
Date: Jan. 13, 2020

To: Environmental Quality Commission

From: Richard Whitman, Director

Subject: Agenda Item I: Proposed modification to the total dissolved gas water quality standard on the Columbia River for fish passage (Action)

Why This is Important

This is an action item. DEQ recommends that EQC modify Oregon's water quality standard for total dissolved gas in the lower Columbia River from 110 percent to 125 percent for the period from April 1 through June 15 for 2020 and 2021, and from 110 percent to 120 percent for the period from June 16 through August 31 for the same two years.

The purpose of the proposed modification is to allow additional voluntary spill to aid fish passage at the four lower mainstem Columbia River dams. Releasing water over the dams' spillways is a fishery-management tool on the Columbia River. However, spilling water over the dams increases the level of total dissolved gas in the river. Water plunging from a spillway traps air and carries it to a depth where the pressure forces the gas into solution. Total dissolved gas levels above 110 percent of saturation can cause gas bubble trauma in fish.

Oregon adopted the U.S. Environmental Protection Agency's total dissolved gas criteria of 110 percent of saturation. The 110 percent total dissolved gas standard protects beneficial uses of the Columbia River, and protects aquatic life, such as endangered and threatened salmon and trout salmonid species.

The U.S. Army Corps of Engineers is requesting a modification to Oregon's 110 percent total dissolved gas water quality standard to align with the 2019-2021 Spill Operation Agreement (flexible spill agreement). The standard modification would allow increased voluntary spilling of water at the Bonneville Dam, The Dalles Dam, John Day Dam and McNary Dam along the Columbia River to assist fish passage of out-migrating salmon and trout salmonids.

Background

Oregon's statewide standard for total dissolved gas is contained in OAR 340-41-0031. That rule provides that:

(1) Waters will be free from dissolved gases, such as carbon dioxide hydrogen sulfide, or other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such water.

(2) Except when stream flow exceeds the ten-year, seven-day average flood, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 110 percent of saturation. However, in hatchery-receiving waters and other waters of less than two feet in depth, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 105 percent of saturation.

In the Columbia River, however, the statewide standard is superseded by a specific standard for the mainstem of the river. OAR 340-041-0104 (3) provides that the commission may modify the total dissolved gas criteria in the Columbia River for the purpose of allowing increased spill for salmonid migration. To do so, the commission must find that:

- (a) Failure to act would result in greater harm to salmonid stock survival through in-river migration than would occur by increased spill;
- (b) The modified total dissolved gas criteria associated with the increased spill provides a reasonable balance of the risk of impairment due to elevated total dissolved gas to both resident biological communities and other migrating fish and to migrating adult and juvenile salmonids when compared to other options for in-river migration of salmon;
- (c) Adequate data will exist to determine compliance with the standards;
and
- (d) Biological monitoring is occurring to document that the migratory salmonid and resident biological communities are being protected.
- (e) The Commission will give public notice and notify all known interested parties and will make provision for opportunity to be heard and comment on the evidence presented by others, except that the Director may modify the total dissolved gas criteria for emergencies for a period not exceeding 48 hours;
- (f) The Commission may, at its discretion, consider alternative modes of migration.

Fish migration and spill

In order to survive, juvenile salmonids must migrate downstream past the Columbia River dams. Juvenile salmonids can migrate past each dam via bypass systems, through the powerhouse turbines, or over the spillways. Passage routes by the powerhouses, including passage through turbines and fish bypass systems, increase the incidence of mortality and hinder out-migration of juvenile salmonids.

Water is deliberately spilled from McNary, John Day, The Dalles and Bonneville dams at certain times to increase the proportion of fish passing by the spillways. This is commonly referred to as voluntary fish passage spill. Water is commonly spilled at these dams when river flows are high (in the late spring and summer) for other reasons – to pass flood flows and as a result of limits on power generation and/or power demand. This type of spill is commonly referred to as involuntary spill, and levels of involuntary spill can be quite high – particularly during flood events.

Whether involuntary or voluntary, higher levels of spills can increase total dissolved gas in the river to levels greater than the statewide water quality standard of 110 percent. When total dissolved gas levels are too high it can harm migrating juvenile and adult salmonids as well as other fish by causing gas bubble trauma, similar to the bends in humans.

Balancing spills and total dissolved gas for fish survival

Based on monitoring from 1995 to present, the incidence of gas bubble trauma in salmon smolts due to spill is approximately 1 percent when total dissolved gas levels are managed to 120 percent below the dams in the tailraces.

In more recent years, fish passage spill in this portion of the river has been managed to a total dissolved gas limit of 115 percent in the forebay upstream of the dams and 120 percent downstream of the dams in the tailrace. Oregon removed the forebay upstream limit in 2009 by order, based on the findings of the adaptive management team that this was protective of migrating salmonids during voluntary fish passage spill. However, the Washington Department of Ecology (Ecology) retained the 115 percent requirement for the forebay, which may be lifted under certain conditions for spring spill. In bi-state waters the U.S. Army Corps of Engineers (Corps) manages spill to meet the stricter TDG water quality standard.

2019-2021 Spill Operation Agreement

On December 14, 2018, the State of Oregon, the State of Washington, the Nez Perce Tribe, Bonneville Power Administration, Bureau of Reclamation and the Corps entered into the 2019-2021 Spill Operation Agreement, referred to as the “flexible spill agreement.” The Corps agreed to increase spill to improve juvenile salmonid migration during times of low hydropower demand. For the 2020-2021 spring spill, the flexible spill agreement calls for modification of the standards to 125 percent. The agreement is provided in Attachment C to this report.

2019 Columbia River System Biological Opinion (2019 Biological Opinion)

The National Oceanic and Atmospheric Administration National Marine Fisheries Service issued a 2019 Biological Opinion on March 29, 2019, for operation of the federal Columbia River System. The Biological Opinion anticipates that

Washington and Oregon will increase their TDG standard for spring spill to 125 percent that will allow the Corps to operate the system to meet the higher spill levels intended to increase the survival of juvenile salmonids and to increase smolt-to-adult return ratios.

History of EQC Modifications of the TDG Standard

The Environmental Quality Commission has granted standard modifications to federal agencies, including the Corps, for increased levels of total dissolved gas since 1994 to allow increased spill. EQC has granted the modifications because of the demonstrated low incidence of gas bubble trauma, and the effectiveness of voluntary spill for increasing fish passage.

The most recent EQC order, adopted in 2015 for the period 2015-2019, allows for fish passage spill April 1 through Aug. 31 at Bonneville, The Dalles, John Day, and McNary dams. The order requires physical monitoring of total dissolved gas below the dams in the tailrace, with a limit of 120 percent, measured as the average of the 12 highest hours in a day. The order also requires biological monitoring of gas bubble trauma in fish during the spill period and annual reporting to DEQ.

Total Maximum Daily Load for Total Dissolved Gas

In 2002, Oregon and Washington issued a Lower Columbia River total dissolved gas total maximum daily load that was approved by EPA. The TMDL allows fish passage spills until 2020 with a provision that operational and structural modifications that reduce total dissolved gas generated during spill must be in place by that time. The goal of the total maximum daily load was to meet the 110 percent total dissolved gas state criteria, while allowing for voluntary fish passage spill.

The Corps operates the dams and is responsible for implementing the operational and structural modifications identified in the TMDL. The Corps has stated that they have implemented all feasible structural modifications.

Request to Renew the Total Dissolved Gas Standard Modification

The Corps' request for a total dissolved gas standard modification

On July 12, 2019, DEQ received a request from the Corps for a modification to the state's total dissolved gas standard to align with the flexible spill agreement. The current EQC order, which modifies the total dissolved gas standard, was issued in 2015 for a five-year period from 2015 through 2019. The last day the modification was in effect for juvenile fish passage was Aug. 31, 2019. The requested modification must be in place by April 1, 2020, for the Corps to provide voluntary spill for the beginning of the 2020 fish passage season.

The request summary and supporting information, including DEQ's recommended findings, are presented in Attachment B.

Public Input

Public comment received

DEQ issued a public notice Nov. 6, 2019, opening a 30-day public comment period during which two public hearings were held. The first hearing occurred Nov. 15, 2019, during the Environmental Quality Commission meeting. DEQ held the second hearing on December 4. Written comments were due by 5 p.m. on Dec. 6, 2019.

DEQ received fourteen comment letters and oral testimony, which stated support for approval of an EQC order for total dissolved gas standard modification, with suggestions for changes to the order.

Comments include:

- Two-thirds of comment letters and oral testimonies suggested a five-year term for the modification. These commenters suggested a spring spill two-hour maximum that is higher than the proposed two-hour maximum of 126 percent. The purpose of the higher two-hour limit is to enable the Corps to spill closer to a 125 percent over a 12-hour average.
- One-third of comment letters and oral testimony agreed with the two-year term of the modification because it aligns with the time period of the flexible spill agreement. The shorter time period would require earlier consideration of the Columbia River System Operations Environmental Impact Statement, due for completion in September 2020, and a new Biological Opinion, due for completion in late 2020. These commenters also suggested including a 16-hour per day limit for the spring period 125 percent total dissolved gas modification, reflecting the analysis in the 2019 Biological Opinion and spill tables in the flexible spill agreement.
- A commenter suggested removing non-salmonid-based biological thresholds as action criteria for reducing voluntary spill because the criteria are not based on gas bubble trauma studies, unlike the biological thresholds for salmonids. Additionally, the commenter cautioned that spill could be reduced based on action criteria applied to sample sizes that are too small. However, the commenter stated that obtaining a sample size of 100 non-salmonids is unlikely. The commenter suggested that non-salmonid based gas bubble trauma management criteria could be developed over the course of the next couple years during implementation of a pilot non-salmonid gas bubble trauma monitoring program. Another commenter suggested the potential for expanding existing monitoring programs by including non-salmonid monitoring to assess the relationship between total dissolved gas and gas bubble trauma symptoms for non-salmonids to refine monitoring and adaptive management programs.

Summary of DEQ Response to Comments

DEQ recommends that the commission approve the modification with a two-year term. The two-year term aligns with the 2019-2021 Spill Operation Agreement time frame. The shorter time period also will allow for earlier consideration of a subsequent total dissolved gas standard modification, which would consider the Columbia River System Operations Environmental Impact Statement, due to be completed in Sep. 2020, and the new Biological Opinion, anticipated in late 2020.

DEQ agrees that a 126 percent two-hour maximum provides little allowance for adjustment in targeting spill levels at a 12-hour average of 125 percent TDG. As a result, DEQ recommends adopting a 127 percent consecutive two-hour maximum, as recommended by the Oregon Department of Fish and Wildlife. However, DEQ notes that this would set the two-hour maximum at a slightly higher level than the Washington Department of Ecology's recently adopted total dissolved gas standard, which uses 126 percent for this metric.

DEQ recommends gas bubble trauma monitoring of salmonids and non-salmonids during voluntary spill above the 120 percent total dissolved gas level. DEQ removed the 100 best effort sample size. Instead, weekly minimum sample size of 50 for both salmonids and non-salmonids should be required. Biological thresholds for spill reduction are recommended corresponding to those included in Washington Ecology's recently revised TDG standard for the Columbia (and Snake). DEQ is also recommending annual reporting include an evaluation of the relationship between exposure to elevated total dissolved gas levels and observations from non-salmonid gas bubble trauma monitoring to inform adaptive management of total dissolved gas and future total dissolved gas modification monitoring requirements and action criteria.

Please refer to Attachment D for the list of commenters and DEQ response to comments document. Attachment E contains the full written comments and oral testimony transcripts.

Washington Department of Ecology Water Quality Standard Amendments

On Dec. 30, 2019, Washington Department of Ecology adopted amendments to Washington's water quality total dissolved gas standard to allow higher spring spill levels, with two limits: (a) up to 126 percent total dissolved gas for the average of the two highest consecutive hourly measurements; and (b) up to 125 percent TDG for the average of the twelve highest hourly measurements in a calendar day. Washington also lifted the 115 percent forebay adjustment when the 125 percent criterion is in effect. Based on a public comment suggesting use of a similar calculation method, DEQ changed its recommended methodology for calculating compliance to align with Washington's standard.

Washington's 125 percent total dissolved gas rule further states that 125 percent may be used as the criterion associated with spring spill provided that:

1. The criterion is applied in accordance with Endangered Species Act consultation documents associated with Snake and Columbia River spill operations.
2. Ecology must approve a biological monitoring plan for monitoring fish exposed to higher total dissolved gas levels. Beginning in 2021 and continuing for at least five years, the plans must include monitoring for non-salmonid species.
3. If biological thresholds for gas bubble trauma in salmonids are exceeded, the total dissolved gas allowance is reduced to 120 percent in the tailrace and 115 percent in the forebay.

Ecology has submitted the rule package to the Environmental Protection Agency for approval, which includes Endangered Species Act consultation with the U.S. Fish & Wildlife Service and National Marine Fisheries Service.

**Evaluation of
Modification
Criteria**

The commission may modify the total dissolved gas criteria in the Columbia River for the purpose of allowing increased spill for salmonid migration if it finds that:

(a) Failure to act would result in greater harm to salmonid stock survival through in-river migration than would occur by increased spill.

Failure to act would leave the TDG standard at the statewide level of 110 percent. That level would substantially curtail voluntary spill in the four lower Columbia dams. Approving a modification to 125 percent for the spring migration season and to 120 percent for the summer period would enable the Corps to operate the system in conformity with the 2019 Biological Opinion and the flexible spill agreement. The 2019 Biological Opinion finds that implementing the flexible spill agreement will reduce juvenile migration travel time while likely slightly increasing incidence and severity of gas bubble trauma symptoms and mortality. The Comparative Survival Study predicts increases in smolt-to-adult return ratios, a measure of overall survival.

(b) The modified total dissolved gas criteria associated with the increased spill provides a reasonable balance of the risk of impairment due to elevated total dissolved gas to both resident biological communities and other migrating fish and to migrating adult and juvenile salmonids when compared to other options for in-river migration of salmon.

Considering consistently low smolt-to-adult to return rates for Snake River spring/summer Chinook salmon and summer steelhead tracked by the Comparative Survival Study, the increased risk to salmonids and resident aquatic species due to

exposure to higher levels of total dissolved gas, up to 125 percent during spring spill, is reasonably balanced by the benefits of reducing powerhouse passage and increasing downstream migration via spill.

(c) Adequate data will exist to determine compliance with the standards; and

TDG is being monitored in the tail race of each of the four lower Columbia River dams, providing data to allow hourly reporting of TDG levels needed to determine compliance with the standards as they are proposed to be modified.

(d) Biological monitoring is occurring to document that the migratory salmonid and resident biological communities are being protected.

Although aquatic life has been exposed to total dissolved gas above 120 during periods of involuntary spill due to high stream flow, regular exposure to total dissolved gas above 120 percent is unusual for long time periods. To protect aquatic life, biological monitoring for gas bubble trauma in both salmonids and non-salmonids is required during spring spill when total dissolved gas up to 125 percent is allowed. Allowing summer spill up to 120 percent requires gas bubble monitoring of juvenile salmonids as has been historically conducted.

(e) The Commission will give public notice and notify all known interested parties and will make provision for opportunity to be heard and comment on the evidence presented by others, except that the Director may modify the total dissolved gas criteria for emergencies for a period not exceeding 48 hours.

Public notice and hearings have been provided for the proposed modification, as described earlier in this report.

(f) The Commission may, at its discretion, consider alternative modes of migration.

DEQ did not evaluate other modes for migration beyond the information that is in the 2019 Biological Opinion and the flexible spill agreement.

**DEQ
Recommendation**

DEQ recommends that the EQC modify the total dissolved gas standard, as set forth in Attachment F.

EQC Alternatives

The EQC has three primary alternatives:

1. Approve the modification as recommended;
2. Approve the modification with changes to the term or to other conditions; or
3. Not approve the modification – leaving the TDG standard the same as the statewide standard.

Action Item: Request from U.S. Army Corps of Engineers for a modification to the total dissolved gas water quality standard on the Columbia River for fish passage
Jan. 23-24, 2020, EQC meeting
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- Attachments**
- A. Oregon Administrative Rule Relating to the Total Dissolved Gas Water Quality Standard
 - B. U.S. Army Corps of Engineers' July 10, 2019, Request to Renew the Total Dissolved Gas Standard Modification
 - C. 2019-2021 Spill Operation Agreement
 - D. Response to Public Comments on the Proposed Total Dissolved Gas
 - E. Public Comments
 - F. Recommended EQC Order for Total Dissolved Gas Standard Modification
- Available Upon Request**
- 2002 Lower Columbia River total dissolved gas total maximum daily load
 - NMFS 2019 Biological Opinion

Report prepared by Paula Calvert
Columbia River Coordinator

Oregon Administrative Rules Total Dissolved Gas Criteria Applicable to the Main Stem Columbia River

OAR 340-041-0031 - Total Dissolved Gas

- (1) Waters will be free from dissolved gases, such as carbon dioxide hydrogen sulfide, or other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such water.
- (2) Except when stream flow exceeds the ten-year, seven-day average flood, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 110 percent of saturation. However, in hatchery-receiving waters and other waters of less than two feet in depth, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 105 percent of saturation.

OAR 340-041-0104 - Water Quality Standards and Policies Specific to the Main Stem Columbia River

- (3) Total Dissolved Gas. The Commission may modify the total dissolved gas criteria in the Columbia River for the purpose of allowing increased spill for salmonid migration. The Commission must find that:
 - (a) Failure to act would result in greater harm to salmonid stock survival through in-river migration than would occur by increased spill;
 - (b) The modified total dissolved gas criteria associated with the increased spill provides a reasonable balance of the risk of impairment due to elevated total dissolved gas to both resident biological communities and other migrating fish and to migrating adult and juvenile salmonids when compared to other options for in-river migration of salmon;
 - (c) Adequate data will exist to determine compliance with the standards; and
 - (d) Biological monitoring is occurring to document that the migratory salmonid and resident biological communities are being protected.
 - (e) The Commission will give public notice and notify all known interested parties and will make provision for opportunity to be heard and comment on the evidence presented by others, except that the Director may modify the total dissolved gas criteria for emergencies for a period not exceeding 48 hours;
 - (f) The Commission may, at its discretion, consider alternative modes of migration.



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
PORTLAND, OR 97208-2870

July 10, 2019

Mr. Richard Whitman, Director
Oregon Department of Environmental Quality
811 S.W. Sixth Avenue
Portland, Oregon 97204-1390

Dear Mr. Whitman:

This letter is to facilitate the State of Oregon's Department of Environmental Quality (OR DEQ) total dissolved gas (TDG) saturation standard modification for spill for juvenile fish passage at the four lower Columbia River dams operated and maintained by the U.S. Army Corps of Engineers (Corps). As you are aware, the current standard modification expires September 1, 2019. Beginning in early April 2020, the Corps has agreed to implement spill for juvenile fish passage as outlined in the enclosed 2019-2021 Spill Operation Agreement (Agreement). This Agreement, signed by the Corps, Bonneville Power Administration, Bureau of Reclamation, the State of Oregon, the State of Washington, and the Nez Perce Tribe in December, 2018 identifies spring spill up to and including 125 percent TDG for up to 16 hours per day to be used as a tool for spring juvenile fish passage beginning in 2020. The Agreement is based upon the principle of implementing a flexible approach to providing spill intended to benefit salmonids while managing the Columbia River System for multiple congressionally-authorized purposes, including hydropower generation. Spring spill operations identified in the Agreement are expected to remain in place until the Columbia River System Operations Environmental Impact Statement and associated Records of Decision are completed; currently scheduled for September, 2020.

Spring spill operations for juvenile fish passage up to 125 percent TDG as identified in the Agreement have not been implemented before by the Corps and are beyond the scope of what had been previously included in OR DEQ's standard modifications. The Agreement contemplates incorporating spill up to and including 125% TDG, subject to state TDG water quality standard changes,¹ but the Agreement does not contemplate 125% TDG spill on a 24-hour, 7-day basis simultaneously at all lower Columbia River projects. Such an operation would be inconsistent with the principle underlying the Agreement. To avoid this result, the Agreement utilizes flexible periods of spill, with the daily cumulative duration of spill to the state TDG water quality standard limited to 16 hours per day. See Agreement Attachment Table 1.1 Key points and Tables 1.3a and

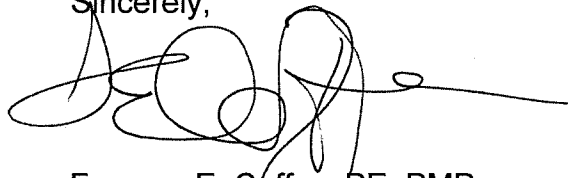
¹ See Agreement Section V.A. and V.C.2.

b.² For consistency with the Agreement and its underlying objectives, the scope of the TDG standard modification should be limited to a change for only the spring fish passage spill seasons (generally April 3-June 20) and to limit any potential increase in the TDG criteria up to 16 hours per day, while also retaining the calculation methodology from previous standard modifications.

As a signatory to the Agreement, the Corps has agreed to incorporate spring spill operations in 2020 that includes spill up to 125 percent TDG, provided that the State of Oregon issues an updated TDG standard modification for 2020 as outlined in the Agreement³ Summer spill levels under the Agreement will adhere to previous TDG standard modifications.⁴

The spill operations described in the Agreement for 2020 were also incorporated into the NOAA Fisheries Columbia River System (CRS) 2019 Biological Opinion (2019 BiOp). Pursuant to the Agreement and the 2019 BiOp, the 2020 spring juvenile fish passage spill operations at the Corps' eight lower Snake River and Columbia River dams will begin in early April 2020. Therefore, to implement the operations contemplated under the Agreement and reviewed in the 2019 BiOp, the Corps would need an updated standard modification from the Oregon Environmental Quality Commission by April 1, 2020 for the initiation of the spring juvenile fish passage spill season. We look forward to working with you and your staff to facilitate this TDG standard modification for implementation of spill operations for juvenile fish passage in 2020. Please contact Tim Dykstra, at (503) 808-3726, if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read 'Frances E. Coffey', with a long horizontal line extending to the right.

Frances E. Coffey, PE, PMP
Director, Programs

² As noted in the Agreement, collaborative technical work is ongoing to refine 2020 spring operations starting from the representative spring spill operation scenarios in Tables 1.3a and b. *See* Agreement Section VI.C.1. The Agreement contemplates a final specific operations plan by September 1, 2019.

³ Under the terms of the Agreement, the Corps' implementation of spring spill operations in 2020 is also dependent on the State of Washington modifying their state water quality standard for TDG and aligning their calculation methodology with Oregon's methodology from previous standard modifications.

⁴ OR. ADMIN. R. 340-041-0031 and 340-041-104(3):

- 1) Spill must be reduced when average TDG concentration of the 12 highest hourly measurements per calendar day exceeds 120% of saturation in the tailrace of McNary, John Day, The Dalles and Bonneville Dams monitoring stations, or
- 2) Spill must be reduced with instantaneous TDG levels exceed 125% of saturation for any 2 hours during the 12 highest hourly measurements per calendar day in the tailraces of McNary, John Day, The Dalles and Bonneville Dams monitoring stations.

