The National Hydropower Association, Inc.
200 Massachusetts Ave NW, Suite 320 Washington, DC 20001* Tel 202.805.5057

April 10, 2023

Mr. Jomar Maldonado
Director for NEPA
White House Council on Environmental Quality
730 Jackson Place NW
Washington, DC 20503

Re: Docket Number: CEQ-2022-0005
Comments on "National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emission and Climate Change"

Dear Director Maldonado,

The National Hydropower Association ("NHA") is a non-profit national association dedicated to securing hydropower as a clean, carbon-free, renewable, and reliable energy source that provides power to an estimated 30 million Americans. Its membership consists of more than 300 organizations, including public and investor-owned utilities, independent power producers, equipment manufacturers, and professional organizations that provide legal, environmental, and engineering services to the hydropower industry.

NHA promotes innovation and investment in all waterpower technologies, including conventional hydropower, marine and hydrokinetic power systems, and pumped storage hydropower to integrate other clean power sources, such as wind, solar, and clean hydrogen. NHA appreciates the opportunity to respond to the White House Council on Environmental Quality's ("CEQ") National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emission and Climate Change ("Interim Guidance").[1]

Background on Hydropower

NHA's members own roughly 85% of the U.S. hydropower generating capacity, which includes over 100 Gigawatts ("GW") of hydropower and pumped storage capacity.

Hydropower is a clean, flexible, and reliable energy source that supports an estimated 72,000 well-paying jobs in the United States.[2] The sector also generates more than 6 percent of the country's utility-scale electricity and nearly one third of all utility-scale renewable power. In addition, pumped storage, which is a long-duration energy storage asset, provides the majority of energy storage on the grid.[3]

The federal government has recognized that the value of hydropower in the United States as a reliable, flexible, and clean technology. The Infrastructure and Investment Jobs Act enacted in 2021 provides nearly $1 billion in incentives for capital improvements at existing infrastructure.[4] Another example are the tax

[1] 88 FR 1196-1212 (January 9, 2023).
[2] U.S. Department of Energy, *U.S. Hydropower Workforce: Challenges and Opportunities* (October 2022). https://www.energy.gov/eere/water/articles/new-report-highlights-hydropower-industrys-demand-new-diverse-talent.
[3] U.S. Department of Energy, *How Does Pumped Storage Work*. At How Pumped Storage Hydropower Works | Department of Energy
[4] "H.R.3684 - 117th Congress (2021-2022): Infrastructure Investment and Jobs Act." Congress.gov, Library of Congress, 15 November 2021, https://www.congress.gov/bill/117th-congress/house-bill/3684

credits within the Inflation Reduction Act enacted in 2022. The Inflation Reduction Act provides numerous tax credits to add new MWs of hydropower generation and to incentivize investment into the domestic supply chain.[5] Significantly, hydropower also plays an often-overlooked role in enhancing grid reliability. For example, while hydropower provides 6 percent of overall U.S. electricity generation, it provides approximately 40 percent of the nation's "black start" capability, which is vital in enabling the grid to restart (such as the 2003 Northeast blackout).[6] Additionally, hydropower provides numerous grid enhancing services such as spinning and non-spinning reserves that correct supply and demand imbalance if another resource trips offline or to match the variability of wind and solar resources through regulation services. The chart below from a recent Brattle Group report highlights hydropower's unique ability to provide frequency control, spinning reserves, and other essential grid reliability services.[7]

Product	Nuclear	Run-of-River Hydro	Pondage Hydro	Pumped Storage	Coal	Combined Cycle	Combustion Turbine	Wind	Solar	Battery Storage	Demand Response	Energy Efficiency
Day-Ahead Energy	✓	✓	✓	✓	✓	✓	O	✓	✓	O	O	O
Real-Time Energy	O	✓	✓	✓	✓	✓	O	✓	✓	O	O	O
Clean Energy	✓	✓	✓	O	X	O	O	✓	✓	O	O	✓
Regulation	X	O	✓	✓	✓	✓	O	O	O	✓	O	X
Spinning Reserves	X	O	✓	✓	✓	✓	✓	X	X	✓	O	X
Non-Spinning Reserves	X	X	✓	✓	X	✓	✓	X	X	✓	O	X
Load-following	O	O	✓	✓	O	✓	✓	O	O	✓	O	X
Reactive Power	✓	✓	✓	✓	✓	✓	✓	O	O	✓	X	X
Black Start	X	✓	✓	✓	O	✓	✓	X	X	O	X	X
Resource Adequacy	✓	✓	✓	✓	✓	✓	✓	O	O	O	✓	✓

