary assessment, and it should be submitted prior to the TGG's fall meeting. Once that assessment goes out for public comment, it would be very useful if the TGG would be willing to provide a letter of support for the Waneta expansion. He said he will provide a presentation on the Waneta expansion at the October TGG meeting.

Also, said Matthews, the Columbia River Integrated Environmental Monitoring Program committee is meeting this Thursday – we're trying to reinvigorate that group, which has been somewhat inactive in recent years. This is mainly a Canadian effort, focused on a variety of water quality parameters in the Columbia. The meeting is being held in Castlegar, he said.

15. Next TGG Meeting Date and Location.

The next Transboundary Gas Group meeting was tentatively set for October 19-20, in Trail or Roslyn, BC. Meeting summary prepared by Jeff Kuechle, BPA contractor.