April 28, 2025
File No. 04225008.00

MEMORANDUM

TO: Jeff Shepherd, P.E. – Civil & Environmental Consultants, Inc.

FROM: Jeff Leadford, P.E. – SCS Engineers

SUBJECT: Republic Services Coffin Butte Landfill – Odor Dispersion Modeling Study Response

This memorandum is provided in response to recent comments received from Maul Foster and Alongi (MFA) concerning the recent odor modeling study performed at the Coffin Butte Landfill by SCS Engineers. These comments were received on April 21, 2025 and are in regard to Exhibit 33 of the 2025 odor modeling study. Responses to each comment are addressed below.

1. *The BOP refers to the 2024 Odor Study on page 1 and in the conclusions on page 3, and it makes assertions from that study about the project odor impacts. MFA does not believe that the 2024 Odor Study should be cited as it does not rely on actual emissions from the landfill to draw conclusions. MFA submitted comments on the 2024 Odor Study pointing out several issues, which have largely been addressed in the 2025 Odor Study.*

This has been addressed and the 2025 Odor Study will be the only study mentioned moving forward.

2. *Per Item C in the BOP and section 5.2 of the 2025 Odor Study, Scenario #1 (2023 actual operations) was not expected to cause detectable nuisance odors since the [dilution-to-odor threshold] (D/T) ratio for each pollutant modeled was well below one. MFA recommends that the 2025 Odor Study include a section on model uncertainties and refer to these uncertainties when making concluding statements. For instance, the model is able to predict offsite odor pollutant concentrations for the majority of hours included in the modeled meteorological dataset. However, the model is unable to accurately predict impacts during low wind speeds, inversions, and very short-term meteorological conditions (less than 1 hour) that may result in less dispersion and, therefore, higher concentrations of odor-causing pollutants on neighboring properties. However, some of these same conditions are also likely to result in higher concentrations of odor-causing pollutants from other neighboring sources as well.*

An uncertainty section has been included in the updated odor model report in Section 5.3 as requested.

3. *Per Item C in the BOP and section 5.2 of the 2025 Odor Study, Scenario #2 (2052 proposed operations) D/T ratios increased by 2 to 2.5 times as compared to Scenario #1 (2023 actual operation) for all pollutants except [total oxides of nitrogen] (NOX). The above statement alludes to the possibility that either the odor detected will be of higher intensity or the odor will be noticed by more people with greater frequency. If odors are primarily detected during calm periods, it is possible it will be more noticeable, but not necessarily more frequently noticed. MFA recommends that the Applicant includes a discussion about what the change in model results between Scenario #1 and Scenario #2 likely indicates.*

It should be mentioned that D/T values are still below 1 in both scenarios, thus nuisance odors are not expected to be detected by the average person based on the model. From years 2023 to 2052, there is a reduction of Nox concentrations and an increase in landfill gas-based pollutants, but all impacts remain significantly below 1 D/T. Additional analysis of change in frequency and intensity was not deemed necessary given the model is not showing a detectable nuisance odor impact. The same meteorological data is being used for both Scenarios, so no change in odor frequency is expected. The odor intensity does increase with the landfill gas based pollutants, but again remains below 1 D/T which is far below the threshold for detectable nuisance odor impacts.

4. *MFA recommends that the Applicant clarify what emission units are included in the aggregate insignificant model identified in Section 3.3.*

The emission units included in the aggregate insignificant are now included in Section 3.3.

5. *MFA recommends that the Applicant confirm if the November 2024 Modeling Report was reviewed and approved by the ODEQ. If not, the Applicant should provide supporting justification for the following modeled release parameters*

The Nox modeling from November 2024 was approved by ODEQ on March 3, 2025.

