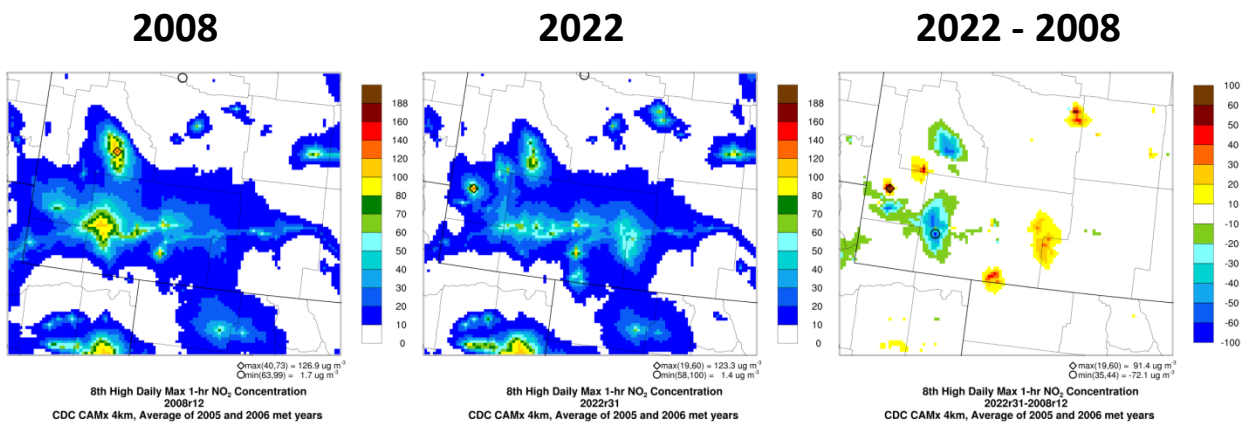

Figure 4-5. CAMx model results for 1-hour NO_2. Left and center panels: 2008 and 2022 absolute model results for 1-hour NO_2 from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 1-hour NO_2. All three panels show average of results for the 2005 and 2006 meteorological years.

Figure 4-6 shows the contribution of the CD-C Proposed Action Alternative (8950 new wells) and the CD-C No Action Alternative (4063 new wells) emissions to regional NO_X. For comparison, the NO_2 field for 2022 is shown in the left hand panel; this panel is identical to the middle panel of Figure 4-5. The maximum CD-C NO_X contributions (which are conservative estimates of the CD-C contributions to regional NO_2) from the Proposed Action Alternative and No Action Alternative emissions are 44 and 20 µg m^{-3}, respectively. Although the CD-C Proposed Action makes a discernible contribution to regional 1-hour NO_2, the impacts are localized and there is no exceedance of the 1-hour NO_2 NAAQS, WAAQS, and CAAQS.

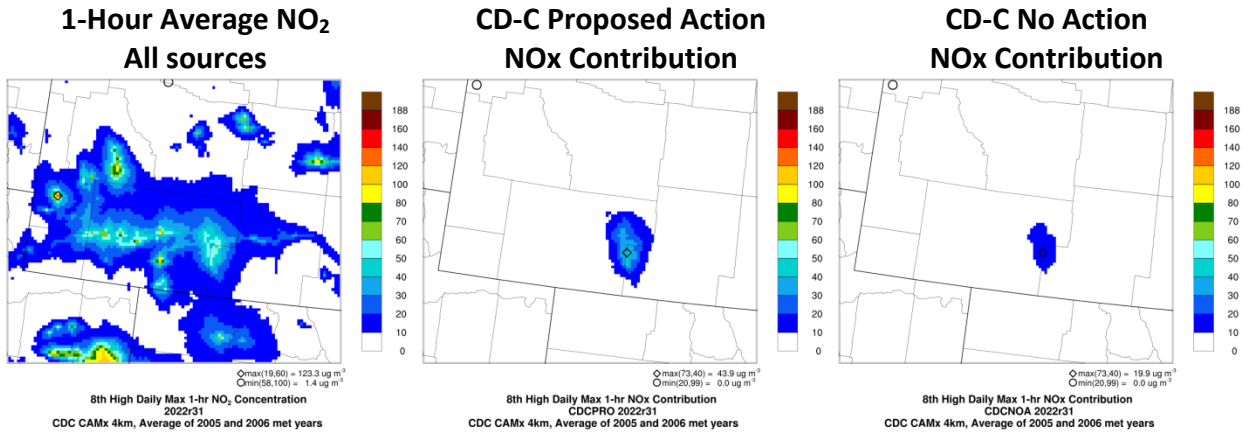

Figure 4-6. Left panel: 2022 absolute model results for 1-hour NO_2 from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to 2022 1-hour NO_X. Right panel: CD-C No Action Alternative contribution to the 2022 1-hour NO_X. All three panels show 1-hour average of results for the 2005 and 2006 meteorological years.

Results for regional annual average NO_2 are shown in Figure 4-7. The spatial pattern of the annual NO_2 results is similar to that of the 1-hour NO_2 results, although the maxima are lower due to the longer averaging time. The NAAQS, WAAQS, and CAAQS for annual average NO_2, are identical and are 100 µg m^{-3}. The maximum value within the 4 km domain in 2022 is 32 µg m^{-3}: the NAAQS is therefore attained throughout the 4 km domain. In 2022, modeled annual average NO_2 is generally below 15 µg m^{-3} except near large point sources and regions of oil and gas and trona development.

As with 1-hour NO_2, the CD-C Project emissions contribute NO_X to regional levels (Figure 4-8). The peak values of the Proposed Action Alternative and No Action Alternative NO_X contributions are 6.3 and 2.9 µg m^{-3}, respectively. The Proposed Action Alternative contribution is approximately half of the regional value of annual average NO_2 in the vicinity of the CD-C Project. However, the annual average NO_2 values of 10-15 µg m^{-3} near the CD-C Project Area are well below the NAAQS of 100 µg m^{-3}.

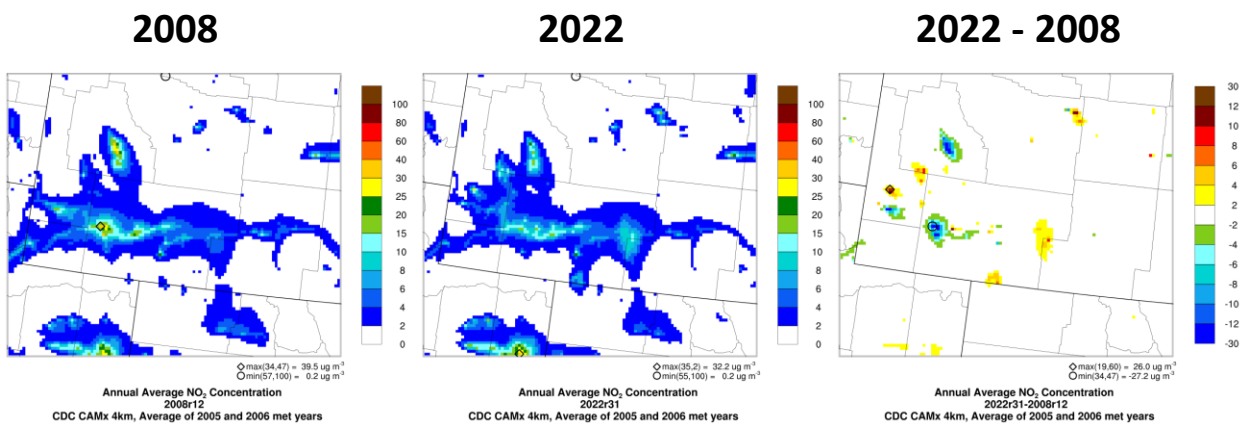

Figure 4-7. CAMx model results for annual average NO_2. Left and center panels: 2008 and 2022 absolute model results for annual average NO_2 from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in annual average NO_2; all three panels show average of results for the 2005 and 2006 meteorological years.

