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Peer Review File

Performance of a Compost Aeration and Heat Recovery System at a Commercial Composting Facility

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First Review

Associate Editor summary:

The manuscript provides valuable information for the design of compost systems and is deserving of publication with some modifications. As pointed out by Dr. Lansing, the authors should make stronger linkages between the study and ecological engineering concepts to meet the overall aim of JEED.

Additionally, the authors should follow the research paper template provided on the JEED website (this template may not have been completed at time of paper submission). Both Dr. Lansing and the AE agree that the results and discussion should be separated. By doing this, it is anticipated that the authors will be able to interpret the results in the context of carbon and nitrogen use by microbes at different oxygen levels. The current version of the manuscript touches on these concepts, but an independent discussion may allow the ideas to be conveyed more thoroughly.

All three reviewers indicated that the authors should compare the two treatments statistically.

Associate Editor review:

This paper presents a detailed comparison of a forced aeration compost system with a conventionally turned system. This study provides valuable information to improve the efficiency of waste management systems. In general, the paper is well written; significant comments are provided below with minor editorial comments following.

When considering microbial degradation of organic wastes, moisture content and C, N, and O concentrations are all interconnected: moisture content impacts oxygen concentrations, which then affects whether aerobic or anaerobic degradation of the wastes is occurring, which then influences the required C:N by the microbes, which in turn determines how much N is immobilized as microbial biomass or lost as excess N. Given these complex relationships, it is recommended that the results be presented first, then all the results discussed together in a separate discussion section.

The methods used for the economic analysis are not well described. Please provide details of the economic analysis in the Methods section.

General comments:
Equations: Number the equations.

Photograph 2: It is difficult to see the actual system. Please provide a closer-up view of the system, including a known object for scale.

L35: N leaching is another potential loss. Was leachate production measured for the two treatments?

L41: A "/" is missing from the savings in SI units.

L72: Given the high specific heat capacity of water, differences in compost temperature could also be explained by differences in moisture content, not just microbial growth.

L92-96: This sentence is excessively long and the punctuation is incorrect. If a list of phrases is presented, separate them by semicolons, not colons. Only one colon should be used in any sentence.

L99: Since "DM" is not a standard unit, spell it out the first time it is used.

L151-159: Recommend incorporating this information into the prior paragraph to provide more detail when the system is initially being described.

L163-169: Please state the number of times each treatment windrow was turned during the study.

L231: Include a space between the number and the unit.

L257-259: Since these are standard unit conversions, it is not necessary to include them in the manuscript.

Section 2.8: The information in this section should be included in figure/table captions (so the figures and tables "stand alone"). Statistical tests of differences in the temperatures, MCs, and N, P, K, C concentrations (and/or masses) between the two treatments should be conducted. Taking the difference between the two treatments at each sample time may eliminate the serial correlation, although that should be confirmed. Then a one-sample test could be conducted to confirm that the differences are significantly different from zero.

L310-311: Given that the conventional treatment had higher moisture content and (assumed) lower oxygen concentrations, potentially more anoxic/anaerobic conditions would have been present. Microbes using an electron acceptor other than oxygen require a higher C:N, which means more C will be utilized to produce the same microbial biomass. It's interesting that the C:N ratio was higher in the conventional treatment. Given the higher C:N required, you would expect the opposite to occur, unless N was being lost, which appears to have happened, based on the final mass balance.

L358: "were" should be "was"

L449: Please explain this statement further or rewrite it to be more explicit. Do you mean that atmospheric contributions of N, P, and K would not be sufficient to account for the additional mass of these elements in the final mass balance?

L453: Please provide the mass of N, P, and K contributed by the leachate. The mass of N is provided on L294, but not the other nutrients.

Table 2: Indicate in the caption if these masses are on a dry weight or wet weight basis.

Table 3: The units for the cost estimates should be "$/m^3".

Reviewer 1:
Stephanie Lansing
University of Maryland, Department of Environmental Science and Technology, College Park, MD USA

Overall, the manuscript text and abstract were clear and well written. The figures and tables helped to understand the data and data analytics, and the results of the case study were appropriately placed within the literature. At the end of the Introduction (Line 126), please work to bring the research aims and objectives back to the field of ecological engineering. Make the connection between compost aeration, GHG emission reduction, and the field of ecological engineering clear to the readers. Additionally, there needs to be more information at the end of the discussion section that clearly places the results in the field of ecological engineering design. Finally, there was mention of GHG emission reductions in the Introduction and objectives, but this was not properly discussed in the results and discussion section.

There were no statistical analyses of any of the results or description of statistics in the Data Analysis section. Where applicable, statistics should be applied; may be more applicable as a time series analytics until Week 13 when the CAHR treatment ended, and/or comparing the conventional compost changes from Week 13 to Week 17. This would help provide data to the statement that the "conventional windrow was also more susceptible to environmental losses due to an additional 4 weeks of composting time" (Line 460).

The JEED provided template requests that Section 3 only contains results, with a separate Section 4 discussion section included. The guide specifically states: "Do not combine results and discussion sections and avoid discussing results" within Section 3. A separate Section 4 was to be included for the authors to "Discuss significance and implications of results, highlighting importance of key findings in the context of ecological engineering design." The editor will need to decide if the manuscript should be rewritten to adhere to these guidelines and the discussion material removed from Section 3 and placed in a new Section 4.

Specific Comments:

- Lines 13-17 (Highlights): Can you be more specific in your highlights with results (percentages or values) included. How much time was reduced? How much heat was recovered, etc.?
- Lines 18-19: (Keywords): Remove repeating words (nutrients twice, management three times) and words already in the title (heat recovery)
- Bottom of Page 1 (Core Ideas): This section was not listed in the Guide for Authors or within the Word template. Please remove and only include sections that are part of the guidelines or template provided.
- Lines 21-22 (Photograph 1): I would label this as the graphical abstract, as it is not a photograph. You could also include some results or more information within the graphical abstract. Additionally, did you get permission from AgriLabs or can you properly cite the original figure that was adapted. Additionally, can you add where the heat is captured from the compost; same pipes as the aeration. More explanation on the negative aeration process and heat capture system on the figure would enhance clarity.
- Lines 23-24 (Photograph 2): Rename as Photograph 1.
- Line 52 (Introduction and throughout): Use proper citation format (last name only) and remove 'M. Pilar' before 'Bernal' throughout the entire manuscript. Check all citations for proper formatting.
- Line 122 (Introduction): Please add USA after Vermont here and throughout the text, as this is an international journal, so the country needs to be stated after any city and state citation.