- *The modeled release height (262.5-feet) and initial vertical dimension (122.1- feet) for the current landfill fugitive surface (Model ID: FUG). MFA is concerned that setting the entire waste-containing area for the current landfill fugitive emissions unit to the north of Coffin Butte Road at a single release height, plus the additive vertical dimension, is unrealistic and will result in a less conservative assessment.*

- *It is unclear from Table 3 whether the modeled release parameters for the current landfill fugitive surface (Model ID: FUG) are the same for Scenario #1 (2023) and Scenario #2 (2052). However, based on a review of the dispersion model output files for Scenario #1 and Scenario #2, MFA understands the modeled release parameters are unchanged between either scenario. The effective release heights appear to be nearly 100 feet above the highest point of the current landfill footprint based on a review of Google Earth terrain data (current as of July 2024) and would be inappropriate to represent existing conditions for 2023. Given the surface heights vary for waste-containing areas on the landfill, and it appears that emissions are being spread evenly over the entire landfill surface area, it would seem more appropriate to assume an average effective release height equal to half of the height of the landfill above the base elevation.*

- *The modeled release height (154-feet) and initial vertical dimension (71.6-feet) for the expanded landfill fugitive surface (Model ID: FUG_EXP).*

- *The modeled extents for the current landfill fugitive surface area (Model ID: FUG) and the expanded landfill fugitive surface area (Model ID: FUG_EXP). Modeled emission rates are divided by the modeled area, meaning the larger the modeled extents, the lower the corresponding modeled emission rate which results in a less conservative assessment.*

MFA recommends separate release parameters for 2023 and 2052, as the landfill heights will be different. Separate tables for the release parameters should be provided and labeled in the 2025 Odor Study. MFA recommends that the modeled surface area be set at half the height of the landfill to account for areas that are both above and below this height unless other values are justified. MFA further recommends that the model include no initial vertical dimension. The landfill gas being released as fugitives from the landfill surface will be slow moving and may only be thermally buoyant a portion of the year. To be conservative, MFA does not recommend an initial vertical dimension for Scenario #1 or Scenario #2.

SCS methodology used the base of the landfill mound as the elevation, the difference between the average height of the landfill mound minus the base as the release height, and dividing the release height by 2.15 to get the initial vertical dimension (zinit) as noted in Table 3-3 of the AERMOD Users Guide. This methodology was used and approved by Oregon Department of Environmental Quality (ODEQ) on July 26th, 2024 for a landfill in the Eastern Region of DEQ for Cleaner Air Oregon health risk assessment modeling. Modeling fugitive landfill emissions is somewhat subjective with no direct federal or state guidance on the subject, so SCS believes the DEQ-approved methodology is justified in these Scenarios.

Engineering drawings were used to determine the area of waste and elevation/release height of the fugitive area sources (FUG and FUG_EXP). It is true that the FUG area source has the same extent and release height in 2023 to 2052, but upon looking at full build out of this source, the base elevation and maximum height would be similar. The landfill is built into the side of a butte, with the maximum height being to the North and the minimum height to the South .As waste is deposited here moving forward the butte will continuously be filled in, with a similar maximum and minimum height as 2023.

6. *The Applicant should clarify the following statement from Section 3.6: Note, wind data in Figure 7 was measured during a different time period and at a different location than the on-site wind data used for the odor complaint analysis. Therefore, the wind data in Figure 7 was not used in the odor complaint analysis. The Applicant should also confirm that the onsite meteorological dataset collected from November 1, 2004 to October 30, 2005 was used for each odor model run.*

The odor complaints analyzed were from 2022 through 2024. The approved on-site meteorological data is from 2004 through 2005. This note is clarifying that different datasets were used for different purposes. The 2004 through 2005 dataset was from an on-site station which will be much more representative for modeling. To analyze complaints, the wind direction and speed during the exact complaint time is needed, thus meteorological data from a different location on-site that has not previously been approved by ODEQ for modeling is required. All odor model runs used the same 2004 through 2005 approved data.

7. *An outdated version of the AERMET program executable (v18081) was used to process the meteorological dataset included in the AERMOD model runs. The selected AERMET executable is outdated and was originally issued in 2018. There have been several new executables issued by the EPA since 2018 that incorporate a wide variety of changes to preprocessing meteorological data. The potential impacts to offsite modeled concentrations may be significantly impacted by using the latest AERMET executable version. MFA recommends that each AERMOD model iteration use the most recent version of the AERMET program executable (v24142).*

On February 10th, 2025 SCS Engineers and Republic had a meeting with MFA to clarify modeling setup. All parties were in agreement to use the AERMOD-ready dataset from PNGC modeling that was approved by ODEQ last year. This approved meteorological dataset was used without adjustment as was agreed upon.