2019-2021 Spill Operation Agreement

December 2018

I. PARTIES

For purposes of this 2019-2021 Spill Operation Agreement (Agreement), the “Parties” means the State of Oregon, the State of Washington, the Nez Perce Tribe, the U.S. Army Corps of Engineers (Corps), the U.S. Bureau of Reclamation (Reclamation), and the Bonneville Power Administration (Bonneville).

II. PURPOSE

This Agreement describes planned 2019-2021 spring fish passage spill operations, using the flexible spill and power principle and objectives described below, and is intended to avoid litigation until the National Environmental Policy Act remand process (commonly referred to as the Columbia River System Operations Environmental Impact Statement and associated Records of Decision) ordered by the United States District Court for the District of Oregon in *National Wildlife Federation v. National Marine Fisheries Service*, Case No. 3:01-cv-00640, (*NWF et al v. NMFS*) is completed.

The Parties have entered into this Agreement in the spirit of regional collaboration with the shared goal of meeting the principles and objectives described below. In order for this collaboration to be possible, the Parties emphasize that, when this Agreement is not in effect, this Agreement is not intended to be used in any litigation or other forum as precedent for, or an endorsement of, any operation, and this Agreement does not represent an endorsement of any biological opinion NOAA Fisheries issues regarding the Columbia River System.

III. FLEXIBLE SPILL AND POWER PRINCIPLE AND OBJECTIVES

- A. The principle central to this Agreement is implementing a flexible approach to providing spill to benefit juvenile spring fish passage in concert with managing the Columbia River System for multiple congressionally-authorized purposes, including power generation to assure the Pacific Northwest of an adequate, efficient, economical, and reliable power supply.
- B. To fulfill this principle, and solely for purposes of this Agreement, the Parties have adhered, and will continue to adhere, to the following objectives in establishing the planned fish passage spill operations described in this Agreement:
 1. Provide fish benefits, with the understanding that (i) in 2019, overall juvenile fish benefits associated with dam and reservoir passage through the lower Snake and Columbia rivers during the spring fish passage season must be at least equal to 2018 spring fish passage spill operations ordered by the Court, and (ii) in 2020 and 2021, these fish benefits are improved further (as estimated through indices of

- improved smolt-to-adult returns, e.g., PITPH, reservoir reach survival, fish travel time); and
2. Provide federal power system benefits as determined by Bonneville, with the understanding that Bonneville must, at a minimum, be no worse financially compared to the 2018 spring fish passage spill operations ordered by the Court;¹ and
 3. Provide operational feasibility for the Corps implementation that will allow the Corps to make appropriate modifications to planned spring fish passage spill operations.²

IV. DEFINITIONS

- A. “Action Agencies” means the Corps, Reclamation, and Bonneville. These agencies jointly manage Columbia River System operations.
- B. “Columbia River System” refers to the fourteen federal dam and reservoir projects within the Federal Columbia River Power System that are operated as a coordinated water management system for multiple congressionally-authorized project purposes.
- C. “Fish” means salmon and steelhead species listed under the Endangered Species Act.
- D. “Gas cap” refers to the applicable state Total Dissolved Gas (TDG) water quality standards (in percent TDG).
- E. “Gas cap spill” means spill to the maximum spill level that meets, but does not exceed, the TDG criteria allowed under the applicable state water quality standard at the four Lower Snake River and four Lower Columbia River projects.
- F. “Lower Columbia River projects” refers to McNary, John Day, The Dalles, and Bonneville dams.
- G. “Lower Snake River projects” refers to Lower Granite, Little Goose, Lower Monumental and Ice Harbor dams.
- H. “NEPA Remand Process” refers to development of the Columbia River System Operations Environmental Impact Statement. This Process will conclude upon the signature of Records of Decision by the Action Agencies.

¹ Bonneville shall have sole discretion over how it conducts its financial analysis. Bonneville measured the financial cost of the 2018 Court-ordered operations using the methodology in Bonneville’s rate proceedings for calculating the estimated average annual cost of additional planned spring fish passage spill in excess of planned spill levels in the Corps’ 2017 Fish Operations Plan.

² As described in Section VI.A.

- I. “PITPH” is the calculated probability, based on Passive Integrated Transponder (PIT) tag detections, that a juvenile fish will pass through one or more powerhouse routes on its outmigration. A PITPH of 0 signifies the fish is projected to pass through 0 of 8 turbines/bypasses and a PITPH of 8 signifies the fish passed through 8 of 8 turbines/bypasses.
- J. “Spill cap” means the spill level (flow through the spillway measured in kcfs) at each project that the Corps estimates will maximize spill to a level that meets, but does not exceed, the Gas cap.
- K. “120% TDG spill” means planned juvenile fish passage spill targeting the maximum level that meets, but does not exceed, the Gas cap for 120% TDG in the tailrace, with Spill caps derived by the Corps using the procedures referenced in Section VI.A, below.
- L. “125% TDG spill” means planned juvenile fish passage spill targeting the maximum level that meets, but does not exceed, the Gas cap for 125% TDG in the tailrace, with Spill caps derived by the Corps using the procedures referenced in Section VI.A, below.

V. STATE WATER QUALITY STANDARDS

- A. The TDG standard for the states of Washington and Oregon is 110%. Both states have provided exceptions to the TDG standard for juvenile fish passage spill operations on the lower Snake River and lower Columbia River. Oregon and Washington intend to work to harmonize their respective methodologies for measuring TDG for the duration of this Agreement. To the extent standards and/or methodologies differ between the two states, the Corps will apply the more stringent standard and/or methodology when operating under all applicable state TDG water quality standards. Oregon and Washington are responsible for any modifications to water quality standards that result from the processes contemplated below.
- B. Washington:
 - 1. Washington’s current criteria adjustment standard provides that TDG must not exceed an average of 115% as measured in the forebays of the next downstream dams and must not exceed an average of 120% as measured in the tailraces of each dam (these averages are measured as an average of the 12 highest consecutive hourly readings in any one day, relative to atmospheric pressure); and a maximum TDG one hour average of 125% must not be exceeded during spillage for fish passage. WAC § 173-201A-200(l)(f)(ii).
 - 2. Washington Department of Ecology (Ecology) is in the process of considering a short-term modification that eliminates Washington’s current forebay TDG standard at the Lower Snake River projects and Lower Columbia River projects

and aligns Washington's calculation methodology with Oregon's current methodology. Ecology acknowledges that there is a desire for this short-term modification to be in effect on or before April 3, 2019, and will work to render a timely decision.

3. Ecology also intends to consider whether to allow spring juvenile fish passage spill up to 125% TDG (as read in the tailrace) under certain conditions. Ecology expects to make a decision on the modification up to 125% TDG prior to the beginning of the 2020 spring juvenile fish passage spill season.

C. Oregon:

1. Oregon's current standard modification provides that spill must be reduced when the average TDG concentration of the 12 highest hourly measurements per calendar day exceeds 120% of saturation at monitoring stations in the tailraces of McNary, John Day, The Dalles, and Bonneville dams, and spill must be reduced when instantaneous TDG levels exceed 125% of saturation for any 2 hours during the 12 highest hourly measurements per calendar day at monitoring stations in the tailraces of McNary, John Day, The Dalles, and Bonneville dams. OR. ADMIN. R. 340-041-0031 and 340-041-104(3).
2. The Oregon Department of Environmental Quality (ODEQ) will ask the Oregon Environmental Quality Commission (EQC) to consider changing the current standard modification to allow spring juvenile fish passage spill up to 125% TDG (as read in the tailrace) at the four Lower Columbia River dams. This issue will be presented to the EQC in time for any potential modification to be in effect for the 2020 spring juvenile fish passage spill season.

VI. SPILL OPERATION

A. General Provisions for Implementing Planned Fish Passage Spill Operations

1. In implementing the planned fish passage spill operations, the Corps will use the process and procedures set forth in the annual Fish Operations Plan and Current Procedures for Setting Spill Caps to establish Spill caps and target spill levels.
2. In-Season Adjustments: In managing the Columbia River System for multiple congressionally-authorized project purposes, the Corps may adjust the planned fish passage spill operations to address conditions set forth in the section of the annual Fish Operations Plan entitled "Modifications to Planned Operations and In-Season Management."

B. 2019 Fish Passage Spill Operations

1. Spring Operations

- a. To meet the flexible spill and power principle and objectives in Section III above, and if the conditions in Section IX.A and Section X are met, the Action Agencies will implement planned juvenile fish passage spring spill operations targeting the spill levels and times provided in **Attachment Table 1.1** in a manner consistent with the general spill implementation provisions in Section VI.A, above.
- b. The Parties acknowledge that the 2019 spring spill operations set forth in this Agreement are contingent upon securing a modification to Washington's water quality standard as described in Section V.B, above.

2. Summer Operations

- a. After implementing the juvenile fish passage spring spill operations in **Attachment Table 1.1**, the Action Agencies will then implement the 2019 planned juvenile fish passage summer operation shown in **Attachment Table 1.2**.

C. 2020 and 2021 Fish Passage Spill Operations

1. If the conditions in Sections V.B.3, V.C.2, IX.A, and X are met, and consistent with Section III, the Parties agree that 2020 and 2021 operations will incorporate spill up to and including 125% TDG as a tool for spring fish passage spill season. Collaborative technical work performed to date has identified representative spring spill operation scenarios. Preliminary analyses indicate these scenarios, which incorporate 125% TDG spill as a tool, meet the Section III principle and objectives (see **Attachment Tables 1.3a-b**).³

Building on further analysis of these representative scenarios and in consideration of 2019 results, the Parties will continue in good faith to evaluate the effect of different variables, such as project-specific spill levels and duration (both daily and seasonal), to refine 2020-2021 spring operations, and complete a final specific operations plan by September 1, 2019. If the Parties cannot agree on a refined operation, one of the two representative spring spill operations shown in **Attachment Tables 1.3.a-b** will be implemented in the 2020-2021 spill seasons

³ Bonneville's analysis, in particular, is especially preliminary and has a high level of uncertainty. Bonneville's financial models were not designed to handle the data associated with daily changes in spill at 125% TDG spill. As a result, Bonneville does not yet have full confidence in the results of the models. Accordingly, the Parties recognize Bonneville will continue to revise its evaluation of the financial implications of any 125% TDG scenarios.

for such time as this Agreement remains in effect, or until the Parties can agree on refinements.

The representative operations shown in Attachment Tables 1.3.a-b do not incorporate 125% TDG spill on a 24-hour, 7-day basis simultaneously at all Lower Columbia River projects and Lower Snake River projects. Such an operation would be inconsistent with the flexible spill and power objectives that are central to this Agreement.

2. The Parties presume that adjustments to summer spill operations in 2020-2021 will likely be necessary to meet the power-cost objective in Section III.B.2. To that end, the Parties have developed the operation reflected in **Attachment Table 1.4**. This operation is designed to meet the power-cost objective, while limiting potential reductions in spill to the last two weeks of August. The Parties agree that, subject to the iterative process specified in Section VI.C.1 above, this operation represents the maximum reduction in summer spill that is compatible with the Section III principle and objectives.
3. The Parties commit to ensuring their analyses are transparent and collaborative. For example, the Parties will continue to share and explain the assumptions and outputs of the biological and financial models, as well as information on any structural or operational constraints that may affect implementation of this Agreement.
4. The Parties acknowledge that implementation of 2020-2021 spring spill operations is contingent upon securing a modification to Washington and Oregon's water quality standards to allow for spill up to 125% TDG as described in Section V above.

VII. MONITORING

With regard to monitoring associated with this Agreement, the Parties agree that:

- A. Monitoring activities for juvenile and adult salmon and steelhead relative to mainstem hydrosystem operations and conditions are generally in place. In addition, the Parties support the installation of a PIT tag detection array on the Lower Granite Removable Spillway Weir as soon as feasible, currently anticipated for use in 2020.
- B. No additional PIT tagging is needed for analyses for spring/summer Chinook and steelhead. Additional PIT tagging, above current levels, may be desired for summer migrating fall Chinook and sockeye.
- C. Enhanced sampling of resident fish, invertebrates, and amphibians may be desirable in 2019. Enhanced sampling activities that meet monitoring needs may be required in 2020-

2021. Existing monitoring of TDG and Gas Bubble Trauma in salmonids will continue. TDG and Gas Bubble Trauma monitoring may be enhanced if deemed necessary and funded.

- D. Validation of fish behavior assumptions inherent in the modeled fish benefits relative to Spill Passage Efficiency are important and may require additional evaluation.
- E. Possible approaches, study designs and funding sources of any new monitoring activities discussed in this Section VII are being explored and discussed, but any additional monitoring Bonneville agrees to fund for the purposes of this Agreement must be within Bonneville's existing overall Fish and Wildlife Program budget. The Corps will continue current monitoring commitments in furtherance of this Agreement.

VIII. REPORTING

- A. The Fish Operations Plans for 2019, 2020 and 2021 will include the same reporting provisions as those set forth in the 2018 Fish Operations Plans. The Corps will provide status updates at the regularly scheduled Technical Management Team (TMT) meetings about the spring fish passage spill operations including review of the project Spill caps and resultant TDG level during the relevant time period. The Corps will address clarifying questions of the status update at the TMT meeting. In the event that a dispute results from the Corps' status update of the project Spill caps and resultant TDG level, that dispute should be expeditiously elevated by the Party seeking resolution of the dispute to the Regional Implementation Oversight Group (RIOG) in accordance with the established Regional Forum process.
- B. Parties to this Agreement agree to participate in the Regional Forum process in a manner that is consistent with the established processes of those groups and is respectful to all participants.

IX. EFFECTIVE DATE, WITHDRAWAL AND TERMINATION

- A. Effective Date.

This Agreement shall become effective where the following two conditions are met:

1. Signatures by the Parties to this Agreement, and
2. The filing of a notice with the U.S. District Court for the District of Oregon in *NWF et al v. NMFS*, that contains representations by the Parties to this Agreement and the National Wildlife Federation, et al., plaintiffs that they do not intend to file or engage in any litigation in *NWF et al v. NMFS* while this Agreement is in effect.

B. Withdrawal.

Any Party may withdraw following conferral and notice pursuant to Section XI below, upon the occurrence of any of the following:

1. The Action Agencies do not continue to implement habitat, hatchery, and monitoring and evaluation actions that provide an equivalent level of protection to fish and wildlife as they are currently implementing under the Action Agencies' 2008 Records of Decision or Record of Consultation and Statement of Decision for the Columbia River System, as supplemented in 2010 and 2014, to the satisfaction of Oregon, Washington or the Nez Perce Tribe.
2. Failure to satisfy any of the conditions or commitments set forth in this Agreement.
3. A Reasonable and Prudent Alternative action providing a fish passage spill operation inconsistent with the provisions of this Agreement, which either U.S. Fish and Wildlife Service or NOAA Fisheries issues following an ESA consultation.
4. While this Agreement is in effect, the filing of any complaint or motion for declaratory, injunctive, or other relief in *NWF et al v. NMFS*, or the initiation of any new action in any court that relates to actions or operations addressed in NOAA Fisheries' 2008 Columbia River System biological opinion and the Action Agencies' 2008 Records of Decision or Record of Consultation and Statement of Decision, as supplemented in 2010 and 2014.

C. Termination.

1. The Agreement terminates automatically upon the completion of the NEPA Remand Process.
2. The Agreement terminates automatically should the Court in *NWF et al v. NMFS* modify the terms of this Agreement in any manner, including adopting some or all of the terms of the Agreement as a court order.
3. If modification of Washington or Oregon's water quality standards does not occur, any Party may terminate this Agreement.
4. If any Party withdraws from this Agreement pursuant to Section IX.B., above, the Agreement may be terminated by any Party following conferral and notice of termination pursuant to Section XI below.

X. FORBEARANCE, RESERVATION OF RIGHTS, NO PRECEDENTIAL EFFECT

- A. While this Agreement is in effect, the State of Oregon and Nez Perce Tribe agree to forbear from filing motions or seeking relief (including declaratory or injunctive relief) in *NWF et al v. NMFS*, and from filing any new action in any court that relates to actions or operations addressed in NOAA Fisheries' 2008 Columbia River System biological opinion and the Action Agencies' 2008 Records of Decision or Record of Consultation and Statement of Decision, as supplemented in 2010 and 2014.
- B. Nothing in this Agreement alters or modifies the Parties' rights (including any claims or defenses) in *NWF et al v. NMFS* or any other forum, and no Party makes any concessions regarding the legal validity, scientific validity, or economic cost/benefit of the spill operations contemplated in this Agreement, the Columbia River System Operations Environmental Impact Statement, or any biological opinion NOAA Fisheries issues on the Columbia River System.
- C. The Parties agree that this Agreement is not intended to be construed as a consent decree enforceable as a court order in *NWF et al v. NMFS*, or otherwise cited or used as precedential on any legal or factual matter in *NWF et al v. NMFS*. The sole and exclusive remedy for any alleged breach or unresolved dispute under this Agreement (following good faith efforts by the Parties to resolve the dispute pursuant to Section XI below) is to withdraw from the Agreement.
- D. Nothing in this Agreement shall be interpreted as or constitutes a commitment or requirement that Reclamation, the Corps, or Bonneville pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341.
- E. Nothing in this Agreement shall be interpreted as limiting the authority granted to, or retained by, the State of Oregon or the State of Washington under the Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. §§ 1251-1387).
- F. Nothing in this Agreement shall be construed as a waiver of any Party's sovereign immunity.

XI. MEET AND CONFER

- A. The Parties agree to communicate the provisions of the Agreement to appropriate staff and work in good faith through existing RIOG coordination and adaptive management processes to implement the terms of this Agreement.
- B. The Parties agree that a Party may exercise its withdrawal or termination options only after: (1) informing the Parties in writing of the issue to be addressed; (2) working in good faith with the Parties to resolve the issue; and (3), where the issue cannot be

resolved, provide written notice to the Parties that the Party is withdrawing from or terminating the Agreement.

- C. As detailed in Section VIII, any disputes arising out of the Corps' status updates on project spill caps and resultant TDG level from spring fish passage spill operations at the regularly scheduled TMT meetings should be immediately elevated to the RIOG in accordance with the established Regional Forum process by the Party seeking resolution of a dispute. RIOG meetings to resolve any disputes will be conducted as appropriate under that established process.

XII. SIGNATURES

By signing below, the Parties represent they affirmatively support this Agreement and its implementation.

The signatures of the State of Oregon, the State of Washington, the Nez Perce Tribe, Reclamation, the Corps, and Bonneville appear on the following pages 11-16.



OREGON

December 13, 2018

Kate Brown
Governor
State of Oregon

Date

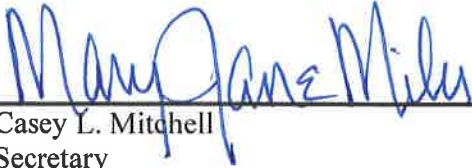
NEZ PERCE TRIBE



Shannon F. Wheeler
Chairman
Nez Perce Tribe

12-14-18

Date

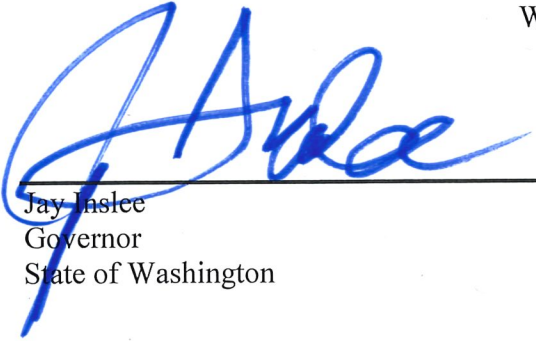


Casey L. Mitchell
Secretary
Nez Perce Tribe

12-14-18

Date

WASHINGTON

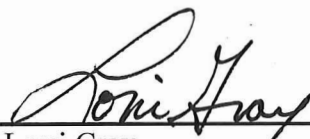


Jay Inslee
Governor
State of Washington

Dec 12, 2018

Date

BUREAU OF RECLAMATION



Lorri Gray
Regional Director
Bureau of Reclamation

12/14/18
Date

U.S. ARMY CORPS OF ENGINEERS

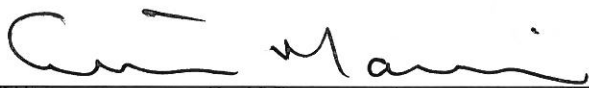


12 DEC 2018

Brigadier General D. Peter Helmlinger
Commander, Northwestern Division
U.S. Army Corps of Engineers

Date

BONNEVILLE POWER ADMINISTRATION



12/14/18

Elliot Mainzer
Administrator
Bonneville Power Administration

Date

Attachment

Table 1.1.

Planned 2019 spring spill operation, applying estimated 120% mean total dissolved gas spill caps and performance standard spill⁴ flex operations.

Location	COE Estimated Mean 120% Total Dissolved Gas Spill Cap (16 hours)	Performance Standard Spill (8 hours)
Lower Granite	45 kcfs	20 kcfs
Little Goose	52 kcfs	30%
Lower Monumental	44 kcfs	30 kcfs (bulk spill pattern)
Ice Harbor	87 kcfs	30%
McNary	180 kcfs	48%
John Day	146 kcfs	32%
The Dalles	135 kcfs	40%
Bonneville	122 kcfs	100 kcfs

Key points:

- Spring spill operations would be initiated April 3 and April 10th and transition to summer spill operations on June 21 and June 16 at Lower Snake River projects and at Lower Columbia River projects, respectively.
- The 8 hours of performance standard spill would occur with some flexibility. Only Little Goose would be set to at least 4 hours in the a.m. (beginning near dawn and not to exceed 5 hours in the a.m.) and no more than 4 hours in the p.m. (generally near dusk) to help with adult passage issues. All other projects could spill either 3 or 4 hours for the performance standard spill a.m. time period and then up to a max of 5 hours in the performance standard spill p.m. period (not to exceed 8 hours in the day).
- No ponding above current MOP assumptions: Snake River - MOP+1.5 ft (to provide 1 ft. of useable space); John Day - MIP+2 ft (to provide 1.5 ft. of useable space).
- Controlled spill at Bonneville Dam capped at 150 kcfs due to erosion concerns.
- Controlled spill at The Dalles contained between the walls (Bays 1-8) unless river flows were over 350 kcfs then spill outside the walls would be permitted.
- Existing adaptive management processes will be employed to help address any unintended consequences that may arise in-season as a result of implementing these proposed spill operations.
- Spill may be temporarily reduced at any project if necessary to ensure navigation safety or transmission reliability.

⁴ “Performance standard” spill is a NOAA Fisheries term and refers to spill levels intended to meet NOAA’s performance standard testing, as described in the 2008 Biological Opinion and accompanying administrative record.

Table 1.2.

Planned summer spill operations, starting June 21 at Lower Snake River projects and June 16 at the Lower Columbia River projects through August 31, 2019; no spill curtailment criteria. Table 1.1 key points apply.

Location	Summer Spill Operation: Volume/Percent of Total Flow Routed to Spillway (June 21/16 – Aug 31)
Lower Granite	18 kcfs
Little Goose	30%
Lower Monumental	17 kcfs
Ice Harbor	30%
McNary	57%
John Day	35%
The Dalles	40%
Bonneville	95 kcfs

Table 1.3.a.

Representative spring spill alternative one, for implementation in 2020 and 2021. Six projects using 125% TDG flexible spill, John Day (JDD) using 120% TDG flexible spill and The Dalles (TDA) using 24 hour performance standard spill. Table 1.1 key points apply.