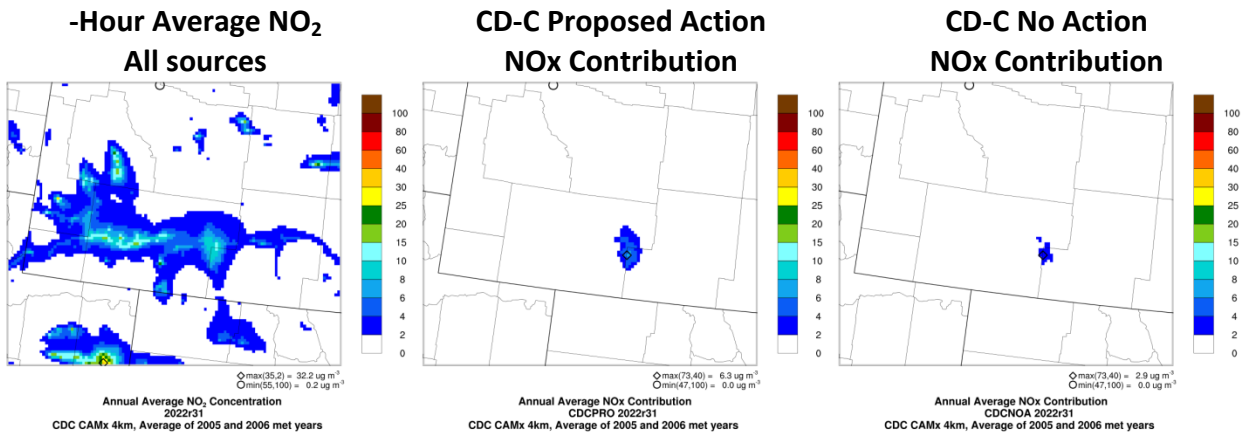

Figure 4-8. 2022 absolute model results for annual average NO_2 from all regional emissions sources, including the CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to 2022 annual average NO_X. Right panel: CD-C No Action Alternative contribution to the 2022 annual average NO_X. All three panels show 1-hour average of results for the 2005 and 2006 meteorological years.

Figure 4-9 shows the results for 1-hour average SO_2. The NAAQS, WAAQS, and CAAQS for 1-hour average SO_2 is 196 µg m^{-3}. 1-hour average SO_2 values are generally below 100 µg m^{-3} except near large point sources. There are two localized regions with 1-hour SO_2 exceeding 196 µg m^{-3} within the 4 km domain in 2022; the maximum value is 230 µg m^{-3} in central Fremont County, the other exceedance is 222 µg m^{-3} in western Sweetwater County, both exceedances are on a single grid cell only. The NAAQS, WAAQS and CAAQS are attained everywhere else within the domain. High 1-hour SO_2 in Fremont County occurs in the vicinity of a high-emitting (~1400 tpy) point source associated with Peak Sulfur, Inc. and with a single grid cell containing high (~1500 tpy) area source SO_2 emissions due to industrial fuel combustion. High SO_2 is present in this Fremont County location in both the 2008 baseline and 2022 future year emission inventories. These predicted exceedances are not related to the CD-C project and in the absence of the CD-C project emissions modeled concentrations at these locations would be comparable.

The right hand panel of Figure 4-9 shows changes in 1-hour SO_2 between the 2008 base year and the 2022 future year. There are SO_2 emissions reductions at the Jim Bridger and Naughton EGUs in Wyoming, and there are large SO_2 increases in 2022 at point sources in Carbon and Uinta counties.

The CD-C Proposed Action and No Action contributions to 1-hour SO_2 are shown in Figure 4-10. The SO_2 contribution from CD-C sources is extremely small, and is not visible on the same scale used to view regional SO_2. The small CD-C contribution to SO_2 is consistent with the fact that the Project's SO_2 emissions are small, since the Project does not access reservoirs containing sour gas. Based on the size of the CD-C contribution to regional 1-hour SO_2, we conclude that neither the Proposed Action Alternative nor the No Action Alternative emissions contribute to modeled exceedances of 1-hour SO_2 ambient air quality standards in Fremont or Sweetwater counties.

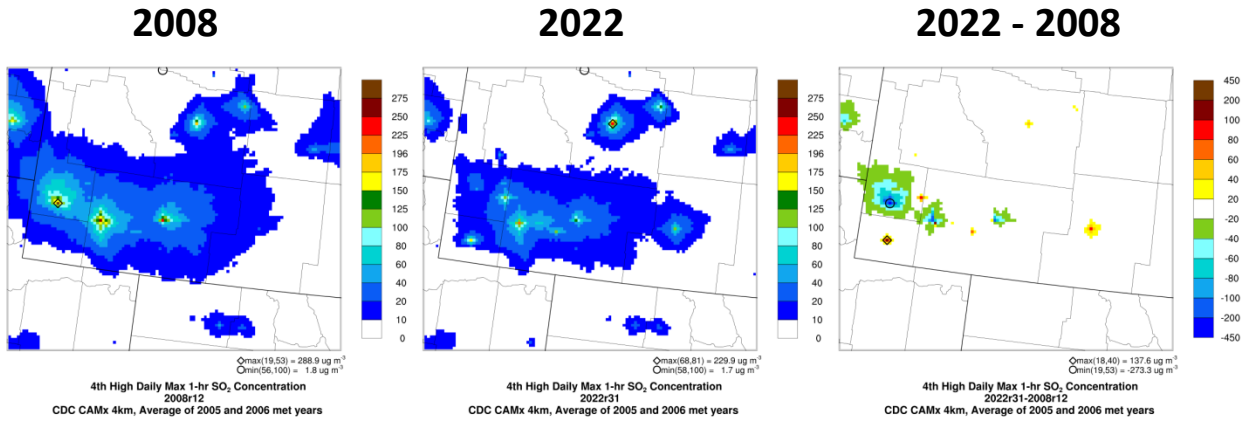

Figure 4-9. CAMx model results for 1-hour SO_2. Left and center panels: 2008 and 2022 absolute model results for 1-hour SO_2 from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 1-hour SO_2. All three panels show average of results for the 2005 and 2006 meteorological years.

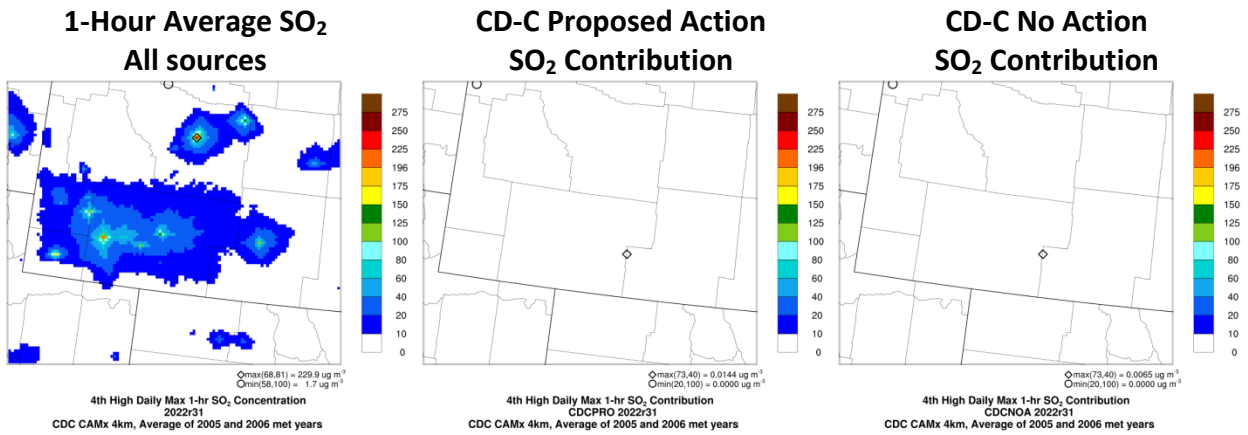

Figure 4-10. Left panel: 2022 absolute model results for 1-hour SO_2 from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to the 2022 1-hour SO_2 shown in the left hand panel. Right panel: CD-C No Action Alternative contribution to the 2022 1-hour SO_2 shown in the left hand panel. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for 3-hour SO_2 are shown in Figure 4-11. The NAAQS and WAAQS for 3-hour SO_2 are 1,300 µg m^{-3}, while the CAAQS is 700 µg m^{-3}. 3-hour SO_2 values within the 4 km domain are generally below 200 µg m^{-3} except in the vicinity of large point sources. The maximum value within the 4 km domain in 2022 is 216 µg m^{-3}; all 3-hour SO_2 standards are attained throughout the 4 km domain. The largest SO_2 increase going from 2008 to 2022 occurs in Uinta County, as noted in the discussion of 1-hour SO_2. As for 1-hour SO_2, contributions to 3-hour SO_2 from the Proposed Action Alternative emissions and the No Action Alternative emissions are too small to be seen on the same scale as regional SO_2 (Figure 4-12).

