Save Our Wild Salmon * American Rivers * Northwest Sportfishing Industry Association * Association of Northwest Steelheaders * Idaho Rivers United * Berkley Conservation Institute * Citizens For Progress * Pacific Coast Federation of Fishermen's Associations

March 8, 2010

Jerry Thielen
Rules Coordinator, Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

RE: PETITION TO AMEND WAC 173-201A-200(1)(f)(ii)

Dear Mr. Thielen,

Pursuant to RCW 34.05.330, Save Our Wild Salmon and its undersigned coalition members (hereinafter collectively referred to as "petitioner" or "SOS") hereby petition the Washington State Department of Ecology ("Ecology") to amend WAC 173-201A-200(1)(f)(ii), which Ecology promulgated pursuant to RCW 90.48.035.[1] This rule sets water quality standards ("WQSs") for total dissolved gas ("TDG") in Washington's fresh surface waters.[2] Generally, the rule requires that TDG levels not exceed 110 percent saturation. However, the rule includes exemptions to facilitate fish passage through the federal dams on the Snake and Columbia Rivers:

> The following special fish passage exemptions for the Snake and Columbia rivers apply when spilling water at dams is necessary to aid fish passage:
>
> - TDG must not exceed an average of one hundred fifteen percent as measured in the forebays of the next downstream dams and must not exceed an average of one hundred twenty percent as measured in the tailraces of each dam (these averages are measured as an average of the twelve highest consecutive hourly readings in any one day, relative to atmospheric pressure); and

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[1] Save Our Wild Salmon previously filed two petitions similar to this one, the first in March 2007 and the second in June 2009. The March 2007 petition was later withdrawn so that SOS could enter into discussions with Ecology about TDG in the Columbia and Snake Rivers. As a result of those conversations and a decision from the Oregon Environmental Quality Commission in June 2007, Ecology convened an Adaptive Management Team ("AMT") as prescribed by the Lower Columbia River Total Dissolved Gas Total Maximum Daily Load ("TMDL"). Petitioner was a member of the AMT, which met approximately monthly from November 2007 through September 2008. Ecology denied the June 2009 petition on August 10, 2009.

[2] Under the Clean Water Act ("CWA"), states have the authority to adopt water quality standards. 33 U.S.C. § 1313. State water quality standards include three central elements: (1) designated uses, (2) water quality criteria, and (3) antidegradation rules. 40 C.F.R. § 131.6(a)-(d); 40 C.F.R. §§ 131.10-.13. Water quality standards must include criteria that will protect each designated use. 40 C.F.R. § 131.11(a)(1). These criteria may be expressed in numeric or narrative form. 40 C.F.R. § 131.11(b)(1), (2). Washington State has set the designated use for the Snake and Columbia Rivers to include "aquatic life uses," including salmonid habitat, spawning, rearing, and migration. WAC 173-201A-200(1)(a)(ii)-(iv).

- A maximum TDG one hour average of one hundred twenty-five percent must not be exceeded during spillage for fish passage.[3]

Petitioner agrees that an exemption to the 110 percent TDG limit is necessary to ensure safe salmonid passage on the Snake and Columbia Rivers; however, the requirement that TDG not exceed 115 percent in the forebays is unduly restrictive, at odds with sound science, and contrary to federal and state law.

On June 19, 2009, SOS submitted a petition to Ecology to amend or remove the 115 percent forebay standard. Ecology denied that petition on August 10, 2009 based primarily on its belief that "aquatic life such as frogs, sturgeon larvae, fish, and daphnia" experience adverse effects at TDG saturation levels approaching 120 percent; Ecology claimed that retaining the 115 percent forebay limit was necessary to fully protect all species of aquatic life. However, in denying SOS's petition on these grounds, Ecology failed to consider relevant studies which demonstrate that aquatic life will not be harmed by the removal of the 115 percent forebay limit. Additionally, in conducting its risk-benefit analysis, Ecology did not appropriately consider the benefits to salmon and other aquatic life, such as Pacific lamprey, from potential increases in spill resulting from the petitioned rule change. Based on this relevant evidence and new information, as well as the information in our June 2009 petition, SOS requests that Ecology grant this petition and remove the 115 percent forebay limit or, alternatively, increase that limit to 120 percent.

I. SPILL IS VITAL TO SALMON AND STEELHEAD PROTECTION.

As SOS asserted in its June 2009 petition, increased spill provides a substantial benefit to endangered salmon and steelhead. Indeed, Ecology has acknowledged that spill is important for salmon and steelhead, and has voiced approval of the higher salmon survival rates achieved by the 115/120 percent TDG criterion that SOS documented in our June 2009 petition.[4] We document the support for those higher survival rates here again.

For juvenile salmon and steelhead migrating in the Snake and Columbia Rivers, spill indisputably provides the safest passage through the Federal Columbia River Power System ("FCRPS") dams.[5] There is also substantial evidence that spill is the safest route of passage for adult salmon and steelhead through dams.[6] Allowing increased water over the spillways at these dams allows juvenile salmon to avoid traveling through the power turbines – a passage route that increases mortality of these fish by subjecting them to rapid pressure changes and direct impacts with turbine blades.[7] Increased spill also results in lower mortality than the practice of diverting fish from the turbine intakes and "bypassing" them through a series of screens, pipes, and tunnels to be ejected at the lower side of the dam – the only other method

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[3] WAC 173-201A-200(1)(f)(ii)

[4] Department of Ecology. August 10th, 2009. Response to Petition for Rulemaking – Chapter 173-201a WAC – Water Quality Standards. Response to Petition Issue 1.

[5] See NMFS 2000 Federal Columbia River Power System Biological Opinion (2000 BiOp) at 6-17.

[6] See CRITFC July 3, 2008 memorandum to the AMT, *Review of Adult Passage Through Different Dam Passage Routes.*

[7] 2000 BiOp at 9-83.

available to ensure that fish migrating in-river are not forced to pass through the turbines.

Recent experience underscores the beneficial effects of increased spill. Court injunctions have required the U.S. Army Corps of Engineers ("Corps") to spill additional water at the FCRPS dams to aid downstream fish passage, which resulted in some of the highest in-river juvenile survival rates in years and allowed more juvenile salmon to migrate in the river under better conditions. These in-river survivals have translated into increased adult returns. For example, the 2008 and 2009 adult return of sockeye salmon to the Columbia and Snake Rivers (fish that had out-migrated in 2006 and 2007) shattered recent records. According to an analysis of these increased adult returns by the Fish Passage Center ("FPC"), survival through the hydrosystem in the years these fish migrated to the ocean was better than any year since the late-1990s:

> [J]uvenile sockeye from the Mid-Columbia had a reach survival from Rock Island to John Day dam of approximately 0.88, which was the highest survival among the years analyzed. Reach survival in 2007 was 0.56, the second highest among the years analyzed.[8]

Critically endangered Snake River sockeye salmon experienced similarly high reach survival in 2007:

> [J]uvenile sockeye from the Snake River had a reach survival from Lower Granite to John Day dam of approximately 0.86, which was the highest survival among the years analyzed. Reach survival for migration year 2007 was 0.62.[9]

These high reach survivals were due in large measure to good river conditions produced by adequate rivers flows and court-ordered spill levels.[10] FPC's conclusions were questioned by the National Marine Fisheries Service/NOAA Fisheries ("NOAA"), which conducted a separate review concluding that the high sockeye returns in 2008 were generally due to favorable ocean conditions. In response, FPC reviewed NOAA's analysis, carefully reexamined its own findings, and concluded that:

> There is no doubt that ocean conditions are important, but this does not reduce the importance of migration conditions and fish survival in-river . . . . The NOAA conclusion that attributes the 2008 high return of sockeye salmon to marine/estuary conditions while discounting the effect of higher in-river survival, lower proportion transported and improved in-river conditions, is flawed because it fails to recognize that fish must reach the ocean/estuary alive to benefit from good

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[8] FPC Memo (July 14, 2008) at 1. A copy of this analysis is available from: http://www.fpc.org/documents/memos/109-08.pdf
[9] FPC Memo (July 14, 2008) at 2. The "years analyzed" in FPC's analysis were 1998-2007.
[10] *Id.* at 2.

> ocean conditions. Even the best ocean conditions will not resurrect dead fish.[11]

FPC has also reviewed NOAA's analysis of juvenile steelhead reach survival for 2009, confirmed the agency's findings of 66-69% in-river steelhead survival rates from Lower Granite to Bonneville dams, and concluded that:

> based upon multi-year analysis the most important variables explaining variability in reach survival for steelhead were spill proportion and water transit time (i.e. flow). Higher spill proportions, particularly for the Snake River, are likely the primary factors contributing to the higher juvenile survivals and faster juvenile travel times which occurred in 2007, 2008, and 2009.[12]

Indeed, NOAA has previously acknowledged that, along with removable spillway weirs, "[h]igher survival for in-river migrants in 2006 was likely the result of higher flows and greater volumes of water spilled."[13] NOAA had also concluded as long ago as 2000 that "measures that increase juvenile fish passage over FCRPS spillways are the highest priority" for passage improvements.[14]

In short, spill provides the best and safest route of passage for juvenile and adult salmon and steelhead by allowing them to avoid higher turbine and screen bypass mortalities, reducing passage delay, and dispersing predators. At the same time, spill *can* cause excessive TDG levels, which can be harmful to fish and other aquatic life by causing gas bubble trauma ("GBT"). State and federal laws require Ecology to set TDG limits that maximize salmon survival by balancing the benefits of spill with the risks of GBT. It is here – when balancing risks and benefits to aquatic biota – that Ecology's decision errs: the evidence indicates that the 115 percent forebay TDG limit does not achieve an appropriate balance.

II. THE 115 PERCENT FOREBAY TDG LIMIT IS NOT GROUNDED IN SCIENCE.

A state's water quality criteria "must be based on sound scientific rationale . . . ." 40 C.F.R. § 131.11(a)(1). Similarly, the Washington Legislature requires Ecology to use "credible data" when it determines "whether any surface water of the state is supporting its designated use . . . ." RCW 90.48.580(2)(c). In order to be considered "credible" the data must be "representative of water quality conditions at the time the data was collected." RCW 90.48.585(1)(b). The 115 percent forebay limit violates the CWA and Washington law because it is not based on sound science or credible data.

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[11] FPC Memo to Ed Bowles, ODFW (Feb. 18, 2009) at 1. A copy of this analysis is available from: http://www.fpc.org/documents/memos/18-09.pdf (last visited February 10, 2010)
[12] FPC Memo to Ed Bowles, ODFW (Sept. 29, 2009) at 1-2. A copy of that analysis is available from: http://www.fpc.org/documents/memos/157-09.pdf (last visited February 10, 2010)
[13] NMFS, Northwest Fisheries Science Center, Preliminary Survival Estimates 2006 Spring Juvenile Migration at 1-4 (Aug. 30, 2006).
[14] 2000 BiOp at 9-82.