Technical Capability to Provide Product
✓ Well-Suited
O Neutral
X Poorly-Suited

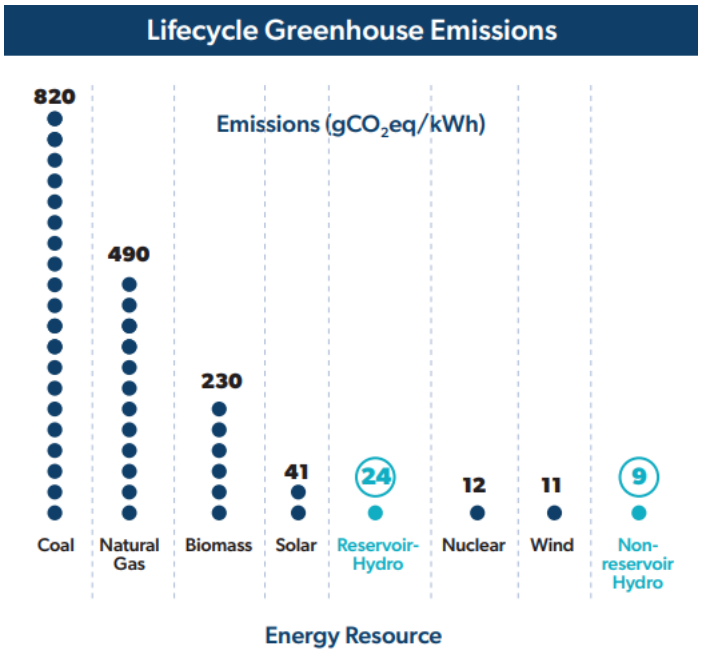
[5] "Text - H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022." Congress.gov, Library of Congress, 16 August 2022, https://www.congress.gov/bill/117th-congress/house-bill/5376/text
[6] U.S. Department of Energy, Hydropower Plants as Blackstart Resources, at https://www.energy.gov/sites/prod/files/2019/05/f62/Hydro-Black-Start_May2019.pdf.
[7] The Brattle Group, Leveraging Flexible Hydropower in Wholesale Markets, Principles for Maximizing Hydro's Value, April 2021, available at Leveraging Flexible Hydro in Wholesale Markets

Hydropower Should be Exempt from Lifecycle GHG Emissions Analyses

CEQ's Interim Guidance outlines offshore wind and solar as examples of technologies that are exempt from lifecycle greenhouse gas ("GHG") emissions analyses:

> Absent exceptional circumstances, the relative minor and short-term GHG emissions associated with construction of certain renewable energy projects, such as utility-scale solar and offshore wind, should not warrant a detailed analysis of lifetime GHG emissions. As a second example, actions with only small GHG emissions may be able to rely on less detailed emissions estimates.[8]

If the CEQ decides that lifecycle GHG emissions should not be analyzed for certain renewable energy technologies, then hydropower should be excluded as well because of its comparable lifecycle emissions. Simply retrofitting existing dam infrastructure with electric generating equipment has the single lowest lifecycle emissions of any technology.[9] The graph below illustrates findings from the United Nations Intergovernmental Panel on Climate Change ("IPCC") that run-of-river and pumped storage hydropower to have less lifecycle greenhouse gas emissions than any other source of renewable energy generation.[10]



Not only does hydropower have some of the lowest lifecycle emissions of any technology, it is an enabler of further integration of other renewable energies. The Department of Energy's ("DOE") Oak Ridge National Laboratory suggests comparing technologies through contextualizing them within the electricity portfolio.

[8] 88 FR 1202.
[9] United Nations Intergovernmental Panel on Climate Change https://www.hydro.org/wp-content/uploads/2021/09/Hydropower-in-Context-Greenhouse-Gas-Emissions.pdf
[10] United Nations Intergovernmental Panel on Climate Change, "Renewable Energy Sources and Climate Change Mitigation" (2012) at https://www.ipcc.ch/site/assets/uploads/2018/03/SRREN_Full_Report-1.pdf

> Energy sources are not directly comparable because they play different roles in supporting the electricity grid. Projects that support integration of variable renewables to the grid will likely lower the carbon footprint for the electricity portfolio as a whole by enabling the intermittent use of wind and solar and by displacing natural gas.[11]

Given that hydropower plays an important role in integrating wind and solar, displacing fossil fuels, and provides other essential grid services, all of which further the net climate benefit that hydropower provides, any evaluation that includes hydropower should be compared on an equivalent basis to the lifecycle emissions of other renewable energy sources.

Hydropower's Role in Achieving Climate and Infrastructure Goals

In April 2021, the President announced new greenhouse gas reduction targets for the United States: a 50 to 52 percent reduction of economy-wide net greenhouse house pollution by 2030, based on 2005 greenhouse gas emission levels.[12] The United States has set a goal to reach 100 percent carbon-free electricity by 2035.[13] The nation's hydropower infrastructure is a critical resource for achieving the Administration's climate policy goals. The 2016 DOE Hydropower Vision Report ("Vision Report") outlines the potential for adding energy generation to non-powered dams. The Vision Report shows that by 2050, 4.8 GW of new energy generation could be added to existing infrastructure within the United States with the potential for 6.3 GW of added generation at existing hydropower plants due to upgrades.[14] Further, the Vision Report shows the potential for 35.5 GW of new pumped storage in the United States by 2050.[15]

Hydropower is America's oldest and most reliable renewable energy source and contributes to climate change mitigation by avoiding GHG emissions. The International Energy Agency ("IEA") labels hydropower as a "cheap and mature technology that contributes to climate change mitigation, and could play a key role in climate change adaptation of water resource availability," increasing U.S. climate resiliency.[16] Hydropower plays a key role in mitigating the global impacts of climate change by providing massive quantities of low-carbon electricity and its unmatched capabilities for providing flexibility and storage.[17]