8. *Each dispersion model was executed using the 1-hour averaging period. Odors are generally considered a nuisance if they recur over longer periods of time. Modeling for one-hour impacts may not accurately reflect the potential impacts from longer exposure. As a result, MFA recommends the AERMOD model iterations assume the 24-hour averaging period to more accurately represent exposure to emissions from the landfill and to local weather patterns.*

Modeling over larger time periods, such as 24-hour averaging, would only decrease impacts. Modeling was setup only looking at one hour averages to take a more conservative approach.

9. *As noted above, each dispersion model was executed using the 1-hour averaging period, but annual emission estimates were used as the basis for modeled emission rates. Annual emission rates in units of pounds per year were converted to grams per second (g/s) by dividing by 31,536,000 seconds (e.g., the number of seconds in a calendar year) and multiplying by 453.592 grams as shown in Appendix C and D of the 2025 Odor Study. Modeling annual-based emission rates with 1-hour averaging periods is inconsistent and may not accurately reflect short-term emission rates that tend to bias high for a wide variety of factors. MFA recommends that the Applicant add clarifying justification for modeled emission rates or conservatively incorporate a short-term variability factor (e.g., 20% or 30% contingency factor) to better represent potential short-term surges to emission rates.*

This odor model specifically looked at one hour average concentrations as mentioned in the report. This is reasonable and consistent with AERMOD guidance because the model uses one-hour increments. Because the onsite data is available in one-hour increments, the modeled impacts followed the actual available data. SCS would disagree that a short-term variability analysis is appropriate given the use of actual data. In addition, SCS is not familiar with the use of randomly selected percentages (i.e., 20%-30%) for use in modeling short-term variability.

10. *Per Section 3.9, the total landfill fugitive surface area is 1,011,815 square meters, with 81% of this being in the current area, and 19% in the southern proposed expansion. Total fugitive emissions were split between FUG and FUG_EXP based on this area percentage. However, the modeled emission rates for the current and expanded landfill fugitive source representations (Model IDs: FUG and FUG_EXP, respectively) are equal as shown in the dispersion modeling output (*.ADO) files for each Scenario #2 model run, except for the NOX models. The Applicant should review, clarify, and update modeled emission rates.*

The current and expanded fugitive landfill sections (FUG and FUG_EXP, respectively) were both modeled at the same grams per second-meter squared (g/sec-m2) for each pollutant. For example, Dimethyl Sulfide was modeled at 2.027*10^-8 grams per second-meter squared (g/sec-m2) for each source. Thus taking into account the size difference between the two sources, FUG was modeled at a total of 0.01659 grams per second (g/s) and FUG_EXP was modeled at 0.00391 g/s. Landfill gas is projected to emit evenly in all portions of the landfill surface.

11. *The 1-hour nitrogen dioxide (NO2) National Ambient Air Quality Standard (NAAQS) is 188 micrograms per cubic meter (ug/m3). As shown in Tables 6 and 7, Scenario #1 and Scenario #2 result in maximum predicted offsite concentrations of 769 and 512 ug/m3, respectively, which are well above the NAAQS. Although this is not an odor- related issue, presenting a NAAQS exceedance may represent a larger issue for the Coffin Butte Landfill.*

Odor modeling was performed much more conservatively then NAAQS modeling. NAAQS modeling has shown compliance with NO2 standards in the November 2024 modeling report submitted to ODEQ.

12. *In Section 4.0 it is stated, "A D/T ratio of less than one indicates that the predicted impact would not cause a detectable nuisance odor impact. Detectable, nuisance, and impact all have arguably different thresholds and meaning. While a D/T ratio of less than 1 would not result in a detectable odor for the average person, there will be some people that are more sensitive and would still smell something. A nuisance is typically assumed to be a D/T value greater than or equal to 7 for state agencies that rely on this measurement method. Oregon does not utilize a technology-based method, choosing to rely instead on documenting frequency, duration, intensity and offensiveness of an odor. Because Oregon does not establish a numeric threshold based on D/T measurement, the predicted impact is subject to legal interpretation. It may be more appropriate to state that "the average person is not expected to detect a nuisance odor at the predicted concentration where the calculated D/T value is less than one."*

This language has been updated as requested in Section 4.0.