A. Ecology overstated the potential for harm to aquatic biota

The AMT looked in detail at the relationship between increased TDG levels due to spill and the incidence of GBT in aquatic organisms. Accordingly, the joint report issued by Ecology and the State of Oregon[15] described three independent literature reviews conducted by Ecology, NOAA Fisheries, and Parametrix. Each review examined the effects of TDG on aquatic life and took special notice of species other than salmonids. NOAA and Parametrix both concluded that removing the 115 percent forebay monitoring requirement would produce negligible harmful effects on aquatic life.[16] Ecology reached a different conclusion: while it conceded that any aquatic life living deeper than one meter would not be affected if TDG increased to 120 percent, Ecology emphasized that the potential impact to aquatic life within one meter of the water surface, while small, is not negligible.[17]

In spite of the conflicting reviews, Ecology then stated: "[t]he weight of the evidence from available scientific studies *clearly* points to detrimental effects on aquatic life near the surface when TDG approaches 120 percent."[18] Based on this assertion, Ecology conducted a risk-benefit analysis – weighing the "overall benefits of additional spill versus additional risk of gas bubble trauma"[19] – to determine whether to remove the 115 percent forebay requirement. The agency concluded that a rule revision was not necessary or required. This conclusion formed the basis of Ecology's denial of our June 2009 petition to remove or revise the 115 percent TDG forebay standard.[20]

Ecology's reasoning – and thus its conclusion – is faulty for two reasons. First, Ecology failed to consider a number of studies in their discussion of "impacts on aquatic life (in the top one meter)." In addition, some of the studies Ecology did consider are misrepresented. These omitted and misrepresented studies demonstrate that Ecology substantially overestimated the risk of GBT to surface-dwelling aquatic life.[21] Second, Ecology based its conclusion that invertebrates and other surface-dwelling aquatic life would be harmed by removal of the 115% standard on the mortality rates found in experimental studies, and failed to consider or give sufficient weight to field studies reaching contrary conclusions.[22] As multiple studies have noted, because TDG levels in captive fish are substantially

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[15] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002. 68 p. [hereinafter AMT Evaluation].
[16] *Id.* at 59.
[17] *Id.*
[18] *Id.* at 60, emphasis added.
[19] *Id.* at 61.
[20] Department of Ecology. August 10th, 2009. Response to Petition for Rulemaking – Chapter 173-201a WAC – Water Quality Standards. See Response to Petition Issue 1, Petition Issue 2, Petition Issue 4, Petition Issue 5.
[21] See, e.g., Ryan, Brad A., E.M. Dawley, & R.A. Nelson. 2000. Modeling the effects of supersaturated dissolved gas on resident aquatic biota in the main-stem Snake and Columbia Rivers. North American Fisheries Management 20:192-204.
[22] AMT Evaluation at 46-47.

higher than levels found in the field, experimental data systematically overestimates the risk of GBT.[23] Ecology's exclusive reliance on experimental studies in lieu of field studies thus also led Ecology to substantially overestimate the risk of GBT to aquatic life.

1. Ecology Failed to Appropriately Consider All Relevant Studies

a. Ecology missed key studies

Ecology failed to consider a number of studies demonstrating that aquatic life in the top one meter would not be harmed by removal of the 115 percent TDG standard. Most significantly, the Ecology literature review analysis failed to discuss field studies conducted between 1994 and 1997 by National Marine Fisheries Service ("NMFS") scientists on non-salmonid fishes and invertebrates in the Columbia and Snake rivers. NMFS specifically designed those field studies to examine the consequences of Ecology's temporary waiver of the 110 percent dissolved gas saturation standard granted to the Corps in 1994 to accommodate spillway passage of juvenile salmonids. In particular, scientists were looking for the prevalence of GBT with increased levels of TDG on all species of fish and invertebrates.[24]

In the NMFS study, biologists sampled resident fish between 0-3 meters and held them for 4 days in net-pens anchored in their respective reaches. In addition, benthic and epibenthic macroinvertebrates were collected from depths up to 0.6 m. Zooplankton samples at the water surface were also collected. The river produced a variety of TDG levels: in heavy run off years such as 1997, the TDG ranged from 120 percent to 130 percent. During the 4 year study, scientists examined 39,924 fish representing 27 species; only 3.9 percent of all fish displayed GBT signs[25] and signs of GBT were rare when TDG was less than 120 percent.[26] Additionally, 5,434 invertebrates representing 27 species were collected; only *seven* individuals showed signs of GBT.[27]

Both the NOAA and Parametrix literature reviews included NMFS's results and discussed them at length.[28] The Ecology literature review, however, failed to discuss or evaluate these studies in its discussion document.[29] Indeed, contrary to

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[23] See Parametrix. 2008. Total Dissolved Gas Supersaturation Biological Effects, Review of Literature 1980-2007. Draft. Prepared by Don E. Weitkamp. at page 7-8.

[24] Ryan, Brad A., E.M. Dawley, & R.A. Nelson. 2000. Modeling the effects of supersaturated dissolved gas on resident aquatic biota in the main-stem Snake and Columbia Rivers. North American Fisheries Management 20:192-204 at 192.

[25] Ryan, Brad A., E.M. Dawley, & R.A. Nelson. 2000. Modeling the effects of supersaturated dissolved gas on resident aquatic biota in the main-stem Snake and Columbia Rivers. North American Fisheries Management 20:192-204. Table 3, p. 196-197.

[26] *Id.* at 192, see abstract.

[27] *Id.* at 196 & Table 4.

[28] Schneider, Mark J. 2008. Washington and Oregon State – Adaptive Management Team Resident Fish Literature Review. at page 7; Parametrix. 2008. Total Dissolved Gas Supersaturation Biological Effects, Review of Literature 1980-2007. Draft. Prepared by Don E. Weitkamp. at page 25.

[29] Evaluation of Total Dissolved Gas Criteria (TDG) Biological Effects Research. 2008. Washington State Department of Ecology. Pub. No. 08-10-059, at pp. 4-5; Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas

the evidence collected in these empirical, multi-year studies of fish and invertebrates, the Ecology literature review concluded there is "little information on free-floating and surface dwelling organisms such as larvae of fish, crustaceans, and mollusks."[30] Moreover, while Ecology did cite NOAA's article in its bibliography, it misrepresented the importance of the study by characterizing it as an attempt to "[c]orrelate TDG levels and exposure to bubble signs in non resident aquatic organisms" and cursorily noting the study examined "27 species of aquatic organisms."[31]

The field data gathered in the NMFS study alone strongly supports the conclusion that fish and invertebrates will not be harmed by the removal of the 115 percent forebay standard; however, Ecology also failed to consider additional studies that support the same conclusion:

- Schrank et al. (1997) monitored invertebrates and resident nonsalmonid fish species held in net-pens downstream from Bonneville Dam and Ice Harbor Dam in 1995. Of the 1,303 invertebrates (representing 18 taxa) sampled, only one species showed any signs of GBT (between 0.5-3.5 percent prevalence, overall frequency of 0.23 percent).[32]
- Cochnauer (2000) examined more than 30,000 resident fish for GBT over a 5 year period in the Clearwater river, Idaho, with never greater than a 1 percent overall incidence of GBT in a given year.[33]
- Toner et al. (1995) collected 18,000 specimens of resident fish and invertebrates below Bonneville and Ice Harbor dams and above and below Priest Rapids Dam in 1994. Of the 4,133 invertebrates sampled, only one species showed any signs of GBD and only at a minimal prevalence.[34]
- Nebeker et al. (1981)[35] determined the effects on TDG on survival and adult emergence of mayflies, caddisflies, mosquitoes, and midges in laboratory tests. All of these insects were more tolerant of TDG supersaturation than fish.

Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002. at page 45-53.

[30] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002. at page 50.

[31] Department of Ecology. 2008. Evaluation of Total Dissolved Gas Criteria (TDG) Biological Effects Research: A literature Review. Publication Number 08-10-059 at page 75.

[32] Schrank, B.P., E.M. Dawley, & B. Ryan. 1997. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates in Pries Rapids Reservoir, and downstream from Bonneville and Ice Harbor Dams, 1995., at p. 12-13. Unpublished Report available from National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA. 45 p.

[33] Cochnauer, Tim. 2000. "Summarization of Gas Bubble Trauma Monitoring in the Clearwater River, Idaho", 1995-1999 Final Report, Project No. 199701700, 17 electronic pages, (BPA Report DOE/BP-31259-3), at p.2.

[34] Toner, M.A., B. Ryan and E.M. Dawley. 1995. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates downstream from Bonneville, Ice Harbor, and Priest Rapids Dams, 1994. Unpublished report available from Coastal Zone and Estuarine Studies Division, Northwest Fisheries Science Center. 38 p. at p.17.

[35] Nebeker, A.V., F.D. Baker, and S.L. Weitz. 1981. Survival and adult emergence of aquatic insects in air-supersaturated water. Journal of Freshwater Ecology. 1:243-250.

- Schneider (2000)[36] provides an assessment by the National Marine Fisheries Service of the 120 percent criterion and concludes that the risk associated with the 120 percent TDG is warranted by the projected 4-6 percent increase in salmon survival from increased spill.

Both the NOAA and the Parametrix literature reviews recognize the importance of these studies and discuss them in detail[37]; Ecology, in contrast, omitted them entirely. These crucial omissions skewed the conclusions Ecology drew from its literature review. We request that Ecology revisit and change its prior decision to retain the 115% forebay TDG standard based on full consideration of all the relevant literature, including these previously omitted studies.

b. Ecology misrepresented other studies

Even in those studies it did summarize and presumably consider, Ecology either incompletely or inaccurately characterized the results in the AMT Evaluation[38]:

- Ecology's reference to Parametrix (2003) [39] does not disclose that of the 9,855 invertebrates that were examined, only 2 showed any signs of GBT (0.02% of the total sample),[40] that TDG peaked in the 130-134 percent range,[41] and that the statistic "Mayflies: 9 percent had GBD at 118 percent" quoted in Table 14 actually represented *one single insect*.[42] In addition, 37,258 fish were collected, of which 3,000 were examined for GBT.[43] No GBT was found in spring samples (TDG 103-127 percent), though evidence of GBT was found in summer samples (TDG 107-134 percent).[44]
- Ecology's reference to Weitkamp et al. (2003a) fails to note that the authors concluded that intermittent exposure to 125-130 percent TDG has essentially no effect on resident fish and that TDG levels below 125 percent do not result in substantial incidence of GBT in fish,[45] and that TDG varied greatly over the

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[36] Schneider, M.L. 2000. Risk assessment for spill program described in 2000 draft biological opinion. Appendix E, 2000 FCRPS Biological Opinion, National Marine Fisheries Service, Portland, Oregon. 30 p.

[37] Schneider, Mark J. 2008. Washington and Oregon State – Adaptive Management Team Resident Fish Literature Review. at p. 7-11; Parametrix. 2008. Total Dissolved Gas Supersaturation Biological Effects, Review of Literature 1980-2007. Draft. Prepared by Don E. Weitkamp. at p. 25.

[38] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002. at pages 46-48.

[39] Parametrix. 2003. Total Dissolved Gas Biological Effects, 2002. Final Report on the Rocky Reach Hydroelectric Project FERC Project No. 2145.

[40] *Id.* at page 2.

[41] *Id.* at pages 2, 3-7.

[42] *Id.* at page 3-19.

[43] *Id.* at page 3-22.

[44] *Id.* at page 3-22 to 3-24.

[45] Weitkamp, D.E., R.P. Sullivan, T. Swant, and J. DosSantos. 2003a. Gas Bubble Disease in Resident Fish of the Lower Clark Fork River. Transactions of the American Fisheries Society. 132:865-876 at 875.

study period (1997-2000), sometimes reaching as high as 132-158 percent for extended periods.[46]

- Ecology's reference to Richter et al. fails to note that the study sampled 3,012 fish specimens and confirmed that when TDG is 120 percent or less symptoms of GBT are minimal to nonexistent.[47]

Through its incomplete or inaccurate characterizations, Ecology failed to recognize that many of the studies it did consider strongly support the conclusion that aquatic life is not harmed when TDG levels are generally at or below 120 percent.

2. <u>It is inappropriate to conclude TDG negatively affects biota based solely on experimental studies; field studies are critical</u>

Nearly every (if not every) study Ecology cites where the authors report large GBT mortality numbers was conducted under experimental conditions.[48] The authors of those studies were not investigating if mortality would occur, but how long it would take to occur. Such experimental conditions where fish or invertebrates are held in shallow (e.g., 0.25 meter) water with constant, high levels of TDG for extended periods of time are vastly different from actual conditions faced by aquatic biota around dams in Washington's rivers where depth compensation is available and where TDG levels fluctuate substantially.[49] Indeed, experimental studies and field studies have reached dramatically different conclusions regarding the effects of elevated levels of TDG on the same species: for example, Nebeker et al. (1976),[50] an experimental study which Ecology cites as finding "50 percent mortality for daphnia in 93 hours"[51] in its summary of findings on page 46, is directly contradicted by Ryan et al. (2000), a field study that Ecology failed to consider, which sampled 1,514

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[46] *Id.* at 869-870.

[47] Richter, T.J., J. Naymik, and J.A. Chandler. 2006. HCC gas bubble trauma monitoring study. Idaho Power Company Boise, Idaho. 38p.