---

[11] U.S. DOE Oak Ridge National Laboratory, "Getting Lost Tracking the Carbon Footprint of Hydropower" (H. Jager et al. 2022)
[12] The White House, *Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies* (Apr. 22, 2021) at FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies | The White House
[13] Ibid.
[14] Department of Energy Hydropower Vision Report (2016) at https://www.energy.gov/sites/default/files/2018/02/f49/Hydropower-Vision-021518.pdf
[15] Ibid., pg. 16, DOE Hydropower Vision Report (2016)
[16] International Energy Agency, Hydropower has a crucial role in accelerating clean energy transitions to achieve countries' climate ambitions securely" (2021) at https://www.iea.org/news/hydropower-has-a-crucial-role-in-accelerating-clean-energy-transitions-to-achieve-countries-climate-ambitions-securely
[17] Ibid., IEA

Misinformation Regarding Reservoir Emissions

Certain commentors have asserted that reservoirs and dams emit methane.[18] Running water through a turbine to generate electricity does not release any form of greenhouse gases. In addition, since the vast majority of man-made reservoirs were built for flood control, water storage, irrigation, and/or recreation, the presence of a hydropower facility at a multi-purpose reservoir has no impact on greenhouse gas emissions.

NHA acknowledges that all water bodies emit some form of methane due to natural forces and anthropogenic inputs beyond the waterbody such as runoff and industrial effluents. Ponds, lakes, and reservoirs emit varying levels of methane based on a range of factors such as size, depth, age, oxygen levels, and location to name a few. [19] Reservoirs can act as a carbon storage mechanism by storing 40% of carbon from inland water bodies as well as sequestering greenhouse gases.[20]

Attached in the Appendix is NHA's response to a Petition for Rulemaking submitted to the U.S. Environmental Protection Agency referenced in the commentors pleading that provides an overview of the current scientific consensus regarding methane emissions from waterbodies. To directly respond to some of the evidentiary statements made by the commentors, they point to reservoir emissions from certain reservoirs. However, when one digs into the calculations made, it is clear that these estimates are not utilizing the best-available science or information related to reservoir emissions. NHA found that:

> A closer look at the specific publications cited by Petitioners further confirms this point. The estimates provided in the Petition are each the result of statistical regressions trained on relatively small data sets of GHG emission measurements in reservoirs throughout the world. For example, Deemer et al. (2016), is cited repeatedly in the Petition for its estimates, which are developed from a regression based on a limited set of relatively static characteristics (age, surface area, maximum temperature, and watershed soil erosion rate) from a limited number of reservoirs. The regression does not incorporate inflows, outflows, or throughput of energy and mass, each of which play an essential role in determining water quality, and thus emissions. While such regression findings may explain some of the variation in GHG emissions data from reservoir to reservoir, their application to unmeasured reservoirs does not represent evidence of emissions. The findings also fail to account for the management or regulation of individual rivers, streams, lakes, or water bodies, which can have a significant impact on emissions. For example, the Petition's application of these statistical regressions to individual waterbodies such as Lake Mead, Kentucky Lake, and Lake Whitney, for which no field measurements of GHGs have ever been attempted, is inaccurate because the regressions fail to account for the management, operation, and regulation of those systems, a characteristic of these waterbodies which differs vastly from the waterbodies upon which the regressions were based.[21]

The requests from the commentors call into question their credibility. Requesting costly drone or satellite imagery and tracking would impose unnecessary costs that are ultimately borne by ratepayers. Utilizing drone or satellite technology is nascent and unproven even for easily detectable point-source fugitive

[18] Save the Colorado, Patagonia, et. al., Comments on "National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change," Docket No.: CEQ2002-0005 (March 10, 2023).
[19] Environmental Science & Technology, "Organic Carbon Burial in Lakes and Reservoirs of the Conterminous United States" (DW Clow et al. 2015)
[20] Renewable and Sustainable Energy Reviews, "Getting Lost Tracking the Carbon Footprint of Hydropower" (H. Jager et al. 2022)
[21] Appendix at page 9.

emissions from fossil fuel infrastructure and facilities. The third option, incorporating their undocumented and unvalidated model, appears to be a marketing ploy to drive traffic to their own website. It's unclear how such a model could include all the source categories that would influence reservoir emissions. In fact, there are two apparent inputs that the tool misses such as direct precipitation and insolation. These inconsistencies and scientific lapses demonstrate why the request by the commentors should be dismissed.

Conclusion

NHA thanks CEQ for the opportunity to provide comments on the Interim Guidance. Clean and reliable hydropower provides tremendous value to the Biden Administration to reaching its net zero goals and with appropriate incentives and guidelines, could attain these goals by 2035. NHA would be happy to provide further information to the White House CEQ office as needed.