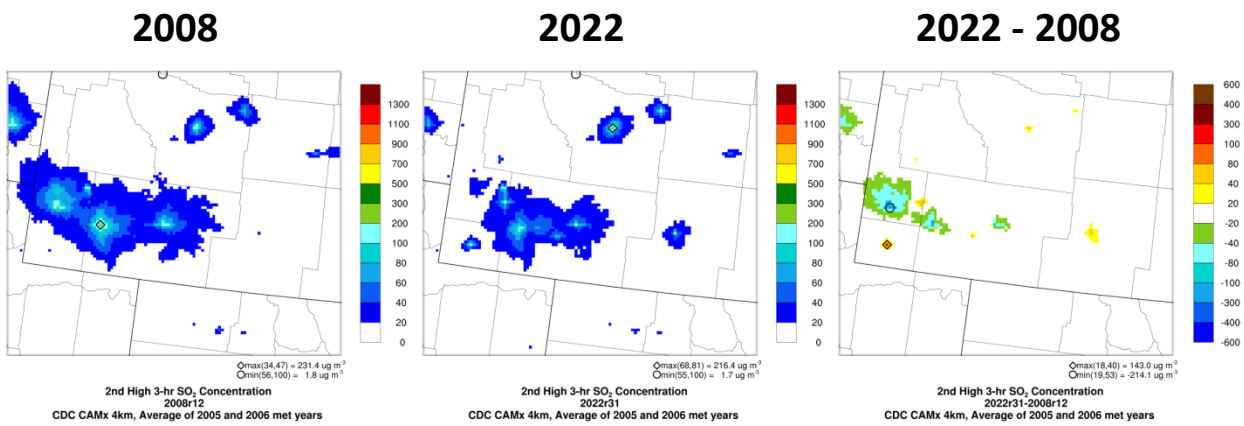

Figure 4-11. CAMx model results for 3-hour SO_2. Left and center panels: 2008 and 2022 absolute model results for 3-hour SO_2 from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 3-hour SO_2. All three panels show average of results for the 2005 and 2006 meteorological years.

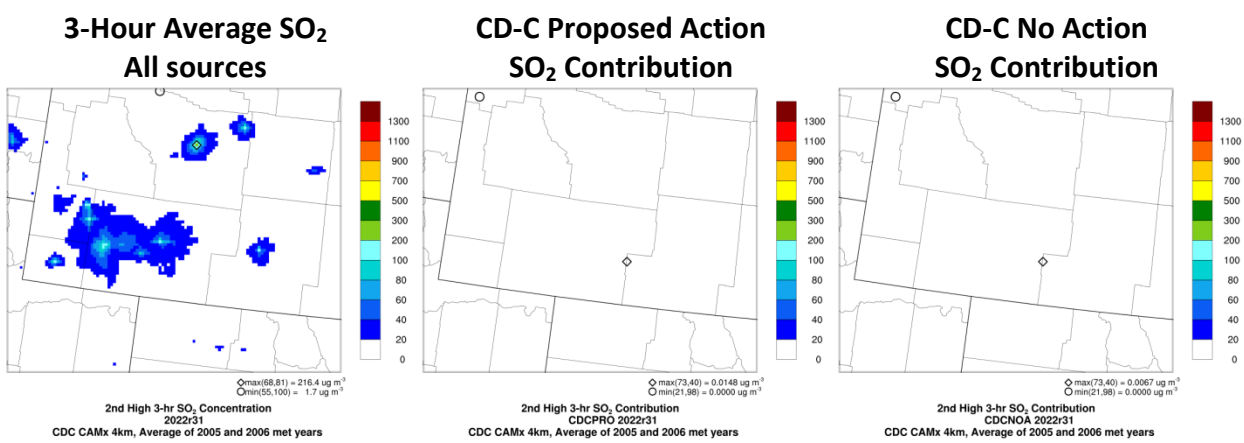

Figure 4-12. Left panel: 2022 absolute model results for 3-hour SO_2 from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to the 2022 3-hour SO_2 shown in the left hand panel. Right panel: CD-C No Action Alternative contribution to the 2022 3-hour SO_2 shown in the left hand panel. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for 24-hour SO_2 are shown in Figure 4-13. Although the NAAQS and WAAQS have been revoked the 24-hour SO_2 CAAQS of 365 µg m^{-3} is still applicable. 24-hour SO_2 values within the 4 km domain are generally below 40 µg m^{-3} except in the vicinity of large point sources. The maximum value within the 4 km domain in 2022 is 126 µg m^{-3}; all 24-hour SO_2 standards are attained throughout the 4 km domain. The largest SO_2 increases going from 2008 to 2022 occur in Uinta and Fremont counties, as noted in the discussion of 1-hour SO_2. As for the 1-hour and 3-hour SO_2, contributions to 24-hour SO_2 from the Proposed Action Alternative and No Action Alternative emissions are too small to be seen on the same scale as regional SO_2 (Figure 4-14).

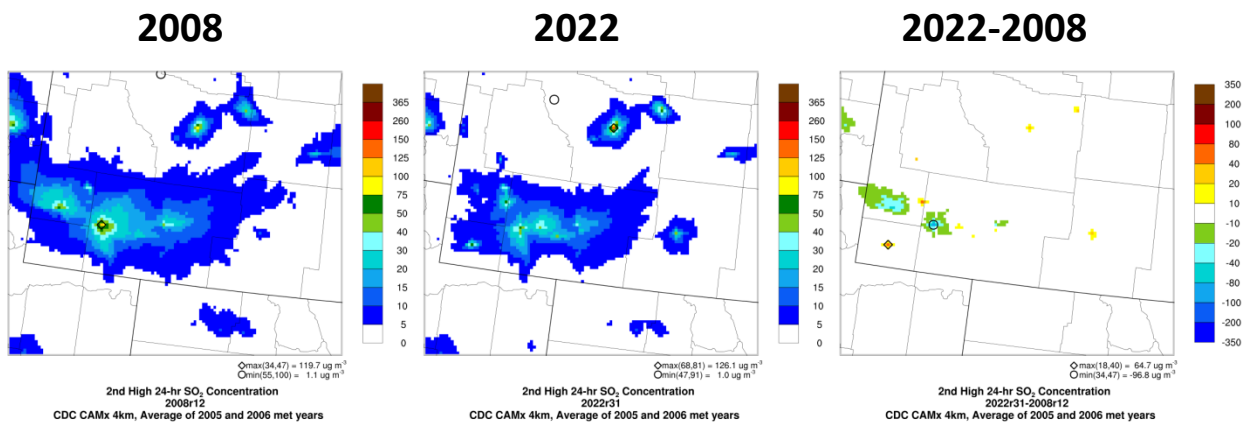

Figure 4-13. CAMx model results for 24-hour SO_2. Left and center panels: 2008 and 2022 absolute model results for 24-hour SO_2 from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 24-hour SO_2. All three panels show average of results for the 2005 and 2006 meteorological years.