[48] E.g., Antcliffe, B., L.E. Fidler, and I.K. Birtwell. 2002. Effects of Dissolved Gas Supersaturation on the Survival and Condition of Juvenile Rainbow Trout (*Oncorhynchus mykiss*) Under Static and Dynamic Exposure Scenarios. Canadian Technical Report of Fisheries and Aquatic Sciences 2370:1-70. (From page 42-44 of this study Ecology cites "42 percent mortality in 9 days" in its summary of findings on page 46. However, Anticliffe et al. collected data under experimental conditions and concluded that strict adherence to the 110 percent Water Quality Act Criterion may not be necessary where water depth allows fish to escape to a compensatory depth).

[49] See Parametrix. 2008. Total Dissolved Gas Supersaturation Biological Effects, Review of Literature 1980-2007. Draft. Prepared by Don E. Weitkamp. at page 7-8; Weitkamp, D.E., R.P. Sullivan, T. Swant, and J. DosSantos. 2003a. Gas Bubble Disease in Resident Fish of the Lower Clark Fork River. Transactions of the American Fisheries Society. 132:865-876 at 873, 875..

[50] Nebeker, A.V., Stevens, D.G., and Brett, J.R. 1976. Effects of Gas Supersaturated Water on Freshwater Aquatic Invertebrates. Pages 51-65 in DH Fickenstein and Scheider, Gas Bubble Disease. Tech Info Center, ERDA. NTIS Conf 741033.

[51] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002. at page 47.

specimens of Cladocera (a taxa that includes daphnia)[52] *using the exact same methods* described by Nebeker et al.[53] and showed only 0.5 percent prevalence of GBT. Moreover, studies have shown that even in live-cage investigations where resident fish are held captive in-river in pens allowing for depth compensation, GBT levels in captive fish are still substantially higher than GBT levels observed in free-swimming fish.[54] Indeed, noting these discrepancies, one study noted "the need for caution in using the results of the laboratory and live-cage investigations to interpret conditions in the natural environment."[55] Thus, Ecology's overreliance on experimental studies of captive biota – that routinely document higher levels of GBT compared with levels observed in the wild – led Ecology to overestimate the risk of GBT posed by eliminating the 115 percent TDG standard in the forebays.

Ecology even acknowledged that depth compensation renders experimental studies of most aquatic species in shallow water unrealistic for determining actual levels of GBT experienced in the Snake and Columbia rivers. For example, although Ecology analyzed the impact of TDG on aquatic life in the top one meter, it went on to analyze the depth distribution of fish. Ecology found that the "mean depth [where fish reside] was always deeper than one meter, and usually deeper than two meters. The amount of time spent at depths shallower than one meter was usually (but not always) less than the amount of time where significant detrimental effects were found."[56] Unfortunately, Ecology then proceeded to give greater weight to the controlled experimental studies that do not account for depth compensation. The results of the field studies demonstrate that fish and other biota move around in the water column and are unlikely to spend significant time in the portion of the water column with elevated levels of TDG.[57]

Even if Ecology is mainly concerned with invertebrates or other aquatic life found in the top one meter of water, it is not rational for Ecology to conclude that retaining the 115 percent forebay TDG standard is necessary. Even the experimental studies of invertebrates on which Ecology relied concluded that invertebrates were more

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[52] Ryan, Brad A., E.M. Dawley, & R.A. Nelson. 2000. Modeling the effects of supersaturated dissolved gas on resident aquatic biota in the main-stem Snake and Columbia Rivers. North American Fisheries Management 20:192-204 at 194.
[53] *Id.* at page 194.
[54] *Id*. at 200; Schrank, B.P., E.M. Dawley, & B. Ryan. 1997. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates in Pries Rapids Reservoir, and downstream from Bonneville and Ice Harbor Dams, 1995, at Executive Summary page v.; Weitkamp, D.E., R.P. Sullivan, T. Swant, and J. DosSantos. 2003a. Gas Bubble Disease in Resident Fish of the Lower Clark Fork River. Transactions of the American Fisheries Society. 132:865-876 at 872.
[55] Weitkamp, D.E., R.P. Sullivan, T. Swant, and J. DosSantos. 2003a. Gas Bubble Disease in Resident Fish of the Lower Clark Fork River. Transactions of the American Fisheries Society. 132:865-876 at 872.
[56] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002. at page 48.
[57] E.g., Weitkamp, D.E., R.P. Sullivan, T. Swant, and J. DosSantos. 2003a. Gas Bubble Disease in Resident Fish of the Lower Clark Fork River. Transactions of the American Fisheries Society. 132:865-876 at 869-870.

resistant than fish to GBT.[58] More importantly, it is inappropriate for Ecology to rely solely on experimental studies of invertebrates and other shallow-dwelling aquatic life, while ignoring or misunderstanding the vast amount of field data collected on invertebrates discussed above. Those field studies by NMFS,[59] Parametrix,[60] and others conducted around dams to determine the effects of TDG on invertebrates provide the best evidence of the actual levels of GBT experienced by those biota, and these studies universally concluded that the incidence of GBT in invertebrates in the Snake and Columbia rivers is low.[61]

B. Ecology did not appropriately consider benefits to salmon and other species such as Pacific lamprey

1. Benefits to Salmon

Petitioner and Ecology agree that spill generally benefits salmon. However, the question at hand is how much additional benefit will salmon receive from the removal of the 115 percent TDG forebay standard? The answer depends on how much additional water is spilled. Current forecasts predict that 1-2 percent additional water would be spilled without the 115 percent TDG standard under current conditions.[62] This amount is predicted to change, however, with an increase in demand for power in coming years. When that change materializes, dams will spill less often for overgeneration reasons. In fact, "[i]f both the BiOp spill requirements and overgeneration spill volumes change significantly over time, removal of the 115 percent forebay requirement has the possibility of affecting spill even more significantly (up to a theoretical maximum of 60 percent more spill in some years)."[63]

Nevertheless, even under the current conditions modeled and discussed in the joint report – forecasting a 1-2 percent increase in water spilled – "each analysis found that there is likely a small, positive effect on Chinook survival percentage."[64] Those percentages ranged from -0.02 to a 9 percent increase in survival, depending on the

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[58] Nebeker, A.V., F.D. Baker, and S.L. Weitz. 1981. Survival and adult emergence of aquatic insects in air-supersaturated water. Journal of Freshwater Ecology. 1:243-250. Nebeker, A.V., Stevens, D.G., and Brett, J.R. 1976. Effects of Gas Supersaturated Water on Freshwater Aquatic Invertebrates. Pages 51-65 in DH Fickenstein and Scheider, Gas Bubble Disease. Tech Info Center, ERDA. NTIS Conf 741033.

[59] Ryan, Brad A., E.M. Dawley, & R.A. Nelson. 2000. Modeling the effects of supersaturated dissolved gas on resident aquatic biota in the main-stem Snake and Columbia Rivers. North American Fisheries Management 20:192-204.

[60] Parametrix. 2003. Total Dissolved Gas Biological Effects, 2002. Final Report on the Rocky Reach Hydroelectric Project FERC Project No. 2145.

[61] *Id.* at page 4-2 (conclusions re invertebrates and summarizing conclusions from other studies of invertebrates).

[62] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002. at page 59.

[63] *Id.* at 59.

[64] *Id.* at 59.

model used. Ecology's dismissal of these benefits as small[65] focuses on the low range of these survival improvements while ignoring equally credible estimates at the higher end.

Moreover, in light of the millions of dollars spent in the Columbia River Basin and Puget Sound region on a variety of projects to improve salmon survival by only a few percentage points,[66] even the most conservative improvement in survival by simply spilling more water should be seen as a significant benefit to salmon. Additionally, changing future conditions, as noted above, may result in even more benefit to salmon.

In sum, petitioners believe that Ecology did not adequately consider or weigh the potential benefit of increased spill to threatened and endangered salmon against the negligible – when appropriately viewed – risk increased spill poses to invertebrates and other biota.

2. Benefits to Pacific Lamprey

Salmon are not the only anadromous species migrating through the hydrosystem. Pacific lamprey (*lampetra tridentata*) may also benefit from the removal of the 115 percent TDG forebay standard, a benefit to aquatic biota that Ecology did not consider in its denial of SOS's June 2009 petition.

Pacific lamprey have shown widespread decline since the 1960s in the Columbia River system due to habitat loss, water pollution, ocean conditions, and problems with dam passage.[67] Lamprey decline is of particular concern in the northwest because of their importance to Native Americans' cultural heritage and tribal fisheries.[68] In fact, the lamprey's situation is perilous enough that the Oregon Natural Resources Council petitioned the USFWS to list the species under the Endangered Species Act in 2002. Although the USFWS denied the petition in 2004, due to a lack of scientific or commercial information, the USFWS has continued to voice concern over the status and distribution of Pacific lamprey. For example, as

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[65] Department of Ecology. August 10th, 2009. Response to Petition for Rulemaking – Chapter 173-201a WAC – Water Quality Standards. See Response to Petition Issue 5.

[66] To put these potential survival benefit into perspective, it is interesting to compare these survival numbers to survival improvements expected from the 2008 FCRPS BiOp (at page 8.5-54), which the State of Washington is vigorously defending:

- a 5% survival improvement for Snake River spring/summer chinook from all of the prospective hydro actions required by the BiOp
- a 6% survival improvement for spring/summer chinook from prospective estuary habitat improvements
- a 2% survival improvement for Snake River spring/summer chinook from prospective bird predation actions
- a 1% survival improvement for Snake River spring/summer chinook from prospective pike-minnow predation actions

[67] Close, D.A., M. Fitzpatrick, H. Li, B. Parker, D. Hatch & G. James. 1995. Status report of the Pacific lamprey (*lampetra tridentata*) in the Columbia River Basin. Prepared for the U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon.

[68] *Id.* See also Nez Perce, Umatilla, Yakama and Warm Springs Tribes. 2008. Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin. Formal Draft, at page 4.

part of an effort to collect information to help monitor and conserve the species, the USFWS organized a "Coastwide Conservation Initiative" intended to highlight lamprey restoration.[69] The Conservation Initiative working group in 2009 identified "[r]emoving impediments to anadromous lamprey passage…as the highest priority recovery objective for lampreys in the Columbia River basin."[70]

Petitioners recognize that there is little information available to indicate precise juvenile lamprey survival benefits from increasing spill by eliminating the 115 percent forebay standard; however, it is highly likely that juvenile lamprey will benefit indirectly from increased spill. Juvenile lamprey are frequently impinged and are injured or die on the turbine intake screens that are meant to divert juvenile salmon into the bypass system; one study estimated a juvenile lamprey mortality rate of as high as 25% for passage of dams with extended length turbine intake screens.[71] When spill is reduced, more juvenile lamprey are forced through the screened bypass routes.[72] Conversely, when spill is increased, the bypass systems are more frequently closed, and fewer lamprey will be forced through the screened bypass routes, resulting in lower rates of lamprey impingement and mortality.[73] Indeed, the FPC recently highlighted that reducing spill (and increasing transport of salmon in barges) during lamprey migration in the spring:

> will be detrimental to lamprey, since elimination of spill will result in additional juvenile lamprey passage through screened power house bypass systems (Starke and Dalen 1995,1998; Moursand et al., 2000, 2001, 2002, 2003; Bleich and Moursand, 2006). Impingement of juvenile lamprey on turbine intake screens is a serious regional problem.[74]

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[69]Nez Perce, Umatilla, Yakama and Warm Springs Tribes. 2008. Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin. Formal Draft, at page 4.

[70] Moser, M.L., M.G. Mesa. 2009. Passage Considerations for Anadromous Lampreys. American Fisheries Society Symposium 72:115-124; also see Luzier, C.W. and 7 coauthors. 2009. Proceedings of the Pacific Lamprey conservation Initiative Work Session – October 28-29, 2008. U.S. Fish and Wildlife Service, Regional Office, Portland, Oregon, USA, pages 9-13, available at: http://www.fws.gov/pacific/fisheries/sp_habcon/lamprey/pdf/October%202008%20Work%20Session%20Proceedings%20Final%204-9-09.pdf (last visited February 8, 2010).