Sincerely,

/s/ Anthony Laurita

Anthony Laurita
Program Manager

/s/ Michael Purdie

Michael Purdie
Director of Regulatory Affairs and Markets

The National Hydropower Association, Inc.
200 Massachusetts Ave NW, Suite 320 Washington, DC 20001* Tel 202.805.5057

Appendix

The National Hydropower Association, Inc.
200 Massachusetts Ave NW, Suite 320 Washington, DC 20001* Tel 202.805.5057

VIA E-MAIL & U.S. MAIL

November 22, 2022

Paul Gunning, Director
Climate Change Division
Office of Atmospheric Protection (MC-6207A)
United States Environmental Protection Agency
1200 Pennsylvania Ave. NW.
Washington, DC 20460
Gunning.Paul@epa.gov

RE: Response to petition for rulemaking to add dams and reservoirs as a source category under the Greenhouse Gas Reporting Program

Dear Director Gunning,

On March 21, 2022, a group of organizations submitted a petition for rulemaking to EPA requesting an expansion of the Mandatory Greenhouse Gas Reporting Program, 40 CFR Part 98, to include a new source category for dams and reservoirs ("Petition"). With this letter, the National Hydropower Association ("NHA") opposes the Petition because no scientifically validated method exists for accurately estimating anthropogenic greenhouse gas ("GHG") emissions from individual dams and reservoirs. Without a viable method for estimating GHG emissions, adding dams and reservoirs to EPA's reporting program would be premature at best. At worst, it would place a massive regulatory burden on potentially thousands of individual dam and reservoir owners and operators, forcing them to make estimates that would inevitably prove to be highly inaccurate, inconsistent, and unreliable. As a result, granting the Petition would only distort the information available for evaluating future policy choices.

Moreover, the assertions made in the Petition regarding the magnitude of GHG emissions attributable to dams and reservoirs are wholly unsupported and highly overstated. The Petition strains to characterize reservoirs as an equal or even greater risk to climate change than the use of fossil fuels, an absurd claim that completely ignores the fact that much of what may be emitted from reservoirs would be emitted from natural waterbodies as part of the earth's natural carbon cycle. The Petition also fails to acknowledge numerous factors that draw into question the alarmist statements it makes about U.S. reservoirs. Contrary to the biased claims made in the Petition, U.S. reservoirs are far less likely to be significant sources of GHG than the reservoirs evaluated in the studies upon which the Petition relies because U.S. reservoirs differ significantly in age, climate, and water quality management practices.

I. The National Hydropower Association

NHA is a non-profit national association dedicated to securing hydropower as a clean, carbon-free, renewable, and reliable energy source that provides power to an estimated 30 million Americans. NHA's members own approximately 85% of the non-federal U.S. hydropower generating capacity, which includes over 100 Gigawatts ("GW") of hydropower and pumped storage capacity. Its membership consists of more than 300 organizations, including public and investor-owned utilities, independent power producers, equipment manufacturers, and professional organizations that provide legal, environmental, and engineering services to the hydropower industry. NHA promotes innovation and investment in all waterpower technologies, including conventional hydropower, marine and hydrokinetic power systems, and pumped storage hydropower to integrate other clean power sources, such as wind, solar, and clean hydrogen.

Hydropower is a clean, flexible, and reliable energy source that supports an estimated 72,000 well-paying jobs in the United States.[1] The sector also generates more than 6 percent of the country's utility-scale electricity and nearly one third of all utility-scale renewable power. In addition, pumped storage, which is a long duration energy storage asset, provides over 90 percent of energy storage on the grid.

II. The Mandatory GHG Reporting Program

In 1993, the EPA Office of Atmospheric Programs, in coordination with the Office of Transportation and Air Quality, began tracking annual GHG emissions through development of the Inventory of U.S. Greenhouse Gas Emissions and Sinks ("Inventory"). Each year since then, EPA has led an interagency team in developing the Inventory using internationally accepted methods for estimating GHG emissions in accordance with the United Nations Framework Convention on Climate Change Treaty ratified by the United States in 1992. The Inventory is a comprehensive "top-down" national assessment of national GHG emissions that primarily relies on national energy data and other national statistics to estimate GHG emissions. In other words, GHG emissions in the Inventory are not based on individual facility information, but instead calculated via activity data from national-level databases, statistics, and surveys.

In 2009, EPA realized individual facility-level data might help improve the accuracy of the Inventory by identifying shortcomings in the national statistics and identify where adjustments may be needed. Accordingly, EPA adopted the Mandatory GHG Reporting Program to collect that data. Importantly, EPA did not intend for the program to replace the "top-down" approach for producing the Inventory. Rather, EPA intended for the program to serve as a useful "tool" to improve the accuracy of future national-level inventories, where reliable information was available.

[1] U.S. Department of Energy, U.S. Hydropower Workforce: Challenges and Opportunities (October 2022). https://www.energy.gov/eere/water/articles/new-report-highlights-hydropower-industrys-demand-new-diverse-talent

To accomplish this goal, EPA selected source categories for the new mandatory GHG reporting program for which facility-specific measurement capabilities are sufficiently accurate and consistent. In explaining how it selected which source categories to cover, EPA stated the following:

> EPA considered whether or not facility reporting would be as effective as other means of obtaining emissions data. For some sources, our understanding of emissions is limited by lack of knowledge of source-specific factors. In instances where facility-specific calculations are feasible and result in sufficiently accurate and consistent estimates, facility-level reporting would improve current inventory estimates and EPA's understanding of the types and levels of emissions coming from large facilities, particularly in the industrial sector. These source categories have been included in the proposal. For other source categories, uncertainty about emissions is related more to the unavailability of emission factors or simple models to estimate emissions accurately and at a reasonable cost at the facility-level. Under this criterion, we would require facility-level reporting only if reporting would provide more accurate estimates than can be obtained by other means, such as national or regional-level modeling.

