

25 August 2023

Pierina N. Fayish
NEPA Compliance Officer
National Energy Technology Laboratory
626 Cochran Mill Rd, Pittsburgh, PA 15236

Re: Response to DOE/EA-2197D: Project Tundra, Environmental Assessment

Dear Dr. Fayish:

Please find enclosed comments on DOE/EA-2197D: Project Tundra, Environmental Assessment. I am an Associate Professor of Sustainable Energy Policy at the University of Notre Dame, submitting comments on behalf of myself as an individual. My expertise includes life cycle assessment, the US power sector, and carbon management.

My comment primarily addresses the critically flawed GHG life cycle analysis presented in the Draft EA, which contains both significant mathematical and structural errors. Given the importance of life cycle GHGs of a carbon management project for evaluating its prudence, this highly erroneous LCA presents a significant impediment to public engagement.

Sincerely,

Dr. Emily Grubert, PE
Associate Professor of Sustainable Energy Policy
Concurrent Associate Professor of Civil and Environmental Engineering and Earth Sciences
University of Notre Dame
egrubert@nd.edu
574.631.5911

Summary

The draft environmental assessment (EA) provided for Project Tundra, a proposed carbon capture and storage (CCS) retrofit of the Milton R. Young (MRY) coal-fired power plant in North Dakota, includes an unacceptable life cycle assessment (LCA) – arguably one of the most critical elements of the EA. The LCA does not provide accurate and meaningful information to the public.

The LCA only addresses greenhouse gases (GHGs) and contains numerous serious errors that should have been obvious to anyone familiar with life cycle methods, and should have prompted questions even for people unfamiliar with life cycle methods. Although the Draft EA is in response to a National Environmental Policy Act (NEPA) requirement associated with funding under Funding Opportunity Announcement (FOA) 1999, rather than to either of the two funding opportunities (FOA 2711 and FOA 2962) that might fund future project activities, note that one of the two – FOA 2962, focused on CCS rather than carbon storage alone – requires an LCA. The LCA presented in the Draft EA is fundamentally nonresponsive to the guidance put forth in FOA 2962, most significantly by 1) not evaluating impacts per unit of delivered electricity (LCA results “shall be normalized to 1 MWh of electricity”); 2) not providing sensitivity analysis (“A sensitivity analysis shall be provided for key model inputs...”) and 3) not evaluating non-GHG impacts (“the scope of environmental impacts shall include all the additional impact categories listed in Section 2.1.8.2 of the NETL CO₂U LCA Guidance Document”).

Recognizing that the terms of the current funding under FOA 1999 might not require the same level of detail under an LCA as FOA 2962, not making an LCA at the level of detail required by 2962 available to the public severely limits the public’s ability to meaningfully engage on the environmental implications of Project Tundra. Not providing a 2962-compatible LCA is particularly puzzling if such an LCA already exists (e.g., if Project Tundra applied for a grant under FOA 2962, as has been reported in the media¹). In any case, what has been provided in the Draft EA is unacceptably flawed, regardless.

Particularly given that GHG reductions are the main purpose of CCS on a plant like MRY, the LCA is crucial for understanding whether public investment is prudent and is a critical evaluation tool for both project evaluators and the public. Publicly issuing this LCA is both confusing and disrespectful to stakeholders for whom accurate information is now delayed, and who are asked to spend time to respond to a critically flawed analysis. Given the increasing attention to LCA in numerous federal processes, including statutory requirements for LCA in some cases, the fact that this LCA was issued publicly by DOE with such serious flaws raises significant questions about capacity. Moreover, the fact that DOE recommended proceeding with this CCS project, despite (incorrect) LCA results suggesting that the CCS project would generate more than 3 kilograms (kg) of carbon dioxide-equivalent (CO₂e) per kg CO₂ sequestered, is deeply concerning for the integrity of the carbon management program and its ability to provide meaningful climate benefits in exchange for substantial investment.

The remainder of this comment addresses major errors of the LCA and its incompatibility with requirements under FOA 2962 (the CCS demonstration program under the Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law), then describes additional needs for the future LCA. Given the seriousness of the problems with the LCA in the Draft EA, this comment is not intended to be exhaustive in its critiques, but rather highlights major concerns.