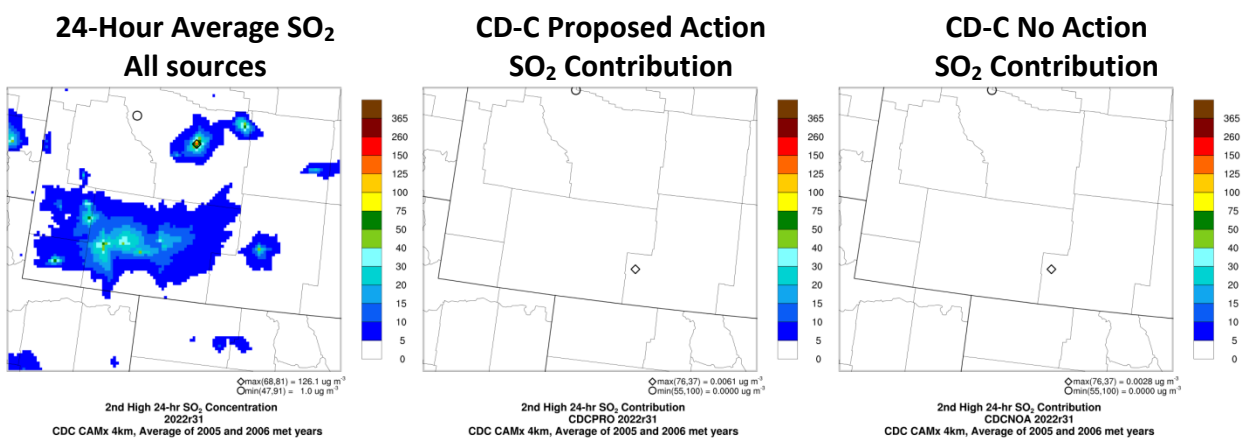

Figure 4-14. Left panel: 2022 absolute model results for 24-hour SO_2 from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to the 2022 24-hour SO_2 shown in the left hand panel. Right panel: CD-C No Action Alternative contribution to the 2022 24-hour SO_2 shown in the left hand panel. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for annual average SO_2 are shown in Figure 4-15. There are no NAAQS or WAAQS for annual average SO_2 but the CAAQS of 80 µg m^{-3} remains in effect. Annual average SO_2 values within the 4 km domain are generally below 10 µg m^{-3} except in the vicinity of large point sources. The maximum value within the 4 km domain in 2022 is 48 µg m^{-3}; all annual SO_2 standards are attained throughout the 4 km domain. The largest SO_2 increase going from 2008 to 2022 occurs in Lincoln County. As for short-term SO_2, contributions to annual average SO_2 from the Proposed Action Alternative and No Action Alternative emissions are too small to be seen on the same scale as regional SO_2 (Figure 4-16).

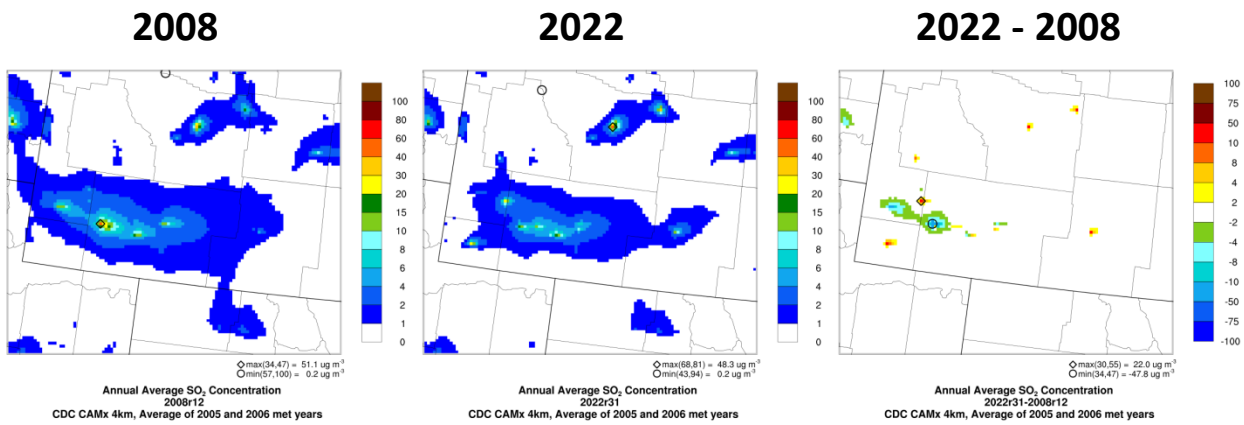

Figure 4-15. CAMx model results for annual average SO_2. Left and center panels: 2008 and 2022 absolute model results for annual average SO_2 from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in annual average SO_2; all three panels show average of results for the 2005 and 2006 meteorological years.

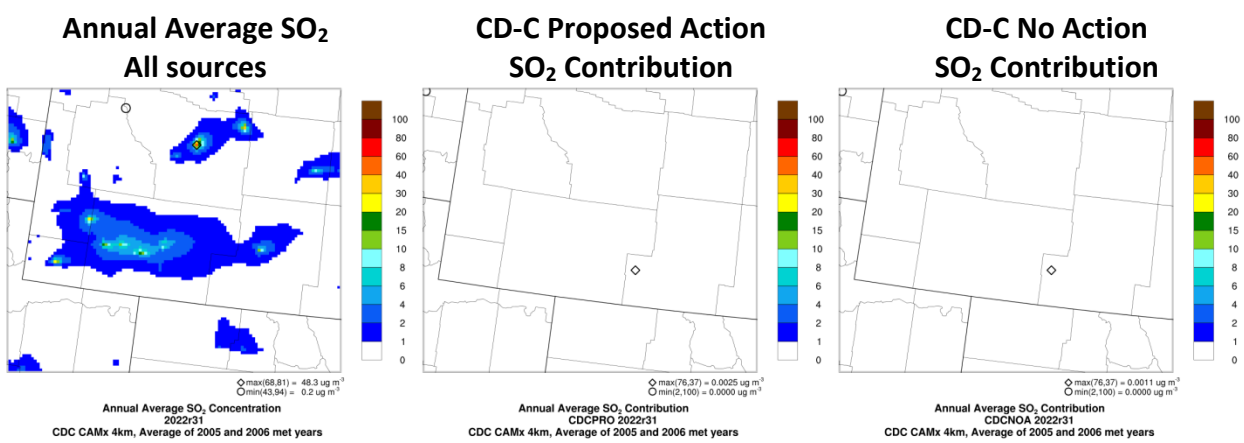

Figure 4-16. Left panel: 2022 absolute model results for annual average SO_2 from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to the 2022 annual average SO_2 shown in the left hand panel. Right panel: CD-C No Action Alternative contribution to the 2022 annual average SO_2 shown in the left hand panel. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for 98th percentile 24-hour $PM_{2.5}$ are shown in Figure 4-17. The NAAQS, WAAQS and CAAQS for 24-hour $PM_{2.5}$ are 35 µg m^{-3}. The 24-hour $PM_{2.5}$, NAAQS, WAAQS and CAAQS are violated if the 98th percentile value of 24-hour $PM_{2.5}$ averaged over three successive years exceeds 35 µg m^{-3}. The modeling results were calculated to match the form of the standard as closely as possible, and are the 8th highest per year (98th percentile value) averaged over the two CAMx future year runs (2022met05 and 2022met06). The 98th percentile 24-hour $PM_{2.5}$ values within the 4 km domain are generally below 10 µg m^{-3} and the maximum concentration within the 4 km domain in 2022 is 20 µg m^{-3} and occurs near the Jim Bridger Power Plant; the 24-hour $PM_{2.5}$ standard is attained throughout the 4 km domain. Peak contributions to the 24-hour $PM_{2.5}$ from the CD-C Proposed Action Alternative and No Action Alternative emissions are 1.4 µg $m^{-3}$and 0.6 µg m^{-3}, respectively. The CD-C $PM_{2.5}$ contribution is too small to be visible on same scale as regional $PM_{2.5}$ (Figure 4-18).