In short, EPA only proposed to include source categories for which some form of individual facility-level information would be available that would be more accurate than national or regional-level modeling already used by EPA in developing the Inventory. Conversely, EPA did not seek to require individual facility-level reporting for source categories that would not be able to provide better or more accurate data at the facility level, and thus would not improve current national-level estimates of GHG emissions.

Two examples illustrate this critical point. On one hand, EPA decided to require GHG reporting from municipal solid waste landfills. For this source category, well-established models have been used for many years to estimate GHG emissions based on site-specific characteristics, such as the amount and type of waste placed in the landfill each year and the age of the waste in place. Thus, information is available for individual landfills that can accomplish EPA's goal of using facility-level information as a tool to improve the accuracy of the Inventory.

On the other hand, EPA chose not to require reporting from various agricultural and land use sources, including the following:

> enteric fermentation, rice cultivation, field burning of agricultural residues, composting (other than as part of a manure management system), agricultural soil management, or other land uses and land-use changes, such as emissions associated with deforestation, and carbon storage in living biomass or harvested wood products."

EPA's reason for excluding these potential sources of GHG had nothing to do with the amount of emissions they may release. Instead, EPA determined that requiring these sources to submit individual facility-level information would not accomplish the goals of the GHG reporting program because "practical reporting methods to estimate facility-level emissions for these sources can be difficult to implement and can yield uncertain results." Specifically, EPA noted that, for these types of sources:

> currently, there are no direct greenhouse gas emission measurement methods available except for research methods that are prohibitively expensive and require sophisticated equipment. Instead, limited modeling-based methods have been developed for voluntary GHG reporting protocols which use general emission factors, and large-scale models have been developed to produce comprehensive national-level emissions estimates, such as those reported in the U.S. GHG inventory report.

EPA further explained that forcing individual facilities to report would not only fail to provide useful information, but would also impose an unreasonably heavy burden:

> To calculate emissions using emission factor or carbon stock change approaches, it would be necessary for landowners to report on management practices, and a variety of data inputs. Activity data collection and emission factor development necessary for emissions calculations at the scale of individual reporters can be complex and costly.

For these reasons, and because these activities typically involve a large number of small emitters, EPA concluded:

> Without reasonably accurate facility-level emissions factors and the ability to accurately measure all facility-level calculation variables at a reasonable cost to reporters, facility-level emissions reporting would not improve our knowledge of GHG emissions relative to national or regional-level emissions models and data available from national databases.

EPA reiterated these fundamental points when it finalized the rule.[2] All subsequent revisions to the program have continued to follow the same approach—requiring facility-level reporting only where facility-level information is available to better inform EPA's national-level GHG emission estimates in the Inventory.

[2] 74 Fed. Reg. 56271 (Oct. 30, 2009) ("These categories were excluded because currently available, practical reporting methods to calculate facility-level emissions for these sources can be difficult to implement and can yield uncertain results.… Due to the current lack of reasonably accurate facility-level emissions/stock change factors and the ability to accurately measure all facility-level calculation variables at a reasonable cost to reporters, the reporting of emissions and sequestration associated with deforestation and carbon sequestration from forestry practices was excluded as a source category.")

III. Requiring Dams and Reservoirs to Report Facility-Level Data Will Not Improve GHG Emissions Estimates.

By asking EPA to require reporting of GHG from individual dams and reservoirs, the Petition essentially asks EPA to change its longstanding policy, summarized above, for selecting source categories for facility-level reporting requirements. EPA should not grant that request. Since accepted and reliable methods for estimating site-specific emissions from dams and reservoirs do not exist, a requirement for facility-level reporting would be pointless. Granting the Petition would only impose great cost and confusion on dam and reservoir owners and operators without providing any more accurate information for use in estimating U.S. GHG emissions. To the extent more information is needed on GHG emissions from reservoirs, EPA should continue evaluating GHG emissions via its ongoing studies and the development of national or regional level models.

A. Unlike other sources subject to reporting, reservoirs vary widely in emissions based on many complex factors that cannot be easily measured or modeled.

The primary reason that estimating GHG emissions from individual dams and reservoirs remains an unresolved challenge is that no two reservoirs are the same, and their differences can dramatically affect emission rates—including whether a particular reservoir emits at all. Reservoirs differ with respect to a wide variety of factors that affect whether a reservoir is a sink or source of GHG, and the magnitude of the GHG emissions or sequestrations. The Petition itself inherently recognizes this fact, stating that "scientists have identified at least seventeen distinct individual sources and sub-sources of GHG emissions from dams and reservoirs." Since each of those seventeen different sources and sub-sources of emissions are likely influenced by myriad factors, the task of estimating them for an individual reservoir is daunting.