Lines 128-129 (Materials and Methods): The first paragraph of this section states that this protocol for the study was adapted from the "Protocol for Third Party Evaluation of Agricultural Nutrient Management Technologies (Bronstad et al., 2019). Yet, if you go to the web address listed in the reference list (https://www.fda.gov/medical-devices/premarket-submissions/third-party-review), the first paragraph of this website states, "The 510(k) Third Party Review Program provides medical device manufacturers with a voluntary alternative review process, in which accredited Third Party Review Organizations (3P510k Review Organizations) are allowed to review certain low-to-moderate risk medical devices." I am not sure if this is the wrong URL included or how this medical device protocol was adapted for agricultural nutrient management. Either way, please be more specific on how Bronstad et al. (2019) was adapted for this study. What adaptions took place?

Lines 131 (Materials and Methods): add the abbreviation (VNAP) after the company is listed, as this abbreviation is then used throughout the paragraph.

Line 231 (Materials and Methods): add a space between the numeric and the unit.

Line 241 (Materials and Methods): Does the equation use the window volume at the beginning or end of the study? Please specify. Was there a significant reduction in the windrow volume due to mass loss during the composting process? Was it different between the two piles and does this need to be accounted for the mass balance?

Line 286-287 (Results): Can you be more specific on the "temperatures did not rise too high and moisture contents did not drop too low" statement, with the (Onwosi et al., 2017) citation. This is likely better placed in the discussion, but what these "too high" and "too low" values are and how they compare to your results should be part of the discussion.

Line 289-290 (Results): It does not seem that the higher leachate volume (double in CAHR) was taken into the account in the economic analyses? I would assume they were paid for this feedstock. Was the higher volume used for the CAHR windrow since it was expected to be drier over time. This information about the leachate addition should probably be in the Methods as well, as this was part of the feedstock.

Line 311 (Results): Please give the final TOC values.

Line 425 (Table 1): Fecal coliforms were results in Table 1 but these results were not discussed in the text or detailed in the Methods. Please add this information and discuss the relevancies of the results to the composting process and detail why the CAHR final data point was so much higher than the conventional system.

Reviewer 2:
Rebecca Ryals
University of California, Merced

The authors present a study that compares two compost systems: a forced aeration and heat recovery system and conventional system with turned windrows. Measurements for this comparison were numerous and robust, with a focus on nutrient dynamics and retention, time to maturity, and operational costs. They found that …..

Overall, this manuscript is well-written and addresses knowledge gaps that benefit the understanding and practice of forced aeration compost systems. The introduction provides excellent context to evaluate the study, and the discussion nicely synthesizes the results, impacts, and limitations. I recommend this manuscript for publication, along with the following recommendations for improvement.

First, it is not clear when treatment differences are statistically significant. I recognize that the large-scale of this research (i.e. one pile of each treatment at commercial scale, composited samples) makes statistical analysis more challenging. However, some relationships could be evaluated using repeated measures tests, for example. Related, variance of data (when available) is not reported, but could be helpful for giving ranges of bulk density estimates and the error associated with the mass balance calculations.

Second, it would be helpful to have more details about the observations or data that the VNAP staff made and how that translated to management decisions. No doubt their experience was valuable to the management of both systems, but it would be helpful for readers to have more information about how they evaluated the progress of the composting process.

Lastly, I have a few minor suggestions:

Ln 34: Change TN to total N, or total N (TN)

Ln 54: Change CO_2 to carbon dioxide (CO_2)

Ln 101-104: The knowledge gaps that this study addresses were clearly articulated in the Introduction. In these lines referencing the review by Smith (2017), were any knowledge gaps or data limitations related to heat recovery from compost?

Ln 118. “An analysis of compost…) should be a new sentence.

Ln 171&173: How frequent was the periodic turning for each compost system?

Ln 185-186: What criteria did VNAP staff use to determine when the compost was suitable for the market?

Ln 257-265: I was wondering throughout if upfront capital costs were included. It was clear in the Discussion section that this analysis was restricted to operational costs, and that it also drew non-operational costs from a previous study. This is a nice approach but could be made clearer in the methods section.

Ln 291-293 & Ln 304-305: Again, please provide some detail on what was monitored and how these observations translated to decisions.

Ln 351: Was NOx-N determined by subtraction of TKN from TN?

Ln 359: I suggest not using an acronym for moisture content.

Ln 381-385: I agree with this hypothesis and how it points to future research directions (Ln 388-389).

Ln 390: Later on, it is noted that the treatment difference in pH could explain potentially greater NH_3 volatilization from the conventional windrow. That text could be move here.

Ln 401: WEP is defined earlier.

Ln 434, Table 1: Why are the final N-P-K values in bold? Please add statistical significance notation and variance, where possible.

Ln 456-458: As mentioned above, errors in bulk density could be propagated through the mass balance calculation to quantify the final error.

Ln 470, Table 2: Why are retention values bolded?

Ln 508-511: If I am understanding correctly, this system requires more costs than a "typical" CAHR, so it's fair to say that the cost savings is a conservative estimate.

Response to Reviewers (First Review):
"Performance of a compost aeration and heat recovery system at a commercial composting facility"

We would like to thank all three reviewers for their fair and critical assessment of this case study. We thank you also for your time and efforts in ensuring that JEED is a success. We have endeavored to address all comments made, and have indicated our responses below. We have also made minor revisions to improve flow, conciseness, and clarity during this revision (see tracked changes version) and moved some material to the Supplementary Materials to avoid going far over the recommended word count.

Authors:
Finn A. Bondeson, Joshua W. Faulkner, Eric D. Roy

Associate Editor Summary:

The manuscript provides valuable information for the design of compost systems and is deserving of publication with some modifications. As pointed out by Dr. Lansing, the authors should make stronger linkages between the study and ecological engineering concepts to meet the overall aim of JEED.