[71] CRITFC, Pacific Lamprey Passage Design, Project No. 2008-524-00. FY 2008-2009 F&W Program Accords (MOA) Proposal Review. Pages 10-11; see also BioAnalysts, Inc. 2000. A Status of Pacific Lamprey in the Mid-Columbia Region. Rocky Reach Hydroelectric Project. FERC Project No. 2145. at pages 26-27.

[72] Fish Passage Center, "Review of the NOAA Transportation analyses and potential effects of reducing spill for fish passage in May and beginning the transportation program earlier in the spring and supporting analyses". Feb. 9, 2010. at page 2 and10-12. Available at: http://www.fpc.org/documents/memos/15-10.pdf (last visited February 12, 2010).

[73] Even if lamprey do not pass through the spillway, lamprey are less susceptible to injury or mortality from turbine passage compared with other, particularly larger fish. Moursund, R.A., M.D. Bleich, K.D. Ham, and R.P. Mueller. 2003. Evaluation of the Effects of Extended Length Submerged Bar Screens on Migrating Juvenile Pacific Lamprey (*Lampetra tridentate*) at John Day Dam in 2002. Final Report prepared for the U.S. Army Corps of Engineers, Portland Oregon under Contract DE-AC06-76RL01830 at p. 4.3.

[74] Fish Passage Center, "Review of the NOAA Transportation analyses and potential effects of reducing spill for fish passage in May and beginning the transportation program earlier in the spring and supporting analyses". Feb. 9, 2010. at page 10. Available at: http://www.fpc.org/documents/memos/15-10.pdf (last visited February 12, 2010).

Moreover, juvenile lamprey move downstream primarily at night and are strongly affected by flow,[75] so increases in nighttime spill will increase juvenile lamprey dam passage at the time when such passage is safest due to the closure of the bypass system. Additionally, if sufficient salmon pass via spill, allowing screens to be removed or lifted at some projects during even parts of the year, lamprey mortality due to screen impingement could be reduced even further.

In sum, although "the lack of information on juvenile lamprey movements is…alarming,"[76] Ecology's failure to consider the potential benefits to Pacific lamprey may have negatively affected its risk-benefit analysis.. As noted above, Ecology's designation for Washington's fresh surface waters includes "aquatic life uses," WAC 173-201A-200(1)(a)(ii)-(iv). Any potential benefit to Pacific lamprey from increased spill therefore should be considered in Ecology's decision. Petitioner thus asks Ecology to reconsider and change its conclusion in light of the benefits to salmon, lamprey and other species requiring dam passage to survive.

C. Oregon DEQ's correct conclusion

The Oregon Department of Environmental Quality (ODEQ) correctly balanced the evidence reporting negligible GBT in aquatic life in water with TDG up to 120 percent with the potential benefits to salmon and other species. As Ecology notes in the January 2009 joint decision with the ODEQ, NOAA and Parametrix concluded that the incidence of GBT in juvenile and adult chinook and steelhead, in resident fish, and in invertebrates is negligible when TDG levels meet the 120 percent tailrace criteria.[77] And the percentage of fish afflicted with GBT does not exceed 1 percent until TDG levels surpass 120 percent.[78]

Accordingly, as was recognized by ODEQ in its January 2009 decision and its June 2009 formal modification of its TDG waiver, there is no scientific basis for limiting TDG in the forebays to 115 percent.[79]

In sum, salmon and steelhead will benefit from the removal of the 115 percent forebay limit. Other species, such as Pacific lamprey, may also benefit. Full consideration of the best available science and credible data from field studies reveals that the risk (if any) to other fish species and invertebrates is negligible. Removal of the forebay limit is necessary to comply with Ecology's obligation to

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[75] Moser, M.L., M.G. Mesa. 2009. Passage Considerations for Anadromous Lampreys. American Fisheries Society Symposium 72:115-124. page 120.
[76] Moser, M.L., M.G. Mesa. 2009. Passage Considerations for Anadromous Lampreys. American Fisheries Society Symposium. 72:115-124, at page 121.
[77] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002 at p. 53, citing analyses from the FPC GBT Monitoring Program, Ecology's *Evaluation of Total Dissolved Gas Criteria (TDG) Biological Effects Research*, NOAA Fisheries' *Washington and Oregon State – Adaptive Management Team Resident Fish Literature Review*, and the Don Weitkamp/Parametrix *Total Dissolved Gas Supersaturation Biological Effects, Review of Literature 1980-2007.*
[78] Ecology/ODEQ Evaluation at pp. 51-52.
[79] *Id*. at p. 61.

protect aquatic life in Washington's fresh surface waters.

III. FOREBAY MONITORS DO NOT PROVIDE CREDIBLE DATA NECESSARY FOR MONITORING COMPLIANCE WITH WATER QUALITY STANDARDS.

Ecology responded to SOS's June 2009 petition by stating that "difficulty in monitoring is not a valid reason to eliminate a criterion in the water quality standards."[80] While this may be an appropriate general rule, it does not apply here, where the inaccurate forebay TDG monitoring often reduces spill beneficial to salmon, while at the same time tailrace monitors provide credible data upon which the risks of spill may be monitored. Under these circumstances, forebay monitors should not be the limiting factor determining spill amount. Rather, because forebay monitors are unreliable, we ask Ecology to eliminate or amend the requirement for forebay monitoring at this time.

It is well documented that forebay monitoring is unreliable. As described in the joint Ecology/ODEQ Evaluation from January 2009, there is a long history of concern about the validity of data from forebay monitoring, particularly the Camas-Washougal gauge. In its 2000 BiOp, NMFS acknowledged the concerns over the adequacy of forebay monitors because of their tendency to produce thermally-induced and seemingly non-representative spiking of TDG. For this reason, that BiOp included a reasonable and prudent alternative (RPA 132) directing federal agencies to conduct a systematic review of the TDG monitoring stations in the forebays of all the mainstem Snake and Columbia River dams. Based on that review, the Corps concluded that routine spikes in daily water temperature were strongly associated with the daily spikes in TDG and subsequently relocated several of the forebay monitors to see if that would remedy the inaccuracies.[81]

The Fish Passage Center included an extensive review of the utility of forebay monitors in a 2006 memo evaluating spring spill in the FCRPS. As that memo relates in great detail, the Corps undertook a follow-up to its RPA 132 study to determine whether the relocation of the forebay monitors solved the problem. In the course of this study, it became clear that "forebay monitors do not accurately reflect the TDG of mixed waters and continue to be impacted by localized processes. Measures (relocation) taken under RPA 132 to assure that the forebay monitors were representative of mixed water at several of the projects did not achieve that objective."[82] FPC concluded in its 2006 evaluation that "[d]ownstream forebay monitors, as presently configured, are not indicative of the readings in a well-mixed water column due to the local influence of temperature, barometric pressure and biological processes."[83]

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[80] Department of Ecology. August 10th, 2009. Response to Petition for Rulemaking – Chapter 173-201a WAC – Water Quality Standards. See Response to Petition Issue 3.
[81] BiOp Measure 132 Final Report, December, 2004: "Total Dissolved Gas Forebay Fixed Monitoring Station Review and Evaluation for Lower Snake River Projects and McNary Dam, 2003-2004," http://www.nwd-wc.usace.army.mil/tmt/wq/studies/rpa132_20041230.pdf (last visited February 12, 2010).
[82] Fish Passage Center, Spring Spill 2006 Memorandum (Sept. 29, 2006) at p. 9.
[83] *Id*. at pp. 1-2.

The Ecology/ODEQ joint evaluation also acknowledges that the Camas-Washougal gauge is particularly suspect and cites to 2001 and 2004 USGS studies of the efficacy of that gauge. The evaluation notes that those studies found that daily variations of TDG were "probably due to the production of oxygen by aquatic plants and to water-temperature variations on warm, sunny days."[84]

As years of implementation and study demonstrate, monitoring data produced by the forebay monitors is not the kind of "credible data" that Ecology may rely on when it determines "whether any surface water of the state is supporting its designated use" because it is not "representative of water quality conditions at the time the data was collected." *See* RCW 90.48.580(2)(c); RCW 90.48.585(1)(b). Under these circumstances, Ecology must eliminate the requirement for forebay TDG monitoring.

IV. THE 115 PERCENT FOREBAY TDG LIMIT DOES NOT PROTECT THE MOST SENSITIVE DESIGNATED USE OF THE SNAKE AND COLUMBIA RIVERS: SALMONID HABITAT.

In response to SOS's June 2009 petition, Ecology stated that it was "not convinced that salmon are the most sensitive aquatic life in terms of effects from high TDG."[85] Ecology voiced concern over other aquatic life such as frogs, sturgeon larvae, fish, and daphnia at TDG levels of 115 percent and above. These concerns should be alleviated once Ecology considers the numerous field studies outlined in Section II of this petition. Additionally, SOS stresses that while all aquatic biota must be protected by water quality standards, the benefits and risks to an endangered *population* deserves greater weight than effects of TDG on *individuals* of healthy populations (even if the best science did not find those effects to be negligible at 120 percent TDG or less).

States adopting WQSs are required to designate uses for state waters and ensure that their WQSs "protect the designated use." 40 C.F.R. § 131.11(a)(1). When there are multiple use designations, the WQSs "shall support the most sensitive use." *Id.* Ecology has designated four uses for Washington's fresh surface waters. WAC 173-201A-200. The first of these designated uses – "aquatic life uses" – includes providing salmonid habitat and facilitating salmonid spawning, rearing, and migration. WAC 173-201A-200(1)(a)(ii)-(iv). In addition, Ecology designated "recreational uses," "water supply uses," and "miscellaneous uses." WAC 173-201A-200(2)-(4). The miscellaneous freshwater uses "are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics." WAC 173-201A-200(4). Power generation is not a designated use for Washington's fresh surface waters.

Despite proven benefits, spill has been limited in recent years in the spring and summer months in the Snake and Columbia Rivers in order to comply with the 115 percent forebay dissolved gas standard. As noted in our prior petitions, FPC

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[84] Water-Resources Investigations Report 01-4273, page 11 and Figure 13 on page 12, http://or.water.usgs.gov/pubs_dir/WRIR01-4273/index.html (last visited February 12, 2010).
[85] Department of Ecology. August 10th, 2009. Response to Petition for Rulemaking – Chapter 173-201a WAC – Water Quality Standards. See Response to Petition Issue 4.

conducted an extensive analysis of spring spill in 2006 for the eight FCRPS dams. That evaluation found that, primarily due to the Corps' actions to meet the forebay limits, spring spill was approximately 4.4 million acre feet ("MAF") less than would be expected under the Court's Order if TDG were not a constraint at all. Without the forebay gas caps and only the tailrace waiver at 120 percent, 4.1 MAF of this 4.4 MAF would have been spilled.[86] Thus the forebay gas caps play a dominant role in reducing spill for salmon survival.

The AMT's investigation of the matter went even farther, considering analyses by the Corps[87] and Bonneville Power Administration,[88] along with a new FPC examination.[89] The conclusions from those analyses varied widely, as did the assumptions that went into the different analyses. However, all agreed that there would be additional spill in the system if the forebay monitoring requirement were removed, ranging from the 1 percent to 60 percent increase predicted by FPC to an overall increase of just an average of 1.3 percent according to BPA. Additionally, there was basic agreement across the analyses that Little Goose, Lower Monumental, and Bonneville dams would see the greatest increase in spill if the 115 percent requirement were removed.

Ecology's claims regarding the additional protections afforded aquatic life by the 115 percent forebay standard are simply not supported by the science. In the first place, as noted in Section III above, downstream forebay monitor readings are not accurately gauging the effects of upstream spill, but are instead reflecting local conditions such as temperature and wind. Thus, basing actions to protect the most sensitive use – aquatic life – on TDG measurements that do not actually represent the conditions in the river makes no sense.