The potential for a water body to emit GHGs simply cannot be reliably discerned based on the mere size and location of a reservoir. Any attempt to estimate GHG emissions from a reservoir would need to consider all inflows, outflows, and throughput that influence water quality and chemistry in the water body. Without accounting for these highly variable factors, there would not be sufficient information to estimate emissions or even determine whether a specific water body is a source or a sink for GHGs.

Water quality and chemistry, including carbon fate and transport and the multiple pathways for GHG emissions from an individual reservoir, depend not only on the configuration of the reservoir and dam, but also on the flows (fluxes) of mass and energy to and from the water body. Mass inflows include upstream water sources, direct precipitation into the water body, water and eroded soil and nutrients conveyed by runoff, and groundwater. Energy inflows include insolation (heating by the sun), as well as kinetic and potential energy from precipitation, runoff, and upstream flows entering the water body. Anthropogenic inputs of energy and mass also occur, including treated or untreated industrial effluents that may alter water quality and

temperature. Outflows of mass and energy from a water body include controlled and uncontrolled releases of water (and compounds in the water) at the outlet of the water body, evaporation and heat loss from the surface of the water body, seepage to groundwater, and emissions of gases including, in some cases, carbon dioxide or methane. Each of these factors influences the potential for GHG emissions but cannot be accurately accounted for in numeric calculations or assumptions that could be applied generically to all water bodies, given the high level of variability in the factors.

The factors affecting GHG emissions and sequestrations in water bodies also have complex spatial and temporal variations. Rivers, streams, lakes, and reservoirs have complex three-dimensional shapes that create shallow and deep regions, stagnant and flowing regions, and regions of streamlined and tumultuous flows. Diurnal (night and day), seasonal, and long-term trends in climate add time-varying complexity to these spatial variations. The spatial complexity and temporal variation of water quality, including carbon fate and transport, follows from this geometric and hydrodynamic complexity, creating a formidable challenge for researchers attempting to characterize the overall effect of a reservoir as a carbon source or sink. Without an adequate sensor network—one appropriately positioned throughout a reservoir to capture spatial complexity and appropriately sampled through time to capture gradual and rapid changes in conditions—field researchers may significantly overestimate or underestimate emissions and the role of the water body in the natural carbon cycle.

Unlike other sources included in the GHG reporting program, streams, lakes, rivers, and reservoirs are neither a homogeneous population of machines nor a technology with a consistent or predictable emission rate that can fit into a neat formula. The diversity and complexity of water bodies precludes any meaningful reporting of anthropogenic GHG emissions at the site-specific level with currently available measurement, modeling, or other estimation techniques. Moreover, the many factors that influence aquatic geochemistry and water quality are highly varied across the world, within regions, and even within river basins. As a result, water bodies differ in kind from all other source categories currently subject to the GHG reporting program.

For example, while fossil fuel combustion sources may vary in emission rate somewhat based on fuel and technology, this variation can be estimated and accounted for at the facility level to develop relatively accurate emissions estimates, using relatively few variables. Accordingly, EPA saw clear value in requiring facility-level reporting from these sources when it originally adopted the mandatory GHG reporting program. In contrast, the variation in waterbodies is far too significant and multi-faceted to accurately estimate emissions at the facility level with currently available methods. Even more importantly, unlike fossil fuel-fired emissions sources, not all reservoirs emit GHGs. Rather, some reservoirs may instead serve as a GHG sink, actually sequestering carbon from the atmosphere, further complicating any attempt to estimate site-specific emissions. Without an accepted and reliable methodology for estimating emissions, reservoirs are much more like the types of land use changes that EPA has consistently declined to include in the GHG reporting program. The Petition provides no basis for a different conclusion for dams and reservoirs.

B. Unlike other sources subject to the reporting rule, natural causes of GHG emissions from reservoirs cannot be distinguished and may predominate.

Another reason EPA should reject the Petition is that GHG emissions from reservoirs, unlike most source categories subject to the GHG reporting program, are influenced by both natural and anthropogenic factors. Not only would distinguishing between natural and anthropogenic emissions from reservoirs be difficult, natural sources may be the predominant cause of any GHG emissions from a reservoir. While the Petition may be correct that constructing a dam could alter the emission rate for what was previously a natural watercourse, the Petitioners make no attempt to support their claim that the anthropogenic impact is significant or even positive in every case. In fact, just as there is no currently accepted method for determining or estimating an individual reservoir's annual GHG emission rate, there is even less agreement regarding how to discern what portion of that GHG emissions rate is attributable to natural versus man-made causes. As a result, any attempt to require individual reservoirs to report under the program would likely return inaccurate, over-inclusive, and even double-counted values, only convoluting EPA's attempt to inform the Inventory .

While a water body altered by human activity may emit GHG, the natural background mass of GHG that would be emitted cumulatively in the absence of anthropogenic alteration may already be significant. The Petition attempts to characterize anthropogenic emissions from water bodies using subjective terms, such as "exceedingly large," "massive," "significant," and "substantial" based solely on claims about total emissions, without recognizing that most of a reservoir's emissions may have occurred without any man-made activity at all. EPA should reject the leap of faith the Petition asks it to take in assuming that all reservoir emissions are anthropogenic, since the portion of emissions attributable to anthropogenic activity for any given reservoir may actually be quite minimal.