¹ https://bismarcktribune.com/news/state-regional/business/experts-say-project-tundra-carbon-capture-plans-may-not-be-worth-climate-financial-risks/article_cfa437f2-24b6-11ee-9769-2f63d327da25.html

Errors

The LCA in the Draft EA contains numerous serious errors. Possibly most significantly, the LCA interprets a sulfur hexafluoride (SF₆) emissions factor provided in the FOA as being in SF₆ rather than CO₂e terms, despite stating correctly on page 3 of Appendix E that the emissions factor is given as CO₂e. The LCA multiplies the CO₂e value by the SF₆ 100-year horizon global warming potential (GWP-100) of 23,500, and thus reports a value that is off by a factor of 23,500. This error leads the Draft EA to conclude that SF₆ emissions from transportation and distribution of electricity, which is not relevant to the functional unit of CO₂ stored in any case, contribute 1.84 kg CO₂e/kg CO₂ stored. Although the document notes in several places that such emissions would have occurred with or without the CCS project, which also should have been a signal that it was inappropriate to include this value in the LCA scope, there is no reflection on the implication of such a large value. This result is obviously in error: given any familiarity with GHG emissions profiles for the United States, or observation of the extensive attention to GHG mitigation from power plants but essentially none given to GHG mitigation from transmission and distribution lines, the preparers should have recognized immediately that something was wrong. The fact that this error not only was submitted, but passed (ostensibly) several stages of review, is a serious issue that should have been identified at numerous points before the Draft EA was released. The GHG balance of the CCS plant is arguably among the most important elements of the Draft EA, so this level of inattention is extremely concerning relative to the rest of the Draft EA as well.

It is worth acknowledging that OCED's FOA 2962 guidance bears some responsibility here, namely for offering the SF₆ inventory value without a clear unit (as "7.87E-05 kg/kg CO₂ stored" without noting "kg CO₂e") – but again, the impact of this misinterpretation is so large that someone should have noticed and clarified with OCED if there was any confusion. Relatedly, OCED provided AR5 GWP values but labeled them as AR6 values (despite clearly linking to AR5, which is stated in the web link address): again here, an experienced LCA analyst should have noticed this and commented on it, particularly because the methane GWP meaningfully changed between the AR5 and AR6 issuances, but this is an error within the FOA itself. Note, however, that the way the EA references the GWP table (repeatedly referring to the AR6 Appendix J) suggests that the preparers do not know what AR6 is – AR6, the Intergovernmental Panel on Climate Change's 6th Assessment Report, is one of the most important documents in climate analysis and should be familiar to LCA preparers. OCED's errors are also cause for concern, given that they dictate how the LCAs must be carried out, but these errors reflect sloppiness rather than incompetence.

Other errors in the LCA are potentially even more concerning given that they both indicate further analytical inattention and stem from deep misunderstandings of the way that both CCS and LCA work. Most significantly, the LCA claims that the total emissions associated with the capture facility are 38,000 tonnes/year associated with startup, shutdown, and malfunction of the carbon capture system – a trivial value. Anyone familiar with carbon capture should be well aware that carbon capture is energy intensive, and therefore carries a GHG emissions burden when that energy is provided by GHG-emitting fuels, like lignite coal in the case of MRY. Ignoring the emissions associated with the capture unit's operations is puzzling and deeply concerning. One potential explanation is that the preparers lumped together all emissions from coal combustion into one process without allocating emissions to either carbon capture and storage or electricity production, which is inappropriate for an LCA and also contradicts statements (e.g., page 3-9) within the Draft EA that all emissions from the power plant would

happen with or without the intervention (in which case they should not be assigned to the functional unit). Relevant notes in the LCA also suggest gross errors in evaluation that should have been readily apparent to reviewers with or without LCA experience. Namely, the LCA does acknowledge the energy intensity of carbon capture – claiming that the capture unit would consume 1,836 megawatts (MW) of power and 600 gigajoules (GJ) per day of steam, and that this consumption would simply reduce the output of MRY with “minimal cumulative impact on GHG emissions.” The source of these values is unclear, but note that the entire capacity of MRY is only about 680 MW – a factor of 2.7 smaller than the claimed parasitic power load. As such, the claim of 1,836 MW of power draw (which, according to the LCA, results in 0 additional emissions) is on its face incorrect, and otherwise would have extremely significant impact on cumulative GHG emissions. The claim of 600 GJ per day of steam consumption is unusually small (accounting for an estimated <0.05% of the plant’s typical energy inputs), and steam demand is usually characterized as parasitic power load for coal CCS (because steam is otherwise used to make power), which also raises questions about the nature, source, and accuracy of these values.