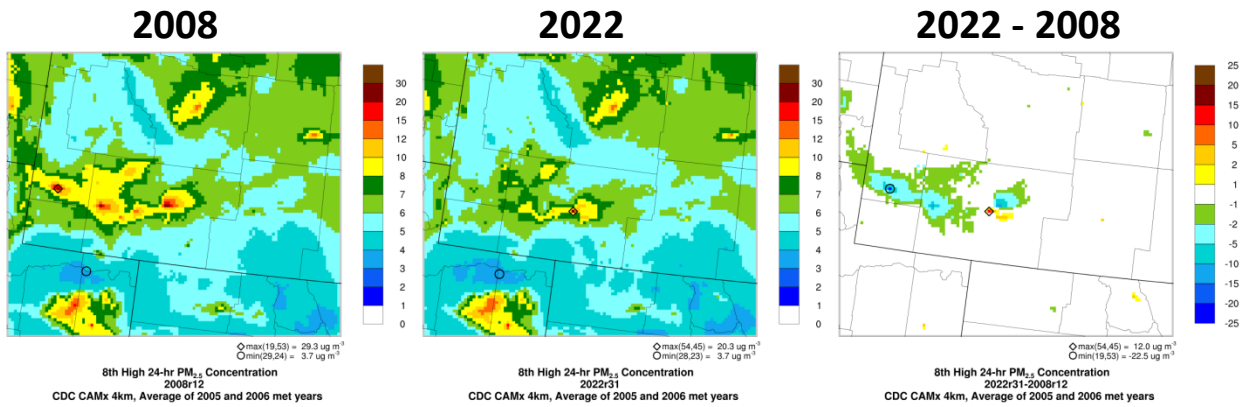

Figure 4-17. CAMx model results for the 98th percentile 24-hour $PM_{2.5}$. Left and center panels: 2008 and 2022 absolute model results for 98th percentile 24-hour $PM_{2.5}$ from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 98th percentile 24-hour $PM_{2.5}$. All three panels show average of results for the 2005 and 2006 meteorological years.

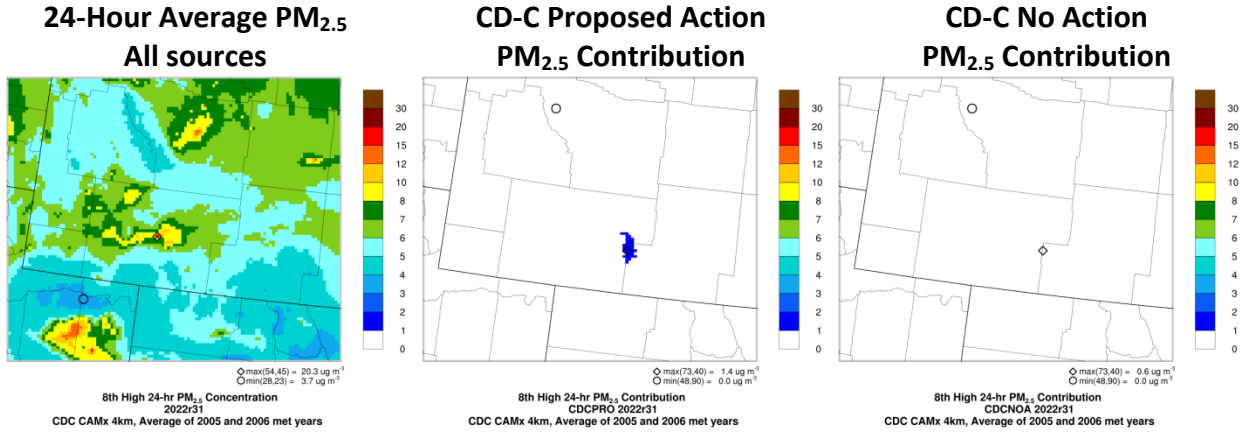

Figure 4-18. Left panel: 2022 absolute model results for 98th percentile 24-hour $PM_{2.5}$ from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to the 2022 24-hour $PM_{2.5}$ shown in the left hand panel. Right panel: CD-C No Action Alternative contribution to the 2022 highest 24-hour $PM_{2.5}$ shown in the left hand panel. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for annual average $PM_{2.5}$ are shown in Figure 4-19. The NAAQS and CAAQS for annual average $PM_{2.5}$ is 12 µg m^{-3}; Wyoming has not yet adopted through rulemaking the more stringent standard. The annual average $PM_{2.5}$ concentrations within the 4 km domain in 2022 are generally below 4 µg m^{-3} and the maximum value is 10 µg m^{-3}; therefore, the standard is attained. Peak contributions to the annual $PM_{2.5}$ from the CD-C Proposed Action Alternative and No Action Alternative emissions are 0.5 µg $m^{-3}$and 0.2 µg m^{-3}, respectively. The CD-C $PM_{2.5}$ contribution is too small to be visible on same scale as regional $PM_{2.5}$ (Figure 4-20) except for within a small area located around the CD-C Project Area in the Proposed Action Alternative case.

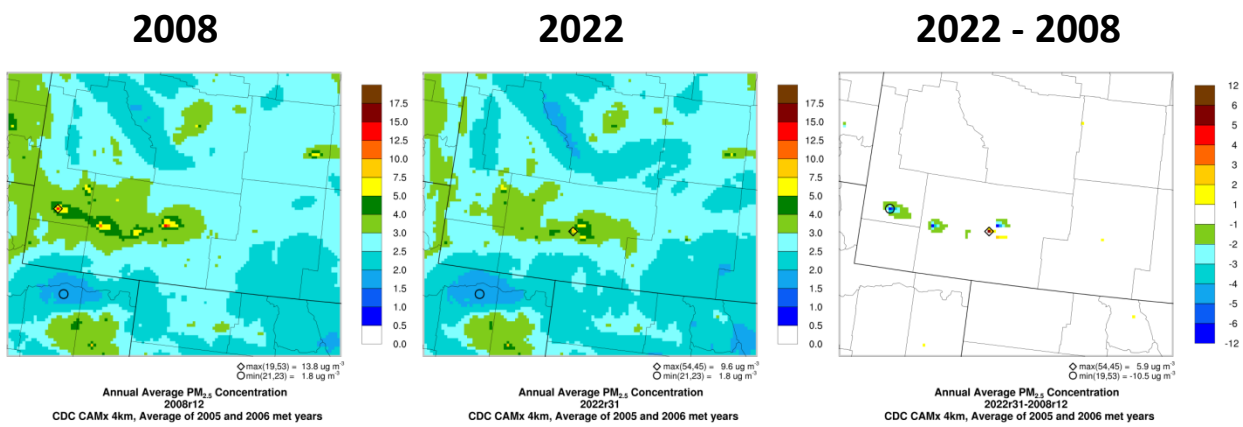

Figure 4-19. CAMx model results for annual average $PM_{2.5}$. Left and center panels: 2008 and 2022 absolute model results for annual average $PM_{2.5}$from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in annual average $PM_{2.5}$. All three panels show average of results for the 2005 and 2006 meteorological years.