Location	COE Estimated mean 125% Total Dissolved Gas Spill Cap (16 hours), with alternative operation at JDD and TDA.	Performance Standard Spill (8 hours).
Lower Granite (125 flex)	72 kcfs	20 kcfs
Little Goose (125 flex)	79 kcfs	30%
Lower Monumental (125 flex)	98 kcfs	30 kcfs (bulk spill pattern)
Ice Harbor (125 flex)	119 kcfs	30%
McNary (125 flex)	265 kcfs	48%
John Day (120 flex)	146 kcfs	32%
The Dalles (Performance Standard)	40%	40%
Bonneville (125 flex)	150 kcfs	100 kcfs

Table 1.3.b.

Representative spring spill alternative two, for implementation in 2020 and 2021. Six projects using 125% TDG flexible spill with JDD and TDA using 24-hour performance standard spill. Table 1.1 key points apply.

Location	COE Estimated mean 125% Total Dissolved Gas Spill Cap (16 hours), with alternative operation at JDD and TDA.	Performance Standard Spill (8 hours)
Lower Granite (125 flex)	72 kcfs	20 kcfs
Little Goose (125 flex)	79 kcfs	30%
Lower Monumental (125 flex)	98 kcfs	30 kcfs (bulk spill pattern)
Ice Harbor (125 flex)	119 kcfs	30%
McNary (125 flex)	265 kcfs	48%
John Day (Performance Standard)	32%	32%
The Dalles (Performance Standard)	40%	40%
Bonneville (125 flex)	150 kcfs	100 kcfs

Table 1.4.

Planned summer spill operations for 2020 and 2021. Cessation of juvenile transportation June 21 through August 14 with allowance for Technical Management Team adaptive management adjustments.

Location	Initial Summer Spill Operation: Volume/Percent of Total Flow Routed to Spillway (June 21/16 – August 14)	Late Summer Transitional Spill Operation: Volume/Percent of Total Flow Routed to Spillway (August 15 – August 31)
Lower Granite	18 kcfs	RSW or 7 kcfs
Little Goose	30%	ASW or 7 kcfs
Lower Monumental	17 kcfs	RSW or 7 kcfs
Ice Harbor	30%	RSW or 8.5 kcfs
McNary	57%	20 kcfs
John Day	35%	20 kcfs
The Dalles	40%	30%
Bonneville	95 kcfs	55 kcfs - includes 5k corner collector



Oregon Department of Environmental Quality
Proposed Modification to Total Dissolved Gas Water
Quality Standard for Mainstem Columbia River
Response to Comments

Nov. 6 – Dec. 6, 2019, Public Comment Period
 Contact: Paula Calvert
 700 NE Multnomah St., Suite 600, Portland, OR 97232

The Department of Environmental Quality issued a Public Notice Nov. 6, 2019, opening a public comment period on the request from the U.S. Army Corps of Engineers for a modification to the total dissolved gas water quality standard on the Columbia River. Two public hearings were held during the 30-day public comment period. The first hearing occurred Nov. 15, 2019, during the Environmental Quality Commission meeting. DEQ held the second hearing on Dec. 4, 2019. Written comments were due at 5 p.m. on Dec. 6, 2019. DEQ received fourteen comment letters and oral testimonies during the public comment period. Summaries of public comments and DEQ’s responses are below.

Table 1. List of commenters for the total dissolved gas water quality standard modification

Commenter	Affiliation	Date Received and Comment Format
1. Ed Bowles	Oregon Department of Fish and Wildlife	Nov. 15, 2019 oral testimony
2. Miles Johnson	Columbia Riverkeeper	Nov. 15, 2019 oral testimony
3. Liz Hamilton	Northwest Sportfishing Industry Association	Nov. 15, 2019 oral testimony
4. Miles Johnson	Columbia Riverkeeper; comments submitted on behalf of: American Rivers, Association of Northwest Steelheaders, Columbia Riverkeeper, Greater Hells Canyon Council, Institute for Fisheries Resources, Natural Resources Defense Council, Nimiipuu Protecting the Environment, Northwest Environmental Defense Center, Northwest Sportfishing Industry Association, Pacific Coast Federation of Fisherman’s Associations, Pacific Rivers, Save Our Wild Salmon Coalition, Sierra Club Oregon Chapter, Whale and Dolphin Conservation and Whale Scout	Nov. 15, 2019 written
5. Liz Hamilton	Northwest Sportfishing Industry Association	Nov. 15, 2019 written
6. Brandon R. Chockley	Fish Passage Center	Nov. 25, 2019 written
7. Kurt Miller	Northwest RiverPartners	Dec. 4, 2019 oral testimony

Table continues on following page.

Table 1. List of commenters on the total dissolved gas water quality standard modification
 continued from previous page

Commenter	Affiliation	Date Received and Comment Format
8. Michael Dean	Public Power Council	Dec. 4, 2019 oral testimony
9. Kurt Miller	Northwest RiverPartners	Dec. 4, 2019 written
10. Frances E. Coffey	U.S. Army Corps of Engineers; comments submitted on behalf of: U.S. Army Corps of Engineers, Bureau of Reclamation and Bonneville Power Administration	Dec. 6, 2019 written
11. Shannon F. Wheeler	Nez Perce Tribal Executive Committee	Dec. 6, 2019 written
12. Michael Dean	Public Power Council	Dec. 6, 2019 written
13. Shannon Hurn	Oregon Department of Fish and Wildlife	Dec. 6, 2019 written
14. Giulia C.S. Good Stefani	Natural Resources Defense Council; comments submitted on behalf of the member groups of the Orca Salmon Alliance: Center for Biological Diversity, Defenders of Wildlife, Earthjustice, Friends of the San Juans, Natural Resources Defense Council, Oceana, Orca Network, Puget Soundkeeper Alliance, Save Our Wild Salmon, Seattle Aquarium, Sierra Club, Toxic Free Future, Washington Environmental Council, Whale and Dolphin Conservation, Whale Scout and Wild Orca	Dec. 6, 2019 written

1. Ed Bowles, Oregon Department of Fish and Wildlife

Oral testimony provided at Nov. 15, 2019, public hearing.

The commenter commended the collaborative effort for achieving the 2019-2021 Spill Operation Agreement and stressed the importance of the 125 percent total dissolved gas standard modification for fish survival. The commenter encourages consideration of a five-year term instead of the draft modification’s two-year term and expressed concern with the 126 percent two-hour maximum because it may serve to be the limiting factor for spill instead of the 125 percent twelve-hour average. The commenter stated that past experience with involuntary spill has informed outcomes for higher allowable total dissolved gas.

Department Response to Comments:

DEQ thinks the two-year term is most appropriate because it aligns with the 2019-2021 Spill Operation Agreement time frame. The shorter time period will allow for earlier revision of the subsequent total dissolved gas standard modification, which will consider the Columbia River

System Operations Environmental Impact Statement, due for completion in Sep. 2020, and the new Biological Opinion, anticipated in late 2020.

DEQ agrees that the 126 percent two-hour maximum provides little allowance for adjustment in targeting spill levels at an average 125 percent TDG. DEQ will recommend an increase of the two-hour maximum to 127 to provide for a measure of safety by limiting exposure to elevated TDG, while allowing more flexibility in adjusting spill levels to achieve a 125 percent TDG average. However, DEQ acknowledges that the U.S. Corps of Engineers conducts spill operations based on the most stringent criteria, which would be Washington's 126 percent two-hour maximum that is in effect concurrent with their 125 percent twelve-hour limit.

An evaluation of twenty-five years of tailrace total dissolved gas levels shows spring time total dissolved gas at the four lower Columbia River dams has been higher than 120 percent for approximately 22 percent of hourly measurements and higher than 125 percent for approximately 7 percent of hourly measurements. It should be kept in mind that these estimates are low as they do not consider occasions when monitoring equipment requires repair or replacement such as when equipment is damaged from debris carried by high flows. Although it is not uncommon for involuntary flows to result in total dissolved gas above 120 percent, total dissolved gas of 125 percent is infrequent so caution should be taken in considering allowing more sustained exposure to 125 percent total dissolved gas.

2. Miles Johnson, Columbia RiverKeeper

Oral testimony provided at Nov. 15, 2019, public hearing.

The commenter supports the 125 percent total dissolved gas standard modification and states that allowing 125 percent is critical for survival of the Snake River fish stocks. The commenter suggests 130 percent as the two-hour maximum to allow the most benefit from spilling up to 125 percent without constraint of the 126 percent two-hour maximum. The commenter also suggests a five-year term for the modification as it is likely that 125 percent total dissolved gas will be found beneficial regardless of the National Environmental Policy Act and Endangered Species Act outcomes.

Department Response to Comments:

For DEQ's response to the suggestions of a five-year modification term and a two-hour average higher than 126 percent total dissolved gas, please refer to the response to Commenter 1.

3. Liz Hamilton, Northwest Sportfishing Industry Association

Oral testimony provided at Nov. 15, 2019, public hearing.

For comments summary and response to comments, please refer to Commenter 5.

4. Miles Johnson, Columbia RiverKeeper; comments submitted on behalf of: American Rivers, Association of Northwest Steelheaders, Columbia RiverKeeper, Greater Hells Canyon Council, Institute for Fisheries Resources, Natural Resources

Defense Council, Nimiipuu Protecting the Environment, Northwest Environmental Defense Center, Northwest Sportfishing Industry Association, Pacific Coast Federation of Fisherman's Associations, Pacific Rivers, Save Our Wild Salmon Coalition, Sierra Club Oregon Chapter, Whale and Dolphin Conservation and Whale Scout

Written comments received Nov. 15, 2019.

The commenters support the 125 percent total dissolved gas standard modification for at least a five-year term instead of the draft modification's two-year term. The commenters state that gas bubble trauma incidence in fish is low at total dissolved gas levels in excess of 125 percent total dissolved gas.

The commenters also urge increasing the instantaneous two-hour maximum to 130 percent total dissolved gas instead of the 126 percent two-hour maximum stated in the draft modification. The commenters assert that the 130 percent maximum will allow spill to an average of 125 percent without unnecessarily reducing spill to avoid exceeding 126 percent.

Department Response to Comments:

For DEQ's response to the suggestions of a five-year modification term and a two-hour average higher than 126 percent total dissolved gas, please refer to the response to Commenter 1.

5. Liz Hamilton, Northwest Sportfishing Industry Association

Written comments received Nov. 15, 2019.

The commenter states that spilling 24 hours a day at 125 percent total dissolved gas will yield smolt to adult return rates that approach what is needed for long term recovery. The commenter referenced a Fish Passage Center document describing increased powerhouse passage resulting from timing of the eight-hour daily spill reduction. The document shows that the 16-hour 125 percent spill level is not as favorable as spilling up to 125 percent for 24 hours a day to reduce incidence of powerhouse passage.

The commenter supports a five-year term for the modification instead of the draft modification's two-year term. The commenter also states that the two-hour 126 percent maximum is too low and will result in spill levels below 125 percent.

The commenter suggests the non-salmonid monitoring requirements are burdensome and unnecessary because river conditions with 125 percent TDG is not unusual.

Department Response to Comments:

For DEQ's response to 24-hour spill at 125 percent total dissolved gas, please refer to the response to Commenter 9. For DEQ's response to the suggestions of a five-year modification term and a two-hour average higher than 126 percent total dissolved gas, please refer to the response to Commenter 1.

Oregon rules require biological monitoring to document protection of migratory salmonid and resident biological communities. Although monitoring of resident communities has not been a requirement of the most recent total dissolved gas standard modifications, it is included as a requirement for the proposed modification because of the higher than historically allowed total dissolved gas. Uncontrolled spill during periods of high stream flow have resulted in total dissolved gas levels up to 125 percent and higher. However, it is outside the U.S. Army Corps of Engineers' normal operating procedures to voluntarily spill at elevated total dissolved levels for a sustained period of time. There is an insufficient amount of data collected to evaluate non-salmonid biological response to long-term exposure to elevated total dissolved gas. Requiring monitoring of non-salmonids will help protect aquatic life and contribute to the body of data that can be used to relate exposure levels and biological response.

6. Brandon R. Chockley, Fish Passage Center

Written comments received Nov. 25, 2019.

The commenter recommends a five-year term for the modification instead of the two-year term. The commenter also recommends a two-hour average maximum of at least 128 percent total dissolved gas instead of the draft modification's 126 percent, which may result in less spill than what was intended under the 2019-2021 Spill Operation Agreement and the adaptive management study that evaluated flexible spill operations. A larger difference between the 125 percent average and the two-hour maximum will better allow for measurement errors and environmental factors that may lead to setting more restrictive spill caps.

The commenter expresses concerns about non-salmonid monitoring requirements and spill reduction based on non-salmonid gas bubble trauma thresholds. It is unlikely that 100 non-salmonids can be sampled under the current gas bubble trauma monitoring program. Additionally, the draft modification requires spill reduction, as an action criteria, for exceedances of gas bubble trauma incidences, which could be based on sample sizes that are too small. The gas bubble trauma action criteria referenced in the most recent modifications originated in laboratory studies on salmonid gas bubble trauma incident rates and mortality. The commenter thinks it is premature to establish non-salmonid based gas bubble trauma action criteria given no comparable gas bubble trauma studies for non-salmonids. Instead, the non-salmonid based gas bubble trauma management criteria could be developed over the course of the next couple years during implementation of a pilot non-salmonid gas bubble trauma monitoring program.

The commenter states that the Smolt Monitoring Program, which currently conducts the Gas Bubble Trauma Monitoring Program, has limited funding to expand monitoring to include non-salmonids, which may require modifications to the protocol, additional staff time and additional equipment.

The commenter notes that the goal of increasing voluntary spill will help avoid juvenile fish passage through the powerhouse, which includes the bypass system in addition to the turbines. The commenter points out that the findings, which accompany the draft modification, omit reference to the bypass system.

Department Response to Comments:

For DEQ's response to the suggestions of a five-year modification term and a two-hour average higher than 126 percent total dissolved gas, please refer to the response to Commenter 1.

DEQ thinks non-salmonid gas bubble trauma action criteria for reducing voluntary spill is appropriate considering the proposed modification allows higher than usual average total dissolved gas over the entire spring spill period. However, the action response has been changed to enable resumption of spilling up to 125 percent provided observed reductions in gas bubble trauma incidence. This language was taken from Washington Department of Ecology's newly adopted total dissolved gas rules.

DEQ acknowledges the commenter's concerns regarding the draft modification's reference to a sample size of 100 for both salmonids and non-salmonids. DEQ revised the recommended modification to require a minimum sample size of 50 for both salmonids and non-salmonids. This language is based on Washington Department of Ecology's newly adopted total dissolved gas rules. Specifying a minimum sample size for the biological threshold provides better statistical support for spill reduction. Data from monitoring non-salmonids will contribute to the body of information that will be used to inform subsequent total dissolved gas modifications.

DEQ acknowledges the commenter's concerns for having resources for the additional non-salmonid biological monitoring requirement. Please refer to DEQ's response to Commenter 5 for additional response regarding non-salmonid monitoring requirements.

DEQ changed the findings to state that a goal of voluntary spilling up to 125 percent total dissolved gas is avoidance of powerhouse passage, which includes the bypass system and turbines.

7. Kurt Miller, Northwest RiverPartners

Oral testimony provided at Dec. 4, 2019, public hearing.

For comments summary and response to comments, please refer to Commenter 9.

8. Michael Dean, Public Power Council

Oral testimony provided at Dec. 4, 2019, public hearing.

For comments summary and response to comments, please refer to Commenter 12.

9. Kurt Miller, Northwest RiverPartners

Written comments received Dec. 6, 2019.

The commenter supports the two-year term of the draft modification because it aligns with the Flexible Spill Agreement and does not extend far beyond the conclusion of the Columbia River System Operations Environmental Impact Statement, which is due for completion in September 2020.

The commenter encourages addition of the 16-hour per day limit for spilling up to 125 percent total dissolved gas as stated in the Flexible Spill Agreement and evaluated by the National Marine Fisheries Service 2019 Columbia River System Biological Opinion.

The commenter supports the requirement for monitoring salmonids and non-salmonids and suggests an adult monitoring program with metrics including increased upstream migration time and mortality resulting from increased spill levels.

The commenter cites a recent study by National Marine Fisheries Services scientists, which finds juvenile survival to adult return is more dependent on fish size than dam passage route. The commenter also cited the 2009 document coauthored by Washington Department of Ecology and DEQ titled, "Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement." In the document, the agencies acknowledged detrimental effects on aquatic life near the surface when total dissolved gas approaches 120 percent.

Department Response to Comments:

DEQ acknowledges the 16-hour daily limit for spill operations up to 125 percent total dissolved gas specified in the 2019-2021 Spill Operation Agreement and evaluated by the by the National Marine Fisheries Service 2019 Columbia River System Biological Opinion. As with past total dissolved gas modifications DEQ looks to the Biological Opinion for guidance in developing the modifications. The proposed modification includes the requirement to apply the modified criteria in accordance with the 2019 Biological Opinion. This language is similar to Washington Department of Ecology's newly adopted rule.

DEQ acknowledges the importance of metrics, such as upstream migration time, in evaluating direct and indirect effects of spill on aquatic life. However, DEQ is requiring monitoring for direct impacts of elevated total dissolved gas by considering use of existing monitoring infrastructure so that monitoring can begin at the start of the 2020 spring spill.

DEQ acknowledges the new National Marine Fisheries Service study that shows fish length is an important factor in determining adult returns and considering fish length may help to explain survival variability associated with hydropower passage routes. DEQ also acknowledges past discussions and decisions involving evaluations of the 115 percent forebay requirement. Considerations for allowing the 125 percent modified standard in the tailrace is supported through balanced consideration of the Comparative Survival Studies' projected benefits for Snake River salmon and steelhead and National Marine Fisheries Service 2019 Columbia River System Biological Opinion risk evaluation.

10. Frances E. Coffey, U.S. Army Corps of Engineers; comments submitted on behalf of: U.S. Army Corps of Engineers, Bureau of Reclamation and Bonneville Power Administration

Written comments received Dec. 6, 2019.

The commenters stated that spring juvenile fish passage spill up to 125 percent total dissolved gas should be limited to 16 hours a day as referenced in the U.S. Army Corps of Engineers' July

10, 2019, request for the standard modification. The 16-hour limit will best align with the 2019-2021 Spill Operation Agreement and will help address uncertainties associated with impacts to aquatic species. Additionally, the National Marine Fisheries Service 2019 Columbia River System Biological Opinion evaluated spill up to 125 percent for 16 hours a day.

The commenters also provided a correction to DEQ's misstatement during the Dec. 4, 2019, public hearing. The commenters stated that Biological Opinion spill levels are "maximum levels that avoid negative impacts on both juvenile and adult salmonids, including gas bubble trauma, increased tailrace predation, and upstream and downstream passage delay."

The commenters cite a new study by the National Marine Fisheries Service showing the importance of fish size in survival variability for the different dam passage routes and adult returns. This study emphasizes the uncertainty of spilling higher volumes to achieve increases in adult returns.

The commenters support appropriate monitoring performed by other parties however, the Corps is not able to provide funds for additional monitoring and Bonneville Power Administration is limited to the existing Fish and Wildlife Program budget for funds it can contribute for additional monitoring.

The Corps expects that Oregon will monitor, track and inform the Corps of exceedances of biological thresholds during spill operations up to 125 percent total dissolved gas. The Corps additionally expects Oregon to communicate modified total dissolved gas levels that will reduce observed gas bubble trauma below thresholds established in the proposed standard modification and return spill operations to within compliance.

Department Response to Comments:

For DEQ's response to the suggestion to include a 16-hour per day limit for spilling up to 125 percent total dissolved gas, please refer to the response to Commenter 9.

DEQ acknowledges the correction for interpreting spill levels stated in the Biological Opinion and also acknowledges that the new National Marine Fisheries Service study shows fish length is an important factor in determining adult returns and considering fish length may help to explain survival variability associated with hydropower passage routes.

DEQ acknowledges the commenter's statements regarding resources for the additional non-salmonid biological monitoring requirement. Please refer to DEQ's response to Commenter 5 for additional response regarding non-salmonid monitoring requirements.

DEQ acknowledges the Corps' request for technical assistance regarding compliance. DEQ will work with the Corps to determine options for operational responses for biological threshold exceedances that may occur during voluntary spill.

11. Shannon F. Wheeler, Nez Perce Tribal Executive Committee

Written comments received Dec. 6, 2019.

The commenter supports the 125 percent total dissolved gas standard modification and feels the benefits of spill warrant changing Oregon's total dissolved gas water quality criteria.

Department Response to Comments:

The Department appreciates the commenter's input. A rule change for the total dissolved gas water quality criteria is outside the scope of the standard modification currently under consideration.

12. Michael Dean, Public Power Council

Written comments received Dec. 6, 2019.

The commenter believes it is prudent that the total dissolved gas standard modification is consistent with the purpose, scope and timing of the 2019-2021 Spill Operation Agreement. The modification should include a 16-hour limit for higher spill levels up to 125 percent total dissolved gas, which is specified in the Agreement and is considered in the 2019 NOAA Fisheries Columbia River System Biological Opinion. The commenter states that the most appropriate venues for long-term consideration of spill levels are the Columbia River System Operations Environmental Impact Statement and Endangered Species Act consultation process.

The commenter points to uncertainties of overall biological benefit and cites a new research, which found minimal evidence for differences in latent mortality based on dam passage route when fish size is considered. The commenter also referenced Washington Department of Ecology's 2009 decision to retain the 115 percent total dissolved gas forebay water quality criterion because Ecology thought there lacked clear and sufficient benefits of additional spill compared with the additional risk of gas bubble trauma.

The commenter suggests more representative biological monitoring should occur with frequency greater than once a week at each dam to best assess total dissolved gas impacts occurring at each dam. The current Smolt Monitoring Program does not collect samples representative of total dissolved gas exposure in the tailrace. The commenter points out that there is currently no program for monitoring gas bubble trauma for juvenile sockeye, adult fish or resident fish in the Federal Columbia River Power System.

Department Response to Comments:

For DEQ's response to the suggestion to include a 16-hour per day limit for spilling up to 125 percent total dissolved gas, suggested additional monitoring and 2009 forebay decisions please refer to the response to Commenter 9.

13. Shannon Hurn, Oregon Department of Fish and Wildlife

Written comments received Dec. 6, 2019.

The commenter supports the modification for 125 percent total dissolved gas and suggests a 2-hour maximum of 127 percent. The commenter states that a 2-hour maximum of 126 percent will result in overly conservative spill management and inquired as to the source of 126 percent.

Based on modeling conducted by the commenter, there is a 0.98 probability of spill curtailments with 126 percent maximum compared with a 0.33 probability with 127 percent maximum. The commenter also suggests using a calculation methodology that is consistent with Washington Department of Ecology.

The commenter requests consideration of a 5-year modification term for consistency with past orders so as to not require revisiting after a short 2-year time period.

Regarding biological monitoring, the commenter suggests approaches to augment existing information on non-salmonids and gas bubble trauma including assessing gas bubble trauma symptoms of non-salmonids, reasonably increase more non-salmonids if gas bubble trauma symptoms are observed, and assess gas bubble trauma and total dissolved gas relationships for non-salmonids.