Likewise, Ecology's statements regarding the effects of TDG on aquatic life near the water surface are unfounded. We know from screen bypass data and tests of fish approaching dams with and without surface bypass and spill that nearly all juvenile salmon approach the dam in the forebay from depths in excess of one meter. For example, in extensive surface collector tests at Bonneville Dam, all juvenile fish (15,800 targets) from 17 meters out to the face of the dam were located with sonar equipment between 2.5 and 10 meters in depth.[90] At Lower Granite Dam, another study found that as fish approached the dam in the forebay, they tended to move to the center of the river at a deeper depth than upstream where they were found in shallower areas near shore. The study also noted that fish 100 feet upstream of the dam were found deeper in the water column in front of the spillbays than in front of

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[86] Fish Passage Center, Spring Spill 2006 Memorandum (Sept. 29, 2006) at p. 2-3.
[87] U.S. Army Corps of Engineers, Northwest Division, Report On the SYSTDG Modeling for AMT With and without 115% TDG standard (July 7, 2008).
[88] Bonneville Power Administration, HYDSIM Use in Analysis of Removing 115% TDG Forebay Gauge Requirements, BPA Report to the Adaptive Management Team – May 2008
[89] Fish Passage Center, Spill Volume Changes with Use of Tailrace Monitors (January 2008).
[90] Johnson, R.L., R.A. Moursund and M.A. Simmons. Fish behavior in front of the prototype surface collector at Bonneville Dam, 1998. Project No. 2877. Prepared for Portland Division, Corps of Engineers, by Pacific Northwest Laboratory, Richland, WA.

the powerhouse. Furthermore, most of the fish in the forebay were in the 5-15 meter depth range and few if any were in the 0-1 meter depth range.[91]

Regarding duration of exposure to TDG, Ecology's statement that "most aquatic life spends more of their time in the forebays"[92] is not fully accurate. In fact, some evidence indicates that dams with spill reduce forebay residence time and fish density. For example, one study found that yearling chinook residence time in the McNary Dam forebay was only 0.6 hours with spill and 2.6 hours without spill.[93] Another study found that during 64 percent spill, the mean forebay residence time was 0.1 hour; under 30 percent spill, the mean residence time was 1 hour. In short, with spill, residence time was only "fractions of an hour."[94]

A study at The Dalles Dam noted that forebay residence time was correlated with spill volume: the greater the spill, the lower the residence time for juvenile steelhead. The authors summarized the importance of reduced fish residence time in the forebay:

- Delay in emigration disrupts life history synchrony
- Delay causes fish fatigue from searching and milling which can lead to stress, which will increase the predation risk due to reduced predator avoidance fitness
- Increased residence time may attract predators to areas of high prey density[95]

Thus, in light of the abundant evidence that GBT is unlikely to occur if TDG levels stay below 120 percent in the tailrace and that the 115 percent forebay standard affords no additional protection, the spill that is being foregone due to the 115 percent standard is actually impeding salmon and steelhead survival. For this reason, the 115 percent forebay standard is unlawful because it interferes with the most sensitive designated use of Washington's fresh surface water: habitat for salmonids. Furthermore, the 115 percent forebay TDG exemption is simply not based on sound science. Accordingly, Ecology should amend the exemption to its water quality standards to remove the 115 percent forebay gas cap.

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[91] Adams, N.S., D.W. Rondorf , E.E. Kopfoot, M.J. Banach and M.A. Tuell. Migration characteristics of juvenile salmon and steelhead in the forebay of Lower Granite Dam relative to 1996 surface bypass collector tests. Project No. E 86930151 to Walla Walla District Corps of Engineers, by USGS and Nez Perce Tribe. Cook, WA, 1997.

[92] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002 at p. 60.

[93] Axel, G.A., E.E. Hockersmith, M.B. Eppard and B.P. Sandford. 2004. Passage and survival of hatchery yearling Chinook salmon at McNary Dam, 2003. Contract W68SBV92844866 to Walla Walla District Corps of Engineers, by Fish Ecology Division, Northwest Fisheries Science Center, NOAA Fisheries. Seattle, WA.

[94] Allen, M.B and eight co-authors. 1999. Movement, distribution, and behavior of radio-tagged yearling and subyearling salmon in the tailrace of The Dalles Dam, 1999. Report to Portland District, Corps of Engineers, by USGS, Cook WA.

[95] Ploskey, G., T. Poe, A.Giorgi and G. Johnson. 2001. Synthesis of hydroacoustic, radio telemetry and survival studies of juvenile salmon at The Dalles Dam (1982-2000). Contract with Portland District, Corps of Engineers and Pacific Northwest Laboratory, Portland, OR, and Richland, WA.

V. ECOLOGY SHOULD AMEND WAC 173-201A-200(1)(F)(II) TO REMEDY ITS VIOLATIONS OF FEDERAL AND STATE LAW.

Ecology should delete the requirement that TDG be monitored in the forebays. This amendment would not only allow for spill to maximize, to the extent possible, salmon and steelhead survival through the hydrosystem, but it would also eliminate a monitoring approach that is well documented as being unreliable. Alternatively, Ecology should increase the forebay TDG limit to 120 percent.

Oregon's Department of Environmental Quality considered the same evidence as Ecology and came to the conclusion that "the removal of the forebay monitoring requirement will not cause excessive harm to the beneficial use, aquatic species in the Columbia River, during fish passage spill season."[96] Based on that conclusion, ODEQ has removed the requirement for the use of forebay monitors as of 2009.[97]

Ecology, on the other hand, did not dispute the science, but instead determined that the benefits to salmon from changing its water quality standards was outweighed by the complexity of the process for making that change in Washington State law.[98] Nothing in the Clean Water Act or Washington law suggests that administrative convenience is a sufficient rationale for retaining a water quality standard that is harmful to beneficial uses. In addition, notwithstanding its finding that 120 percent TDG level in the tailrace "does allow for additional spill that benefits salmon," Ecology declined to change its 115 percent forebay standard because it placed weight on its inaccurate belief that there is a risk of "detrimental effects on aquatic life near the surface when TDG" exceeds 115 percent in the forebays and "approaches 120 percent."[99] But Ecology has not pointed to any specific evidence it relied on to make this finding, how it weighed or combined this evidence with other evidence, or why it found this line of evidence more compelling than another.[100] Nor has it addressed the contrary evidence regarding near-surface use of water in the forebays by salmon discussed above. Washington State's Administrative Procedure Act prohibits the agency from relying upon such unexplained statements.[101]

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[96] Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers; Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. 2009. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. Publication No. 09-10-002at p. 61.

[97] *Id.* at 62. ("Based on these consultations and the findings and conclusions described in this document, the Department proposes to remove the requirement for the use of forebay monitors in 2009.") That proposal was adopted by the Oregon Environmental Quality Commission on June 18, 2009.

[98] *Id.* at 61. (reciting the requirements that may be triggered by a rule change, including state environmental policy act review and approval by EPA, and summarily concluding that "Ecology does not believe the overall benefits of additional spill versus additional risk of gas bubble trauma are clear and are sufficient for a rule revision.")

[99] *Id.* at 60.

[100] Indeed, Ecology offered only an unsupported assertion that the "evidence from available scientific studies *clearly* points" to the conclusion that TDG levels approaching 120 percent risk harm to aquatic life near the surface. *Id.* (emphasis added).

[101] *See* RCW 34.05.570.

Ecology's failure to follow the science and change its standards will limit spill at the dams and further harm the designated beneficial use of salmon migration in these rivers. In addition, the spill limitations pursuant to the decision not to modify or eliminate the forebay standards will increase fish residence time, which will increase TDG exposure and may actually cause fish to occupy higher portions of the water column where they will be more affected by TDG.

Ecology's refusal to revise its standards also threatens to undermine ODEQ's more protective waiver that eliminates the forebay monitoring requirement. Unless and until Ecology changes Washington's standards, the Corps apparently will seek to abide by the lowest common denominator in Washington's standards, rather than the more protective standard contained in Oregon's waiver.[102] This will result in the undermining of Oregon's decision and continue to deprive these threatened and endangered fish of spill levels that would increase their survival, though there is no adequate basis for doing so.[103]

Ecology should therefore either abandon altogether the counterproductive requirement that TDG be monitored in the forebay or it should increase the forebay limit to 120 percent. Petitioner proposes the following amendments to WAC 173-201A-200(1)(f)(ii):

Preferred amendment proposal:

The TDG criteria may be adjusted to aid fish passage over hydroelectric dams when consistent with a department approved gas abatement plan. This plan must be accompanied by fisheries management and physical and biological monitoring plans. The elevated TDG levels are intended to allow increased fish passage without causing more harm to fish populations than caused by turbine fish passage. The following special fish passage exemptions for the Snake and Columbia rivers apply when spilling water at dams is necessary to aid fish passage:

- TDG must not exceed an average of ~~one hundred fifteen percent as measured in the forebays of the next downstream dams and must not exceed an average of~~ one hundred twenty percent as measured in the tailraces of each dam (these averages are measured as an average of the twelve highest consecutive hourly readings in any one day, relative to atmospheric pressure); and
- A maximum TDG one hour average of one hundred twenty-five percent must not be exceeded during spillage for fish passage.

Alternative amendment proposal:

The TDG criteria may be adjusted to aid fish passage over

[102] *See* 2009 Summer Fish Operations Plan. June 2, 2009. attached as Exhibit A.
[103] *See Arkansas v. Oklahoma*, 503 U.S. 91, 105. 1992. (reviewing regulations that prohibit issuing pollution permits that "'cannot ensure compliance with the applicable water quality requirements of all affected States'").

hydroelectric dams when consistent with a department approved gas abatement plan. This plan must be accompanied by fisheries management and physical and biological monitoring plans. The elevated TDG levels are intended to allow increased fish passage without causing more harm to fish populations than caused by turbine fish passage. The following special fish passage exemptions for the Snake and Columbia rivers apply when spilling water at dams is necessary to aid fish passage:

- TDG must not exceed an average of one hundred ~~fifteen~~ *twenty* percent as measured in the forebays of the next downstream dams and must not exceed an average of one hundred twenty percent as measured in the tailraces of each dam (these averages are measured as an average of the twelve highest consecutive hourly readings in any one day, relative to atmospheric pressure); and
- A maximum TDG one hour average of one hundred twenty-five percent must not be exceeded during spillage for fish passage.

*The stricken text indicates suggested deletions from the current regulation. The italicized text indicates suggested additions to the current regulation.

CONCLUSION

It is well documented that voluntarily spilling water over the dams on the Snake and Columbia Rivers benefits salmonids. While spill can pose a risk to salmonids if TDG levels are too high, biological monitoring conducted over the last decade and more demonstrates the minimal negative impact to migrating salmonids, resident fish, and invertebrates when TDG levels are at 120 percent. On the other hand, setting TDG standards at levels below 120 percent unnecessarily and illegally limits the benefits of spill for these fish and degrades and diminishes a beneficial use of the Snake and Columbia Rivers. Therefore, it is counter to the science and the requirements of the CWA and Washington law for Ecology to limit forebay TDG in the Snake and Columbia Rivers to 115 percent.

For the above reasons, SOS hereby petitions Ecology to promptly amend WAC 173-201A-200(1)(f)(ii) by either deleting the forebay monitoring requirement or, at the very least, setting both forebay and tailrace TDG standards to 120 percent so that these revised standards can be adopted and in place before the 2010 juvenile salmon migration season begins. SOS would also request that this change be made on an emergency basis for 2010 if a complete rule amendment process cannot be completed before the commencement of the spring migration and spill season on or about April 10, 2010.

Sincerely,

Nicole Cordan *

R. Nicole Cordan, Policy and Legal Director
Save Our Wild Salmon

* PER TELEPHONE AUTHORIZATION

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EXHIBIT A

CENWD-PDD June 2, 2009

2009 Summer Fish Operations Plan

BACKGROUND

The 2009 Summer Fish Operations Plan (FOP) describes the U.S. Army Corps of Engineers (Corps) planned operations for fish passage at its mainstem Federal Columbia River Power System (FCRPS) dams during the 2009 summer fish migration season. The 2009 Summer FOP is consistent with the adaptive management provisions in the 2008 NOAA Fisheries FCRPS Biological Opinion (2008 BiOp) and the Corps' Record of Consultation and Statement of Decision (ROCASOD) adopting the project operations contained in the 2008 BiOp and the Columbia Basin Fish Accords (Accords).