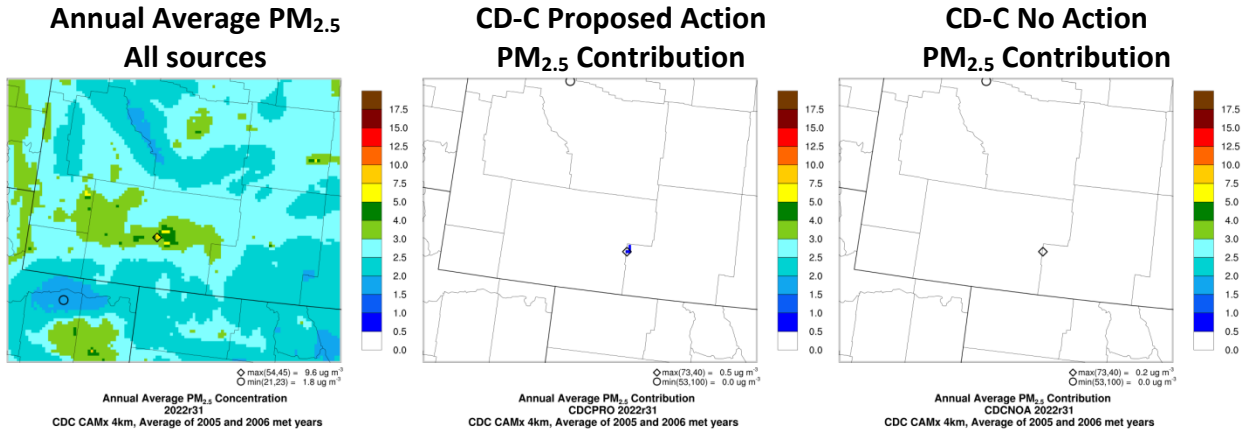

Figure 4-20. Left panel: 2022 absolute model results for annual average $PM_{2.5}$ from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to the 2022 annual average $PM_{2.5}$. Right panel: CD-C No Action Alternative contribution to the 2022 annual average $PM_{2.5}$. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for the 2nd highest 24-hour PM_{10} value are shown in Figure 4-21. The NAAQS, WAAQS and CAAQS for 24-hour PM_{10} are 150 µg m^{-3} which is not to be exceeded more than once per year on average over a 3-year period. To match the standard as closely as possible the annual 2nd highest modeled value in each grid cell is reported. The 2nd highest 24-hour average PM_{10} values within the 4 km domain are generally below 35 µg m^{-3} and the maximum value within the 4 km domain in 2022 is 458 µg m^{-3}, which exceeds the NAAQS. However, the only exceedances of the NAAQS are associated with a fire that occurred in northeastern Lincoln County in 2005. There are no exceedances of the PM_{10} NAAQS in 2006 (not shown; see Appendix J). Fire emissions were held fixed from the 2005-2006 base case emission inventories in both the 2008 and 2022 emission inventories. Therefore, the PM impacts from the fire are absent in the 2022-2008 difference plot in the right panel. Contributions to 24-hour PM_{10} from the CD-C Proposed Action and No Action emissions are 6.6 µg $m^{-3}$and 3.0 µg m^{-3}, respectively (Figure 4-22). Figure 4-22 shows that the CD-C Proposed Action Alternative emissions do not contribute significantly to the exceedance in Lincoln County.

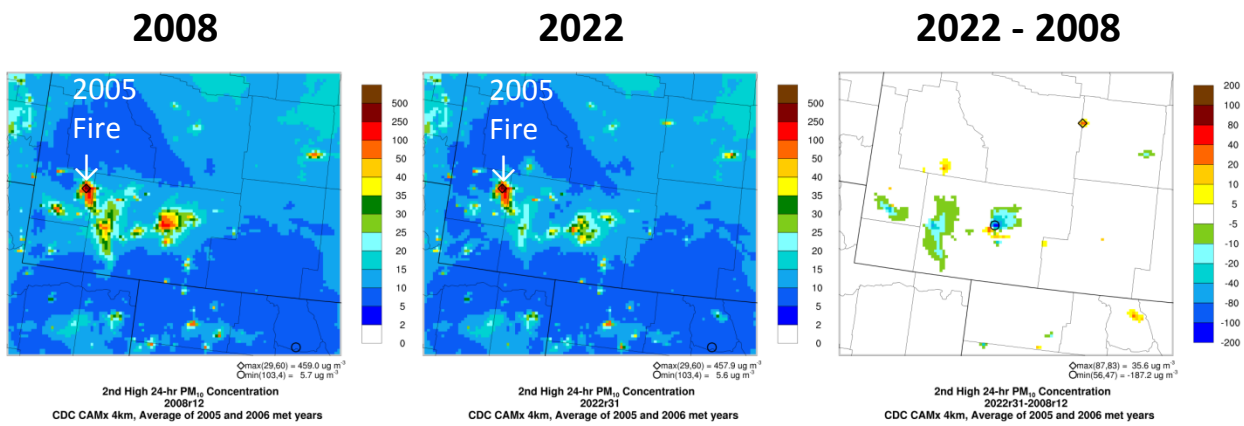

Figure 4-21. CAMx 2008 and 2022 model results for 2nd high 24-hour average PM_{10}. Left and center panels: 2008 and 2022 absolute model results for 2nd high 24-hour average PM_{10} from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 2nd high 24-hour average PM_{10}. All three panels show average of results for the 2005 and 2006 meteorological years.

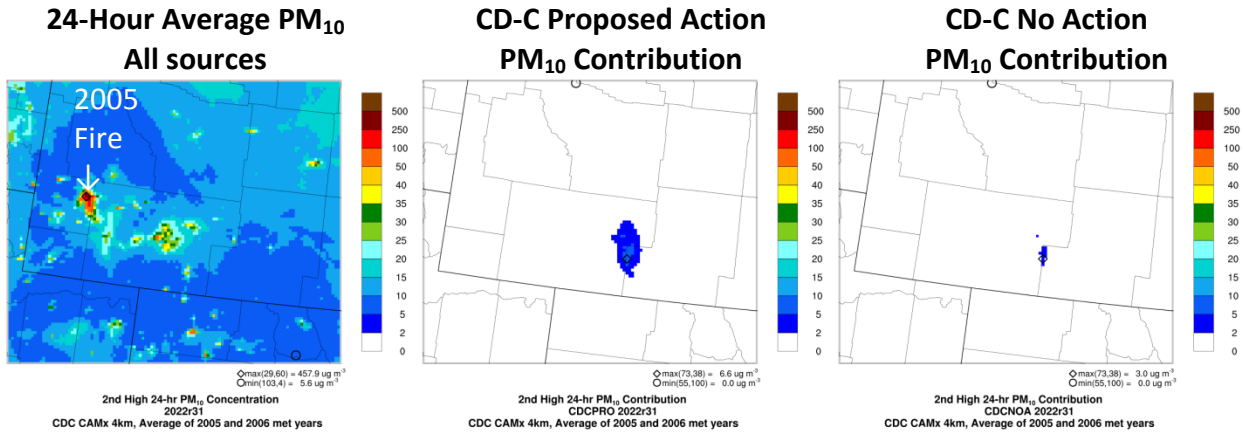

Figure 4-22. Left panel: 2022 absolute model results for 2nd high 24-hour average PM_{10} from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action Alternative contribution to the 2022 2nd high 24-hour average PM_{10} shown in the left hand panel. Right panel: CD-C No Action Alternative contribution to the 2022 2nd high 24-hour average PM_{10} shown in the left hand panel. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for annual average PM_{10} are shown in Figure 4-23. The WAAQS for annual average PM_{10} is 50 µg m^{-3}. There is no CAAQS or NAAQS for this averaging time. Annual average PM_{10} values within the 4 km domain are generally below 10 µg m^{-3} and the maximum value within the 4 km domain in 2022 is 28 µg m^{-3}, therefore, the standards are attained throughout the 4 km domain. Contributions to 24-hour PM_{10} from the CD-C Proposed Action Alternative and No Action Alternative emissions are 2.4 µg m^{-3} and 1.1 µg m^{-3}, respectively (Figure 4-24). The CD-C PM_{10} contribution is too small to be visible on same scale as regional PM_{10}.

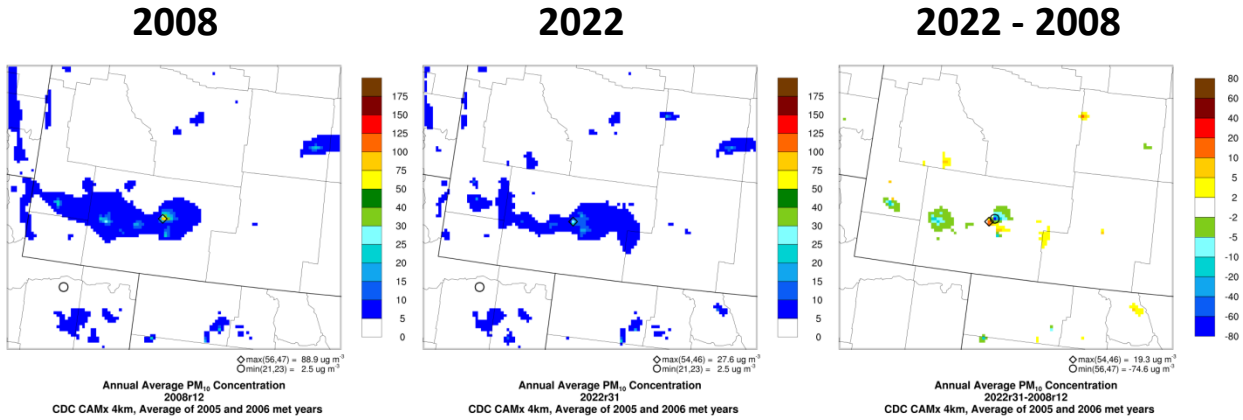

Figure 4-23. CAMx 2008 and 2022 model results for annual average PM_{10}. Left and center panels: 2008 and 2022 absolute model results for annual average PM_{10} from all regional emissions sources, including CD-C Project. Annual average PM_{10} results from the 2005 and 2006 meteorological years using 2008 emissions were averaged together to produce these plots. Right panel: 2022-2008 difference in annual average PM_{10} contribution from the CD-C Project sources, Average of results for the 2005 and 2006 meteorological years.