The Petition also entirely ignores the high risk of double-counting associated with estimation of individual reservoir emissions. The Petition asks EPA to assume, without measurement and analysis, that carbon moving into or out of a reservoir is attributable to that reservoir, and that the same carbon has never been and never will be accounted for elsewhere. However, there are multiple pathways and fates for carbon that comes into water bodies from watersheds. Some of these pathways lead to temporary or permanent sequestration of carbon, while others lead to emissions downstream of a water body during transport toward oceans. Assigning GHG emissions to a reservoir assumes that, in the absence of that reservoir, carbon emitted as a GHG would never have been emitted as a GHG from the unaltered water body, but would have instead been sequestered permanently and not emitted at a later time through a different mechanism downstream. The Petition offers no justification whatsoever for this assumption.

Unlike reservoirs, the source categories currently included in the GHG reporting program exhibit direct and predictable pathways from source to emission, with the amount of emissions

related directly to the level of production, and little uncertainty as to the ultimate fate of the carbon involved. For example, there can be little doubt of the anthropogenic nature of emissions resulting from the extraction and use of fossil fuel for transportation or power generation. Those activities add new carbon to the natural carbon cycle that would otherwise have remained sequestered for millions of years, whereas reservoirs simply circulate the carbon already available within that existing natural cycle.

The Petition fails to recognize the fundamental difference between natural and anthropogenic emission sources, and essentially asks EPA to treat both sources as equally relevant in setting national policy. However, forcing reservoirs to report what may be largely natural emissions from reservoirs alongside what are clearly anthropogenic emissions from currently regulated sources will only distort the data collected by the program, and thus distort any policy decisions that rely upon it. EPA should reject the Petitioners' request to assume all man-made and natural emissions are created equal from a policy perspective.

C. The Petition Offers No Solutions to the Challenges Associated with Estimating Individual Reservoir GHG Emissions.

Rather than address the primary challenges presented by any attempt to estimate individual reservoir GHG emissions—the lack of accepted methods for determining total GHG emissions, or for distinguishing between natural and man-made emissions—the Petition dodges these critical issues. In fact, the Petition says almost nothing at all about exactly what methodology should be required under the GHG program for reporting from dams and reservoirs. Just a single paragraph on the topic can be found at the very end of the otherwise lengthy Petition filled with unsupported claims about the magnitude of emissions. It is short enough to be quoted here in full:

> In addition, there are several methodologies currently used for calculating GHG emissions from dams and reservoirs. As noted above, some of these methodologies more accurately calculate dams and reservoirs' GHG emissions than others. [citation omitted]. As a result, it will be important in future rulemakings for EPA to ensure that the equations and methodologies it requires owners and operators to use for this source category represent the best available science and accurately reflect the actual and complete GHG emissions from dams and reservoirs.

In this, the only portion of the Petition that even approaches the centrally relevant question of how individual reservoirs might report, the Petitioners finally admit they have no idea how to do what they are asking EPA to require of tens of thousands of potential stakeholders across the country. This paragraph also admits that there is no generally accepted methodology for estimating individual reservoir GHG emission rates and that the accuracy of some of the methodologies still under development remains questionable.

A closer look at the specific publications cited by Petitioners further confirms this point. The estimates provided in the Petition are each the result of statistical regressions trained on relatively small data sets of GHG emission measurements in reservoirs throughout the world. For example, Deemer et al. (2016), is cited repeatedly in the Petition for its estimates, which are developed from a regression based on a limited set of relatively static characteristics (age, surface area, maximum temperature, and watershed soil erosion rate) from a limited number of reservoirs. The regression does not incorporate inflows, outflows, or throughput of energy and mass, each of which play an essential role in determining water quality, and thus emissions. While such regression findings may explain some of the variation in GHG emissions data from reservoir to reservoir, their application to unmeasured reservoirs does not represent evidence of emissions. Nor do the findings account for the management or regulation of individual rivers, streams, lakes, or water bodies, which can have a significant impact on emissions. For example, the Petition's application of these statistical regressions to individual waterbodies such as Lake Mead, Kentucky Lake, and Lake Whitney, for which no field measurements of GHGs have ever been attempted, is likely inaccurate because the regressions fail to account for the management, operation, and regulation of those systems, a characteristic of these waterbodies which differs vastly from the waterbodies upon which the regressions were based.

Simply put, the failure of the Petition to put forth any proposed method for estimating individual reservoir emissions confirms that requiring such estimates is premature. Short of requiring measurements at individual dams and reservoirs, which would be exorbitantly costly and still highly uncertain due to temporal and spatial variability within each reservoir, there is no means of estimating individual reservoir emissions that could also be applied at the national level to all reservoirs. Until a scientific consensus can be reached on an accurate and reliable method for estimating those emissions, EPA should not grant the Petition and should remain focused on research and evaluating emissions at the national level.

IV. The Petition Offers No Support for its Claims Regarding the Magnitude of Reservoir GHG Emissions, or the Effect of Those Emissions on Climate Change.