Department Response to Comments:

The 2-hour 126 percent total dissolved gas maximum originated from a comment received by the Washington Department of Ecology on their total dissolved gas rule change. For additional response regarding a two-hour average higher than 126 percent total dissolved gas and suggestion of a five-year modification term, please refer to the response to Commenter 1.

DEQ will change the calculation methodology to using consecutive hourly measurements to determine compliance with the 2-hour 126 percent maximum, as specified in Washington Department of Ecology's recently adopted rule change.

DEQ appreciates the commenter's suggestions regarding biological monitoring. DEQ anticipates that required gas bubble trauma monitoring for non-salmonids will help to build a better understanding of non-salmonids' total dissolved gas sensitivity.

14. Giulia C.S. Good Stefani, Natural Resources Defense Council; comments submitted on behalf of the member groups of the Orca Salmon Alliance: Center for Biological Diversity, Defenders of Wildlife, Earthjustice, Friends of the San Juans, Natural Resources Defense Council, Oceana, Orca Network, Puget Soundkeeper Alliance, Save Our Wild Salmon, Seattle Aquarium, Sierra Club, Toxic Free Future, Washington Environmental Council, Whale and Dolphin Conservation, Whale Scout and Wild Orca

Written comments received Dec. 6, 2019.

The commenter emphasized the importance of Chinook salmon in the diet of endangered Southern Resident orca population. The commenter cites a study showing declines in Chinook salmon are correlated with the Southern Resident orcas' increased mortality and declines in health and behavior-related metrics. The commenter states that the 125 percent total dissolved gas modification aligns with the Washington State Southern Resident Orca Task Force's Year 1 Report Recommendation No. 8 in addition to the Flexible Spill Agreement. Allowing more juvenile salmon to pass the dams by spilling more water will help to offset harmful dam impacts such as increased water temperatures and exacerbating predation. The commenter supports the

125 percent total dissolved gas standard modification and prefers a rule change. If a science-based reason does not support a rule change, the commenter requests a 5-year modification.

Department Response to Comments:

DEQ acknowledges the importance of Chinook salmon for survival of the Southern Resident orca population.

For DEQ's response to the suggestions of a five-year modification, please refer to the response to Commenter 1.



Oregon Department of Environmental Quality
Proposed Modification to Total Dissolved Gas Water
Quality Standard for Mainstem Columbia River
Comments Received

Nov. 6 – Dec. 6, 2019, Public Comment Period

Contact: Paula Calvert
 700 NE Multnomah St., Suite 600, Portland, OR 97232

The Department of Environmental Quality issued a Public Notice on Nov. 6, 2019, opening a public comment period on the request from the U.S. Army Corps of Engineers for a modification to the total dissolved gas water quality standard on the Columbia River. Two public hearings were held during the 30-day public comment period. The first hearing occurred Nov. 15, 2019 during an Environmental Quality Commission meeting. DEQ held the second hearing on Dec. 4, 2019. Written comments were due at 5 p.m. on Dec. 6, 2019. DEQ received 14 comment letters and oral testimonies during the public comment period. The table below lists the commenters.

Table 1. List of commenters on the total dissolved gas water quality standard modification

Commenter	Affiliation	Date Received and Comment Format
1. Ed Bowles	Oregon Department of Fish and Wildlife	Nov. 15, 2019 oral testimony
2. Miles Johnson	Columbia Riverkeeper	Nov. 15, 2019 oral testimony
3. Liz Hamilton	Northwest Sportfishing Industry Association	Nov. 15, 2019 oral testimony
4. Miles Johnson	Columbia Riverkeeper; comments submitted on behalf of: American Rivers, Association of Northwest Steelheaders, Columbia Riverkeeper, Greater Hells Canyon Council, Institute for Fisheries Resources, Natural Resources Defense Council, Nimiipuu Protecting the Environment, Northwest Environmental Defense Center, Northwest Sportfishing Industry Association, Pacific Coast Federation of Fisherman’s Associations, Pacific Rivers, Save Our Wild Salmon Coalition, Sierra Club Oregon Chapter, Whale and Dolphin Conservation and Whale Scout	Nov. 15, 2019 written
5. Liz Hamilton	Northwest Sportfishing Industry Association	Nov. 15, 2019 written
6. Brandon R. Chockley	Fish Passage Center	Nov. 25, 2019 written
7. Kurt Miller	Northwest RiverPartners	Dec. 4, 2019 oral testimony
8. Michael Dean	Public Power Council	Dec. 4, 2019 oral testimony

Table continues on following page

Table 1. List of commenters on the total dissolved gas water quality standard modification
Continued from previous page

Commenter	Affiliation	Date Received and Comment Format
9. Kurt Miller	Northwest RiverPartners	Dec. 4, 2019 written
10. Frances E. Coffey	U.S. Army Corps of Engineers; comments submitted on behalf of: U.S. Army Corps of Engineers, Bureau of Reclamation and Bonneville Power Administration	Dec. 6, 2019 written
11. Shannon F. Wheeler	Nez Perce Tribal Executive Committee	Dec. 6, 2019 written
12. Michael Dean	Public Power Council	Dec. 6, 2019 written
13. Shannon Hurn	Oregon Department of Fish and Wildlife	Dec. 6, 2019 written
14. Giulia C.S. Good Stefani	Natural Resources Defense Council; comments submitted on behalf of the member groups of the Orca Salmon Alliance: Center for Biological Diversity, Defenders of Wildlife, Earthjustice, Friends of the San Juans, Natural Resources Defense Council, Oceana, Orca Network, Puget Soundkeeper Alliance, Save Our Wild Salmon, Seattle Aquarium, Sierra Club, Toxic Free Future, Washington Environmental Council, Whale and Dolphin Conservation, Whale Scout and Wild Orca	Dec. 6, 2019 written

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Oregon Department of Environmental Quality
Proposed Modification to Total Dissolved Gas Water
Quality Standard for Mainstem Columbia River
Oral Testimonies

Nov. 6 – Dec. 6, 2019 Public Comment Period

Contact: Paula Calvert

700 NE Multnomah St., Suite 600, Portland, OR 97232

Nov. 15, 2019, Public Hearing

Environmental Quality Commission Meeting, 3rd Floor Conference Room, 700 NE Multnomah Street, Portland, OR

Item I, Informational item and comment opportunity: Total Dissolved Gas standard modification

Ed Bowles, Oregon Department of Fish and Wildlife

Good morning, Chair George and commissioners. Pleasure to be with you again today, enjoyed the dam tour yesterday. As I mentioned, my name is Ed Bowles. I am the administrator for the Fish Division of Oregon Department of Fish and Wildlife and have been one of the lead architects for the State of Oregon for the flexible spill agreement, working closely with my own agency side as well as other collaborators and the Governor's Office and other sovereigns.

I'm really here today, I provided at Madras a kind of contextual background on the benefits of spill and the context of the agreement. I think you have that information. If not, I can include it in our comment period. And my agency will be providing more comprehensive written comments, before the deadline, with more details. I just wanted to chat a little bit at the high level, kind of summary of things. And I do appreciate you taking this on. It is a vital of, as you mentioned this morning, the flexible spill agreement, so I just want to ground you again in that. This is an agreement that's about flexible spill and flexible power. So it's a balancing act for those two, trying to be better for fish and for power than the status quo. And to position both on the ecological side and the power structure side, position parties to be better equipped and nimble for moving into the future. So, it's important on all those fronts – as a bridge and kind of evolution of our flexibility. It's also extremely important from the context of collaborations. In the past, as you know, spill has been a big part of Columbia River fish management for a long time. It's part and parcel for having a dammed river and it is absolutely the best way of getting fish past the concrete, as scientist from Fish Passage Center say. Both direct mortality and latent mortality that occurs with that experience. And in the past the State of Oregon and other partners have had to achieve the sort of fish benefits through spill, through a more litigious route and that has been very regrettable. And this new chapter we are hopeful we'll provide the collaborations that avoid the litigious route of securing fish benefits.

And so that is another important aspect of this agreement is collaborations. One of the commissioners had asked about those collaborations and I think the response focused, from Paula, on the in-season adaptive management. There is a front end collaboration that is very steeped in science, both on the power side and the fish side. And that went into the spill agreement. And there were technical teams of scientists and our producers and marketers that worked on that balancing act. As Brandon also said, the importance of the 125 total dissolved gas allowance is really about allowing the flexibility to achieve more spill at times of the day when we're investing more in fish survival. Without that, we're constrained in the amount of spill that can be provided. And therefore, that constraint forces that spill to occur during the hours that we're trying to set aside for more focus on power, when power's most marketable. So, by allowing the 125, it's a tool for us to make more hay when the sun's shining for fish during those hours. And allows us not to

rob the shoulders of the hours for power production in order to meet that balance. Without that additional allowance of gas we can't achieve the biological benefits during that window of time. So, the spill agreement reflects support from all state, tribal and federal sovereigns in the Northwest region associated with this. That's unique - hasn't been seen in my time. So, it is supported, it's signatory Governor Brown from Oregon, as well as governors of Washington and Idaho. So, this is a big deal.

Separate from the agreement, Director Whitman was talking about where we're heading from here with the NEPA process. And this relates to the two versus five-year piece of this. From my perspective, I think that you should consider using your usual approach of a five-year allowance. And the reason for that is that this is obviously centered on the agreement. But this agreement is part of the evolution of the region. And everything that is being discussed through the NEPA process is very, even if you go to something including breaching the dams to other actions, regardless of where that lands, I am highly confident that this flexibility within balancing spill and power is going to be part of a bridge to that regardless. And, so I would encourage you to consider this as a five-year allowance simply because you wouldn't have to revisit this immediately.

And the precautionary side of that is, well, what happens if this hurts fish or other critters? That adaptive management is already in place. If that occurs right now the Corps is required, based on some criteria, to ratchet spill back.

And then, the other think I would like mention is just to insure that we have the ability to get as much ecological benefit squeezed out of this as possible, I'm just mildly concerned about 126 two-hour piece of the rule. And the intent of that was as a safety net for the Corps if they were to happen to exceed. So, our comments will detail this, but it would be nice if that had a little more cushion in it so that it then becomes the bottleneck. The bottleneck for spill should be the 125 over the 12 hours. That's the key use of this and that's the biological benefits.

Lastly, as I talked to you yesterday, and Brandon mentioned, we, this is based on empirical data. The benefits of spill and its effects on juvenile salmon and steelhead with gas is all based on empirical information. We are applying more voluntary spill. But involuntary spill has informed us, so we know what to expect here with quite high confidence. And so this isn't uncharted ground. Thank you.

Miles Johnson, Columbia Riverkeeper

Thank you, this is Miles Johnson with Columbia Riverkeeper. Thank you, Chair George and members of the commission. I really appreciate the opportunity to speak with you today. First of all, I want to thank the EQC for taking up this important issue. Salmon and steelhead in the Columbia River are suffering and have been for a long time. That said, spill is a little bit like a tourniquet - we absolutely need it but it's not going to resolve the issue in the way that we need in order to see actual salmon and steelhead recovery. If you look at the good work done by the Fish Passage Center, spill is a stopgap measure at best. But we absolutely need it because our fish stocks, especially those fish returning to the Snake River are collapsing. So, thank you for turning to this important matter.

Riverkeeper strongly supports EQC's proposed modification. We think going to 125 percent is necessary and important. We have concerns that the flex spill agreement is, certainly better than what we've had before. But if you, again, look at modeling from the Fish Passage Center, it's not that it's much better than spill to 120 in terms of fish survival.

That said, I would echo Mr. Bowles' comment about the instantaneous two-hour 126 percent limit. It would be better if that was at 130 so that we could achieve the maximum benefits from the move to 125 percent.

Also, I think moving this modification to 125 percent for five years has been Oregon's practice, is going to, would be beneficial just so we can have that 125 percent standard in place and we're not all back here doing this again. It seems likely that some version of 125 percent is going to be recommended or beneficial, regardless of what comes out of the NEPA and ESA processes that are underway from the federal agencies. So, thank you very much for your attention to this. Spill is super important but we also need to consider larger structural changes to the way we operate the river. Including Snake River dam removal. And Yakima Nation and Lummi Nation have recently advocated – we need to start thinking seriously about the value of the main stem dams over the next several decades as we transition to a cleaner energy economy in the Northwest. So, thank you for your time.

Liz Hamilton, Northwest Sportfishing Industry Association

Thank you, Chair George, Director Whitman. Nice to see you. I'm here on behalf of the Northwest Sportfishing Industry Association and I appreciate this opportunity to comment on your water, modification of your water quality standards to 125. By approving this waiver, the EQC would help improve juvenile salmon and steelhead survival on the Columbia River by using spill to keep migrating baby salmon out of the turbines. It's kind of a no-brainer, right? So, we appreciate it because we believe it will lead to bigger, more adult returns in the future. NSIA is a trade organization consisting of hundreds of businesses and thousands of family wage jobs that are dependent on healthy fishery resources. And for our businesses the Columbia River is a critical component for the entire region and our industry is suffering from the consequences of these greatly declining Columbia River salmon and steelhead returns that you heard mentioned earlier. For instance, this year, the spring Chinook return was less than 40 percent of the 10-year average. The steelhead numbers are (unintelligible) they're so low back to Idaho, they've triggered another opening of the Biological Opinion by NOAA because of 3-year drastic declines. So, as these fish decline, the orca die and our industry dies. So, this is really important what you're doing for jobs here in the region.

We actually first appeared in front of the EQC on this issue back in the mid-90s. So, before we had all this empirical data, it was just recognized that when there were big flows and spills we got big adult returns to go with it. I've attached a chart, in your packet there, from the Comparative Survival Study showing that if we don't spill up to 125 24-7, that's the only think we can do, outside of breaching the dams, that will actually lead to recovery levels. So, that's why I have to express some disappointment in the flex spill because it really isn't what fish need. And if you look at the attachment that I put in there from the Fish Passage Center, you'll note that more fish actually went through the turbines with this year's flex spill than the injunction spill from the year before. So, we commend that we've got an agreement on the science in the region, that 125 is the right level, and commend the collaborative process that got the flex spill agreement. We just want to strongly state that that's not really not enough for what fish need according to decades of data.

A couple points to your waiver – we think the two-year is too short and we'd prefer that it were five years or more, so we agree with that. We also note that the two-hour cap at 126 is going to be too low. Monitoring has shown very few gas bubble trauma effects at levels below 130. And for many time periods the spring out-migrants experience even higher rates during uncontrolled spill from snowmelt and rain. So, during periods of managed spill, the Corps of Engineers has a history of taking every opportunity to avoid exceedance. And we fear the effect of using 126 will be a spill cap that is below, average spill that will be below 125, so, we would ask that to be considered.

And the last thing I would say is that we think the non-salmonid monitoring program is an undue burden on the Corps of Engineers. I can go faster than that. You know, as I stated earlier, this is a system where snowpack and rainfall frequently result in high spill scenarios and there's scant evidence in the region or

even anecdotal evidence to suggest there's harm to other species. And so the study demands will be difficult to obtain and the costly investment that 125 TDG river conditions because they're not so unusual. So, again, I say thank you for the time to operate, to testify. I'm thrilled that the region has finally high-centered on 125, and just got to do a lot more. Thank you.

Dec. 4, 2019, Public Hearing

Oregon DEQ, 3rd Floor Conference Room, 700 NE Multnomah Street, Portland, OR

Kurt Miller, Northwest RiverPartners.

Absolutely. This is me whispering right now, so I have a loud voice, that is what my wife says anyway. That's off the record, though, right? Excellent. All right, so thank you for this opportunity to comment to Oregon DEQ about the Oregon Environmental Quality Commission proposal for a 2-year modification to increase total dissolved gas levels, TDG, pursuant to the flexible spill agreement of which Oregon is a signatory. My name is Kurt Miller and I am the executive director of Northwest RiverPartners. Northwest RiverPartners represents most of the region's not for profit community owned electric utilities as well as numerous boards, businesses and farmers. And we embrace a holistic approach to fighting the climate crisis, restoring healthy salmon populations and addressing energy equity issues for a sustainable energy future that includes hydropower, wind and solar. We will be submitting more extensive written comments but we wanted to make these public comments tonight so thank you for the opportunity.

First, we ask that you consider the following critical points. First of all, recent science questions the benefit of increased spill levels. Any changes in TDG standards should be based on well supported science. The decision behind risking higher spill levels has been based on the theory that powerhouse and fish bypass system encounters cause latent mortality. To elaborate, the theory posits that although juvenile salmon have a high survival rate, approximately 97 percent past each of the lower Columbia and Snake River dams, that the act of going through those structures and powerhouses takes a toll and results in fewer returning adult salmonids. However, a recent peer reviewed study from NOAA Fisheries Science Center, shows that there is little evidence that fish, which go through these systems, suffer higher mortality once they reach the estuary and ocean after smolt size is accounted for. Rather they survive about the same rate as fish that go through the spillways and turbines. The study concludes that the survival and eventual return of juvenile Snake River salmon and steelhead to spawning streams as adults depends more on the size than the way they go through the system. This important finding should encourage DEQ to question assumptions about the benefits of increased spill levels for salmonid survival and the role that the lower Snake River and Columbia River dams play in overall salmonid mortality.

Another thing that we ask is that DEQ limit the flexible spill agreement parameters, I'm sorry, limit the increased TDG parameters to the flexible spill agreement parameters. We were pleased to see the language that coincided with the flexible spill agreement's 2-year limit but we were concerned about the fact that the proposal from DEQ, or from EQC, was a 24/7 spill period and not a 16-hour spill period which would be consistent with the flexible spill agreement. As you know, the flexible spill agreement was a negotiated agreement and the idea was to benefit both people who take electricity from the hydrosystem, to benefit salmonids, and to be flexibly feasible for Corps of Engineers to integrate. We would encourage DEQ to ensure that spill for longer than 16 hours a day is not included in the final version because we want to make sure that communities are not burdened with more expensive power supply.

Lastly we would encourage that the state of Oregon implement a spill monitoring program for adult salmon returning. As you know approximately less than 1 in 100 salmon return as adults from smolts. And so the survival of the adults is of utmost importance. And the impact of increase spill on them should

be a top priority for the state of Oregon. So with that, we will conclude and again, submit more detailed written comments. We definitely thank you for this opportunity to participate in this forum and thank you for figuring out how to record us, even in a non-standard way. So, Appreciate it. Thank you.

Michael Dean, Public Power Council

Alright good evening, I am Michael Dean with the Public Power Council. I am the policy director at that organization. PPC is a trade association representing non-profit consumer owned utilities that take wholesale power and transmission services from Bonneville Power Administration. They rely on that power that BPA provides at cost to provide both affordable and carbon free electricity to the consumers that they serve. We will be submitting some more detailed written comments before the deadline but did want to take the opportunity to emphasize a few points here this evening during the public comment period here.

So bottom line, we support a modification that is limited in duration to the flexible spill agreement time period of the 2019 BiOp. But we do, would encourage, as well, the limitation of that 16-hour per day portion, again, to be consistent with the flexible spill agreement. We think that is well supported, given that it is clear in the documents that the basis of the standard change is being contemplated is the flexible spill agreement which has the underlying legally valid 2019 BiOp and, as well, considering the experimental nature, I think, of this spill operation is unprecedented, and I think the significance of the biological and scientific uncertainty regarding the operation as well. So I think the prudent stepwise approach that is linked back to legally valid BiOp and the flexible spill agreement is the most prudent way to proceed.

Lastly I think this timing and sort of limited approach is prudent, given that the CRSO and EIS process we view is the appropriate vehicle for a long-term consideration on how to operate the river system and mitigate the effects of the hydrosystem on salmonids and other creatures in the river. So with that, thank you again for the opportunity to comment and we will be submitting some additional written comments. Thank you.

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November 15, 2019

Oregon Environmental Quality Commission
c/o Paula Calvert, Columbia River Coordinator
700 NE Multnomah St., Suite 600
Portland, OR 97232

Sent via email to: calvert.paula@deq.state.or.us

RE: Modification of Columbia River Total Dissolved Gas Water Quality Standard

Dear Oregon Environmental Quality Commissioners and Oregon DEQ,

The fifteen undersigned organizations support modifying the Columbia River water quality standard for total dissolved gas to 125 percent of saturation for at least the next five years. By approving the modification, the Environmental Quality Commission (Commission) would take a step toward restoring salmon and steelhead in the Columbia River.

Restoring healthy, abundant salmon and steelhead runs in the Columbia River is extremely important to the undersigned organizations, our members, and the many Oregonians who appreciate, eat, and make a living from these once-plentiful fish. Moreover, the highly endangered Southern Resident orcas, a fish-obligate population that specializes on Chinook salmon, require an immediate increase in prey availability, including Columbia River Chinook salmon, to avoid extinction.

Sending more water over the spillways of Columbia River dams during the spring and summer would help juvenile salmon and steelhead migrate successfully to the ocean.^{1, 2} Increased spill has been found to reduce harmful powerhouse encounters, predation of juvenile migrants in reservoirs due to shorter migration travel time, and exposure to high water temperatures as a result of reduced transit time, especially in low-water years. And decades of studies, as well as anecdotal evidence, show that dissolved gas concentrations at and above 125 percent of saturation rarely result in gas bubble trauma in salmon, steelhead, or other aquatic life. Unfortunately, Oregon's current water quality standard unnecessarily limits the amount of water that can be directed over the dams' spillways—to the detriment of Oregon's iconic, imperiled,

¹ See *Nat'l Wildlife Fedn. v. Nat'l Marine Fisheries Serv.*, 2017 U.S. Dist. LEXIS 44026, *26 (D. Or. Mar. 27, 2017) (J. Simon) (reviewing scientific evidence linking increased spill to salmon survival, and agreeing with Judge Redden's conclusion that more spill "can offer immediate survival benefit").

² See Tucker Jones (ODFW), [Salmon, Spill, and the Flexible Spill Agreement Presentation to the Commission](#), Slide 4 (May 17, 2019) (showing predicted Snake River spring/summer Chinook smolt-to-adult return rates as a function of different spill and dissolved gas levels).

and economically important salmon and steelhead. We therefore strongly support the proposed modification of the Columbia River dissolved gas standard to 125 percent, pursuant to the Commission’s authority under OAR 340-041-0104(3).

The 125-percent dissolved gas standard is biologically appropriate during juvenile salmon and steelhead migrations and could be safely implemented on a full-time basis. According to the Oregon Department of Environmental Quality,³ in 2018, the Fish Passage Center examined 6,074 juvenile salmonids that had traveled through the Columbia River hydro system, some of which had experienced naturally occurring dissolved gas levels above 125 percent. Just one percent of those fish had signs of gas bubble trauma and none were seriously affected. In 2017—when high runoff caused dissolved gas levels significantly to exceed Oregon’s water quality standard—only 1.2 percent of the 6,424 juvenile salmon and steelhead sampled showed any gas bubble trauma. Less than 0.1 percent of those 6,424 fish showed serious gas bubble trauma. Sampling during frequent periods of involuntary spring spill, when dissolved gas levels were well above 125 percent, found the incidence of gas bubble trauma well below Oregon’s already-conservative thresholds for reducing spill. Thus, the proposed water quality standard modification would not unduly expose juvenile salmon or steelhead to gas bubble trauma.