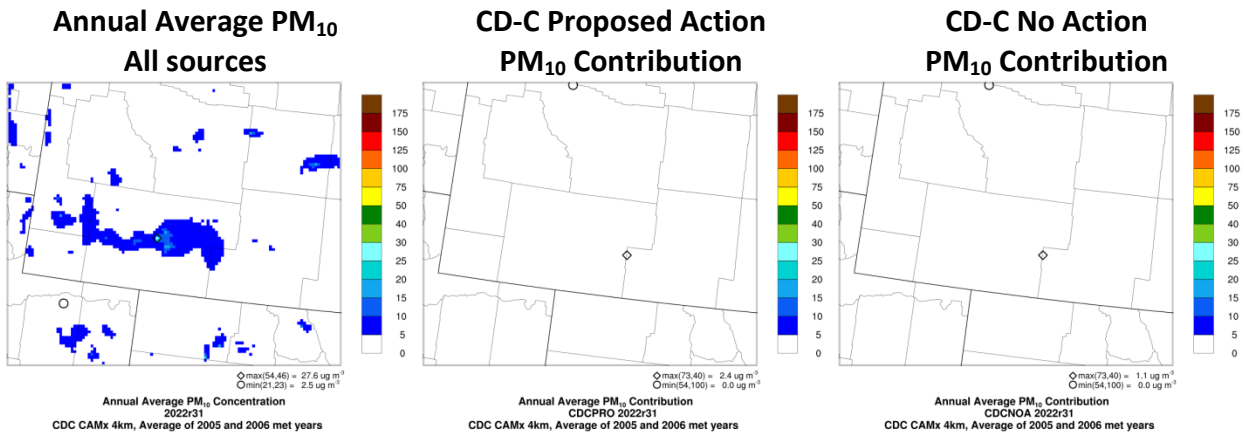

Figure 4-24. Left panel: 2022 absolute model results for annual average PM_{10} from all regional emissions sources, including CD-C Project. Center panel: CD-C Proposed Action contribution to the 2022 annual average PM_{10} shown in the left hand panel. Right panel: CD-C No Action (existing wells) contribution to the 2022 annual average PM_{10} shown in the left hand panel. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for 1-hour average CO concentrations are shown in Figure 4-25. The NAAQS, WAAQS and CAAQS for 1-hour CO are 40,000 µg m^{-3}. 1-hour average CO concentrations within the 4 km domain are generally below 4,000 µg m^{-3} except the near the location of the 2005 fire in Lincoln County. The maximum value within the 4 km domain in 2022 is 24,838 µg m^{-3}, therefore, the standards are attained throughout the domain. The CD-C CO contribution cannot be shown because PSAT does not track CO.

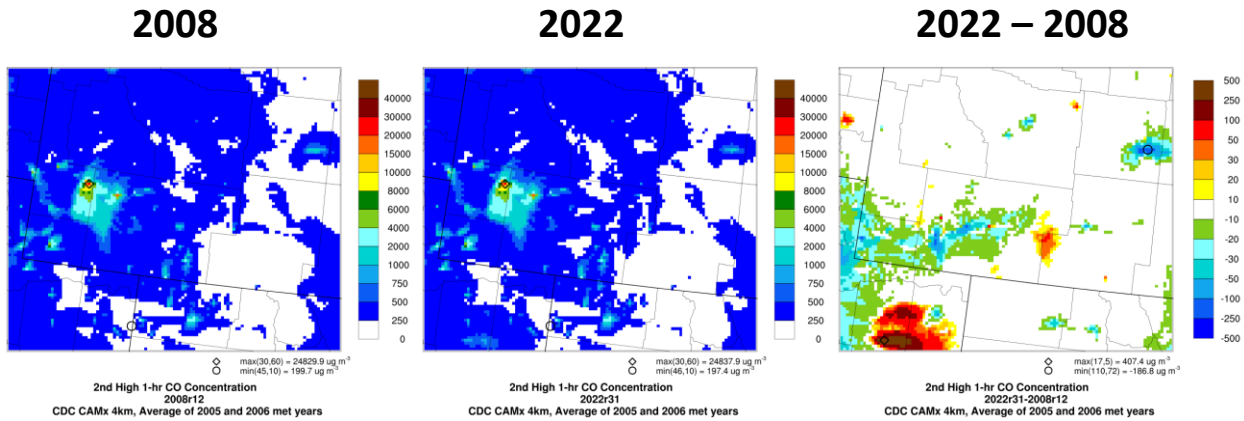

Figure 4-25. CAMx model results for 1-hour average CO. Left and center panels: 2008 and 2022 absolute model results for 1-hour average CO from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 1-hour average CO. All three panels show average of results for the 2005 and 2006 meteorological years.

CAMx results for the 8-hour CO are shown in Figure 4-26. The NAAQS, WAAQS and CAAQS for 8-hour CO are 10,000 µg m^{-3}. 8-hour average CO values within the 4 km domain are generally below 4,000 µg m^{-3} except the near the location of the 2005 fire in Lincoln County. The maximum value within the 4 km domain in 2022 is 18,949 µg m^{-3}, therefore the standards are not attained. This modeled exceedance is not related to the CD-C project and the predicted impacts related to the fire are not relevant to the impact analysis of the CD-C project. The CD-C CO contribution cannot be shown because PSAT does not track CO. However the CD-C Project area is located far away from the location of the exceedance and has much lower values of 8-hour CO. It is reasonable to conclude that the CD-C Project does not play a significant role in the CO exceedance in Lincoln County.

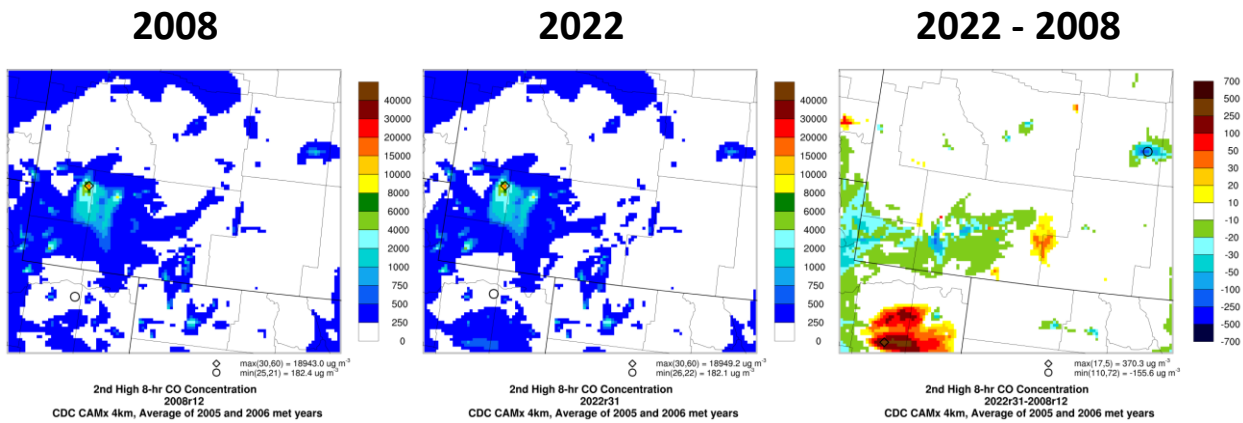

Figure 4-26. CAMx model results for 8-hour average CO. Left and center panels: 2008 and 2022 absolute model results for 8-hour average CO from all regional emissions sources, including CD-C Project. Right panel: 2022-2008 difference in 8-hour average CO. All three panels show average of results for the 2005 and 2006 meteorological years.

For pollutants that show an exceedance of the NAAQS (1-hour SO_2, 24-hour PM_{10} and 8-hour CO), the magnitude and spatial extent of the CD-C Proposed Action Alternative and No Action Alternative impacts make it clear that the CD-C Project Alternatives do not significantly contribute to the exceedances. For 24-hour PM_{10} and 8-hour average CO, the exceedance is caused by the 2005 fire in Lincoln County and is not related to CD-C Project Alternative emissions.