As in 2008, the 2009 Summer FOP incorporates planned operational adjustments necessary to perform essential research, and to accommodate the adjustment of surface bypass structures or other features for the 2009 summer migration season. The FCRPS water management and project operations not specifically addressed in this 2009 Summer FOP are consistent with the 2008 BiOp and other operative documents including the 2009 Water Management Plan (WMP), seasonal WMP updates, and the 2009 Fish Passage Plan (FPP). As in 2008, operations may be adjusted through coordination with regional sovereigns.

The following sections describe: factors that influence management of fish operations during various runoff conditions, including TDG management, spillway operations, and minimum generation; specific summer operations for fish passage at each mainstem project; the juvenile fish transportation program operations; protocols for emergencies; coordination with the region; and, monthly reporting.

GENERAL CONSIDERATIONS FOR FISH OPERATIONS

For planning purposes, the Corps' 2009 Summer FOP spill levels, summarized in Table A below, assume "average" run-off conditions. However, because actual run-off conditions vary in timing and shape and may be higher or lower than average, adjustments in spill levels (kcfs discharge rates, spill percentages, or spill caps) will be adaptively managed in-season as needed to avoid or minimize poor juvenile or adult fish passage conditions, navigation safety concerns, or to accommodate powerhouse or transmission constraints. Actual spill levels may be adaptively managed from those displayed in the table below for research or other conditions and will be coordinated through the Technical Management Team (TMT) or other appropriate regional forum. Such conditions are discussed in more detail below.

Management of Spill for Fish Passage

The Corps will continue to manage spill for fish passage to avoid exceeding 120% in the project tailrace, and 115% in the forebay of the next project downstream consistent with the current State of Washington total dissolved gas (TDG) saturation upper limits.[1] These levels are referred to as "gas caps." The project maximum flow rate or spill discharge level that meets but does not exceed the gas caps, is referred to as the "spill cap." The gas caps are constant, whereas, spill caps may vary daily depending on flow, temperature, and other environmental conditions.

As noted above, the spill rates presented in Table A are the planned summer spill operations and assume average runoff conditions; however, adjustments to these spill rates may be necessary for the following reasons:

1. high runoff conditions where flows exceed the powerhouse hydraulic capacity with the specified spill rates;
2. navigation safety concerns;
3. generation unit outages that reduce powerhouse capacity;
4. power system or other emergencies that reduce powerhouse discharges; and,
5. a lack of power demand resulting in an increase in the rate of spill.

Spill below the specified rates could also occur during low runoff conditions when meeting minimum generation levels at a project requires reducing spill rates. This would most likely occur in July and August. Minimum generation and spill rates are included below in the project specific information.

The Corps' Reservoir Control Center (RCC) is responsible for daily management of TDG responsive to changing conditions. In order to manage gas cap spill rates consistent with the States' TDG saturation limits, RCC establishes the spill caps for each project on the lower Columbia and Snake rivers on a daily basis throughout the fish passage season. These spill caps are set so that resultant TDG percent saturation levels are not expected to exceed the 120%/115% TDG limits, measured as the average of the highest 12 hourly readings each day.

Within any given day, some hours of measured TDG levels may be higher or lower than the gas caps due to changing environmental conditions (wind, air temperature, etc.). The process of establishing daily spill caps entails reviewing existing hourly data at each dam (including flow, spill, temperature, and TDG levels) and taking into consideration a number of forecast conditions (including total flow, flow through the powerhouse, wind and temperature forecast, etc.). This information is used as input into the System TDG (SYSTDG) modeling tool. The SYSTDG model estimates TDG levels in the rivers several days into the future, and is a tool integral to daily decision-making when establishing spill caps at individual dams.

[1] In February 2009, the State of Oregon modified its waiver for 2009 to remove the 115% forebay TDG limit. However, the Corps will continue to manage to 120% and 115% limits (the Washington TDG standard) in 2009.

Spill caps set by RCC in daily spill priority requests will be met at the projects by using the spill pattern in the appropriate FPP spill table which most closely corresponds to the requested spill (i.e. may be slightly over or under). During the freshet when flows are often expected to be greater than hydraulic capacity with the specified spill rates at the dams, or if a lack of power load results in an increase in the spill rate, the Corps will attempt to minimize TDG on a system-wide basis. In this case, spill caps are also developed for 125%, 130%, or 135% saturation to minimize TDG throughout the system.

In accordance with the 2009 Spring FOP, spring spill operations commenced on April 3 at 0001 hours for the Corps' lower Snake projects and on April 10 at 0001 hours for the lower Columbia projects. Spill caps have been established at the specified amounts and will continue unless conditions require changing to maintain TDG within the upper limits of 120% in the tailwater of a dam and 115% in the forebay of the next project downstream (and at Camas/Washougal). Spill will transition to summer levels at 2359 hours, or shortly before midnight, at each project just prior to the summer start dates specified.

Operations to manage TDG will continue to be coordinated through the TMT.

Spillway Operations

The Action Agencies will meet the specified spill levels to the extent feasible; however, actual hourly spill quantities at dams will be slightly greater or less than specified in Table A below. Actual spill levels depend on the precision of spill gate settings, flow variations in real time, varying project head (the elevation difference between a project's forebay and tailwater), automatic load following, and other factors.

Operational Considerations:

- Spill discharge rates: Due to limits in the precision of spill gates and control devices, short term flow variations, and head changes, it is not possible to discharge exactly the spill rates stated in Table A, or as stated in RCC spill requests (teletypes) to projects that call for specific spill discharges. Therefore, spillway gates are opened to the settings in FPP spill pattern tables, which provide discharges that are the closest to the spill discharge rates. The spill rates in Table A coincide with specific gate settings in the FPP spill tables. Actual spill may be higher or lower than the identified spill rate due to low flow conditions, periods of minimum generation, TDG spill cap limitations on spill amounts, spill curtailment for navigation safety, and other circumstances.

- Spill percentages: Spill percentages are considered target spill levels. The project control room operator and BPA duty scheduler calculate spill rates to attempt to be within +/- 1% of the target percentage for the following hour (or +/- 1.5% at Little Goose Dam when flows are less than 30 kcfs). These percentages may not be attained due to low flow conditions, periods of minimum generation, TDG spill cap

limitations on spill amounts, spill curtailment for navigation safety, and other circumstances. Operators and schedulers will review the percentages achieved during the day and adjust spill rates in later hours, with the objective of ending the day with a day average spill that achieves the target.

Minimum Generation

The Corps has identified minimum generation flow values derived from FPP tables which specify turbine operation within the 1% of best efficiency range. These values are approximations and do not account for varying head or other small adjustments that may result in variations in the reported minimum generation flow and spill amount. Conditions that may result in minor variations include:

1. Varying pool elevation: as reservoirs fluctuate within the operating range, flow rates through the generating unit change.
2. Generating unit governor "dead band": the governor controls the number of megawatts the unit should generate and cannot precisely control a unit; variations can be +/- 1% to 2% of generation.
3. System disturbances: once the generator is online and connected to the grid, it responds to changes in system voltage and frequency. These changes may cause the unit to increase flow and generation slightly within an hour.
4. Individual units may operate slightly differently or have unit specific constraints.
5. Generation control systems regulate megawatts (MW) generation only, and not flow through turbines.

All of the lower Snake River powerhouses may be required to keep one generating unit on line at all times for power system reliability, which may result in a reduction of spill at that project. During low flows, one generator runs at the lower end of the 1% of best efficiency range. All of the Snake River plants have two “families” of turbines with slightly different capacities. In most cases one of the smaller units, with somewhat less generation and flow, will be online during these times. The smaller units are generally numbered 1 – 3 and are the first priority for operation during the fish passage season. An exception to this is at Ice Harbor Dam, where the unit priority list has been modified to accommodate the transformer bank outage at Sacajawea. Also, if smaller units are unavailable, one of the larger units may be used. Further, at Lower Monumental, generating unit 1, which is the first priority unit during fish passage, was damaged, then welded in a fixed blade configuration. Consequently the unit cannot operate at the low end of the design range. In addition, Ice Harbor units cannot be operated at the lower end of the 1% of best efficiency range. These units experience cavitation at a generation level somewhat higher than the lower 1% limit, which damages the turbine and can be detrimental to fish. Therefore, Ice Harbor units will operate at their lower cavitation limits. Minimum generation flows are 50 kcfs at McNary, John Day and The Dalles and 30 kcfs at Bonneville.

Low Flow Operations

Low flow operations at lower Snake River projects are triggered when inflow is not sufficient to provide for both minimum generation and the planned spill levels. In these situations, the projects will operate one unit at minimum generation and spill the remainder of flow coming into the project. As flows transition from higher flows to lower flows, there may be situations when flows recede at a higher rate than forecasted. In addition, inflows provided by nonfederal projects upstream are variable and uncertain. The combination of these factors may result in instances where unanticipated changes to inflow result in forebay elevations dropping to the low end of the Minimum Operating Pool (MOP). Since these projects have limited operating flexibility, maintaining minimum generation and the target spill may not be possible on every hour.

During low flow conditions, when the navigation lock is being emptied, the total spill remains unchanged but the spill stated as a percent of total flow may be temporarily reduced below the target spill percentage. This occurs because the volume of water needed to empty the navigation lock during periods of low flow is a greater percentage of the total flow than when flows are higher.

At Little Goose Dam, when day average flows in the lower Snake River are below about 40 kcfs, achieving 30% spill requires changing turbine operations between 2 units at the low end of the 1% of best efficiency range and one unit at the high end of the 1% range. This operation is incompatible with the more constant discharge upstream at Lower Granite Dam. It is also difficult to meet the constant FOP spill level downstream at Lower Monumental Dam. The unsteady flow at Little Goose also impacts that project's reservoir operation and can cause inadequate navigation depths at the downstream sill of the Lower Granite navigation lock. In 2008, through coordination with TMT during these low flow periods, Little Goose spill changed from the 30% level in the FOP to a flat spill pattern of approximately 11 kcfs to smooth out Little Goose discharges, meet Lower Monumental spill levels, and maintain the MOP operating range at Little Goose. A similar operation, modified as necessary to consider configuration or operational changes such as spillway weir and turbine unit 1 operations, will be implemented in 2009 if needed during low flow periods, in coordination with TMT.

Operations during Rapid Load Changes

Project operations during hours in which load and/or intermittent generation changes rapidly may result in not meeting planned hourly spill level because projects must be available to respond to within-hour load variability to satisfy North American Electric Reliability Council (NERC) reserve requirements ("on response"). This usually occurs at McNary, John Day and The Dalles dams. In addition to within-hour load variability, projects on response must be able to respond to within hour changes that result from intermittent generation (such as wind generation). During periods of rapidly changing loads and intermittent generation, projects on response may have significant changes in turbine discharge within the hour while the spill quantity remains the same within the hour. Under normal conditions, within-hour load changes occur mostly on hours

immediately preceding and after the peak load hours, however, within-hour changes in intermittent generation can occur at any hour of the day. Due to the high variability of within-hour load and intermittent generation, these load swing hours may have a greater instance of reporting actual spill percentages that vary more than the +/- 1% requirement than other hours.

Turbine Unit Testing around Maintenance Outages

Turbine units may be operationally tested for up to 30 minutes by running the unit at speed no load and various loads within the 1% of best efficiency range to allow pre-maintenance measurements and testing and to allow all fish to move through the unit. Units may be operationally tested after maintenance or repair efforts but before a unit comes out of a maintenance or forced outage status. Operational testing may consist of running the unit for up to 30 minutes before it is returned to operational status. Operational testing of a unit under maintenance is in addition to a unit in run status (e.g. minimum generation) required for power plant reliability. Operational testing may deviate from unit operating priorities and may use water that would otherwise be used for spill if the running unit for reliability is at the bottom of the 1% of best efficiency range. Water will be used from the powerhouse allocation if possible, and water diverted from spill for operational testing will be minimized. The Corps will coordinate this testing with the region through the Fish Passage Operations and Maintenance Coordination Team (FPOM).