> At lines 129-138 we have addressed this comment with the following:
> "Although the formal definition of ecological engineering can vary (Mitsch & Jørgensen, 2003; Schönborn & Junge, 2021), the underlying goal does not: the integration of ecology and engineering to provide solutions that benefit humans and their environment. This case study is exemplary of ecological engineering in three ways. First, the CAHR system studied combines biological processes driven by microbial communities engaged in ecosystem function with non- biological technology and human management. Second, the potential for the CAHR system to reduce environmental impacts (e.g., nutrient emissions to the environment) and provide human benefits (e.g., building heating) was a focus of the case study. Finally, an aim of this work was to produce knowledge that can help increase the viability of a regional circular bioeconomy inspired by ecology."
>
> We have added the following citations:
> Mitsch, W. J., & Jørgensen, S. E. (2003). Ecological engineering: A field whose time has come. *Ecological Engineering*, *20*(5), 363–377. https://doi.org/10.1016/j.ecoleng.2003.05.001
>
> Schönborn, A., & Junge, R. (2021). Redefining Ecological Engineering in the Context of Circular Economy and Sustainable Development. *Circular Economy and Sustainability*, *1*(1), 375–394. https://doi.org/10.1007/s43615-021-00023-2

Additionally, the authors should follow the research paper template provided on the JEED website (this template may not have been completed at time of paper submission). Both Dr. Lansing and the AE agree that the results and discussion should be separated. By doing this, it is anticipated that the authors will be able to interpret the results in the context of carbon and nitrogen use by microbes at different oxygen levels. The current version of the manuscript

touches on these concepts, but an independent discussion may allow the ideas to be conveyed more thoroughly.

> The Results and Discussion have been separated into two distinct sections. We thank the reviewers for providing this suggestion – we think it has resulted in a better paper.

All three reviewers indicated that the authors should compare the two treatments statistically.

> Reviewers will now see that statistical testing has been conducted and is presented throughout the results. All statistical testing was conducted using the "t.test" function in base R to compare treatments on a weekly, monthly, or 13-week period basis.

Associate Editor Review:

This paper presents a detailed comparison of a forced aeration compost system with a conventionally turned system. This study provides valuable information to improve the efficiency of waste management systems. In general, the paper is well written; significant comments are provided below with minor editorial comments following.

When considering microbial degradation of organic wastes, moisture content and C, N, and O concentrations are all interconnected: moisture content impacts oxygen concentrations, which then affects whether aerobic or anaerobic degradation of the wastes is occurring, which then influences the required C:N by the microbes, which in turn determines how much N is immobilized as microbial biomass or lost as excess N. Given these complex relationships, it is recommended that the results be presented first, then all the results discussed together in a separate discussion section.

> We have created a separate Discussion section to address our results as they relate to complexities inherent to the composting processes, as aforementioned.

The methods used for the economic analysis are not well described. Please provide details of the economic analysis in the Methods section.

> We have addressed this comment in the Supplementary Materials, where we have stated the assumptions made for operational economic and energy analysis and provided a table detailing our calculations.

General comments:

Equations: Number the equations.

> The equations have been numbered.

Photograph 2: It is difficult to see the actual system. Please provide a closer-up view of the system, including a known object for scale.

> We have chosen a different photo to use as Photograph 2 and have annotated it for clarity.

L35: N leaching is another potential loss. Was leachate production measured for the two treatments?

> Leachate production was not measured for the two treatments due to budgetary and site constraints. The possibility of N leaching is now addressed directly in our Discussion.

> Lines 460-465: "When NOx-N decreased, it is also possible that some NO3-N was lost to the environment through leaching. However, because of the high retention of P and K shown in Table 2, as well as low levels of N in the onsite stormwater runoff lagoon, we do not believe that NOx-N leaching was a primary

driver of N loss for either compost. This is consistent with low N leaching losses relative to gaseous N losses found by others (Chowdhury et al., 2014; Wang et al., 2021; Yang et al., 2019)."

L41: A "/" is missing from the savings in SI units.

This has been addressed.

L72: Given the high specific heat capacity of water, differences in compost temperature could also be explained by differences in moisture content, not just microbial growth.

The following sentence has been added on Lines 425-427:
"It should also be noted that the relatively high specific heat of water means that drier compost mixtures can heat and cool more rapidly than wetter mixtures (Trautmann, 1996)."

Trautmann, N. 1996. Compost Physics. Cornell Waste Management Institute, Cornell University.

L92-96: This sentence is excessively long and the punctuation is incorrect. If a list of phrases is presented, separate them by semicolons, not colons. Only one colon should be used in any sentence.

At lines 90-96, we have addressed this long sentence by splitting it into multiple sentences:

"Heat can be recovered from compost in three ways: directly, by conduction, or by vapor heat exchange (Smith et al., 2017). Direct heat recovery typically situates the compost inside a greenhouse or underneath growing plant beds. Conductive heat recovery typically passes wateror other liquid through piping embedded within the compost volume, allowing the compost to heat the liquid. Vapor heat exchange captures the warm vapor within the pore space of the compost and passes this vapor through a heat exchanger to heat water or other liquid (Smith et al., 2017)."

L99: Since "DM" is not a standard unit, spell it out the first time it is used.

This has been rectified. See line 99.

L151-159: Recommend incorporating this information into the prior paragraph to provide more detail when the system is initially being described.

This has been incorporated into the prior paragraph. See lines 162-170.

L163-169: Please state the number of times each treatment windrow was turned during the study.

The number of times each windrow was turned has now been stated. See lines 179-181.

"The conventional windrow was turned nine times, and the CAHR windrow was turned eight times."

L231: Include a space between the number and the unit.

This has been rectified. See line 243.

L257-259: Since these are standard unit conversions, it is not necessary to include them in the manuscript.

These unit conversions have been removed from the manuscript.

Section 2.8: The information in this section should be included in figure/table captions (so the figures and tables "stand alone"). Statistical tests of differences in the temperatures, MCs, and N, P, K, C concentrations (and/or

masses) between the two treatments should be conducted. Taking the difference between the two treatments at each sample time may eliminate the serial correlation, although that should be confirmed. Then a one-sample test could be conducted to confirm that the differences are significantly different from zero.

> In your review of the new Results section, you will now see changes in the figures and text indicating the results of t-tests for temperature, moisture content, and nutrient parameters, including n-values and asterisks indicating significant differences ($p < 0.05$).

L310-311: Given that the conventional treatment had higher moisture content and (assumed) lower oxygen concentrations, potentially more anoxic/anaerobic conditions would have been present. Microbes using an electron acceptor other than oxygen require a higher C:N, which means more C will be utilized to produce the same microbial biomass.

It's interesting that the C:N ratio was higher in the conventional treatment. Given the higher C:N required, you would expect the opposite to occur, unless N was being lost, which appears to have happened, based on the final mass balance.

> These are interesting points. We agree that N loss was likely the driver of this observation, as we state in the manuscript. We did not measure microbial biomass, but it is possible that the conventional treatment did not achieve the same magnitude of microbial biomass in areas where oxygen was limited.

L358: "were" should be "was"

> This has been rectified.