The long-running Comparative Survival Study produced by the Fish Passage Center provides a sound biological basis for modifying the dissolved gas water quality standard to 125 percent of saturation. The model incorporates decades of empirical evidence about spill, dissolved gas, and juvenile salmonid survival, including data on the effects of dissolved gas at levels well above 125 percent. The Comparative Survival Study shows that spill to 125 percent is safe for juvenile fish; but it also predicts that increasing spill to 125 percent would significantly increase smolt-to-adult survival for some Columbia basin salmon runs.⁴ Accordingly, the proposed water quality standard modification would bring the Columbia River closer to fully supporting the designated beneficial use of juvenile salmon and steelhead migration, without any adverse environmental effects.

Finally, we urge the Commission to amend its proposed order at part 1(iv)(a)(ii) to set the “instantaneous” dissolved gas limit at 130 percent—rather than at 126 percent, as the order currently proposes. Raising the instantaneous limit to 130 percent will allow the maximum beneficial spill to enhance fish survival and avoid instances where spill might be unnecessarily reduced below the 125 percent average spill limit, for which Oregon negotiated in Flex Spill

³ For all references in this paragraph, *see* Memorandum from Paula Calvert to the Commission, [2018 Annual Report on Columbia River Total Dissolved Gas and Spill for Fish Passage](#), pp. 1–2 (May 1, 2019).

⁴ Fish Passage Center, [2017 Annual Report: Comparative Survival Study of PIT-tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye](#), p. 50 (December 2017).

Agreement. Moreover, spill to 130 percent is perfectly safe for fish. Observations of salmon and steelhead during involuntary spill events when dissolved gas levels reached 130 to 139 percent show that the incidence of gas bubble trauma was well below Oregon's already-conservative action thresholds.⁵ An instantaneous limit of 130 percent is supported by the science and will ensure that Columbia River salmon and steelhead actually experience the benefits of spill to 125 percent on an average basis.

In conclusion, we urge the Commission to modify the Columbia River water quality standard for total dissolved gas to 125 percent of saturation beginning in 2020 and lasting for at least five years thereafter. Thank you for your consideration.

Sincerely,

s/ Miles Johnson
Senior Attorney, Columbia Riverkeeper
Submitted on behalf of the following organizations:

American Rivers
Association of Northwest Steelheaders
Columbia Riverkeeper
Greater Hells Canyon Council
Institute for Fisheries Resources
Natural Resources Defense Council
Nimiipuu Protecting the Environment
Northwest Environmental Defense Center
Northwest Sportfishing Industry Association
Pacific Coast Federation of Fishermen's Associations
Pacific Rivers
Save Our Wild Salmon Coalition
Sierra Club, Oregon Chapter
Whale and Dolphin Conservation
Whale Scout

cc'd via email:

- Richard Whitman, Director, Oregon DEQ
- Jason Miner, Natural Resources Policy Advisor, Office of Governor Kate Brown
- Tucker Jones, Ocean Salmon and Columbia River Program Manager, ODFW
- Carl Merkle, Salmon Recovery Policy Analyst, CTUIR
- Paul Ward, Program Manager, Yakama Nation Fisheries
- JP Patt, Columbia River Planner, CTWSRO Fisheries Department
- Dave Cummings, Nez Perce Tribe OLC

⁵ See Tucker Jones (ODFW), [*Salmon, Spill, and the Flexible Spill Agreement Presentation to the Commission*](#), Slide 5 (May 17, 2019).

Box 4, Oregon City, OR 97045
503.631.8859 www.nsiafishing.org

November 14, 2019

Oregon Environmental Quality Commission
700 NE Multnomah Street, Suite 600
Portland, OR 97232

RE: Request to Modify Columbia River Total Dissolved Gas Water Quality Standard

Dear Oregon Environmental Quality Commissioners,

On behalf of the Northwest Sportfishing Industry Association (NSIA), we appreciate the opportunity to testify in support of modifying the Columbia River water quality standard for total dissolved gas to 125 percent of saturation. By approving the modification, the Environmental Quality Commission would help improve juvenile salmon and steelhead survival in the Columbia River by using spill over the tops of dams to keep migrating juveniles out of the powerhouses. We appreciate the work of the Department of Environmental Quality leadership and staff to adjust the standard to 125% TDG to benefit outmigrants, which will lead to greater abundance of adult returns.

NSIA is a trade organization consisting of hundreds of businesses and thousands of family wage jobs dependent on healthy fishery resources. For our businesses, the Columbia River is critical to the health of our industry. And like the Orca, our industry is suffering the consequences of greatly declining Columbia River salmon and steelhead returns. The 2019 spring chinook returns were only 60% of last year's depressed returns, and less than 40% of the 10-year average. Sockeye and B-run steelhead returns are even more abysmal, precipitating unprecedented fishing closures. These fish need bold action, as do the Orca, and fishing dependent communities.

NSIA first appeared in front of the EQC in the mid-1990s seeking higher spill levels for the benefit of migrating juvenile salmon and steelhead. Decades of empirical data compiled and analyzed in the Comparative Survival Study (CSS), demonstrate that smolt to adult survival rates (SARs) increase when spill is utilized to help smolts avoid passage through the powerhouses. I've attached Figure 2.10 from the December 2017 CSS Annual Review. Without breaching the four Lower Snake River dams, *only spill at 125% TDG 24 hours per day even approaches the four percent average SARs needed for long term recovery.*

Therefore, we feel compelled to testify regarding our disappointment in only going to 125% TDG only 16 hours per day in 2020. The flex spill agreement does represent progress in supporting 125% TDG as the best available science for the appropriate spill levels. We also commend the collaborative manner with this the agreement was reached. But the flex spill agreement should be

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Maddy Sheehan, *OF COUNSEL*

Item I 000054

treated as the adaptive management opportunity that is it: to learn what the effects of lower spill levels for 8 hours per day are on migrating smolts. We highly suggest examining the July 31st, 2019 Review of 2019 Flex Spill Operations from the Fish Passage Center, an excerpt of which is attached. There are future adaptations necessary if we are to succeed in diverting more smolts away from powerhouse encounters.

NSIA also suggest that the two-year time duration for the Modification is inappropriate. As the region's scientists have coalesced around the need for 125% total dissolved gas levels, adequate spill levels will be in any future scenarios or preferred alternatives if salmon and steelhead are to be preserved and recovered. We strongly support a five-year Modification.

We would also note that the two-hour cap of 126% TDG is too low. Monitoring has shown few gas bubble trauma effects at levels below 130% TDG and for many time periods in the spring outmigrants experience even higher rates during uncontrolled spill from snow melt and rain. During periods of managed spill, the ACOE has taken every opportunity to avoid exceedance and we fear the effect of using 126% TDG as a cap will result in suppressing spill levels below 125% TDG.

Finally, we find the non-salmonid monitoring program an undue burden on the ACOE. As stated earlier, this is a system where snowpack and rainfall frequently result in high spill scenarios, and there is scant scientific or anecdotal evidence of harm to other species. The study demands will be difficult to attain and a costly investment considering that 125% TDG river conditions are not so unusual.

Thank you for the opportunity to comment on DEQ's Request to Modify Columbia River Total Dissolved Gas Water Quality Standard, and again thank you for your work on this important step to improve hydro management for salmon and steelhead. We look forward both increased spill and the valuable conversations occurring in our region surrounding the full recovery of this amazing, salmon-producing river.

In Service,



Liz Hamilton, Executive Director
Northwest Sportfishing Industry Association
503.631.8859

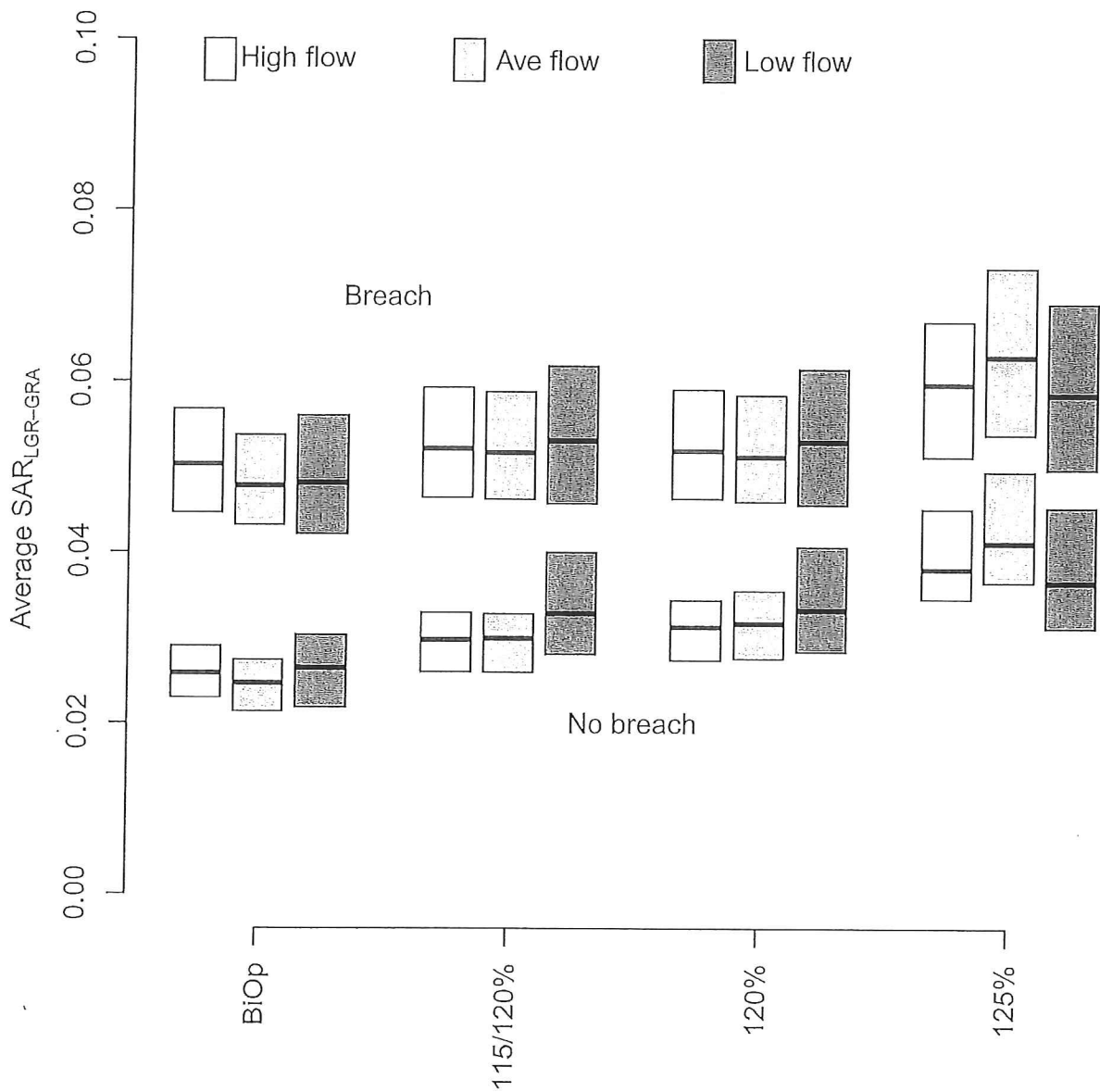


Figure 2.10: Sensitivity analysis of predicted long-term average SAR at LGR between 2036 and 2045 at all combinations of spill levels and flow levels. Each cluster of three bars represent high flow (white boxes), average flow (light grey boxes), and low flow (dark grey boxes). Boxes represent the 25%-75% quartiles. Median values are shown with dark horizontal lines inside boxes.



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MEMORANDUM

TO: Ed Bowles, ODFW

Michele DeHart

FROM: Michele DeHart

DATE: July 31, 2019

SUBJECT: Review of 2019 Flex Spill Operation

In response to your request the Fish Passage Center (FPC) has completed a review and report of the results of the adaptive management “flex spill” operation conducted during the spring salmon and steelhead migration in 2019. In the following report, we review past fish passage analyses, present a detailed report of the spill operations that took place in 2019, report juvenile passage characteristics, survival, and travel time and powerhouse encounters (PITPH), and report results of detailed analyses of fish passage patterns from acoustic tag studies. For perspective, this is followed by a comparison of 2019 fish passage characteristics under flex spill with predicted fish passage characteristics under implementation of the injunction spill order under 2019 flow conditions. The overall purpose of this report is to inform the implementation of the adaptive management “flex spill” experiment planned for 2020.

This report is organized into five sections; 1) a brief review of results of past studies of juvenile fish passage through the mainstem hydrosystem, 2) a detailed report of the actual flex spill operations which took place in 2019, 3) estimates of juvenile fish survival, travel time, and PITPH in 2019 compared to recent years, 4) an analysis of diel fish passage based on acoustic tag data, and 5) estimation of PITPH, juvenile survival, and FTT in 2019 under the flex spill operation compared to predicted PITPH, juvenile survival, and FTT in 2019 under implementation of the injunction spill order.

The following represent the overall conclusions from this review of fish passage data and the analyses of 2019 flex spill operation.

- Research over the past 60 years consistently show that, juvenile salmon approach dams at a constant rate, day and night, but juvenile fish that approach during daylight will resist

sounding to pass through powerhouses and will pass through spill if adequate day time spill is provided. Powerhouse passage efficiency increases at evening and night. Decreasing spill in the evening and at night will result in delay and increased powerhouse passage.

- Simulation analyses of recent acoustic tag data are consistent with historical study results. Powerhouse passage efficiency is at its highest at dusk and nighttime. Reducing spill at night will direct more fish through the powerhouse, more so than the same amount of spill reduction during the day.
- The estimation of PITPH for 2019 represents an underestimate of average powerhouse encounters because the decrease in spill efficiency during night time hours is not presently captured in the calculation of PITPH.
- In 2019, 61.3% of pm performance spill period hours (on days when performance spill was provided) occurred during evening/dark.
- The seasonal average PITPH estimates for 2019 were 2.10 for yearling Chinook and 1.98 for steelhead. These seasonal average PITPH estimates were higher than what occurred in 2018 under the Injunctive Spill order (1.99 for yearling Chinook and 1.95 for steelhead).
- The largest difference in PITPH in 2019, when compared to 2018, was at BON. This is because the 2018 operation at BON was essentially 24-hour spill to the 120% spill cap, whereas that for 2019 was 16 hours of spill to the 120% spill cap and 8 hours of 100 Kcfs spill
- The modeled Injunctive Order spill operation resulted in lower seasonal average spill volumes at LGR, LGS, LMN, JDA, and TDA and higher seasonal average spill volumes at IHR, MCN, and BON, when compared to the 2019 Flex Spill Operation.
 - As a result of these changes in spill, the modeled Injunctive Order spill operation resulted in higher estimates of seasonal average PITPH at LGR, LGS, LMN, JDA, and TDA and lower estimates of seasonal average PITPH at IHR, MCN, and BON, when compared to the 2019 Flex Spill Operation.
- Steelhead cohort survivals were lower than what modelling predicted based on the WTT and PITPH that the cohorts experienced in 2019. However, because the calculation of PITPH does not account for reduced spill efficiency at night, the PITPH calculation is likely an underestimate of what actually occurred in 2019.
- Steelhead cohort travel times in 2019 were similar to what was predicted from modelling, based on WTT and PITPH that cohorts experienced.
- Yearling Chinook survivals were near what would have been predicted given the relatively rapid WTT and low PITPH the cohorts experienced in 2019. However, because the calculation of PITPH does not account for reduced spill efficiency at night, the PITPH calculation is likely an underestimate of what actually occurred in 2019.
- Yearling Chinook cohort fish travel times were near or even more rapid than the rate that would have been expected given the relatively rapid WTT and low PITPH the cohorts experienced in 2019.
- The reported metrics for 2019 should be considered with caution, since analyses show that the total impact of increased powerhouse encounters cannot be determined until smolt to adult return data are available. CSS analyses have shown that each powerhouse encounter reduces smolt to adult return rates by a relative 9-13%.

I – Review of Past Studies on Fish Passage Behavior

Summary Conclusions

- Past studies of juvenile salmon and steelhead passage behavior through the FCRPS provide useful insight into the implementation of the flex spill concept, adaptive management experiment.
- The purpose of spill is to avoid juvenile fish encounters with the powerhouse.
- 24 hour spill for fish passage is based upon over 60 years of research on fish passage behavior which consistently showed that juvenile salmon approach projects at a constant rate day and night, but juvenile fish that approach the project during the daylight hours will resist passing through powerhouses and will pass via the spillway if adequate spill is provided. Juvenile fish will sound to pass through powerhouses at dusk and night time hours.
- The flex spill concept represents a reduction in spill from the 24 hour spill program
- The impact of the flex concept spill reduction could result in more fish passing through the powerhouse depending on when the lower spill period is implemented.

Juvenile passage characteristics at hydroelectric projects have been documented throughout the hydrosystem over several decades. Two separate synthesis reports of research results (Whitney et al. 1997, Ferguson et al. 2005), reached similar conclusions. Juvenile passage characteristics have been found to be consistent in these studies. Juvenile fish approach the project at a constant rate all 24 hours of the day. If adequate spill is provided juvenile salmon and steelhead will pass in spill rather than sounding to pass the powerhouse. During evening and nighttime hours, spill efficiency decreases, particularly surface spill. These studies of passage behavior led to the implementation of 24 hour a day spill for fish passage and the development of juvenile fish surface passage structures.

Under the auspices of the Northwest Power and Conservation Council, Whitney et al (1997) completed a summary of existing downstream salmon passage studies, focused on the Columbia River hydrosystem. In that summary, Whitney et al. (1997) emphasize that historical passage studies, summarized in Eicher (1998), which included studies of passage behavior back to 1957 concluded that “fish sound to greater depths as a last resort and if an alternative such as an artificial outlet is available they will use it preferentially.” These studies indicated that juvenile fish delay in forebays during the day and will only sound to pass through powerhouses during the dark. Fish passage characteristics and surface orientation of juvenile downstream migrants was noted in early monitoring and studies at hydroelectric projects (Long 1968, Wagner and Ingram 1973, Mighetto and Ebel 1995). Early monitoring was conducted by dip netting powerhouse gatewells on an hourly basis and fyke net sampling. Subsequently, hydro acoustic monitoring was implemented at several projects. Hydro acoustic monitoring showed that daytime spill was highly effective at passing fish and avoiding powerhouse passage. Hourly powerhouse gatewell sampling (Long 1968, Brege 1996) showed that peak passage of juvenile migrants

through the powerhouse increased just after dark, and that a smaller proportion of the total daily passage entered the powerhouse during daylight hours.

In 2005 NOAA Fisheries prepared a synthesis (Ferguson et al. 2005) of 60 years of information, up to 2005, of juvenile salmon passage through the Federal Columbia River Power System dams. The synthesis included studies on diel passage. Ferguson et al. (2005) conclude that, in general, research results indicate that when daytime spill is provided, spillway passage of juvenile salmonids occurs at fairly constant rates, day and night. Juvenile salmonid migrations may be delayed if spill is managed based on powerhouse diel passage patterns. In addition, the results of diel passage studies showed that spill passage efficiency decreased during the night time hours.

More recent studies (Beeman et al. 2010, Li et al. 2015) of juvenile fish passage characteristics confirm earlier studies. Fish that approach hydroelectric projects during the day will delay in the forebay if there is not adequate spill provided as an alternative route. At dark, fish sound to pass through powerhouses. Lower spill during daylight hours could delay fish in forebays and cause more fish to pass through the powerhouses at night.

The extensive body of studies and observations of fish passage behavior indicate that daytime spill is the best operation to avoid powerhouse passage and delay. In addition these studies show that if an adequate level of daytime spill is not provided, fish delay in the forebay during daylight hours and sound to pass through the powerhouse in the evening. Daytime spill passage efficiency is different than night time spill passage efficiency. During the night time hours spill passage efficiency could be reduced depending on the proportion of the river flow spilled. Reducing spill at night could result in a larger proportion of fish passing through the powerhouse. This combination of fish behavior and spill operations could increase daily fish powerhouse encounters.

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November 25, 2019

Paula Calvert, Columbia River Coordinator
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232

Re: Comments on Proposed Modification to Total Dissolved Gas Water Quality Standard for the Mainstem Columbia River for 2020 and 2021.

Dear Ms. Calvert-

Thank you for the opportunity to review and provide comments on the draft document entitled: Order Approving the U.S. Army Corps of Engineers' Request for a Modification to the State's Total Dissolved Gas Water Quality Standard (herein referred to as the Draft Order). **Overall, we support the implementation criterion for 2020 and 2021 of 125% TDG based on an average of the 12 highest hourly TDG measures in a calendar day. However, we have concerns with the maximum TDG criterion of not exceeding 126% TDG over a 2-hour average and the proposed use of the existing salmonid monitoring program to assess GBT in non-salmonids.** We offer the following comments for your consideration, followed by more detailed discussion.

- It is important to note that the objective of increasing voluntary spill is to avoid juvenile fish passage through the powerhouse altogether, not just the turbines.
- The FPC has concerns over the 2-hour average maximum TDG criterion 126%.
 - It may be difficult to reach the objective of spilling to the 125% TDG spill cap if the maximum TDG limit is subject to complications like rounding, instrumentation measurement error, and/or changes in environmental conditions. Therefore, we recommend a 2-hour average maximum TDG of at least 128%.
 - The small degree of difference between the 12-hour and 2-hour maximum TDG criteria may lead to more conservative estimates of spill caps under the Flexible Spill

- Agreement. This would not meet the intent of the agreement or the adaptive management study evaluating Flexible Spill Operations.
- The Fish Passage Center (FPC) is committed to working with DEQ to conduct a non-salmonid GBT monitoring effort. However, it must be recognized that the Smolt Monitoring Program (SMP), which covers the current Gas Bubble Trauma (GBT) Monitoring Program, was developed to monitor GBT in salmonids and has been flat funded since 2017. Adding non-salmonids to the current GBT Monitoring Program may require modifications to the protocol, additional staff time, and additional equipment.
 - Since monitoring GBT in non-salmonids has not been an objective of the present GBT monitoring program, there are unknowns regarding appropriate sample sizes, handling mortality, GBT incidence rates, and the linkage between observed GBT incidence rates and mortality in non-salmonids.
 - The sample size requirement of 100 fish was established for salmonids to ensure confidence that GBT incidence rates in sample populations accurately represent the salmonid population as a whole. It is unknown if the same sample number can be applied to non-salmonids.
 - If 100 non-salmonids is deemed appropriate, meeting the requirement of 100 non-salmonids for biological monitoring is unlikely under the current GBT sampling program and modifications may be necessary.
 - The action criteria for reducing voluntary spill are based on laboratory studies on salmonids linking the effects of GBT incidence rates on mortality. Given that no such laboratory studies exist for non-salmonid species, additional investigations may be necessary to evaluate appropriate action criteria based on results of the non-salmonid GBT monitoring program.
 - For these reasons, the FPC is concerned that, at this early stage, the Draft Order ties specific management decisions to the non-salmonid GBT monitoring program. We would recommend that management criteria for the non-salmonid GBT sample be developed over the course the next two years, as the pilot non-salmonid monitoring program is implemented, further developed, and refined.
 - We recommend expanding the time frame of the waiver to cover five years of operations, as is typically the case with these waivers.