Navigation Safety

Short-term adjustments in spill may be required for navigation safety, primarily at the lower Snake projects but may also be necessary at the lower Columbia projects. This may include changes in spill patterns, reductions in spill discharge rates, or short-term spill stoppages. In addition, adjustments to pool elevation in the Little Goose pool of up to 1.0 foot above the MOP operating range may be necessary to accommodate safe navigation at Lower Granite Dam during periods of low flow (approximately 40 kcfs or less). These adjustments may be necessary for both commercial tows and fish barges.

2009 SUMMER SPILL OPERATIONS

Lower Snake River Projects

Summer spill will begin on June 21 at Lower Granite, Little Goose, and Ice Harbor dams. However, at Lower Monumental Dam, fish run timing and research schedules may require transitioning to summer spill earlier than June 21. Such changes will be coordinated through TMT. Summer spill will occur through August 31, 2009 at all four lower Snake River projects. Summer spill levels are shown in Table A.

Lower Columbia River Projects

Summer spill will begin July 1 at John Day and The Dalles dams, and will begin June 21 at Bonneville Dam. However, at McNary Dam, fish run timing and research schedules may require transitioning to summer spill earlier than July 1. Such changes will be coordinated through TMT. Summer spill will occur through August 31, 2009 at all four projects. Summer spill levels are shown in Table A.

Table A. Summary of 2009 summer spill levels at lower Snake and Columbia River projects.[2]

Project	Planned Operations for Summer 2009 (Day / Night)	Comments
Lower Granite	**18 kcfs / 18 kcfs**	Same as 2008
Little Goose	**30% / 30%**	Same as 2008
Lower Monumental	**17 kcfs / 17 kcfs**	Same as 2008
Ice Harbor	**45 kcfs / gas cap on non-test days; 30% / 30% or 45 kcfs / gas cap on test days**	Same as 2008
McNary	**40% / 40% or 60% / 60%**	Same as 2008
John Day	**30% / 30% on non-test days; 30% / 30% or 40% / 40% on test days**	Same as 2008
The Dalles	**40% / 40%**	Same as 2008
Bonneville	**85 or 75 kcfs day / gas cap night** (85 kcfs day through July 20, then 75 kcfs day through August 31)	Same as 2008

SUMMER FISH OPERATIONS BY PROJECT

The following describes the 2009 summer spill operations for each project. Included in the description are planned research activities identified in the 2008 BiOp. The Corps, regional agencies, and Tribes are interested in the continuation of project research studies under the Corps' Anadromous Fish Evaluation Program (AFEP). The 2009 studies have been through the annual AFEP review process with the regional agencies and Tribes, with the study designs being finalized in an interagency meeting held on January 15, 2009. The studies are intended to provide further information on project survival and

[2] Table A displays in summary form the planned summer spill operations. More specific detail governing project operations is in the section entitled "Summer Fish Operations By Project."

assist the region in making decisions on future operations and configuration actions to improve fish passage and survival at the lower Snake and Columbia River dams.

Lower Granite

Summer Spill Operations June 21 through August 31, 2009: 18 kcfs (including approximately 6 kcfs from the RSW and 12 kcfs from training spill) 24 hours per day. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Summer research operations: Normal summer spill patterns and rates as described in the FPP will be used. An alternate (bulk) spill pattern may be used at Lower Granite in summer, as discussed and recommended at the April 2009 FFDRWG meeting. This pattern was evaluated in 2006 and 2007 and will have the same spill level as the FPP spill pattern. There will be no specific spill level variations for testing.

Operational Considerations:

- Lack of power load or unexpected unit outages could cause involuntary spill at higher total river discharges that could result in exceeding the gas cap limits.
- During high flow periods when involuntary spill occurs, there may be periods where certain spill levels create hydraulic conditions that are unsafe for fish barges crossing the tailrace and/or while moored at fish loading facilities. If such runoff conditions occur, spill may be reduced temporarily when fish transport barges approach or leave the barge dock or are moored at loading facilities. If conditions warrant a spill reduction, the MOP elevation range at Lower Granite will be exceeded temporarily to enable the barge to exit the tailrace safely.
- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such low runoff conditions occur, alternative spill operations at the dam will be coordinated through the TMT.
- Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% of best efficiency range and is needed for power system reliability. This operation will result in individual turbine flows of approximately 11.3 kcfs – 13.1 kcfs at units 1 – 3 and 13.5 kcfs - 14.5 kcfs at units 4 - 6. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This condition may occur in early spring before the freshet and during the late summer period with low flow conditions.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.

Little Goose

Summer Spill Operations June 21 – August 31, 2009: 30% spill 24 hours per day. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Juvenile passage will be studied throughout the summer spill period.
- Summer research operations: 30% spill 24 hour/day. The spill pattern used in the spring will be continued in the summer. Final test conditions will be coordinated through FPOM and/or Studies Review Work Group (SRWG).
- Objectives of the biological test: The goals of this study include: (1) Determine the timing and route of passage for subyearling Chinook salmon relative to spillway weir spill and powerhouse operations; (2) Estimate route-specific and overall concrete survival of sub-yearling Chinook; (3) Determine the effects of spillway weir operation and associated training spill, as well as powerhouse operations, on smolt approach paths in the forebay of Little Goose Dam; (4) Estimate survival (concrete) as the first year to determine if BiOp performance standards are being met with the tested configuration and operation.
- Spill pattern during the biological test: The test spill patterns have been developed through ERDC modeling and in coordination with FPOM and/or SRWG.

Operational Considerations:

- Day average flows in the lower Snake River below about 40 kcfs can result in incompatible operations with Lower Monumental Dam and cause spill quantity fluctuations. Little Goose operations to resolve this issue are described in the Low Flow Operations section above (page 5).
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.
- Turbine Unit 1 Operation: For 2009, a new more limited operating range is set within the GDACS program for Little Goose Dam to restrict Turbine Unit 1 operation to approximately the upper 25% of the 1% of best efficiency range (about 16 kcfs). This will ensure a strong flow along the south shore to counter the strong eddy that forms during certain spill conditions. A strong south shore current is important for both adult fish passage and juvenile fish egress. Special turbine operations are expected to continue through the spring and summer spill periods until river flow can support only one operating turbine unit. Once low flow conditions occur, the full 1% of best efficiency range will be restored, to minimize impacts on spill levels.
- Minimum spill: During periods of low flow before the spring freshet and during the late summer period, there may be periods where spill quantities are so low that it creates tailrace conditions not advantageous to fish passage. If such flow conditions occur, alternative operations at the dam will be coordinated through the TMT.

- Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% efficiency range and is needed for power system reliability. This should result in individual turbine flows of 11.3 kcfs – 13.1 kcfs at units 1 – 3 and 11.5 kcfs – 14.5 kcfs at units 4 – 6. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This situation may occur in early spring before the freshet and during the late summer period with low flow conditions.

Lower Monumental

Summer Spill Operations Approximately June 21 – August 31, 2009: Spill 17 kcfs 24 hours per day (subject to 120%/115% TDG spill cap limits) with the RSW operating. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Summer testing will begin approximately June 21 or earlier, and lasting until mid-July. The dates of testing will be dependent on the availability of subyearling fall Chinook of sufficient size for tagging. Final dates for testing will be coordinated through FPOM and/or SRWG.
- Summer research operations: 17 kcfs 24 hours per day with one spill pattern treatment. The spill pattern will be the pattern used in 2008 and coordinated through FPOM and/or SRWG.
- Objectives of the biological test: Estimate passage distribution, survival, forebay retention, tailrace egress, and vertical distribution of fish passing over the RSW for subyearling fall Chinook under one spill pattern. Estimate survival (concrete) to determine if BiOp performance standards are being met with the tested configuration and operation.
- Spill pattern during the biological test: The 2008 FPP spill pattern will be used for summer testing.

Operational Considerations:

- Daily average flows near 30 kcfs results in incompatible operations with Little Goose Dam and results in spill quantity fluctuation.
- As in the spring, the amount of water spilled in the summer at Little Goose may affect the Lower Monumental spill volume (due to elevated TDG levels).
- Transit of the juvenile fish barge across the Lower Monumental tailrace, then docking at and disembarking from the fish collection facility, may require the level of spill to be reduced due to safety concerns. The towboat captain may request that spill be reduced or eliminated during transit. During juvenile fish loading operations, spill is typically reduced to 15 kcfs, but can be reduced further if needed for safety reasons. Loading periods can take up to 3.5 hours. Because of the time needed to complete loading at Lower Monumental, the Little Goose Project personnel will notify the Lower Monumental personnel when the fish barge departs from Little Goose. This ensures that BPA scheduling is provided advance notice for spill control at Lower

Monumental Dam. Reducing spill may cause Lower Monumental to briefly operate outside of MOP conditions.

- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods when spill quantities are limited so that tailrace conditions are not advantageous to fish passage. This condition is interpreted to be a minimum spill level provided through the spillway weir only (approximately 6.8 kcfs with the reservoir operating at MOP). If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% of best efficiency range and is needed for power system reliability. This will result in individual turbine flows of approximately 11.3 kcfs – 13.1 kcfs for units 2 and 3 and 13.5 kcfs – 14.5 kcfs for units 4 – 6 and 16.5 kcfs – 19.5 kcfs for unit 1. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This limit may occur in early spring before the freshet and during the late summer period with low flow conditions.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.

Ice Harbor

Summer Spill Operations June 21 – August 31, 2009: Spill 30% 24 hours per day or 45 kcfs day / spill cap night; then 45 kcfs day / spill cap night after the end of the test, with the RSW operating. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Summer research operations: Spill patterns will be verified and coordinated through FPOM and/or SRWG. Radio tagged fish will be monitored for passage route and survival.
- Objectives of the biological test: The objectives of the test are to determine passage routes and estimate route-specific and concrete survival under the two spill conditions for subyearling Chinook.
- Spill pattern during the biological test: Spill patterns will be verified and coordinated through FPOM and/or SRWG.

Operational Considerations:

- Minimum generation or higher powerhouse operation will occur at all times during the 2009 summer fish spill season, until repairs are complete at BPA's Sacajawea transmission facility near the project. Mobile capacitor groups remain in use at BPA's Franklin transmission facility to partially resolve power system issues. In addition, continuous generation is required at Ice Harbor Dam for power system stability and reliability. Normal unit operating priorities will be re-established when the Sacajawea transformer is returned to service, expected in July 2009.

- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. The minimum spill for Ice Harbor Dam is 15.2 kcfs, which includes providing spill through the RSW and training spill to ensure good tailrace egress conditions. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: The minimum generation amount represents the operation of one unit at the lower cavitation limit. The cavitation limit is within the 1% of best efficiency range. This will result in individual turbine flows of approximately 8.5 kcfs – 11.5 kcfs at units 1 – 3 and 10.8 kcfs – 13.8 kcfs at units 4 – 6. Unit 2 has been modified by fixing the blades in a single position to eliminate an oil leak. As a result, its MW output and kcfs discharge at the low end of 1% will be higher than the other 5 units. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This limit may occur in early spring before the freshet and during the late summer period with low flow conditions.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.

McNary

Summer Spill Operations Approximately July 1 through August 31, 2009: 40% or 60% spill 24 hours per day, in two day blocks throughout the summer spill period. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately early June through August 3. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.
- Summer research operations: 40% or 60% spill 24 hours per day. Continue to evaluate spillway weir performance by changing the configuration to optimize the spillway and reduce navigation issues. Each test spill level will occur for two days in a randomized block test design, throughout the period. Two spillway weirs will be in place during the test, located at spill bays 4 and 20.
- Objectives of the biological test:
    - Estimate passage and survival rates of subyearling fall Chinook salmon under two treatments.
    - Characterize subyearling fall Chinook behavior in the forebay of McNary Dam under two treatments.
- Spill pattern during the biological test: Spill patterns have been identified using the general model at ERDC by USACE Walla Walla District staff and representatives of the regional fisheries agencies and tribes. Test spill patterns are modifications of the

2003-2005 flat pattern and the 2008 test pattern to accommodate the new placement of the spillway weirs.