L449: Please explain this statement further or rewrite it to be more explicit. Do you mean that atmospheric contributions of N, P, and K would not be sufficient to account for the additional mass of these elements in the final mass balance?

> See Lines 526-528 in our revision:
>
> "This is unlikely, as annual atmospheric deposition rates of N, P, and K are many orders of magnitude smaller than the total masses of N, P, and K in the windrows (Mahowald et al., 2008; Mikhailova et al., 2019; L. Zhang et al., 2012)."
>
> The following citations were added:
>
> Mahowald, N., Jickells, T. D., Baker, A. R., Artaxo, P., Benitez-Nelson, C. R., Bergametti, G., Bond, T. C., Chen, Y., Cohen, D. D., Herut, B., Kubilay, N., Losno, R., Luo, C., Maenhaut, W., McGee, K. A., Okin, G. S., Siefert, R. L., & Tsukuda, S. (2008). Global distribution of atmospheric phosphorus sources, concentrations and deposition rates, and anthropogenic impacts. *Global Biogeochemical Cycles*, *22*(4), 1–19. https://doi.org/10.1029/2008GB003240
>
> Mikhailova, E. A., Post, G. C., Cope, M. P., Post, C. J., Schlautman, M. A., & Zhang, L. (2019). Quantifying and mapping atmospheric potassium deposition for soil ecosystem services assessment in the United States. *Frontiers in Environmental Science*, *7*(JUN), 1–13. https://doi.org/10.3389/fenvs.2019.00074
>
> Zhang, L., Jacob, D. J., Knipping, E. M., Kumar, N., Munger, J. W., Carouge, C. C., Van Donkelaar, A., Wang, Y. X., & Chen, D. (2012). Nitrogen deposition to the United States: Distribution, sources, and processes. *Atmospheric Chemistry and Physics*, *12*(10), 4539– 4554. https://doi.org/10.5194/acp-12-4539-2012

L453: Please provide the mass of N, P, and K contributed by the leachate. The mass of N is provided on L294, but not the other nutrients.

> Lines 306-311 now contain the masses of N, P, and K contributed by lagoon watering for both treatments. "Masses of N, P, and K added through watering the conventional windrow were 1.33 kg, 0.17 kg, and 4.66 kg, respectively. Masses of N, P, and K added through watering the CAHR windrow were 2.66 kg, 0.34 kg, and 9.32 kg, respectively. Each addition of nutrients through watering was <1% of the total final mass of that nutrient estimated for each treatment, and were deemed negligible for consideration in this study."

Table 2: Indicate in the caption if these masses are on a dry weight or wet weight basis.

> Table 2's caption now reads: "Mass balance for major compost nutrients. Bulk densities are given on a wet weight basis."

Table 3: The units for the cost estimates should be "$/m3".

> Units have been rectified in Table 3 per this suggestion.

Reviewer 1:

Stephanie Lansing, University of Maryland, Department of Environmental Science and Technology, College Park, MD USA

Overall, the manuscript text and abstract were clear and well written. The figures and tables helped to understand the data and data analytics, and the results of the case study was appropriately placed within the literature. At the end of the Introduction (Line 126), please work to bring the research aims and objectives back to the field of ecological engineering. Make the connection between compost aeration, GHG emission reduction, and the field of ecological engineering clear to the readers. Additionally, there needs to be more information at the end of the discussion section that clearly places the results in the field of ecological engineering design. Finally, there was mention of GHG emission reductions in the Introduction and objectives, but this was not properly discussed in the results and discussion section.

> Connections between this case study and the field of ecological engineering have been discussed, as aforementioned in this document.

There were no statistical analyses of any of the results or description of statistics in the Data Analysis section. Where applicable, statistics should be applied; may be more applicable as a time series analytics until Week 13 when the CAHR treatment ended, and/or comparing the conventional compost changes from Week 13 to Week 17. This would help provide data to the statement that the "conventional windrow was also more susceptible to environmental losses due to an additional 4 weeks of composting time" (Line 460).

> Statistical analyses were performed to compare treatments with t-tests through week 13 on a weekly, monthly, or 13-week overall basis, as aforementioned in this document. However, our analysis did not extend beyond week 13 due to the end of the CAHR trial at that time.

The JEED provided template requests that Section 3 only contains results, with a separate Section 4 discussion section included. The guide specifically states: "Do not combine results and discussion sections and avoid discussing results" within Section 3. A separate Section 4 was to be included for the authors to "Discuss significance and implications of results, highlighting importance of key findings in the context of ecological engineering design." The editor will need to decide if the manuscript should be rewritten to adhere to these guidelines and the discussion material removed from Section 3 and placed in a new Section 4.

> Results and Discussion have been separated, as aforementioned in this document.

Lines 13-17 (Highlights): Can you be more specific in your highlights with results (percentages or values) included. How much time was reduced? How much heat was recovered, etc.?

On Lines 13-17, the highlights section is now written as follows:

"A forced aeration and heat capture system installed at a commercial composting facility was found to reduce the time needed to produce marketable compost by approximately 25%, reduce the possibility of N losses to the environment through a 5x greater NOx-N retention efficiency, reduce water-extractable P by 11.5% thereby decreasing potential for P leaching, and provide cost savings of $\$1.51/m^3$ to the compost producer through offsetting energy and facility expansion costs."

Unfortunately, quantification of the amount or rate of heat recovered was not within the scope of this study.

Lines 18-19: (Keywords): Remove repeating words (nutrients twice, management three times) and words already in the title (heat recovery)

On Line 19, the Keywords are now written as follows:

Keywords: manure; organic wastes; nutrient management; bioenergy

Bottom of Page 1 (Core Ideas): This section was not listed in the Guide for Authors or within the Word template. Please remove and only included sections that are part of the guidelines or template provided.

The Core Ideas have been removed from the manuscript.

Lines 21-22 (Photograph 1): I would label this as the graphical abstract, as it is not a photograph. You could also include some results or more information within the graphical abstract. Additionally, did you get permission from AgriLabs or can you properly cite the original figure that was adapted. Additionally, can you add where the heat is captured from the compost; same pipes as the aeration. More explanation on the negative aeration process and heat capture system on the figure would enhance clarity.

At Line 21, the image previously known as Photograph 1 is now "Graphical Abstract". Annotations and explanations have been added to enhance clarity. The caption has been updated as follows: "*Graphical Abstract: Compost Aeration and Heat Recovery system (adapted with permission from Agrilab Technologies, Inc. (2021))*

Lines 23-24 (Photograph 2): Rename as Photograph 1.