Even more irrational than the Petitioners' request for a mandatory reporting of data that cannot be accurately estimated is the Petitioners' claim that GHG emissions from U.S. reservoirs are not only significant, but more concerning than the GHG emissions from the use of fossil fuels. The Petition is wrong on both counts. First, it ignores evidence indicating that anthropogenic emissions from U.S. reservoirs are likely much lower than the Petition claims. Second, it pretends that those emissions present the same policy question raised by fossil fuels. EPA should recognize these obvious flaws in the Petition and refuse to grant it.

A. GHG Emissions from U.S. Reservoirs Are Likely Far Lower than the Petitioners Claim.

Contrary to the unsupported claims made in the Petition, the vast majority of reservoirs in the Unites States do not have characteristics associated with the potential for significant GHG

emissions, for several reasons. First, U.S. reservoirs in the 48 contiguous states are located in temperate regions and thus have lower water temperature and biomass and carbon production per unit area than reservoirs in the sub-tropical and tropical regions, which are the focus of many of the studies cited in the Petition. As a result, U.S. reservoirs have far lower potential for releasing GHG received from the seventeen different possible sources recognized in the Petition, all other factors being equal. For example, as noted in Deemer et al. (2016), which is cited repeatedly in the Petition:

> [T]he negative correlation between latitude and hydroelectric GHG emissions reported in previous work could reflect higher average water temperatures at low latitudes. In addition, lower latitude regions typically experience higher rates of terrestrial net primary production (NPP), a factor that has been positively correlated with GHG emissions from hydroelectric reservoirs. High rates of NPP may promote enhanced leaching of dissolved organic matter (DOM), fueling additional decomposition of terrestrial organic matter within tropical reservoirs. (internal citations omitted).

Second, U.S. reservoirs are greater than 50 years of age on average, and thus older than most reservoirs worldwide, and well past the early stages of existence when emissions may be higher. Thus, the older reservoirs found in the U.S. are likely to be far lower emitting than reservoirs evaluated in many studies, and perhaps even to serve as a GHG sink instead of an emission source, a possibility entirely ignored in the Petition. Again, from Deemer et al. (2016):

> Elevated GHG emissions from young (less than 10 years) reservoirs are commonly observed and are thought to be due to rapid decomposition of the most labile terrestrial organic matter, although some reservoirs may continue to have elevated GHG emissions at least 20 years after flooding. (internal citations omitted).

Third, and perhaps most importantly, methane emissions from reservoirs, including ebullition (escape of methane bubbles from the surface of a water body), is neither typical nor extensive in reservoirs with well-managed water quality. Ebullition rarely occurs in reservoirs unless the water quality is poor and unmanaged, and there are few such water bodies in the U.S. due to federal and state water quality regulation and management. For significant ebullition to occur, a reservoir would either need a greater residence time or more anthropogenically-caused nutrient inputs than most U.S. reservoirs, and the resulting poor water quality would typically manifest as inadequate or depleted dissolved oxygen, excess nutrients, algal blooms, or fish kills—conditions that would not be allowed to persist in the U.S. under the Clean Water Act.

Hydropower reservoirs in the U.S. in particular are already monitored and managed to mitigate water quality degradation and impaired use through Federal Energy Regulatory Commission ("FERC") license requirements and state water quality permits. Mitigation of water quality degradation and impaired water use in turn mitigates production of methane by a water body. Accordingly, while some studies have indicated that significant methane emissions are

possible from mismanaged or impaired water bodies, well-managed or unimpaired reservoirs do not have a significant propensity for methane emissions.

For all of these reasons, the Petition's reliance on studies of GHG emissions from reservoirs in other parts of the world as a basis for assuming corresponding levels of U.S. reservoir emissions is fundamentally flawed. EPA should therefore reject the Petitioners' unsupported conclusion that GHG emissions from U.S. dams and reservoirs are significant.

B. Regardless of Magnitude, GHG Emissions from Reservoirs Present a Different Policy Question than the Use of Fossil Fuels.

Even if Petitioners are correct that U.S. reservoirs emit GHGs and do so in an amount that might be considered policy-relevant, the claim that dams and reservoirs are as grave a threat to the climate as the use of fossil fuels is absurd and calls Petitioners' credibility into question. Only after greatly exaggerating the estimates of reservoir emissions, ignoring the significant natural causes of those emissions, failing to acknowledge that many reservoirs may serve as GHG sinks instead of sources, and ignoring the ability of hydropower to displace fossil fuel use is the Petition able to cobble together its counter-factual assertion that the impact of GHG emissions from reservoirs is on par with fossil fuels. In short, the Petition fails to recognize the very different character of emissions from reservoirs and asks EPA to require reporting from these sources as if they present the same policy questions. They do not, and EPA should not endorse that disingenuous position.

V. Conclusion

The NHA appreciates EPA's consideration of the additional context and information provided above in evaluating the Petition. We encourage EPA to conclude that the Petition should not be granted, and would welcome the opportunity to discuss our response further with EPA if it would be helpful to ensure EPA's decision on the Petition considers all relevant information available.

Sincerely,

/s/ Michael Purdie
Michael Purdie
The National Hydropower Association, Inc.
Director of Regulatory Affairs and Markets

cc: Michael Regan, Administrator
Regan.Michael@epa.gov