- After the study is complete, about August 3, the spillway weir in spill bay 4 will be removed. The spillway weir in spill bay 20 will remain in place. The project will return to the 2008 summer spill pattern. Spill schedule and configuration will be determined in coordination with FFDRWG and TMT. The spill schedule will consider fish passage, power system needs, and changing flow conditions.

Operational Considerations:

- Spillway weir 1 (relocated from spill bay 19) is located in spill bay 4. Spillway weir 2 remains in spill bay 20.
- During the periods when total river discharge exceeds approximately 320 kcfs, involuntary spill in excess of the States' TDG limits for fish passage may occur.
- In addition, low power demand may also necessitate involuntary spill during any given spill treatment.
- Spill will be curtailed as needed to allow safe operation of fish transportation barges near collection facilities downstream of the project. Spill changes will be minimized in order to reduce effects on spill research. Specifically, the spillway, including spillway weirs in spill bays 4 and 20, will be closed while barges are crossing the tailrace (15 – 30 minutes per crossing). Gate hoists at spill bays 4 and 20 are modified to allow closure with spillway weirs in place.
- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- If total river discharge drops below about 90 kcfs, 40% spill treatments may be reduced to maintain 50 kcfs powerhouse discharge for minimum generation. Similarly, if total river discharge drops below about 135 kcfs, 60% spill treatments may be reduced to maintain a 50 kcfs powerhouse discharge.
- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.

John Day

Summer Spill Operations July 1 – August 31, 2009: 30% or 40% spill 24 hours per day, then 30% spill 24 hours per day after the summer test. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately early June to July 20. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.
- Summer research operations: If planned abatement measures are successful at reducing avian predation in the tailrace of John Day Dam, a repeat of the 2008 spillway weir test will be conducted. Two training spill percentages, 30% and 40% 24 hours per day, will be tested. If avian predation in the tailrace is at an unacceptably high level, to be determined during a May 21 SRWG meeting, spill will revert to the 2008 FPP summer pattern which is 30%, 24 hours per day. The two spillway weirs will be shut off to accommodate this, and a north bulked pattern will use spill bays 1-14.
- Objectives of the biological test: The objectives of the study are to assess passage distribution and efficiency metrics, forebay retention, tailrace egress, and survival for subyearling fall Chinook.
- Spill pattern during the biological test: Spill patterns for 30% and 40% spill have been developed at ERDC in coordination with regional agencies. These patterns are included in the FPP. From approximately early June to July 20, 30% spill versus 40% spill will be evaluated. Pending the outcome of the May 21 SRWG meeting, either spill patterns described in the 2008 FPP or the 30% spillway weir pattern will be used from the conclusion of the spillway weir test to the end of spill (approximately July 20 – August 31).

Operational Considerations:

- Wire lines in the avian wire array across the tailrace need to be replaced. A full spillway outage is required to accomplish the work. The Corps is coordinating with the region to stop spill during daylight hours for one or more days to repair the array. The outage is being considered for early June between spring and summer fish outmigration periods, and prior to the start of the summer spillway weir test.
- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.

- Unit outages and spill outages may be required to repair research equipment. These will be coordinated through FPOM and TMT.
- If river flows drop below about 75 kcfs then spill may need to drop below 30% spill in order to maintain station service and power system needs.

The Dalles

Summer Spill Operations July 1 – August 31, 2009: 40% spill 24 hours per day. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Spill pattern during the biological test: No research is planned for 2009. The FPP spill patterns will be used.

Operational Considerations:

- When high river flows are such that available spill bays 1 – 6 cannot maintain 40% spill (when spill exceeds 162 kcfs), FPOM and TMT will discuss the preferred spill pattern and rate. The project may maintain 40% spill of the total river flow and depart from the spill pattern, or spill less than 40% of the total river flow using a pattern other than that shown in the FPP.
- Spill bays 10, 11, 13, 16, 18, and 19 are not operational due to wire rope and structural concerns. Spill bay 23 has undercutting issues but may be used during high flows.
- The spill pattern in the FPP is based on a nominal Bonneville forebay elevation of 74 feet.
- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.
- If river flows drop below about 90 kcfs then spill may need to drop below 40% spill in order to maintain station service and power system needs.

Bonneville

Summer Spill Operations June 21 through August 31, 2009: Spill 85 kcfs during daytime hours from June 21 through July 20, then spill 75 kcfs during daytime hours from July 21 through August 31. Spill to the 120%/115% TDG spill cap at night. Daytime spill hours change periodically and are defined in FPP Table BON-6. It takes

approximately 10 minutes to change between day and night summer spill levels. See Table A for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: No special spill operations are required in 2009. Spill patterns and durations from the FPP will be used.
- Summer research operations: No special spill operations are required for 2009 biological tests.
- Objectives of the biological test: Estimate juvenile subyearling Chinook passage distribution in response to a behavioral guidance structure at Powerhouse 2.
- Spill Patterns for summer operations: Spill patterns in the FPP will be used.

Operational Considerations:

- Minimum generation: A minimum powerhouse discharge of 30 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 30 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 30 kcfs for all hours.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in the FPP. Dates are subject to change in coordination with FPOM or TMT.
- Turbine unit and corner collector outages may be required to repair hydrophones and other research equipment. These will be coordinated through FPOM.
- Minimum spill discharge level is 50 kcfs. This is to provide acceptable juvenile fish egress conditions in the tailrace.
- Actual spill levels at Bonneville Dam may range from 1 to 3 kcfs lower or higher than specified Table A. A number of factors influence this including hydraulic efficiency, exact gate opening calibration, spillway gate hoist cable stretch due to temperature changes, and forebay elevation (a higher forebay results in a greater volume of spill since more water can pass under the spill gate).
- The second powerhouse corner collector (5 kcfs discharge) will operate until the afternoon of August 31, 2009.
- A mid-season spillway outage will be required to survey the stilling basin for erosion. Pending the outcome of this survey, the 2009 spill operation may be altered to maintain dam safety. Changes to spill operations may include changing the spill pattern to avoid further erosion or discontinuing spill until repairs can be made. The mid-season survey will take approximately ½ day to complete. The Corps will coordinate this work through the Fish Facility Design Review Work Group (FFDRWG), FPOM, and TMT.

JUVENILE FISH TRANSPORTATION PROGRAM OPERATIONS

As noted above, the Corps' planned spill operations assume average runoff conditions. The following explains the juvenile fish transportation program under all runoff conditions and is consistent with the 2008 transport operations. The lower Snake River projects are described first, followed by McNary project operations. Detailed descriptions of project and transport facility operations to implement the program, including the transition from barges to trucks when fish numbers decrease in the summer, and the end dates for transport, are contained in FPP Appendix B.

Lower Snake River Dams - Operation and Timing

The 2009 Spring FOP provides information about the initiation of transport at the lower Snake River collector projects; however, the Snake River projected seasonal average (April 3 – June 20) flows were greater than 70 kcfs and the Corps initiated transportation on a staggered start basis. Dates to begin transport at the lower Snake River collector projects were coordinated through TMT.

The collection of fish for transport began at Lower Granite Dam on May 1 at 0700 hours. It began 4 days later at Little Goose Dam, on May 5 at 0700 hours; and began 3 days after that at Lower Monumental, on May 8 at 0800 hours. Barging of fish began the following day and will continue with collected juvenile fish barged from each facility on a daily or every-other-day basis (depending on the number of fish) throughout the spring and into the summer. Starting on or about August 15, fish will be transported by truck, pending numbers of subyearling Chinook collected. Transport operations will be carried out concurrent with FOP spill operations at each project and in accordance with all relevant FPP operating criteria. Fish transportation operations for the lower Snake River collector projects are described in FPP Appendix B.

Fish transportation operations are expected to continue through approximately October 31 at Lower Granite and Little Goose dams, and through September 30 at Lower Monumental Dam. Transportation operations may be adjusted due to research, conditions at the collection facilities, or through the adaptive management process to better match juvenile outmigration timing or achieve/maintain performance standards.

McNary Dam - Operation and Timing

Juvenile fish collected at McNary between April and the start of transport will be bypassed to the river. The normal operation is to bypass fish through the full flow bypass pipe, which has interrogation capability to monitor for PIT tags. Every other day, however, in order to sample fish for the Smolt Monitoring Program, fish are routed through the separator, interrogated for PIT tags, and then bypassed to the river.

Transportation will be initiated at McNary Dam during July 15 – 30, 2009 as per the 2008 BiOp (RPA 30, Table 4) and in coordination with NOAA Fisheries and TMT. Fish will be transported from McNary Dam by barge through August 16, then transported by

truck every other day. All fish collected will be transported except those marked for in-river studies. Fish are expected to be transported through September 30, 2009. The presence of factors such as excess shad, algae or bryozoans that can clog screens and flumes may result in discontinuing transport operations at McNary Dam before September 30. Detailed criteria for McNary transport are contained in the FPP, Appendix B.

Transportation operations may be adjusted for research purposes, due to conditions at the collection facilities, or as a result of the adaptive management process (to better match juvenile outmigration timing and/or to achieve or maintain performance standards). If new information indicates that modifying (or eliminating) transportation operations at McNary Dam is warranted, adaptive management will be used to make appropriate adjustments through the TMT coordination process.

TRANSPORT, LATENT MORTALITY, AND AVIAN RESEARCH

Spring operations to conduct research on the seasonal effects of transport and latent mortality are described in the 2009 Spring FOP. The avian predation study continues into the summer and is described below.

Avian Predation

A study is being conducted to evaluate the impacts of avian predation on salmonid smolts from the Columbia and Snake rivers. The study will determine how various biotic and abiotic factors are associated with differences in steelhead smolt vulnerability to predation by Crescent Island terns and Foundation Island cormorants. The study requests PIT tagging both hatchery and wild steelhead collected in the smolt monitoring sample at Lower Monumental and Ice Harbor dams, beginning April 1 and continuing through July. The recorded condition of a fish will be attached to a specific tag code and vulnerability to avian predation will be evaluated using PIT tag recovery data collected from the avian bird colonies. The study needs a minimum sample of 100 fish each day that are collected for condition by the smolt monitoring program.

EMERGENCY PROTOCOLS

The Corps and the Bureau of Reclamation will operate the projects in emergency situations in accordance with the WMP Emergency Protocols (WMP Appendix 1). The Protocols define emergency conditions and situations that may arise while operating the FCRPS projects, and the immediate actions that may be taken in the face of the emergency. The most recent version of the Emergency Protocols is located at: http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2009/final/emerproto/

COORDINATION

To make adjustments in response to changes in conditions, the Corps will utilize the existing regional coordination committees. Changes in spill rates when flow conditions are higher or lower than anticipated will be coordinated through the TMT. This could include potential issues and adjustments to the juvenile fish transportation program. Spill patterns and biological testing protocols that have not been coordinated to date will be finalized through the Corps' AFEP subcommittees, which include the SRWG, FPOM, and FFDRWG.

REPORTING

The Corps will provide periodic in-season updates to TMT members on the implementation of 2009 fish passage operations. The updates will include the following information:

- the hourly flow through the powerhouse;
- the hourly flow over the spillway compared to the spill target for that hour; and,
- the resultant 12-hour average TDG for the tailwater at each project and for the next project's forebay downstream.

The updates will also provide information on substantial issues that arise as a result of the spill program (e.g. Little Goose adult passage issues in 2005 and 2007), and will address any emergency situations that arise.

The Corps will continue to provide the following data to the public regarding project flow, spill rate, TDG level, and water temperature.

- Flow and spill quantity data for the lower Snake and Columbia River dams are posted to the following website every hour: http://www.nwd-wc.usace.army.mil/report/projdata.htm

- Water Quality: TDG and water temperature data are posted to the following website every six hours: http://www.nwd-wc.usace.army.mil/report/total.html These data are received via satellite from fixed monitoring sites in the Columbia and Snake rivers every six hours, and placed on a Corps public website upon receipt. Using the hourly TDG readings for each station in the lower Snake and Columbia rivers, the Corps will calculate both the highest and highest consecutive 12-hour average TDG levels daily for each station. These averages are reported at:
  http://www.nwd-wc.usace.army.mil/ftppub/water_quality/12hr/html/