At Line 24, the image previously known as Photograph 2 is now "Photograph 1". Note that this photograph is different than in the initial version due to the request of the Associate Reviewer.

Line 52 (Introduction and throughout): Use proper citation format (last name only) and remove 'M. Pilar' before 'Bernal' throughout the entire manuscript. Check all citations for proper formatting.

Citations throughout have been checked for proper formatting.

Line 122 (Introduction): Please add USA after Vermont here and throughout the text, as this is an international journal, so the country needs to be stated after any city and state citation.

"USA" has been added after Vermont where necessary throughout the text.

Lines 128-129 (Materials and Methods): The first paragraph of this section states that this protocol for the study was adapted from the "Protocol for Third Party Evaluation of Agricultural Nutrient Management Technologies (Bronstad et al., 2019). Yet, if you go to the web address listed in the reference list (https://www.fda.gov/medical- devices/premarket-submissions/third-party-review), the first paragraph of this website states, "The 510(k) Third Party Review Program provides medical device manufacturers with a voluntary alternative review process, in which accredited Third Party Review Organizations (3P510k Review Organizations) are allowed to review certain low-to-

moderate risk medical devices." I am not sure if this is the wrong URL included or how this medical device protocol was adapted for agricultural nutrient management. Either way, please be more specific on how Bronstad et al. (2019) was adapted for this study. What adaptions took place?

> The citation in the initial version was incorrect. The citation for Bronstad et. al (2019) has been corrected. Additionally, the following text has been added at Lines 142-144 to clarify the protocol's adaptation:
>
> "The evaluation protocol by Bronstad et al. is written to assess the management of liquid manures. The protocol herein has been adapted to assess the management of solid materials."

Lines 131 (Materials and Methods): add the abbreviation (VNAP) after the company is listed, as this abbreviation is then used throughout the paragraph.

> At line 146, the abbreviation (VNAP) has been added.

Line 231 (Materials and Methods): add a space between the numeric and the unit.

> This has been rectified.

Line 241 (Materials and Methods): Does the equation use the window volume at the beginning or end of the study? Please specify. Was there a significant reduction in the windrow volume due to mass loss during the composting process? Was it different between the two piles and does this need to be accounted for the mass balance?

> At lines 251-256, the following text has been updated, which should provide the reader clarification:
>
> "At the beginning and end of the study, nutrient content, density, and volume measurements were taken, and the following equation was used to approximate total nitrogen, phosphorus, potassium, and carbon masses contained in each treatment:
>
> $$Nutrient\ mass\ (kg) = Nutrient\ content\ \left(\frac{kg}{kg}\right) \times Compost\ density\ \left(\frac{kg}{m^3}\right) \times Windrow\ volume\ (m^3) \quad (2)$$
>
> Yes, there was reduction in windrow volume which was accounted for. Nutrient masses were calculated using the measured values of nutrient content, bulk density, and volume from the beginning OR end of the study.

Line 286-287 (Results): Can you be more specific on the "temperatures did not rise too high and moisture contents did not drop too low" statement, with the (Onwosi et al., 2017) citation. This is likely better placed in the discussion, but what these "too high" and "too low" values are and how they compare to your results should be part of the discussion.

> At Lines 426-432 in the discussion, the following was added:
>
> "More careful monitoring of the CAHR compost was needed by VNAP staff to regulate windrow temperature. Sustained temperatures above 70°C are harmful to many bacterial communities and fungi (Mengqi et al., 2021; Rastogi et al., 2020) and should be avoided to preserve the microbial diversity of the compost and avoid hampering degradation rates (Onwosi et al., 2017). However, it is generally accepted that temperatures should be kept greater than 55-60 °C for at least one week to ensure pathogen and seed elimination (Bernal et al., 2009; Mengqi et al., 2021)."
>
> The phrase "temperatures did not rise too high and moisture contents did not drop too low" was omitted from the revision.

Line 289-290 (Results): It does not seem that the higher leachate volume (double in CAHR) was taken into the account in the economic analyses? I would assume they were paid for this feedstock. Was the higher volume used

for the CAHR windrow since it was expected to be drier over time. This information about the leachate addition should probably be in the Methods as well, as this was part of the feedstock.

> On Lines 301-311, we have revised wording and included data to indicate that the liquid used for compost watering is not really a leachate, rather it is stormwater runoff pumped out of VNAP's onsite stormwater retention lagoon. This was not something that VNAP paid for.
>
> "On September 15th, 2021, VNAP staff watered the CAHR-treated windrow with ~33.3 m^3 (~8800 gal) of stormwater runoff from the onsite lagoon using a liquid manure tanker. The conventionally treated windrow received ~16.7 m^3 (~4400 gal). To mitigate the drying effects of consistent aeration and higher temperatures, the CAHR windrow received twice as much liquid as the conventional windrow. Composts were immediately turned to integrate the liquid, and a sample of the stormwater used was collected and sent for analysis at A&L Labs. Masses of N, P, and K added through watering the conventional windrow were 1.33 kg, 0.17 kg, and 4.66 kg, respectively. Masses of N, P, and K added through watering the CAHR windrow were 2.66 kg, 0.34 kg, and 9.32 kg, respectively. Each addition of nutrients through watering was <1% of the total final mass of that nutrient estimated for each treatment, and were deemed negligible for consideration in this study."

Line 311 (Results): Please give the final TOC values.

> Final TOC values are given on Lines 315 and 316.

Line 425 (Table 1): Fecal coliforms were results in Table 1 but these results were not discussed in the text or detailed in the Methods. Please add this information and discuss the relevancies of the results to the composting process and detail why the CAHR final data point was so much higher than the conventional system.

> We have now included a section regarding fecal coliforms in the Supplementary Materials. This section was not included in the Manuscript due to word count limitations.
>
> "Fecal coliforms increased over the study, which is surprising, namely for the CAHR system, which provided higher consistent temperatures and potential for pathogen kill. Because fecal coliform data were only obtained for the first few and last samples of each treatment, we were not able to visualize trends. Increases in fecal coliform data could have arisen from a few sources, namely high bird activity at VNAP, localized high levels of coliforms that happened to be randomly sampled, and any pathogen growth between when samples were shipped from UVM to when they were analyzed at A&L Labs. Indeed, variable pathogen levels have been detected in different areas of compost volumes (i.e. surface vs. interior samples) (Sharma & Reynnells, 2018; Shepherd et al., 2010), and sampling from a localized area of contamination may have influenced our results. Interestingly, like our final CAHR results, composts sampled by Ingram (2009) in late fall were found to have higher pathogen content than those sampled in other months. Pathogen regrowth in composts stored in plastic bags has also been documented (Reynnells et al., 2014), and has been related to moisture content, C:N ratio, and TOC of sampled composts. While determining pathogen origin was not included in this study, it is likely that windrow surface contamination or pathogen regrowth resulted in the higher levels of fecalcoliforms in our final samples, especially considering that both treatments sustained internal temperatures sufficient for pathogen kill."