Powerhouse Passage

In Subsection 2a of the Findings, the Draft Order states that a seasonal increase in the total dissolved gas (TDG) standard to 125% will allow the Corps of Engineers (COE) "...to increase voluntary spill, passing more juvenile Snake River spring/summer Chinook salmon and steelhead over the spillway and reduce their passage through the turbines, a route referred to as powerhouse passage". It is important to note that the term powerhouse passage is not limited to turbine passage, but also includes fish that pass through the juvenile bypass systems. As noted in the Draft Order, CSS analyses have demonstrated a negative impact of powerhouse passage on in-river survival and early ocean survival. It is worth noting that these analyses include fish that passed through the juvenile bypass systems. The objective of increasing voluntary spill is to avoid the powerhouse altogether, not just the turbines.

Criteria for Reducing Spill

Subsections 1.iv.a.i and 1.iv.a.ii of the Order outline two criteria that specify when voluntary spill may be reduced under the Draft Order. These criteria include a 12-hour average TDG criterion of 125% in the tailrace and a 2-hour average maximum TDG criterion of 126% in the tailrace. While we support the 12-hour average criterion of 125%, we have concerns with the 2-hour maximum TDG criterion of 126%. Historically, DEQ waivers have included a 2-hour maximum TDG criterion but the magnitude of the difference between the 2-hour average maximum TDG and the 12-hour average TDG has typically been five percentage points.

As with any instrumentation, the forebay and tailrace TDG monitors have an inherent measurement error. Depending on the accuracy of the instrumentation being used to measure the different components of TDG (i.e., total gas pressure and barometric pressure), this measurement error could be on the magnitude of approximately 0.13-0.33 percentage points. In addition, measurements of total gas pressure and barometric pressure are subject to changes in environmental conditions, which may lead to additional uncertainty in estimates of TDG. Using a larger magnitude of difference between the two TDG criteria (125% vs. 126%) ensures that exceedances of the maximum TDG criterion are real and not the result of complications from rounding, measurement error, and/or the influence of changes in weather conditions. As proposed, a one percentage point difference is subject to these types of complications and, thus, may be more restrictive when it comes to setting spill caps. Consequently, it may be difficult to meet the objective spill to the 125% TDG spill cap in the tailrace with a 2-hour average maximum TDG limit of only 126%. We recommend that the 2-hour average maximum TDG limit should be at least 128%, thus minimizing the likelihood that exceedances of this maximum criterion are not the result of these types of complications.

Biological Monitoring

Based on the language in Subsection 2d of the Findings, it appears that Oregon DEQ plans to rely on the existing Gas Bubble Trauma (GBT) Monitoring Program for salmonids to begin monitoring for GBT in non-salmonids as well. While the FPC is committed to working with DEQ to conduct a non-salmonid GBT monitoring effort, it must be recognized that the Smolt Monitoring Program (SMP), which covers the GBT monitoring program, was developed to monitor GBT in salmonids. While it is true that the existing infrastructure can be used for monitoring non-salmonids, a few cautionary points on this matter are warranted.

Funding

The current GBT Monitoring Program is funded by the Bonneville Power Administration (BPA) as part of the SMP. The SMP has been flat funded since 2017 and this flat funding will continue in 2020. Adding non-salmonids to the GBT Monitoring Program at FCRPS projects may require additional staff time and possibly additional equipment. Additional staff time and/or equipment is dependent on availability of non-salmonids for GBT monitoring and may be site specific. Accommodating this additional sampling for non-salmonids may not be possible at the current SMP funding levels.

Non-salmonid Monitoring Sample Sizes

Subsection 1.iv.c of the Order specifies that best efforts must be made to obtain sufficient biological monitoring sample size of 100 each for salmonids and non-salmonids. Given past data, reaching this target sample size for non-salmonids is highly unlikely at any of the current Lower Columbia or Snake River GBT monitoring sites under the present sampling effort. For example, over the last ten years (2010-2019), the daily average sample count for all non-salmonid fish species combined (lamprey excluded) never met the proposed sample size criteria of 100 non-salmonid fish (Figure 1). In fact, the maximum daily average sample count for all non-salmonid fish species combined was less than 10 fish for each of the five FCRPS projects that currently conduct GBT monitoring. Furthermore, the maximum upper limit of the 95% confidence interval was approximately 17 fish, and this only occurred on one day at each of three sites (BON, MCN, and LGS) (Figure 1).

There are two important points to note about the data presented in Figure 1. First, these daily average sample counts are from fish collected in the sample tanks over a 24-hour period at each of the FCRPS projects and are dependent on the daily sample rate. It is possible to increase these sample counts by increasing the sample rate at each project. However, we would strongly recommend against this, as it would also increase the number of listed salmonids that are sampled and handled by the SMP, which may violate the FPC ESA handling permitting for the SMP. Second, only one of these sites (BON) collects fish for the GBT monitoring program from the sample tank. The rest of the sites collect GBT monitoring fish directly from the separator. This is done in order to reduce the amount of time that these fish are held at shallow depths prior to GBT examination. Collecting directly from the separator is not possible at BON. Currently, most of the GBT monitoring crews at FCRPS facilities sample salmonids at the separator for 2-3 hours in order to meet the sample size requirement of 100 salmonids. This process would likely take longer if GBT monitoring crews were required to stay at the separator until the sample size requirement of 100 non-salmonids was also met, which would likely require additional staff time.

Given the many unknowns about GBT monitoring for non-salmonids, and the fact that meeting the sample size criterion for non-salmonids is unknown, the FPC has concerns that management decisions may be made on these non-salmonid GBT samples, as specified in Subsection 1.iv.d of the Order. For example, if only 10 non-salmonids were sampled and two had signs of fin GBT, that would equate to a 20% GBT incidence rate, which may trigger a reduction in voluntary spill per Subsection 1.iv.d of the Order. The fewer fish that are sampled, the less confident managers are that the GBT incidence rate represents the population as a whole. As discussed in the Gas Bubble Trauma Monitoring Protocol ([FPC 2019](#)), the 100 fish sample size criterion was established to maximize confidence that GBT incidence rates in the GBT sample accurately represent the population as a whole, while minimizing excessive handling.

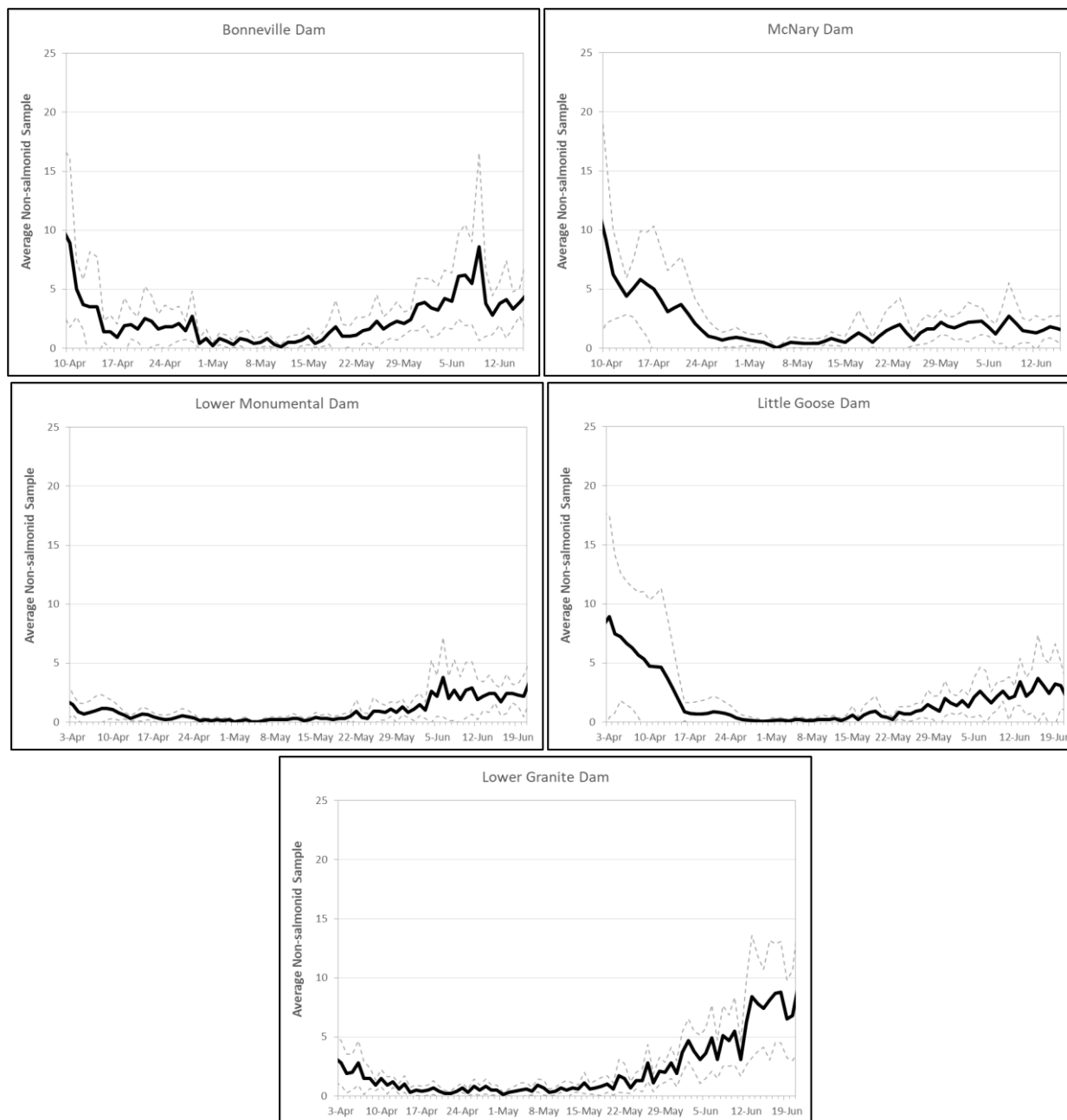


Figure 1. Daily average sample of non-salmonids at GBT monitoring facilities in the Lower Columbia and Snake River. Daily averages are based on samples from 2010 to 2019. Dotted lines represent 95% confidence intervals around these averages. Note that the x-axes represent the spring spill season and are different for the Lower Columbia (Apr. 10-June 15) and Snake River (Apr. 3-June 20) sites.

Application of Salmonid Action Criteria to Non-salmonids

Another concern we have with the biological monitoring program for non-salmonids is the application of the action criteria that were established for salmonids to the non-salmonid biological monitoring program. Subsection 1.iv.d of the Order states that voluntary spill will be reduced if one or both of two biological action criteria are met. These two action criteria are: 1) 15% or more of salmonids or non-salmonids examined show signs of GBT in their non-paired

fins or 2) 5% or more of salmonids or non-salmonids show signs of GBT in their non-paired fins where more than 25% of the surface area of the fin is occluded by gas bubbles (herein referred to as severe GBT). These action criteria were developed based on lab studies on salmonids that indicated that significant mortality did not occur until 60% of the exposed population exhibited signs of GBT or 30% exhibited severe signs in their unpaired fins. The action levels were set at 15% with any signs and 5% with severe signs to provide a large margin of safety, primarily because the results from the salmonid lab studies indicated some level of uncertainty between fin bubble percentage and the onset of mortality ([FPC 2007](#)). To our knowledge, no such laboratory studies have been conducted on fin GBT and mortality rates of non-salmonids. Therefore, it would be premature to apply these same action criteria to the non-salmonid GBT monitoring program, particularly when reductions in voluntary spill will negatively impact listed salmonids.

To reiterate, using the existing infrastructure to monitor GBT in non-salmonids has never been done before and there are a lot of unknowns for what we may observe in terms of sample sizes, handling mortality, GBT incidence rates, and the linkage between GBT incidence rates and mortality in non-salmonids. Collecting GBT monitoring information on non-salmonids in 2020 is a good start in determining what can be done with the current infrastructure and funding levels and what GBT incidence rates may be under 2020 conditions. However, we would caution the DEQ and Environmental Quality Commission (EQC) on making management decisions based on this information until some of these unknowns are answered. The FPC and SMP personnel are eager to work with DEQ and EQC staff to explore what is possible for a GBT monitoring program for non-salmonids under current funding levels, as well as what might be possible if funding was increased.

Draft Order Time Frame

As written, the Draft Order covers operations in 2020 and 2021. We understand that the Draft Order was written to align with the Flexible Spill Agreement but we recommend expanding the waiver period to five years, which is typical of these types of waivers. Under the current NEPA/EIS process, several future operational scenarios are being considered for the FCRPS, some of which may include spill up to a 125% TDG standard at one or more projects (<https://www.nwd.usace.army.mil/Media/News-Stories/Article/1991414/crso-introducing-the-range-of-alternatives/>). Expanding the waiver to cover a five year period will enable these future operations to occur, should they be chosen as the preferred alternative or written into the future Biological Opinion, without additional work for DEQ staff or future deliberation of the EQC.

References

Fish Passage Center. 2007. Questions regarding Gas Bubble Trauma. June 18, 2007 memorandum. <http://www.fpc.org/documents/memos/98-07.pdf>.

Fish Passage Center. 2019. Gas Bubble Trauma Monitoring Protocol and GBT.net Data Entry Users Manual. 2019 Season. http://www.fpc.org/documents/metadata/GBTMonitoringProtocol_2019.pdf.



Kurt Miller
Northwest RiverPartners
711 NE Halsey Street
Portland, OR 97232

December 5, 2019

Paula Calvert, Columbia River Coordinator
700 NE Multnomah St., Suite 600
Portland, OR 97232

RE: Proposed Modification to Total Dissolved Gas Water Quality Standard for Mainstem Columbia River

Dear Ms. Calvert:

Thank you for the opportunity to comment on behalf of Northwest RiverPartners (“RiverPartners”) regarding the Proposed modification to the Total Dissolved Gas (“TDG”) Water Quality Standard for the Mainstem Columbia River. RiverPartners represents not-for-profit, community-owned utilities in Oregon, Washington, Idaho, and Montana. We also have members who are farmers, ports, and businesses. We promote the environmental and socio-economic benefits of the Columbia and Snake rivers; fish and wildlife policies and programs based on sound science; and clean, renewable, reliable hydroelectricity. RiverPartners’ member organizations represent more than 4 million electric utility customers, 40,000 farmers, thousands of port employees, and large and small businesses that provide hundreds of thousands of Northwest jobs. The focus of this letter is the Oregon Department of Environmental Quality’s (“DEQ”) consideration of amending the numeric criteria for total dissolved gas in the Columbia River.

Description of Current Proposal

Per DEQ’s 11/6/19 Public Notice:

EQC [Environmental Quality Commission] proposes to issue a modification to Oregon’s 110 percent total dissolved gas water quality standard based on the Corps’ request for a modification, which will help to fulfill the principle and objectives of the 2019-2021 Spill Operation Agreement, also known as the flexible spill agreement, for which the State of Oregon and the Corps are signatories. A goal of the flexible spill agreement is to increase the proportion of juvenile salmonids passing the four lower Columbia dams via water spilling over the dams during times of low power demand.¹

Specifically, these modifications:

- For the spring spill period of April through mid-June “...allow 125 percent total dissolved gas limit in the tailrace. The proposed limit will be calculated as the average of the 12 highest hourly readings in a calendar day.”²

¹ [11/6/2019 OR DEQ Public Notice](#)

² [11/6/2019 OR DEQ Public Notice](#)

- For the summer spill period of mid-June through August, "...the proposed standard modification will continue the 120 percent total dissolved gas limit in the tailrace calculated as the average of the 12 highest hourly readings in a calendar day."³
- Be limited to a proposed "two-year modification...to the 110 percent total dissolved gas standard, 2020 through 2021, which aligns with time span stated in the flexible spill agreement."⁴

CRITICAL CONSIDERATIONS

Recent Science Questions Benefits of Increased Spill

Any changes in TDG standards should be based well supported science.

DEQ acknowledged in its proposed modification that, "Total dissolved gas levels above 110 percent of saturation can cause gas bubble trauma in fish." However, "Since 1996, the EQC has approved total dissolved gas standard modifications for 120 percent for spill to assist juvenile salmonid migration."⁵

The decision behind risking higher spill levels has been based on the theory that powerhouse and fish bypass system encounters cause *latent mortality*. To elaborate, the theory posits that although juvenile salmon have a very high survival rate (approximately 97% average) past each of the lower Columbia and lower Snake River dams, that the act of going through fish passage structures and powerhouses takes a toll that results in fewer returning adult salmonids.

However, a recent peer-reviewed study from NOAA Fisheries Science Center⁶ shows that there is little evidence that fish which go through these systems suffer higher mortality once they reach the estuary and ocean, once smolt size is accounted for. Rather, they survive at about the same rate as fish that go through spillways and turbines.⁷ The study concludes that the survival and eventual return of juvenile Snake River salmon and steelhead to spawning streams as adults depends more on their size than the way they pass through hydroelectric dams on their migration to the ocean.⁸

This important finding should encourage DEQ to question assumptions about the benefits of increased spill levels for salmonid survival and the role that the lower Snake and Columbia River dams play in overall salmon mortality.

Limited to the Flexible Spill Agreement Parameters

As DEQ acknowledges, the decision to explore a move to higher TDG levels comes from the 2019-2021 Spill Operation Agreement, also known as the Flexible Spill Agreement, which sought to, "increase the proportion of juvenile salmonids passing the four lower Columbia dams via water spilling over the dams during times of low power demand."⁹

We were pleased to see language in the proposal that links the proposed standard to a limited time period defined by the terms of the Flexible Spill Agreement. Without that accordance, spill could be increased without

³ [11/6/2019 OR DEQ Public Notice](#)

⁴ [11/6/2019 OR DEQ Public Notice](#)

⁵ [11/6/2019 OR DEQ Public Notice](#)

⁶ [Associations among Fish Length, Dam Passage History, and Survival to Adulthood in Two At-Risk Species of Pacific Salmon](#)

⁷ [Fish Size Affects Snake River Salmon Returns More than Route Through Dams](#)

⁸ [Fish Size Affects Snake River Salmon Returns More than Route Through Dams](#)

⁹ [11/6/2019 OR DEQ Public Notice](#)

any consideration of the power system impacts or to the experimental nature of the ecological benefits hoped for, which would run counter to the spirit of the Flexible Spill Agreement, federal environmental mandates, and DEQ's stated objectives.

An important data point to flag as DEQ works to finalize this modification, is that in its "Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement" document from 2009, DEQ along with the Washington state Department of Ecology stated:

While some studies did not find any effects at 120% TDG, the weight of all the evidence clearly points to detrimental effects on aquatic life near the surface when TDG approaches 120%. There were fewer effects on aquatic life at 115% TDG. The detrimental effects ranged from behavior changes to high levels of mortality after a few days.¹⁰

With this prior evaluation's warning against TDG increases firmly in mind, it is important for DEQ to identify the science or information it has become aware of that would change its previous conclusion. If DEQ is not aware of new information or science that causes it to change its previous conclusion, then it is highly important to ensure that this modification to TDG limits is temporary to reflect the fact that we are in a period of testing until additional data become available.

The limited two-year timeframe is also significant because it doesn't get too far ahead of the Columbia River System Operations Environmental Impact Statement (CRSO EIS), which is due out in final form by the end of September 2020.

We also note that the National Marine Fisheries Service 2019 Columbia River System Biological Opinion did include proposed limits for spring of 125% TDG and summer of 120% TDG, but did so for only 16 hours per day, in alignment with the Flexible Spill Agreement, not 24 hours as envisioned by DEQ's modified proposal. We encourage DEQ to remain consistent with the spirit and intent of the Flexible Spill Agreement by returning to a 16-hour per day limit at these higher TDG levels.

2019 Represented Uncharted Ground

The operations pursuant to the implementation of the Flexible Spill Agreement in 2019 represented uncharted territory. While there have been periods throughout history with high levels of uncontrolled TDGs, 2019 was the first time in the operation of the Federal Columbia River Power System, where TDGs were maintained at levels as high as 120% on a planned and sustained basis for the entire spring spill period.

While the full effects of this high and sustained spill level on juvenile salmon will not be realized for years, the earliest signs point to poor results for both juvenile salmon and returning adults. As an example, according to a NOAA Fisheries Science Center memo from 9/19/2019, "The combined yearling Chinook salmon survival estimate from the Snake River trap to Bonneville Dam tailrace was 38.1% (31.6-44.6%), substantially below the long-term average of 48.9%."¹¹

¹⁰ [Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers: Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. Washington State Department of Ecology and State of Oregon Department of Environmental Quality. January 2009, Publication no. 09-10-002. Page 46.](#)

¹¹ [Preliminary survival estimates for the passage of spring-migrating juvenile salmonids through Snake and Columbia River dams and reservoirs, 2019](#)

We also note that this year, adult salmon were stalled repeatedly in their efforts to make it upstream past Little Goose Dam, due to increased spill levels. Correspondingly, Claire McGrath, of the National Oceanic and Atmospheric Association, presented the attached report to the US Army Corps of Engineers Technical Management Team Meeting on 7/10/2019. According to the TMT meeting minutes, Ms. McGrath concluded, *...that despite varying results from the data tools, all of the indicators did consistently point to lower than expected conversion rates and slower travel times in the Lower Monumental to Little Goose reach. The 2019 YTD (as of 7/10) conversion of PIT-tagged adult Chinook from Lower Monumental to Little Goose was 96.2%, whereas the historical average for EOY conversion is 98.3%.¹²*

Given that adult spring Chinook are a culturally prized fish with the greatest biological value, and near their spawning grounds in this scenario, this lower conversion rate could represent a significant reduction in survival.

Monitoring Programs Must Include Effects on Adult Fish

Under the proposed modification, DEQ states, “The Fish Passage Center will continue biological monitoring at McNary and Bonneville dams according to the procedure described in its 2009 document, GBT Monitoring Program Protocol for Juvenile Salmonids.”

RiverPartners is supportive of a robust monitoring program for both salmonids and non-salmonids, but we note also that it is critical that the monitoring program not be merely applied to juveniles, but to adults as well. We note that for every 100 salmon smolts in the Columbia River Basin, roughly one or less successfully return to spawn as adults. Given the immense importance of the returning adults, they must be closely monitored to ensure their health is not being negatively affected by increased spill levels.

Also, the adult monitoring program should be applied to all impacts of increased spill—not merely on observed gas bubble trauma. As an example, the adult monitoring program should consider the increased upstream migration time and mortality that adult salmon are exposed to as a result of increased levels of spill.

Conclusion

Northwest RiverPartners advocates for the balanced use of rivers, for the benefit of people and the environment. We are supportive of measures that have proven scientific benefit for salmon and that consider how policies affect vulnerable communities.

With this mission in mind, we ask that DEQ maintain fidelity to the Flexible Spill Agreement principles upon which DEQ’s proposed modification is based. It is critical that the three objectives outlined at the Flexible Spill Agreement’s outset are adhered to – help fish, manage power system costs & maintain system flexibility, and be implementable by the US Army Corps of Engineers.

Further, we encourage DEQ to make sure that it is making the best scientific decision for salmon in its conclusion and ensure adequate safeguards are in place to protect both juvenile and adult salmon.

Thank you again for the opportunity to comment. RiverPartners looks forward to working with DEQ throughout this and other key regulatory processes.

¹² [7/10/2019 Columbia River Technical Management Team Draft Facilitator’s Summary](#)

Best,

A handwritten signature in black ink, appearing to read "Kurt Miller". The signature is fluid and cursive, with a large, stylized "M" at the end.