13. *The 2025 Odor Study does not present an uncertainty analysis, so it does not consider the potential impacts from more or less conservative assumptions. For instance, several of the pollutants with the highest measured concentration are all sulfur-based compounds. While it has been assumed that a D/T value less than 1 will not result in a detectable odor by the average person, several of these compounds could have an additive effect. MFA recommends the Applicant provide discussion to address potential additive effects relating to a nuisance condition. It should also be acknowledged that dispersion modeling has many limitations that may potentially result in predicted offsite concentrations not aligning with actual real-life concentrations. Known model limitations include low wind speeds, inversions, and short duration meteorological events, and their potential impacts should be discussed further.*

An uncertainty section has been included in the updated odor model report in Section 5.3 as requested.

14. *On page 20, it is stated, This middle scenario would show results in between Scenario #1 and #2 with slight differences based on landfill mound height in the expansion area and*

would certainly show D/T values less than 1 for all pollutants. MFA notes that with lower release heights, dispersion characteristics will be different, which may potentially result in higher predicted offsite concentrations. MFA recommends a middle height scenario be included or that more technical discussion be included to justify that statement.

A middle height scenario was not deemed necessary given the low odor concentrations modeled off-site. This middle scenario would have a landfill gas generation in between Scenario #1 and #2, with the tipper engines located either in the FUG or FUG_EXP areas. This will result in impacts somewhere in between the two Scenarios, with source parameters very similar as well.

15. *MFA believes that there are several statements in Section 5.2 that require further explanation.*

    It is stated that: Scenario #1 (2023 actual operations) was not expected to cause detectable nuisance odors since the D/T ratio for each pollutant modeled was well below one. Due to limitations of the dispersion model, it is possible to have periods of odor that are detectable by those who are sensitive to particular odors.

    It is also stated that: Scenario #2 (2052 proposed operations) D/T ratios increased by 2 to 2.5 times as compared to Scenario #1 (2023 actual operation) for all pollutants except NOx. The Applicant should provide a statement about what this means in terms of increases to the frequency or intensity of odors.

This was mentioned in Comment #3 above but language has been updated in the odor modeling report.

It should be mentioned that D/T values are still below 1 in both scenarios, thus nuisance odors are not expected to be detected by the average person based on the model. From years 2023 to 2052, there is a reduction of Nox concentrations and an increase in landfill gas-based pollutants, but all impacts remain significantly below 1 D/T. Additional analysis of change in frequency and intensity was not deemed necessary given the model is not showing a detectable nuisance odor impact. The same meteorological data is being used for both Scenarios, so no change in odor frequency is expected. The odor intensity does increase with the landfill gas based pollutants, but again remains below 1 D/T which is far below the threshold for detectable nuisance odor impacts.

Findings: While the findings of the Applicant's odor model predict that odors generally would not be considered an odor nuisance (where D/T values are below 1), MFA has observed several inconsistencies in the model setup that could significantly affect the predicted values. Specifically, these are without limitation:

- *There is insufficient supporting justification for the modeled release height and initial vertical dimension for the current landfill fugitive surface. The effective release heights appear to be point of the current landfill footprint based on a review of Google Earth terrain data (current as of July 2024) and would be inappropriate to represent existing conditions for 2023.*

Please see Comment #5 response above. It is also not clear from AERMOD guidance that the initial vertical dimension is additive to release height, and not a separate parameter. Is this clarified in other guidance?

- *There is insufficient justification for the modeled release height and initial vertical dimension for the expanded landfill fugitive surface.*

Please see Comment #5 response above.

- *An outdated version of the AERMET program executable (v18081) was used to process the meteorological dataset included in the AERMOD model runs and the potential impacts to offsite modeled concentrations may be significantly impacted by using the latest AERMET executable version.*

Please see Comment #7 response above.

- *There is insufficient justification for the modeled emission rates where 81% of the total landfill surface area is in the current area, and 19% is in the southern proposed expansion, but the modeled emission rates for the current and expanded landfill fugitive source representations are equal.*

Please see Comment #10 response above.

Given the responses above, SCS Engineers recommends additional consideration and approval of the odor modeling study at Coffin Butte Landfill. If any additional information is needed, please contact Jeff Leadford, P.E. at jleadford@scsengineers.com or 720-272-0172.

Sincerely,

Jeff Leadford, P.E.

Project Manager – SCS Engineers