Reviewer 2:
Rebecca Ryals
University of California, Merced

The authors present a study that compares two compost systems: a forced aeration and heat recovery system and conventional system with turned windrows. Measurements for this comparison were numerous and robust, with a focus on nutrient dynamics and retention, time to maturity, and operational costs.

Overall, this manuscript is well-written and addresses knowledge gaps that benefit the understanding and practice of forced aeration compost systems. The introduction provides excellent context to evaluate the study, and the

discussion nicely synthesizes the results, impacts, and limitations. I recommend this manuscript for publication, along with the following recommendations for improvement.

First, it is not clear when treatment differences are statistically significant. I recognize that the large-scale of this research (i.e. one pile of each treatment at commercial scale, composited samples) makes statistical analysis more challenging. However, some relationships could be evaluated using repeated measures tests, for example. Related, variance of data (when available) is not reported, but could be helpful for giving ranges of bulk density estimates and the error associated with the mass balance calculations.

> Statistical analyses were performed to compare treatments with t-tests through week 13, as aforementioned in this document. However, our analysis did not extend beyond week 13. Variances were not included in our statistical results due to the small sample sizes for t-tests (n=3 for each treatment, each week, for each test parameter). As bulk density was taken once weekly using a composite sample, variance calculation was not possible.

Second, it would be helpful to have more details about the observations or data that the VNAP staff made and how that translated to management decisions. No doubt their experience was valuable to the management of both systems, but it would be helpful for readers to have more information about how they evaluated the progress of the composting process.

> We have addressed the knowledge of VNAP staff in the Supplementary Materials:
>
> "Management of compost windrows by VNAP staff did not rely on tested metrics such as lab- tested moisture content or C:N ratio. Rather, staff relied on daily temperature measurements, weather observation, and visual, textural, and olfactory inspection skills gained from decades of compost management experience and nationally respected training programs (Maine Compost School, 2023). Typically, VNAP staff would use a front-end loader to cut out a portion of a windrow for inspection. By using the CAHR system's graphical user interface, VNAP and Agrilab Technologies staff were able to visualize historic and real-time aeration rates, vapor oxygen concentration, and vapor and heating system temperatures. Aeration rates and durations could be set for each zone of the system, allowing staff to fine-tune oxygen supply."

Ln 34: Change TN to total N, or total N (TN)

> This has been rectified.

Ln 54: Change CO2 to carbon dioxide (CO2)

> This has been rectified.

Ln 101-104: The knowledge gaps that this study addresses were clearly articulated in the Introduction. In these lines referencing the review by Smith (2017), were any knowledge gaps or data limitations related to heat recovery from compost?

> The knowledge gap that Smith et al. (2017) was trying to fill was primarily to determine how changing a compost management strategy effects heat recovery rates.

Ln 118. "An analysis of compost…) should be a new sentence.

> This has been rectified.

Ln 171&173: How frequent was the periodic turning for each compost system?

> On Lines 179-182, we have revised the text to read:

> "Both windrows were turned successively on the same day, on a one to two week interval, as shown in Figure 3(d). The conventional windrow was turned nine times, and the CAHR windrow was turned eight times."

Ln 185-186: What criteria did VNAP staff use to determine when the compost was suitable for the market?

> This is discussed in Supplementary Materials Text S2: Management of composts by VNAP staff. See text included in response to this reviewer's second main point above.

Ln 257-265: I was wondering throughout if upfront capital costs were included. It was clear in the Discussion section that this analysis was restricted to operational costs, and that it also drew non-operational costs from a previous study. This is a nice approach but could be made clearer in the methods section.

> At lines 267-274 and 400-406, we have attempted to clarify that we analyzed 1) the operation costs and 2) the "lifecycle" costs of the CAHR system.
>
> Lines 267-274: "Each compost turning event was recorded, and fuel use and labor expenses were calculated for each treatment during the study. Agrilab Technologies assisted with electrical calculations associated with the operation of the CAHR system. Assumptions used to determine operational expense and energy use are provided in the Supplementary Materials.
>
> To quantify the performance of the CAHR system holistically, not just for operational expense, we gathered data on capital expense, fuel/energy savings, and infrastructure cost savings for the CAHR system relative to conventional management. These data were sourced from a 2018 analysis of system performance at VNAP (Foster et al., 2018)."
>
> Lines 400-406: "The calculations in Table 3 only account for normal operational inputs from the time compost batches were assembled until they were removed from production. This study did not monitor time and space savings provided by a managed aeration system and did not monitor the energy and cost savings benefits of the CAHR system to an agricultural producer or waste manager, which have been well documented at VNAP and are summarized in Table 4 (Foster et al., 2018). Table 4 presents expense and cost savings values of the CAHR system throughout its lifetime of construction, operation, and use relative to conventional compost management."

Ln 291-293 & Ln 304-305: Again, please provide some detail on what was monitored and how these observations translated to decisions.

> This is discussed in Supplementary Materials Text S2: Management of composts by VNAP staff

Ln 351: Was NOx-N determined by subtraction of TKN from TN?

> Yes, see Lines 229-230: "NOx-N (the sum of nitrate N (NO3-N) and nitrite N (NO2-N)) was calculated by subtracting TKN from TN."

Ln 359: I suggest not using an acronym for moisture content.

> This has been rectified.

Ln 381-385: I agree with this hypothesis and how it points to future research directions (Ln 388-389).

> Thank you!

Ln 390: Later on, it is noted that the treatment difference in pH could explain potentially greater NH3 volatilization from the conventional windrow. That text could be move here.

Thank you for this suggestion. We also felt as if the N discussion was a better place for this material, and we have moved it to Lines 471-475.

Ln 401: WEP is defined earlier.

This has been rectified. WEP is defined only once in this revision.

Ln 434, Table 1: Why are the final N-P-K values in bold? Please add statistical significance notation and variance, where possible.

Statistical significance calculations we conducted were not applicable to the materials in Table 1, due to single samples being used for Table 1. Bold text has been eliminated from all tables.

Ln 456-458: As mentioned above, errors in bulk density could be propagated through the mass balance calculation to quantify the final error.

Error analysis was not conducted for bulk density due to only one sample being taken per week.