Kurt Miller
Executive Director, Northwest RiverPartners



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
PORTLAND, OR 97208-2870

December 6, 2019

Ms. Paula Calvert, Columbia River Coordinator
700 NE Multnomah St., Suite 600
Portland, OR 97232

Subject: Comments on the Proposed Modification to the Total Dissolved Gas Water Quality Standard for the Mainstem Lower Columbia River

Dear Ms. Calvert:

On behalf of the U.S. Army Corps of Engineers (Corps), Bureau of Reclamation (Reclamation), and Bonneville Power Administration (Bonneville), collectively referred to as the Action Agencies (AAs), I submit the following comments on Oregon's proposed modification to the Total Dissolved Gas (TDG) water quality standard for the mainstem lower Columbia River. As stated in the AAs' July 10, 2019 letter (Attachment 1) that was submitted to facilitate a TDG modification for spill passage at the four lower Columbia River dams, the AAs believe that Oregon should align the proposed TDG modification with the scope of the *2019-2021 Spill Operation Agreement* (Agreement) (Attachment 2). This alignment of the modification would reflect that spill up to 125 percent TDG for the purpose of spring juvenile fish passage is an interim operation that is being conducted and evaluated during 2020 operations and analyzed in the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS). As described in the AAs' July 10 letter, the proposed two-year TDG standard modification for spring juvenile fish passage spill up to 125 percent TDG as measured in the tailrace should be limited to 16 hours per day in order to best align with the Agreement and would be most responsive to the uncertainties of the impacts of spill to this level on aquatic species.

The AAs are committed to the principle underlying the Agreement – implementation of a flexible approach to providing spill intended to benefit salmonids while managing the fourteen dam and reservoir projects that make up the Columbia River System for multiple congressionally-authorized purposes, including hydropower generation – and appreciate Oregon's efforts to facilitate continued implementation of the Agreement. The AAs have continued to work collaboratively with the other parties to the Agreement consistent with this principle to develop Attachment A of the Agreement (Attachment 2 to this letter), which describes spring spill operations for 2020 that incorporate spill up to 125 percent TDG in the tailrace at certain projects for 16 hours per day during spring.

However, the AAs would like to make clear the Agreement does not contemplate spring juvenile fish passage spill up to 125 percent TDG on a 24-hour, 7-day basis simultaneously at all lower Columbia River projects as described in Oregon's proposed modification to the TDG water quality standard for the mainstem Columbia River.

Instead, the Agreement provides for up to eight hours of performance standard spill in order to balance the impacts to hydropower production from the higher levels of spill during the rest of the day. Because of this and the reasons described below, the AAs recommend Oregon add language to the proposed TDG water quality standard modification limiting spring juvenile fish passage spill up to 125 percent TDG for 16 hours per day in the tailrace.

Regarding the statement in the public notice for the proposed TDG water quality standard modification that the “proposed limits are in accordance with the National Marine Fisheries Service [NMFS] 2019 Columbia River System Biological Opinion [2019 CRS BiOp] to provide spill for juvenile salmonids in the spring and summer”, it is important to clarify that the 2019 CRS BiOp did not evaluate the level of spring spill included in Oregon’s proposed TDG water quality standard modification. The 2019 CRS BiOp only evaluated spring juvenile fish passage spill up to 125 percent TDG for 16 hours a day at certain projects, not on a 24-hour, 7-day basis at all lower Columbia River projects as is being contemplated by Oregon. Limiting spring juvenile fish passage spill up to 125 percent TDG to 16 hours in the proposed TDG water quality standard modification is important because then, and only then, would the modification be in accordance with the analysis conducted by the NMFS in the 2019 CRS BiOp. NMFS is the federal agency designated as the expert on impacts to ESA-listed salmon and steelhead and, therefore, it is imperative to have ESA consultation documents in place to ensure protectiveness of these species given the uncertainty of the potential impacts of implementation of this operation.

In addition, at the December 4, 2019 Oregon Department of Environmental Quality (DEQ) Public Hearing on the Columbia River Total Dissolved Gas (TDG) Proposed Standard Modification, the PowerPoint presentation given by DEQ’s Columbia River Coordinator, as part of the administrative and public record, contained a misstatement on Slide 15: “Biological Opinion [Reasonable and Prudent Alternative (RPA)] action¹ sets minimum spill levels.” (emphasis in original). The Action Agencies would like to correct this misstatement and clarify the statutory intent of the Endangered Species Act (ESA) and the content of the related Biological Opinions. The ESA is intended to ensure that federal actions are protective of ESA-listed species and Biological Opinions are the mechanism by which NOAA Fisheries and the U.S. Fish and Wildlife Service recommend actions that are tailored to further the protectiveness of ESA-listed species. NOAA Fisheries has recommended in Biological Opinions on the Columbia River System (CRS) juvenile fish passage spill levels that are protective of the salmonids in the CRS. These levels are not minimums, but rather maximum levels that avoid negative impacts on both juvenile and adult salmonids, including gas bubble trauma, increased tailrace predation, and upstream and downstream passage delay. See e.g., 2019 NOAA Fisheries Biological Opinion pages 340-341, 800. To characterize the Biological Opinion as providing a minimum is misleading to both the Environmental Quality Commission and the public.

¹ The current applicable Columbia River System Biological Opinion, the 2019 NOAA Fisheries Biological Opinion, does not contain RPA actions so this statement mischaracterizes the Biological Opinion.

Given the various uncertainties of the impacts to aquatic species of operating to spill levels up to 125 percent TDG, the AAs believe that Oregon should consider a TDG water quality standard modification that will limit spring juvenile fish passage spill up to 125 percent TDG for 16 hours per day until more information is available on potential impacts at higher levels of spill, especially when river flows are relatively low. This includes information available after completion of the CRSO EIS process expected in September 2020 when Records of Decision will be signed as well as information on biological impacts gained through the implementation of the Agreement in 2020.

The AAs acknowledge spill up to 125 percent TDG is an experiment to test operations to improve juvenile salmon and steelhead survival, and the AAs request that Oregon continue to consider new information on this topic as the science evolves. In fact, new peer-reviewed research that was published in November 2019 by NMFS² suggests that smaller smolts (compared to the run at large) are more likely to be detected in the juvenile bypass systems at most mainstem dams, and that these size differences (smaller smolts survive at lower rates than larger smolts to Bonneville Dam and are less likely to return as adults from the ocean) could explain a substantial amount of the variability in survival of smolts migrating through the juvenile bypass system compared to estimates for other passage routes. This study underscores the uncertainty and experimental nature of spilling higher volumes of water to increase smolt survival and adult returns (by reducing latent mortality that has been hypothesized to affect smolts passing through juvenile bypass systems).

This study does not address other potential sources of delayed mortality, which may still exist in connection with the stress of passage through the Columbia River System, but it does provide an example of the continuing uncertainty around how fish may respond to increased spill levels (e.g., will more fish pass through the spillway and result in higher rates of returns?). As we implement the terms of the Agreement in 2020, we will be comparing how the model-based predictions³ align with results from actual operations on the lower Columbia and Snake Rivers.

Furthermore, the AAs support Oregon's continued efforts to work with the state of Washington to ensure that there is a consistent calculation methodology for TDG in the lower Columbia River. Having a consistent methodology between the two states would streamline implementation and reporting for the Corps.

Finally, regarding the biological monitoring associated with the proposed TDG standard modification, consistent with the Agreement, the AAs fully support appropriate monitoring performed by other parties, but have limitations on their ability to increase existing monitoring efforts or increase funding to support additional biological monitoring. The Agreement states that the Corps will continue current monitoring commitments, but cannot increase funding to conduct additional monitoring, while

² <https://afspubs.onlinelibrary.wiley.com/doi/10.1002/tafs.10200>

³ Based on the Comparative Survival Study (CSS) prediction that increased spill will result in decreased powerhouse encounter probability (PITPH), which will in turn result in increased smolt-to-adult returns and adult return abundance.

Bonneville is limited to its existing overall Fish and Wildlife Program budget for any additional monitoring. See Agreement, Section VII.E. In addition to these limitations, the AAs have concerns that any additional monitoring should be tailored to the species that may be affected by TDG, the existing structural configuration of the Columbia River System, and the potential for additional “take” of species listed under the ESA that may result from expanded monitoring. Oregon should fully account for these considerations because the AAs cannot ensure prospective implementation of the proposed standard modification that is dependent on AAs implementation of new monitoring procedures. Also, the Corps expects that Oregon would monitor, track, and inform the Corps if biological or Gas Bubble Trauma (GBT) thresholds identified in the proposed standard modification were exceeded during spill operations up to 125 percent TDG, as well as communicate modified TDG levels either system-wide or at specific projects to bring incidences of observed GBT back in compliance with the thresholds established in the proposed standard modification.

The AAs have greatly appreciated Oregon’s participation in the CRSO EIS process as a cooperating agency, as well as our collaborations on many different issues impacting the Columbia River System. We look forward to continuing to work closely with Oregon on these important issues.

Sincerely,



Frances E. Coffey, P.E., PMP
Director, Programs

Cc: Richard Whitman, Eugene Foster

Enclosure:

Attachment I: Frances E. Coffey Letter. “AAs’ letter to facilitate a TDG modification for spill passage at the four lower Columbia River dams.” 10 July 2019.

Attachment II: 2019-2021 Spill Operation Agreement and Attachment A



Nez Perce

TRIBAL EXECUTIVE COMMITTEE

P.O. BOX 305 • LAPWAI, IDAHO 83540 • (208) 843-2253

December 6, 2019

Transmitted by email to: calvert.paula@deq.state.or.us

Ms. Paula Calvert
Columbia River Coordinator
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232

Re: *Oregon's Proposed Modification to Total Dissolved Gas Water Quality Standard for Mainstem Columbia River*

Dear Ms. Calvert:


The Nez Perce Tribe (Tribe) appreciates the opportunity to comment on the Oregon Department of Environmental Quality's Proposed Modification to Total Dissolved Gas (TDG) Water Quality Standard for the mainstem Columbia River.

The Tribe has long supported voluntary spill of up to 125 percent TDG as measured at the tailrace while salmon and steelhead are migrating downstream, based on the best available scientific information about the benefits of spill and the effects of TDG levels.

The best available scientific information about the benefits of spill and the effects of TDG levels, referenced in the biological rationale set forth in the proposed findings and order, is not limited to 2020 and 2021 and supports a permanent modification of Oregon's water quality criteria.

Thank you.

Sincerely,



Mr. Shannon F. Wheeler
Chairman



A voice for Northwest public power.

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December 6, 2019

Paula Calvert
Columbia River Coordinator
OR Dept. of Environmental Quality
700 NE Multnomah St.
Portland, OR 97232

Submitted electronically

Ms. Calvert:

The Public Power Council (PPC) appreciates this opportunity to comment on the proposed modification of water quality standards on the mainstem Columbia River pursuant to Oregon Administrative Rule (OAR) 340-041-0104(3). These potential changes to the numeric criteria for total dissolved gas (TDG) on the Columbia river have significant environmental and public policy implications that affect the multiple uses of the river system.

PPC represents the non-profit, community-owned public utility customers that purchase the output of the Federal Columbia River Power System (FCRPS) from the Bonneville Power Administration (BPA). BPA's wholesale power customers depend on hydropower from the federal system to serve the residents of the Northwest with affordable, reliable, carbon-free power at cost. The wholesale power rates paid by Northwest public power recover the costs of the FCRPS, including extensive fish and wildlife mitigation programs throughout the region. This includes funding for \$82.1 million for mitigation projects in the state of Oregon during FY 2018 alone. Overall, approximately one quarter of the wholesale power costs borne by BPA's preference customers are related to fish and wildlife mitigation. Incremental spill at the federal hydro projects in question has the potential for tens or hundreds of millions of dollars in cost impact to regional consumers.

Based on review of the proposed rule revisions and their underlying purposes, we believe the proposed approach of a temporary, limited modification consistent with the terms of 2019-2021 Spill Operation Agreement (Flexible Spill Agreement) is most prudent. However, the proposed modification should be limited to the higher spill levels for only

16 hours per day consistent with the Flexible Spill Agreement and legally valid 2019 NOAA Fisheries Columbia River System Biological Opinion (2019 BiOp).

First, this approach is the most consistent with the scope and spirit of the Flexible Spill Agreement, which is listed as the primary impetus for the proposed rule change. Second, it mitigates biological uncertainty regarding the proposed increased spill levels. Third, the proposed approach aligns with the timing of the Columbia River System Operations (CRSO) Environmental Impact Statement (EIS) and Endangered Species Act (ESA) consultation process, which are the proper venues for long-term consideration of mitigation actions for environmental impacts of operations on the Columbia River system, including spill levels.

Thank you for your consideration of these comments. A detailed discussion of factors that support the adoption of the proposed approach follows.

Purpose of Rule Changes

The most pressing need for the proposed rule revisions is to support 2020 spring spill operations under the 2019-2021 Spill Operation Agreement (Flexible Spill Agreement). The Flexible Spill Agreement is an arrangement for certain spill operations between BPA, the Army Corps of Engineers, and the Bureau of Reclamation (collectively the federal Action Agencies), along with the states of Oregon and Washington and the Nez Perce Tribe.

This agreement rests on three foundations. The first is providing biological benefits relative to 2018 spring operations. The second is providing federal power system benefits, as determined by BPA, that are equal to or greater than 2018 operations. Last, the agreed upon operations must be feasible for the Corps with the ability to make modifications as needed.

The Flexible Spill Agreement represents an attempt at a novel and collaborative approach to river operations. It is by its nature experimental and, for that reason, limited in timeframe and subject to continued analysis and evaluation of annual results. Indeed, the agreement specifically describes its sole purpose as “intended to avoid litigation until the National Environmental Policy Act remand process ... is completed,” and “is not intended to be used ... as precedent for, or an endorsement of, any operation ...” (2019-2020 Spill Operation Agreement, § II). Consistent with the parties’ intent, the agreement is set to expire upon the completion of the CRSO EIS and ESA processes.

Because the proposed modification sunsets at the end of the spring spill seasons in 2021, it best aligns with the purpose, scope, and timing of the Flexible Spill Agreement.

However, the proposed modification should be limited to 16 hours of spill at the higher levels per day. This is consistent with the spill levels contemplated in the Flexible Spill

Agreement and 2019 BiOp. It will also allow consideration of future, long-term rule changes that align with the outcomes of the CRSO EIS and ESA processes, fulfilling the goal of adaptive management using the best available science into the future.

Biological Uncertainty

There is significant uncertainty about the overall biological benefit of the spill operations contemplated for the 2020 spill season for both juvenile and adult salmonids, as well as resident species. Extended operation at 125% TDG is an unprecedented action at these federal projects.

The science on the effects of spill and other migration paths on juvenile salmon is constantly evolving. For example, new research has found that survival and return of juvenile salmon and steelhead is more dependent on size rather than the mechanism of passage through hydroelectric projects. The study found minimal evidence that fish going through bypass systems, turbines, or spillways have substantially different survival or “latent mortality” once size is controlled for.¹ This result calls into question whether spilling additional water to carry more fish through spillways will have meaningful effects on ultimate adult returns.

Oregon has previously recognized that there is a substantial body of science that raises cautionary flags to support an incremental rule change both in timeframe and operational scope. Oregon itself conducted a previous public process examining removal of the 115% TDG forebay standard. In 2009, that process reached the following conclusion:

Ecology decided not to change its 115% TDG forebay water quality criterion for the Columbia and Snake Rivers. Ecology determined that there would be a potential for a small benefit to salmon related to fish spill if the 115% forebay criterion was eliminated, but there would also be the potential for a small increase in harm from increased gas bubble trauma. The weight of all the evidence from available scientific studies clearly points to detrimental effects on aquatic life near the surface when TDG approaches 120%. Based on the information in this document, 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.²

¹ Faulkner, J.R., Bellerud, B.L., Widener, D.L. and Zabel, R.W. (2019), Associations among Fish Length, Dam Passage History, and Survival to Adulthood in Two At-Risk Species of Pacific Salmon. *Trans Am Fish Soc*, 148: 1069-1087. doi:[10.1002/tafs.10200](https://doi.org/10.1002/tafs.10200)

² Washington State Department of Ecology and State of Oregon Department of Environmental Quality 2009. Adaptive Management Team Total Dissolved Gas in the Columbia and Snake Rivers: Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement. Final. January 2009. Publication no. 09-10-002.

Likewise, the current 2019 BiOp that underlies the Flexible Spill Agreement substantially and frequently relies on the short-term duration of 125% spill operation to mitigate the biological uncertainty of the operation. It is also crucial to understand the overall biological impacts of the proposed spill operations to all aquatic species. The biological impacts from the 2019 operations are still being studied and analyzed and the CRSO EIS and ESA processes, which will develop a comprehensive analysis of extended operation at 125% TDG. Results from actual operations during 2020 at the unprecedented 125% level will also be of crucial importance to evaluate long-term changes.

Until these processes are complete, there remains significant uncertainty regarding the biological impacts of extended operation at 125% TDG. A temporary modification based on the timing and constraints of the Flexible Spill Agreement and 2019 BiOp best addresses the biological uncertainty of proposed 2020 spill operations by limiting the timeframe under which 125% TDG spill is permitted to the scope of the Flexible Spill Agreement.

Biological Monitoring

A robust and scientifically-sound fish monitoring program is necessary to correctly evaluate any effect of increased TDG on juvenile and adult fish in the Columbia River System during the period of increased spill. Further, as this rule change and the associated uncertainty result from a Washington state proposal, the State should be prepared to take on incremental costs associated with necessarily robust and scientific monitoring.

The current TDG monitoring is potentially inadequate to assess the incidence of Gas Bubble Trauma (GBT) in fish. First, the current Smolt Monitoring Program (SMP) is designed to only inspect juvenile fish passing five of the eight FCRPS projects in the Lower Snake and Mid-Columbia Rivers. Second, the SMP is designed to inspect juvenile fish collected from the forebay of each of these projects where TDG is likely the lowest. Any acutely affected juvenile fish may be lost before they reach the forebay of each project. In addition, there is currently no juvenile sockeye, adult fish or resident fish monitoring program to inspect for GBT in the FCRPS.

PPC supports a GBT monitoring program that evaluates both adult and juvenile life stages of resident and anadromous fish occurring in the FCRPS. In addition to any forebay collections, fish must be collected from the tailrace of each project to assess the incidence of GBT. Also, fish must be sampled from each tailrace more frequently than the suggested weekly schedule. The levels of TDG can vary significantly throughout the day. Any biological sampling plan must adequately survey conditions experienced by fish in the FCRPS.

The TDG Biological Monitoring Plan must also be comprehensive and statistically sound. The Draft Implementation Plan allows fish data collected from multiple facilities within one segment of the river to be pooled to meet fish size samples. This potentially jeopardizes an effective GBT monitoring program because each project will be generating distinct TDG concentrations and measures to reduce TDG will be taken at each individual project. Therefore, GBT must be monitored at each project to assess the specific effects of TDG levels at that project, and then the effects of any corrective measures. It also should be further noted that in the implementation of the Flex Spill Agreement, certain immediate adjustments had to be made at John Day, The Dalles, and Lower Granite projects because of adverse impacts the heightened spill levels were having at these projects. This demonstrates why data collected at individual projects should not be pooled.

Measurement

PPC supports alignment of measurement of tailrace TDG concentrations between the states of Washington and Oregon. As a practical matter, the specific details of measurement criteria under consideration are unlikely to have a substantial impact on actual operations. The Corps of Engineers must manage an array of forecast uncertainties and operational constraints in real time. These realities are more impactful on actual operations than retrospective comparisons of measurement criteria with perfect hindsight. Washington's proposal for measurement criteria is reasonable and does not undermine the potential scientific value of measuring the effects of higher spill levels on aquatic species.

Columbia River System Operations EIS and ESA Consultation Processes

It is crucial to place this proposed modification in the current context of long-term efforts to manage the Columbia River System instead of considering it in isolation. As discussed above, the federal Action Agencies are conducting the CRSO EIS and ESA consultation processes, which are expected to produce a comprehensive evaluation of options to balance the multiple uses of the river, including protection of endangered species.

The federal Action Agencies are uniquely positioned to conduct this evaluation as those with both the most direct expertise and statutory responsibility for management of river operations. Specifically, one of the alternatives under consideration in the CRSO EIS process features spill operations at 125% TDG at eight lower Snake and Columbia projects from March 1 to August 31. This CRSO alternative is likely to produce

information that would undoubtedly inform any future modifications or rule changes.

Oregon should not make a permanent rule change adopting higher TDG standards until the CRSO EIS and ESA consultation processes are completed. The federally led and Northwest state-advised processes present the proper venue for consideration of a long-term mitigation strategy of impacts from operations, including spill and TDG levels at the federal projects, and should inform future state decisions.

Legally-Valid Endangered Species Act Consultation

Modifications to allowed TDG concentrations in the Columbia River should only be made in accordance with a legally valid Endangered Species Act consultation for the operation of the federal projects. This is crucial to the long-term protection of aquatic life and habitat given the current scientific uncertainty around the benefits and risks of 125% TDG for hydro operations on the Columbia River System.

Consistency with the Flexible Spill Agreement and the underlying, legally valid 2019 BiOp dictate a modification limited in duration to the term of the Flexible Agreement and to increased spill levels for only 16 hours per day.

This approach also mitigates biological uncertainty regarding the proposed increased spill levels and allows development of a better scientific record to explain any future modifications that may be contemplated. That record, arguably, cannot be complete without examining the scientific information developed and analyzed during the CRSO EIS and ESA consultation processes. Moreover, the operation contemplated by the Flexible Spill Agreement is specifically covered by a legally-valid BiOp, but any unanticipated extensions of that operation would have no such legal coverage. By allowing the CRSO EIS and ESA consultation processes to run their course and considering those comprehensive findings in its future rulemakings, the State will be better positioned to adopt legally defensible rule changes in the future as needed.

Thank you again for your consideration of these comments.



Oregon

Kate Brown, Governor

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December 6, 2019

Paula Calvert
Columbia River Coordinator
Oregon Department of Environmental Quality
700 NE Multnomah St., Ste. 600
Portland, OR 97232

Re: Comments on Order Approving the U.S. Army Corps of Engineers' Request for a Modification to the State's Total Dissolved Gas Water Quality Standard

Dear Ms. Calvert:

The Oregon Department of Fish and Wildlife (ODFW) is submitting these comments in response to the State of Oregon's Proposed Modification to Total Dissolved Gas Water Quality Standard for Mainstem Columbia River. This modification by the Oregon Department of Environmental Quality (ODEQ) is vital for the successful implementation beginning this spring of the Columbia River Flexible Spill and Power Agreement (Agreement) supported by all regional state, tribal and federal management partners. We remain a strong proponent of this modification, and offer the following comments and suggestions below. As always, ODFW appreciates the opportunity to contribute to this important process.

Findings 2(a) para. 2: *"A seasonal increase in the total dissolved gas criteria to 125 percent from the historical 120 percent during the spring juvenile salmonid passage will allow the Corps to increase voluntary spill, passing more juvenile Snake River spring/summer Chinook salmon and steelhead over the spillway and reduce their passage through the turbines, a route referred to as powerhouse passage."*

Comment: As a point of clarification, CSS analyses have found powerhouse encounters reduce smolt to adult return rates. This includes passage through both turbine routes, as noted, and juvenile bypass routes. As such, the survival benefits from increased spill are the result of a greater number of fish being passed through spillways as opposed powerhouse routes (turbine and bypass combined).