In general, given the LCA’s purported functional unit of a tonne of CO₂ stored, the stated scope of the analysis reveals serious flaws. I discuss below that it is also incompatible with the FOA 2962 LCA guidance that it repeatedly references, which requires normalization to 1 MWh of electricity. For the LCA as presented, though, the scope includes numerous activities that are irrelevant to the function of storing 1 tonne of CO₂, which the analysis claims as its functional unit. Electricity transmission and distribution in particular should not be assigned to CO₂ storage, and only the MRY emissions generated in order to capture and store the CO₂ are relevant. Such an LCA of GHGs associated with per-tonne stored CO₂ could be useful for identifying carbon return on carbon invested or similar metrics, but is fundamentally not very useful for evaluating the effectiveness of a CCS project on a power plant (whose primary function is to deliver electricity) – likely why FOA 2962 requires an LCA based on electricity delivered, not CO₂ stored. Regardless, the inclusion of irrelevant unit processes, and the failure to include well known contributions to the CO₂ intensity of CO₂ storage – including reservoir leakage and, as mentioned above, the emissions associated with energy used to capture, compress, and transport CO₂ – is puzzling and incorrect even under the terms of the LCA as presented.

Incompatibility with Requirements for FOA 2962

Although this EA is not directly responding to FOA 2962, note that the MRY CCS project is likely eligible under Topic Area 1 (TA-1), “CCS Demonstration at a Coal Electric Generation Facility,” of FOA 2962 and might have already applied (the FOA closed in May 2023, with selection notifications expected in August 2023 – and potentially will have been released prior to the closure of this public comment period). As such, it is reasonable to wonder whether an LCA responsive to FOA 2962 already exists, in which case its exclusion from this Draft EA could be an inappropriate withholding of information from the public.

The LCA presented in the Draft EA is incompatible with the FOA 2962 requirements, most notably in that it selects a functional unit of 1 kg CO₂ stored rather than the required functional unit of 1 MWh delivered electricity. It also fails to provide a required sensitivity analysis and excludes required data on “chemical inputs to the facility” and “construction of the facility and manufacturing impacts for the required materials/equipment.” Further, the LCA does not use the required CO₂ transport and saline aquifer storage life cycle inventory values presented in the FOA, indeed, ignoring any potential reservoir leakage. The guidance also

requires results for several non-GHG impacts: Acidification Potential, Eutrophication Potential, Photochemical Smog Formation Potential, Ozone Depletion Potential, Particulate Matter Formation Potential, and Water Consumption, which are neither included nor mentioned, but are highly relevant for public engagement with LCA information.

Given that the LCA preparers clearly had access to FOA 2962, and specifically had access to Appendix J (the LCA guidance), it is extremely unclear why they failed to generate information compatible with these highly relevant requirements, which both ensure a greater degree of public access to environmental impact information and provide guidelines for conducting a rigorous LCA. This failure not only contributed to the highly erroneous analysis presented in the Draft EA, but has delayed public access to accurate and decision-relevant information about a project being proposed for substantial public support.

Other notes

The LCA presented in the Draft EA is unacceptably flawed for numerous reasons. Attention to addressing these basic flaws can unfortunately distract from more nuanced critiques, which is a major challenge given the complexity of high quality LCA, and that federal efforts increasingly rely on LCA that, as this draft shows, might not meet basic quality requirements and thus require significant capacity building even before more advanced concerns can be raised, often because problems might not be visible until details are clear. One obvious problem with the Draft EA, though, is that the No-Action Alternative does not account for implications of not retrofitting MRY. The two units at MRY are 53 (Unit 1) and 46 (Unit 2) years old, respectively. On average, US units with the same fuel and technology retire after 50 years of operation. A CCS retrofit would likely lead to a lifespan extension given both the significant investment and likely upgrades/repairs to the units to accommodate capture, but without the retrofit, plant retirement should be expected in the near- to medium-term. This expectation is particularly relevant given recent EPA proposed rules under Section 111 of the Clean Air Act, requiring coal plants to either close by 2032, restrict capacity factor to 20% and close by 2035, co-fire with natural gas and close by 2040, or install CCS. Although the rulemaking is not final, it is inappropriate for the the “No-Action Alternative” to assume that MRY will indefinitely operate unabated, both because of infrastructure lifespan limits and because of potential GHG rules. As such, emissions abatement caused by CCS over the planned CCS operational period are more appropriately compared to emissions expected in a scenario where MRY does not receive lifespan-extending capital investment and might be subject to closure or other compliance requirements. This nuance also means that estimating abatement potential based on the highest fuel use year, rather than based on individual operational year projections, is inappropriate.