Ln 470, Table 2: Why are retention values bolded?

Bold text has been eliminated from all tables.

Ln 508-511: If I am understanding correctly, this system requires more costs than a "typical" CAHR, so it's fair to say that the cost savings is a conservative estimate.

This has now been addressed on Lines 551-554:

"Therefore, operational costs concurrent with this study and the management of composts during this study may be conservative estimates, and should not be considered representative of all CAHR systems."

Second Review

Second review by Associate Editor:

The manuscript is significantly improved by the separation of the results and discussion. Additional detail is needed regarding the methods (see comments below) and the figures/tables need to conform to the journal format.

Remove Core ideas table.

Recommend "forced aeration" as keywords

In some places in the manuscript, SI and Imperial units are both provided and in other places only SI units are provided. Be consistent.

L42: "lower" water-extractable is more appropriate than "lesser." Could also use "reduced"

L44: recommend replacing "more expensive" with "higher"

L152: The hypothesis was hinted at in the prior paragraph, but never actually stated.

L208: provide location of manufacturer

L242: Provide the make/model and accuracy of the thermometer.

L378 and L661: Is the "lagoon" a stormwater pond? "Lagoon" implies wastewater, so if it is actually a stormwater pond, there will be less confusion if that term is used instead of "lagoon."

L402-403: Are these %TOC on a wet or dry basis?

L464-469: The strength of this correlation could be tested statistically.

L658: The savings in fossil fuels provides a benefit from a climate-change standpoint – using biological heat instead of fossil fuels is an example of ecological engineering.

L822: Recommend replacing “times more expensive financially” with “greater.”

Section 2.7: Data Analysis – indicate if the data were tested for normality and independence prior to performing a t-test, at least for the monthly and 13-week data. Was the t-test a one-way or two-way test?

Section 3.7: This section consists of a single sentence and a table. Perhaps combine with the prior section?

Figures: Remove the titles from all graphs. In figure/table captions, spell out all abbreviations (e.g. total nitrogen instead of TN).

Figure 1 caption: State that each data point is an average of 48 temperature readings (two readings at each of eight locations, 3X per week) and three composite samples.

Figure 3 – the graphs are very small and the font is difficult to read. Recommend placing this figure on a landscape page.

Tables in general need to be in the format provided in the manuscript template.

Table 3: The energy costs are actually “Energy Use” since the units are in kWh.

Table S1 – Standard practice is the top of landscape page should be at the binding (assuming a print version). Please rotate the table 180 degrees.

References in supplemental information:
• Provide complete reference for Foster et al. report.
• The title of Ingram’s thesis should be capitalized, not the source.
• In the Reynnells et al. reference, the EPA and Composting Council should be capitalized.
• Sharma and Reynnells – only the first letter of the paper title should be capitalized

Second review by Stephanie Lansing:

The revisions have greatly improved the manuscript quality. A few more suggestions for improving the manuscript text are given below:

1) Instead of stating p-value < 0.05, give the exact value (i.e., p-value = 0.032), unless it is p-value < 0.001.

2) When stating that values are statistically different, it would be better to indicate if they were significantly greater or lower. Being more specific on these differences would improve the results section.

3) The addition of the discussion session was a great improvement, but more details are needed in the discussion section. Specifically, within each section, the authors state that 'other results were comparable were our work,' but no values were given. Giving specific values from these other studies and comparing the specific values to your study would be helpful. As written, the comparisons with the literature are a bit vague, and it is not clear how exactly your results fit into the literature - besides being "comparable" or "within the range." Put actual values throughout the Discussion section, with more specific discussions of your results to other specific results.

4) Please turn the page of the first graph in the Supplemental Materials and reposition the table caption, so it is readable.

5) Within the manuscript text, refer to the supplemental materials for the relevant information. At this point, readers are only directed to the supplemental materials at one point in the text (CapEx), while there are many places in the Results where readers could be directed to this information.

6) There are some places where (-1) are used in units, yet, most units use slashes (i.e., mg/L), please remove the superscript units and put all units with slashes for consistency, as there are different units used - sometimes within the same table.

7) Take the notes out of the figure spaces, and place these notes within the caption.

8) I am unclear why CAHR has a final value of 11/19/2024 in Table 2. Instead of dates, can you put number of months?

9) there are still inconsistently with inline citations. For example, Ma (2020), Sun (2018), Chowdhury (2014), and Yang (2019) should all have "et al." after the first author's name and before the date. Please check throughout.

10) There needs to be a better way of denoting statistical differences on the graphs, as there are multiple parameters on one graph, yet, the statistical difference is denoted by a * by the Week number, but it is unclear which of the parameters presented is actually statistically different.

Response to Reviewers (Second Review):
"Performance of a compost aeration and heat recovery system at a commercial composting facility"

We thank both reviewers for their helpful second review of this case study. We have addressed all comments as described below. We have also made minor revisions to improve flow, conciseness, and clarity during this second revision (see tracked changes version).

Authors:
Finn A. Bondeson, Joshua W. Faulkner, Eric D. Roy

Reviewer comments are in bold and our responses are directly below each comment. Line numbers cited in our response correspond with those in the revised manuscript.

Second review by Associate Editor:

Remove Core Ideas table.
The core ideas table has been removed from this revision.

Recommend "forced aeration" as keywords'
"Forced aeration" has been added as a keyword.

In some places in the manuscript, SI and Imperial units are both provided and in other places only SI units are provided. Be consistent.
Imperial units have been removed from the manuscript.

L42: "lower" water-extractable is more appropriate than "lesser." Could also use "reduced"
"Lesser" has been replaced with "lower" at line 36.

L44: recommend replacing "more expensive" with "higher"
"More expensive" has been replaced with "higher" at line 39.

L152: The hypothesis was hinted at in the prior paragraph, but never actually stated.
At line 125, we inserted the sentence "We hypothesized that a heat capture system may help serve two goals: compost nutrient retention and cost savings."

L208: provide location of manufacturer
Manufacturer location noted on line 179.

L242: Provide the make/model and accuracy of the thermometer.
Thermometer specs have been provided beginning at line 208.

L378 and L661: Is the "lagoon" a stormwater pond? "Lagoon" implies wastewater, so if it is actually a stormwater pond, there will be less confusion if that term is used instead of "lagoon."
We now use "stormwater pond" instead of "lagoon".

L402-403: Are these %TOC on a wet or dry basis?
Dry weight basis. See lines 282-283.