Order 1 iv a) ii.: *"Instantaneous total dissolved gas levels exceed 126 percent of saturation, calculated as the average of the two highest hourly total dissolved gas measures in a calendar day in the tailraces of McNary, John Day, The Dalles or Bonneville Dams monitoring stations."*

Comment: ODFW is concerned this stipulation may unduly constrain effective implementation of the spill agreement (see below). ODEQ has a different constraining

Item I 000090

criteria proposed for addressing the Spill Agreement's requirement to manage spill to meet, but not exceed, 125% tailrace TDG, which we fully support. The secondary criteria referenced above is designed to provide a slight cushion to dam operators to help them manage to the 125% TDG allowance. Constraining the 2-hr criteria to 126% may actually act as a further constraint to dam operators, rather than a slight cushion to help them meet, but not exceed, the 125% criteria. As such, we recommend 127% TDG for this secondary criteria to allow more operational flexibility for dam operators to successfully manage spill to meet, but not exceed, 125% tailrace TDG as mandated in the Spill Agreement. Decades of monitoring have not witnessed, even at levels approaching 130% TDG, gas bubble trauma at actionable levels above 15%. Given this, it is unclear why 126 percent of saturation ("calculated as the average of the two highest hourly total dissolved gas measures in a calendar day") was selected as the secondary criterion.

We conducted a simulation exercise to assess the degree to which the spill agreement might be constrained by imposing a threshold at which "Spill will be reduced when:...Instantaneous total dissolved gas levels exceed 126 percent of saturation, calculated as the average of the two highest hourly total dissolved gas measures...". To examine this, we simulated 100,000 daily times series of hourly TDG levels based on a random uniform distribution, where properties of the distribution reflected what might be expected if spill is managed to 125% TDG. For each of these time series, we calculated the mean of the two highest TDG values and tabulated the number of times among all 100,000 series the mean exceeded 126% TDG. The probability that spill would have to be reduced given the threshold was then calculated as the proportion of simulated time series in which the two-hour mean exceeded 126% TDG. This exercise was then repeated assuming a 127% TDG threshold (e.g., "Spill will be reduced when:...Instantaneous total dissolved gas levels exceed [127] percent of saturation, calculated as the average of the two highest hourly total dissolved gas measures...". Under the 126% threshold, and given our assumptions, the probability of having to reduce spill was estimated to be 0.98. Under the 127% threshold, the estimated probability of having to curtail spill at some point throughout the day reduced to 0.33. Thus, the 126% 2-hr average constraint is very likely to unduly constrain the Corps' ability to manage spill to meet the primary criteria of 125% 12-hr average that is the basis for determining fish benefits of the Spill Agreement. This unintended constraint will likely preclude the Spill Agreement from achieving its expected biological benefits.

With regard to the calculation methodology for this exceedance language, i.e., "...calculated as the average of the two highest hourly...measures in a calendar day," ODFW's only comment is that the calculation methodology should be consistent with the Washington Department of Ecology.

Order 1 iv a) iii.: *"The modified total dissolved gas standards will apply for two years, 2020 and 2021."*

Comment: Processes currently underway throughout the region consider operations that could increase spill to 125% TDG over a longer time frame (e.g., CRSO EIS). In its previous action, ODEQ modified the total dissolved gas standards for a period of five years. ODFW asks ODEQ to likewise consider a five-year time frame for the current proposed modification in order to provide consistency with past actions and to ensure the modification does not have to be revisited unnecessarily in the short-term.

Order 1 iv c): *“Biological monitoring must occur and include monitoring for effects of elevated total dissolved gas exposure on salmonid and non-salmonid fish species...”*

Comment: ODFW agrees that biological monitoring is an essential component of any adaptive management strategy. Past monitoring of voluntary and involuntary spill has demonstrated very low risk to anadromous juvenile migrating salmonids at 125% TDG. Further, existing monitoring is adequate to detect and respond to in real-time if voluntary spill to 125% TDG indicates elevated GBT risk beyond that observed in the past. Currently there are no compelling data indicating chronic or acute GBT in non-salmonids, and any available information is anecdotal and is collected ancillary to the established GBT monitoring program. Nonetheless, because non-salmonids are routinely exposed to 125% TDG during involuntary spill events, effects of 125% TDG on non-salmonids are already part of the environmental background observed each year, and part of each non-salmonids' existing population status. To augment this anecdotal data and environmental background, existing monitoring programs could be expanded to include: (1) assessing GBT symptoms in non-salmonids collected, (2) targeting collection of reasonably more non-salmonids if elevated GBT symptoms are observed, and (3) assessing relationships between TDG and GBT symptoms in non-salmonids to better refine monitoring and adaptive management programs.

Thank you for the opportunity to comment on the proposed modification to the total dissolved gas (TDG) criteria in portions of the Columbia Rivers. On behalf of ODFW, we look forward to continuing to working with ODEQ to ensure the Columbia River Flexible Spill and Power Agreement is implemented successfully.

Sincerely,



Shannon Hurn
Deputy Director for Fish and Wildlife Programs
Oregon Department of Fish and Wildlife



December 6, 2019

Oregon Environmental Quality Commission
700 NE Multnomah Street, Suite 600
Portland, OR 97232

Sent via email to: calvert.paula@deq.state.or.us

RE: Request to Modify Columbia River Total Dissolved Gas Water Quality Standard

Dear Oregon Environmental Quality Commissioners,

Thank you for the opportunity to provide comments on the proposal to modify Oregon's Columbia River water quality standard. The Orca Salmon Alliance is a coalition of sixteen local, state, and national organizations. We work together to save Southern Resident orcas by recovering their primary food, Chinook salmon. Our members are actively engaged in policy, legal, educational, and other advocacy efforts in Oregon and across the region to save the whales.

The Washington State Southern Resident Orca Task Force recognized that increasing spill over the Columbia Basin's dams is one of the most effective near-term actions our region can take to provide more salmon for orcas. Oregon's current water quality standard is overly conservative and unnecessarily limits the amount of water that can be directed over the spillways of dams in the Columbia Basin. We, the undersigned sixteen groups and our members, strongly support a permanent modification of the state's total dissolved gas standards to 125 percent. If there are science-based reasons why the change should not be permanent, we ask that it be a modification for not less than five years.

Increasing these standards will allow for more water to be spilled over dams on the Columbia and Snake rivers, both of which support critical salmon runs that the highly endangered Southern Resident orca population relies on. This change in water quality standards is also in line both with the Washington State Task Force's Year 1 Report Recommendation No. 8 and the Flexible Spill Agreement.

Earlier this year, three adult Southern Residents were reported as dead: a matriarch female (J17) and two adult males (K25 and L84). The scientific consensus among orca experts is that the population is food-limited and declines in the availability of Chinook salmon have been correlated with increased mortality, decreased fecundity, changes in social cohesion and declines in adult size.¹

¹ Parsons KM, Balcomb KC III, Ford JKB, Durban JW. (2009). *The social dynamics of southern resident killer whales and conservation implications for this endangered population*. Anim

The population of endangered Southern Residents is now 73 orcas, the lowest it has been since the end of the live-captures in the 1970s. Without bold leaders and strong collective near-term actions, the Southern Residents will go extinct within our lifetime.

The top threat to their survival and recovery is widely recognized as the decline of the whales' primary prey – Chinook salmon. The National Oceanic and Atmospheric Administration (NOAA), the federal agency charged with overseeing management and recovery for the Southern Resident orca population, has recognized in their 2008 Recovery Plan that “[p]erhaps the single greatest change in food availability for resident killer whales since the late 1800s has been the decline of salmon in the Columbia River basin.”²

Allowing for increased “spill” up to 125 percent total dissolved gas is a critical step towards Columbia and Snake river salmon recovery. The Columbia and Snake rivers' dams and their reservoirs directly and indirectly kill a high percentage of the out-migrating smolts. A 2014 study found that 76 percent of Snake River Chinook juveniles that passed through the federal Columbia Basin hydropower dams died as a result of their out-migrating experience.³ Dams reduce water velocity, prolong salmon migration, alter estuary timing, increase water temperatures, exacerbate predation, and increase stress and injury. Increasing the proportion of river flow spilled over crests of dams more closely mimics the natural flow and delivers smolts more quickly and safely to the ocean. Scientific research collected annually by the Fish Passage Center since the mid-1990s demonstrates conclusively that additional spill significantly increases juvenile salmon survival and subsequent adult returns.⁴ For all these reasons, we strongly support increasing the TDG water quality standard for the Columbia Basin to 125 percent.

Behav 77: 963–971; Ward E.J., Holmes E.E., Balcomb K.C. (2009). *Quantifying the effects of prey abundance on killer whale reproduction*. J Appl Ecol 46: 632–640; Ford J.K.B., Ellis G.M., Olesiuk P.F., Balcomb K.C. III. (2010). *Linking killer whale survival and prey abundance: food limitation in the oceans' apex predator*. Biol Lett 6: 139–142; Fearnbach H, Durban J, Ellifrit D, Balcomb K.C. (2011). *Size and long-term growth trends of Endangered fish-eating killer whales*. Endang Species Res 13: 173–180; Foster E.A., Franks D.W., Morrell L.J., Balcomb K.C., Parsons K.M. (2012a). *Social network correlates of food availability in an endangered population of killer whales, Orcinus orca*. Anim Behav 83: 731–736.

² National Oceanic and Atmospheric Administration. (2008). *Recovery Plan for Southern Resident Killer Whales (Orcinus orca)*. Available at: https://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/esa_status/srkw-recov-plan.pdf.

³ Schaller, H.A., C.E. Petrosky, and E.S. Tinus. (2014) *Evaluating river management during seaward migration to recover Columbia River stream-type Chinook salmon considering the variation in marine conditions*. Can. J. Fish. Aquat. Sci. 71: 259-271.

⁴ See e.g. CSS (Comparative Survival Study Oversight Committee). (2018). DRAFT 2018 Annual Report. Comparative Survival Study of PIT-tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye. BPA Project #19960200. Available at: <http://www.fpc.org/documents/CSS/DRAFT2018CSSReportv1-1.pdf>

Conclusion

Increasing salmon runs in the Columbia Basin is essential to preventing the extinction of the Southern Resident orcas. Increasing spill over the Columbia and Snake rivers' dams will directly benefit seven of the fifteen salmon runs identified by NOAA as most important in the orcas' current diet.

We greatly appreciate your attention to this urgent matter and leadership to recover salmon—and, by extension, orcas. We strongly support modifying Oregon's Columbia River total dissolved gas water quality standard to 125 percent.

We look forward to working with you and your staff further to prevent the extinction of orcas and salmon.

Sincerely,



Giulia C.S. Good Stefani
Senior Attorney
Natural Resources Defense Council (NRDC)

On behalf of the member groups of the Orca Salmon Alliance:

Center for Biological Diversity
Defenders of Wildlife
Earthjustice
Friends of the San Juans
Natural Resources Defense Council
Oceana
Orca Network
Puget Soundkeeper Alliance
Save Our Wild Salmon
Seattle Aquarium
Sierra Club
Toxic Free Future
Washington Environmental Council
Whale and Dolphin Conservation
Whale Scout
Wild Orca

Order Approving a Modification to the Oregon’s Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION

In the matter of modifying Oregon’s)	FINDINGS and
Water Quality Standards for Total Dissolved)	ORDER
Gas in the Columbia River Mainstem)	

Findings

1. The Department of Environmental Quality received a request from the U.S. Army Corps of Engineers (Corps) dated July 10, 2019, to adjust the 110 percent total dissolved gas water quality standard as necessary to spill water over McNary, John Day, The Dalles and Bonneville dams on the Lower Columbia River to assist out-migrating threatened and endangered salmonid smolts during the fish passage season of April 10 to Aug. 31. The request sought approval in alignment with the 2019-2021 Spill Operations Agreement

2. Acting under **OAR 340-041-0104(3)** the commission finds that:

(a) *Failure to act would result in greater harm to salmonid stock survival through in-river migration than would occur by increased spill:*

Of the thirteen Endangered Species Act listed evolutionarily significant units (ESUs) of salmonids that migrate past the Columbia River dams, two ESUs in particular have struggled to meet recovery goals. Based on annual reporting of the Comparative Survival Study (CSS) juvenile fish passage survival model, Snake River spring/summer Chinook salmon and summer steelhead have fallen short of the 2-6 percent smolt-to-adult return (SAR) target for recovery established by the Northwest Power and Conservation Council. From 1994 through 2016, Snake River spring/summer Chinook salmon SARs have been above 2 percent for only 2 years, with an average SAR of less than 1 percent, signifying major population declines. From 1997 through 2015, Snake River summer steelhead SARs have been above 2 percent for 8 years with an average SAR of 1.7 percent.

An increase in the total dissolved gas criteria to 125 percent from the level of 120 percent previously allowed during the spring juvenile salmonid migration will allow the Corps to increase voluntary spill, passing more juvenile Snake River spring/summer Chinook salmon and steelhead over the spillways and reducing their passage through the turbines and bypass systems, a route collectively referred to as powerhouse passage. The CSS model finds that increased rates of powerhouse passage negatively impact both in-river survival and early ocean survival of juvenile salmonids.

Fish Passage Center data estimate an approximate 1 percent incidence of gas bubble trauma in juvenile salmonids in the Columbia River when total dissolved gas levels are managed to 120 percent in the tailrace. This estimate is based on monitoring information collected between 1995 and 2019. Opportunities to monitor juvenile salmonid exposure to total dissolved gas above 120 percent occurs during involuntary spill such as times of high stream flows. Based on observations of gas bubble trauma monitoring of juvenile salmonids, gas bubble trauma threshold of 15 percent gas bubble trauma prevalence has generally been exceeded with exposure to total dissolved gas levels near 130 percent or higher.

If the Commission were to not modify the TDG standard, the statewide standard of 110 percent would apply – requiring significant curtailment of voluntary spill.

Based on these considerations, the Commission finds that failure to approve the modification requested by the Corps would, on balance, result in greater harm to salmonid stock survival than would approval of the modification.

- (b)** *The modified total dissolved gas criteria associated with the increased spill provides a reasonable balance of the risk of impairment due to elevated total dissolved gas to both resident biological communities and other migrating fish and to migrating adult and juvenile salmonids when compared to other options for in-river migration of salmon:*

Risk of aquatic life impairment due to elevated total dissolved gas exposure is dependent on factors including species sensitivity to high total dissolved gas and depths where species are located during different life stages. Depth is an important consideration because total dissolved gas is reduced approximately 10 percent for each meter of depth, a phenomenon known as hydrostatic depth compensation. Given the variability of field conditions and life stages it is difficult to generalize relationships of total dissolved gas exposure and gas bubble trauma observed for resident species. Studies have shown instances when greater than 15 percent of resident fish examined have signs of gas bubble trauma when exposed to 120-125 percent total dissolved gas.^{1,2} However, field observations conducted for comparing species sensitivities to total dissolved gas have shown that juvenile salmonids are more sensitive than the resident species examined.³

Increasing the level of total dissolved gas allowed during periods of voluntary spill during the specified periods of the year will increase the risk of impairment to both resident and other migrating fish, as well as to migrating salmon. However, the

¹ Ryan BA and Dawley EM. 1998. Effects of dissolved gas supersaturation on fish residing in the Snake and Columbia rivers, 1997. Bonneville Power Administration.

² Schrank BP, Ryan B and Dawley EM. 1998. Effects of dissolved gas supersaturation on fish residing in the Snake and Columbia Rivers, 1996. Report by National Marine Fisheries Service, to US Army Corps of Engineers, North Pacific Division, Portland, Oregon.

³ Toner MA and Dawley EM. 1995. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates downstream from Bonneville Dam, 1993. Coastal Zone and Estuarine Studies Division, Northwest Fisheries Science Center, National Marine Fisheries Service

predicted benefits to survival rates for Snake River spring/summer Chinook salmon and summer steelhead are significant, and reasonably balance the increase in risk.

(c) Adequate data will exist to determine compliance with the standards:

Physical monitoring for total dissolved gas is necessary for evaluating compliance with the standards. The Corps utilizes real-time total dissolved gas observations from fixed monitoring stations located in the tailraces of McNary, John Day, The Dalles and Bonneville Dams. The Corps reviews their total dissolved gas monitoring plan annually and updates it as needed. The plan will be available at:

<https://www.nwd.usace.army.mil/CRWM/Water-Quality/>. Implementation of the total dissolved gas monitoring plan will ensure that data will exist to determine compliance with the standards for the voluntary spill program identified in this Order. The Corps will report each year's physical monitoring results to DEQ.

(d) Biological monitoring is occurring to document that the migratory salmonid and resident biological communities are being protected:

Biological monitoring occurs according to the Fish Passage Center 2019 document "Gas Bubble Trauma Monitoring Protocol and GBT.net Data Entry Users Manual," available at: ftp://ftp.fpc.org/gbt/gbtmanual_datasheet. Juvenile salmonids are collected at Bonneville and McNary Dams and examined for incidence of gas bubble trauma, and assigned ranks based on severity of their symptoms. Monitoring non-salmonid species for gas bubble trauma can occur by utilizing the existing infrastructure for sampling juvenile salmonids. The Corps will report each year's biological monitoring results to DEQ.

Order

The Environmental Quality Commission approves the following modification to the statewide standard for total dissolved gas (OAR 340-41-0031(2)) of 110 percent for the lower Columbia River at McNary, John Day, The Dalles and Bonneville dams, as provided for in OAR 340-41-0104(3):

1. The total dissolved gas standard for the Columbia River as measured in the tailraces of McNary, John Day, The Dalles, and Bonneville dams is 125 percent for the period from April 1 through June 15.
2. The total dissolved gas standard for the Columbia River as measured in the tailraces of McNary, John Day, The Dalles, and Bonneville dams is 120 percent for the period from June 16 through Aug. 31.
3. These limits do not apply when the stream flow exceeds the seven-day, ten-year frequency flood.
4. The DEQ Director may approve additional periods of application of this modification, beyond the April 1 to Aug. 31 period, subject to subsections 7.a) to 7.d) for reasons including passing Spring Creek Hatchery fish releases, maintenance activities, and biological or physical studies of spillway structures and prototype fish passage devices. The Corps must notify DEQ in writing describing the purposed action, the purpose of the

action and dates of action at least one week prior to the spill. The Corps must obtain written approval from the Director prior to such spill.

5. The modified total dissolved gas standards will apply for two years, 2020 and 2021.
6. Voluntary fish passage spill during the spring spill season, occurring from April 1 through June 15, is subject to the following conditions:
 - a) Spill at a dam must be reduced to 120 percent as calculated in 7.a)i. when:
 - i. Instantaneous total dissolved gas levels exceed 127 percent of saturation, calculated as the average of any two consecutive hourly TDG measurements in the tailrace of the dam; or
 - ii. The average of the twelve highest hourly TDG measurements in the tailrace of the dam in a calendar day exceeds 125 percent; or
 - iii. The calculated incidence of gas bubble trauma in salmonids (with a minimum sample size of fifty fish required weekly) or non-salmonids (with a minimum sample size of fifty fish required weekly) exceeds gas bubble trauma in nonpaired fins of fifteen percent, or gas bubble trauma in nonpaired fins of five percent and gas bubbles occlude more than twenty-five percent of the surface area of the fin. If gas bubble trauma exceeds these biological thresholds, additional monitoring must demonstrate the incidence of gas bubble trauma below biological thresholds before TDG can be increased to the level specified in this order. Gas bubble trauma monitoring data shall be excluded from comparison to biological thresholds when higher than normal river flow contributes to excess spill above 125 percent. This monitoring data exclusion shall apply for one full calendar day after reduced river flow allows attainment of 125 percent TDG levels in the tailrace of the dam.
 - b) The tailrace maximum TDG criteria for spring spill in this modification will be applied in a manner consistent with the 2019 NMFS Biological Opinion.
 - c) Physical monitoring must occur and be adequate for implementing the requirements of this order.
 - d) Application of the tailrace maximum TDG criteria must be accompanied by a DEQ-approved biological monitoring plan designed to measure impacts to fish exposed to increased TDG conditions throughout the spring spill season. Beginning in the year 2021, plans must include monitoring for non-salmonid fish species. Gas bubble trauma monitoring for juvenile salmonids may be halted if there is a high mortality risk due to compounded effects of the evaluation procedure and adverse environmental factors such as high stream temperatures.
7. Voluntary fish passage spill during the summer spill season, occurring from June 16 through Aug. 31, is subject to the following conditions:
 - a) Spill at a dam must be reduced when:
 - i. The average of the twelve highest hourly TDG measurements in the tailrace of the dam in a calendar day exceeds 120 percent of saturation; or
 - ii. Instantaneous total dissolved gas levels exceed 125 percent of saturation in the tailrace of the dam, calculated as the average of the two highest hourly total dissolved gas measures in a calendar day.

- b) The DEQ Director may halt the voluntary spill program or require reductions in voluntary spill to reduce TDG levels if voluntary spill results in biological threshold exceedances when:
 - i. More than 15 percent of salmonids examined show signs of gas bubble disease in their non-paired fins, or
 - ii. More than five percent of salmonids examined show signs of gas bubble trauma in their non-paired fins where more than 25 percent of the surface area of the fin is occluded by gas bubbles.
- c) Physical monitoring must occur and be adequate for implementing the requirements set out in this order.
- d) Application of the tailrace maximum TDG criteria must be accompanied by a DEQ-approved biological monitoring plan designed to measure impacts to fish exposed to increased TDG conditions throughout the summer spill season. Beginning in the year 2021, plans must include monitoring for non-salmonid fish species. Gas bubble trauma monitoring for juvenile salmonids may be halted if there is a high mortality risk due to compounded effects of the evaluation procedure and adverse environmental factors such as high stream temperatures.
8. The Corps must provide written notice to DEQ within 24 hours of any violations of the conditions in the modification as it relates to voluntary spill. Such notice must include actions proposed to reduce total dissolved gas levels or the reason(s) for no action.
9. No later than Jan. 31 following each year of this modification, the Corps must provide an annual written report to DEQ detailing the following:
 - a) Flow and runoff descriptions for the spill season;
 - b) Spill quantities and durations;
 - c) Quantities of water spilled for fish versus spill for other reasons for each project;
 - d) Data results from the physical and biological monitoring programs, including incidences of gas bubble trauma regardless of sample size;
 - e) Evaluation of the relationship between observations of non-salmonid gas bubble trauma monitoring and exposure to elevated total dissolved gas levels;
 - f) Description and results of any biological or physical studies of spillway structures and prototype fish passage devices to test spill at operational levels; and
 - g) Implementation of gas abatement measures identified through adaptive management.
10. If requested, the Corps must report to the commission on any of the above matters or other matters relevant to this order.
11. The commission reserves the right to terminate or modify this order at any time.

Adaptive Management

Implementation of the TMDL for Lower Columbia River Total Dissolved Gas will continue. Oregon may request further studies to determine additional structural and operational gas abatement actions that can be feasibly implemented to reduce total dissolved gas.

Dated: _____

ON BEHALF OF THE COMMISSION

DEQ Director