L464-469: The strength of this correlation could be tested statistically.
We have decided to remove the text referenced here related to the correlation between moisture changes and nitrate changes. Closer inspection revealed that the relationship between delta_moisture and delta_NO3 was inconsistent. We now instead simply hypothesize that the lower moisture content for the CAHR treatment was less conducive to nitrate loss (Lines 374-376).

L658: The savings in fossil fuels provides a benefit from a climate-change standpoint – using biological heat instead of fossil fuels is an example of ecological engineering.
See line 445-446, where we updated the text to read, **"**Biologically-generated heat captured from composts by the CAHR system is an example of ecological engineering in practice and reduces demand for fossil fuel sources."

L822: Recommend replacing "times more expensive financially" with "greater."
"More expensive financially" has been replaced with "greater" at line 612.

Section 2.7: Data Analysis – indicate if the data were tested for normality and independence prior to performing a t-test, at least for the monthly and 13-week data. Was the t-test a one-way or two-way test?
We have inserted the following text on lines 283-287:
"All statistical tests were conducted using the two-sided, unpaired "t.test" function in base R to compare treatments on a weekly, monthly, or 13-week study period basis, unless $p < 0.05$ for the Shapiro-Wilk normality test (for monthly or 13-weel study period). In such cases (13-week temperature, 13-week TOC, 13-week pH, and month 3 percentage of TP as WEP), the Mann-Whitney *U* test was used as a nonparametric alternative."

Section 3.7: This section consists of a single sentence and a table. Perhaps combine with the prior section?
The section formerly known as Section 3.7 has been incorporated into Section 3.6.

Figures: Remove the titles from all graphs. In figure/table captions, spell out all abbreviations (e.g. total nitrogen instead of TN).
Figure titles have been removed and abbreviations have been placed in parentheses next to their respective spelled out versions.

Figure 1 caption: State that each data point is an average of 48 temperature readings (two readings at each of eight locations, 3X per week) and three composite samples.
This has been addressed in all relevant figure captions.

Figure 3 – the graphs are very small and the font is difficult to read. Recommend placing this figure on a landscape page.
Figure 3 has been placed on a landscape page.

Tables in general need to be in the format provided in the manuscript template.
We have adjusted the formatting of all tables to match the template version as closely as possible.

Table 3: The energy costs are actually "Energy Use" since the units are in kWh.
This has been corrected. See Table 3 caption and heading.

Table S1 – Standard practice is the top of landscape page should be at the binding (assuming a print version). Please rotate the table 180 degrees.
This change has been made. See Supplemental Information document.

References in supplemental information:
• Provide complete reference for Foster et al. report.
This is not a publicly published work, but rather an internal report including recordkeeping on the performance of the CAHR system by the compost producer (Foster) and the CAHR manufacturer (AgrilabTech). The CSE style guidelines are not clear on how to reference such a report. We welcome the JEED Editorial team's suggestions for this citation in the final version of the paper.

• The title of Ingram's thesis should be capitalized, not the source.
We have updated this citation to meet CSE formatting guidelines.

• In the Reynnells et al. reference, the EPA and Composting Council should be capitalized.
This has been rectified.

• Sharma and Reynnells – only the first letter of the paper title should be capitalized
This has been rectified.

Second review by Stephanie Lansing:

The revisions have greatly improved the manuscript quality. A few more suggestions for improving the manuscript text are given below:

1) Instead of stating p-value < 0.05, give the exact value (i.e., p-value = 0.032), unless it is p-value < 0.001.
Actual p values have been given where applicable.

2) When stating that values are statistically different, it would be better to indicate if they were significantly greater or lower. Being more specific on these differences would improve the results section.
This wording has been updated where applicable in the results section.

3) The addition of the discussion session was a great improvement, but more details are needed in the discussion section. Specifically, within each section, the authors state that 'other results were comparable were our work,' but no values were given. Giving specific values from these other studies and comparing the specific values to your study would be helpful. As written, the comparisons with the literature are a bit vague, and it is not clear how exactly your results fit into the literature - besides being "comparable" or "within the range." Put actual values throughout the Discussion section, with more specific discussions of your results to other specific results.

To address this comment, we have added details in the three statements below within the Discussion section:

Lines 537-540:
"For both treatments, final N-P-K values, as well as the major metrics of TOC and C:N ratio, were within typical ranges (e.g., 0.5-3.3% N, 0.1-1.5% P, 0.1-3.9% K, ~9-54% TOC, C:N = 8.6-25.5) previously observed for mature manure-based composts (Bernal et al., 2017; Schwarz & Bonhotal, 2017; Zhen et al., 2021)."

Lines 558-561:
"The compost maturation time scales observed in this study are consistent with industry expectations for dairy manure-dominant feedstocks within the region (e.g., ~12 weeks for CAHR systems, <8 months for windrows with an aggressive turning regime) (Kryzanowski, 2019; Vermont Agency of Natural Resources, 2015)."

Lines 576-579:
"Additionally, the relative losses of C, N, P, and K in this study are comparable to loss rankings found by others (loss of C > loss of N > loss of P and K) (Larney et al., 2006; Luebbe et al., 2011; Tiquia et al., 2002), especially for the conventional treatment."

4) Please turn the page of the first graph in the Supplemental Materials and reposition the table caption, so it is readable.
This has been rectified. See Supplemental Materials.

5) Within the manuscript text, refer to the supplemental materials for the relevant information. At this point, readers are only directed to the supplemental materials at one point in the text (CapEx), while there are many places in the Results where readers could be directed to this information.
References to the supplemental materials have been updated globally where applicable.

6) There are some places where (-1) are used in units, yet, most units use slashes (i.e., mg/L), please remove the superscript units and put all units with slashes for consistency, as there are different units used - sometimes within the same table.
This has been rectified.

7) Take the notes out of the figure spaces, and place these notes within the caption.
This has been rectified.

8) I am unclear why CAHR has a final value of 11/19/2024 in Table 2. Instead of dates, can you put number of months?
Number of months have been indicated instead of dates for the "final" table headers in Tables 1 and 2.

9) There are still inconsistenties with inline citations. For example, Ma (2020), Sun (2018), Chowdhury (2014), and Yang (2019) should all have "et al." after the first author's name and before the date. Please check throughout.
We have fixed all "et al" issues throughout.

10) There needs to be a better way of denoting statistical differences on the graphs, as there are multiple parameters on one graph, yet, the statistical difference is denoted by a * by the Week number, but it is unclear which of the parameters presented is actually statistically different.
We have updated wording in the figure captions which should elucidate that the * denotes statistical differences between the two test groups (CAHR and Conventional).