4.5.4 Ozone Impact Analysis

4.5.4.1 Introduction

The CAMx modeling outputs from the two future year annual simulations using 2022 emissions and 2005 and 2006 meteorology were post-processed to derive ozone concentrations for comparison to the ambient air quality standards (WAAQS and NAAQS) across the 4 km domain. In this Section, we present CAMx modeling results for comparison with the applicable air quality standards in two ways:

1. Following EPA's modeling guidance for projecting future-year Design Values for criteria pollutants that are compared against the NAAQS and WAAQS (EPA, 2007); and
2. Using the absolute modeling results that are averaged in accordance with the form of the standard and then compared directly with NAAQS and WAAQS.

In Method (1), 2022 ozone concentrations for the 2005 and 2006 meteorological years were projected using procedures consistent with EPA modeling guidance in effect at the time of the modeling (EPA, 2007). An overview of the EPA method is given in Section 4.5.4.2. The EPA procedures use the modeling results together with observed base year ozone Design Values (defined below) to derive an interpolated base year ozone Design Value field which can then be compared to the NAAQS, which are identical to the WAAQS for 8-hour ozone. The 8-hour ozone NAAQS in effect at the time of the writing of this AQTSD was promulgated on October 1, 2015, has a threshold of 0.070 ppm, and is defined as the annual 4th highest daily maximum 8-hour average ozone concentration averaged over three consecutive years.

In Method (2), the 4th high daily maximum 8-hour ozone value was calculated for each grid cell for the 2022met05 and 2022met06 model runs, and then the 2022met05 and 2022met06 results were averaged and compared to the results of method (1) and the NAAQS.

The CAMx model's APCA ozone source apportionment capability was used to determine the contribution of CD-C Proposed Action emissions to regional ozone levels within the 4 km domain during the 2022met05 and 2022met06 model runs. For days and locations in which the absolute model-estimated daily maximum 8-hour ozone concentrations or observed 2005-2006 daily maximum 8-hour ozone concentrations exceeded a threshold, the CAMx ozone source apportionment contributions were used to estimate the contribution of emissions from 2022 CD-C Proposed Action emissions sources to the exceedances of that threshold. The threshold for high ozone is the 2015 ozone standard (70 ppb).

4.5.4.2. EPA Guidance Ozone Projection Approach

The ozone NAAQS are formulated in terms of a Design Value, which is calculated as the 3-year average of the fourth highest monitored daily maximum 8-hour concentration at each monitoring site. To attain the 2015 ozone standard, the Design Value for a given monitor must not exceed 70 ppb. EPA's latest modeling guidance (EPA, 2007) for projecting future year 8-hour ozone Design Values recommends the use of modeling results in a relative sense to scale the observed current year 8-hour ozone Design Value (DVC) to obtain a future year 8-hour ozone Design Value (DVF). The model-derived scaling factors are referred to as Relative Response Factors (RRF) and are defined as the ratio of daily maximum 8-hour ozone concentrations near a monitor averaged over several days of modeling results for the future year emissions scenario to the current year base case:

$$RRF_{monitor\ i} = \frac{\sum_{days} (daily\ \max 8-hour\ ozone)_{future\ year}}{\sum_{days} (daily\ \max 8-hour\ ozone)_{current\ year}}$$

$$DVF_{monitor\ i} = DVC_{monitor\ i} \times RRF_{monitor\ i}$$

This technique is used to minimize the effect of model uncertainty on future year ozone projections. For example, if the model has a bias toward underestimating ozone at a given

monitor, using the raw future year ozone predictions may result in an underestimate of future year ozone at that monitor. However, if the ratio of the future year to base year modeled ozone values at that monitor is multiplied by the observed base year Design Value to produce a predicted future year value, that future year value will better reflect the change in ozone due to changes in emissions between base and future year cases, and the effect of the model's bias toward lower ozone values will have been reduced.

For the CD-C modeling, 2008 baseline year DVCs and 2022 future year DVFs were calculated for comparison with the NAAQS; these results are presented later in this Section. The model output from the CAMx 2008 baseline run and the 2022 future year run that includes the CD-C Alternative emissions were used to construct the RRFs, which were then used with the observed DVCs to produce projected DVFs for the 2022 future year. The DVFs were used to evaluate future year compliance with the ozone NAAQS. Below, we describe the 2007 EPA guidance for performing these DVC and future year calculations as well as the procedure for calculating the 2008 DVC across the entire modeling domain based on the DVCs at the monitors.

The basic steps in performing future year 8-hour ozone projections using EPA's recommended projection approach (EPA, 2007) are summarized as follows:

1. Develop observed current year 8-hour ozone Design Values (DVC) at each monitoring site as the starting point for the ozone projections. EPA guidance recommends using a three year average of three consecutive years of Design Values centered on the baseline modeling year. For the CD-C modeling, this means Design Values from the five year period of 2006-2010 are required to calculate the three consecutive years of observed DVCs for 2007-2010 required for the three year average centered on the 2008 baseline modeling year.
2. Select the maximum modeled 8-hour ozone concentrations near a monitor for several days from the base year and future year emission scenarios and take the ratio of their averages to construct the monitor-specific RRFs:
    a) EPA guidance defines "near a monitor" to be an array of 7 x 7 grid cells centered on the monitoring location for modeling that uses a 4 km grid resolution as in the CD-C modeling.
    b) EPA recommends that RRFs be based on at least 10 modeled days and recommends selecting days in which the baseline year highest daily maximum 8-hour ozone concentrations near a monitor is greater than an ozone threshold (cut off). This is done so that the model response to future changes in emissions is considered only on high ozone days with conditions comparable to those days that produced the Design Values. Initially, an ozone threshold of 85 ppb is used. If less than 10 modeling days are obtained the threshold is reduced by 1 ppb until at least 10 days are obtained for the RRF. When the 70 ppb threshold floor is reached and there are at least 5 days then the RRF is used. In the CD-C 4 km modeling domain, many sites did not meet this 5 day minimum. To ensure that the greatest number of monitors possible was used to constrain the DVC field, this requirement was relaxed so that the threshold floor was 60 ppb and the minimum number of days above the threshold was 1 day.

   c) Note that this modeling day selection approach for the RRFs automatically eliminates using modeling days in which the model is greatly underestimating the observed ozone concentrations when constructing the RRFs.
3. The RRF is applied to the DVC to obtain the projected DVF at each monitoring site for the future year emission scenarios. The projected DVF is truncated to the nearest ppb.
4. If the future year ozone projections are carried out as part of an attainment demonstration, DVFs are compared with the NAAQS for ozone. If the DVFs at all monitoring sites are less than or equal to the ozone NAAQS, then the modeled attainment demonstration test is passed. If a DVF at any monitor exceeds the ozone NAAQS, the modeled attainment test is not passed. Note that EPA guidance (EPA, 2007) addresses the 84 ppb 8-hour ozone NAAQS and this method was developed to address the 75 ppb 2008 8-hour ozone NAAQS that was in effect at the time of the CD-C modeling in 2012.
5. The method of projecting future year Design Values discussed above applies only to grid cells containing monitors, and it is necessary to project future ozone values for areas in the domain that lie between the monitors. This is known as an unmonitored area analysis (UAA) and is performed by interpolating DVCs from monitoring sites to each grid cell in the modeling domain using the Voronoi Neighbor Averaging interpolation technique. The modeled ozone gradients are taken into account in the interpolation in order to reflect modeled higher and lower ozone areas in the interpolated DVC field.
6. An unmonitored area analysis was performed that interpolates the 2008 DVCs across the modeling domain and performs ozone projections in each grid cell using the procedures given above, except using the modeling results within each grid cell only rather than using the surrounding grid cells in addition to the grid cell itself. For the CD-C 2008 DVC ozone calculations, the unmonitored area analysis is important given the paucity of ozone observations in the region. EPA provides two caveats to be considered when interpreting an unmonitored area analysis:
   a) EPA believes that the unmonitored area analysis is more uncertain than the monitor-based ozone projections. EPA indicates that in an attainment demonstration additional emissions reductions are likely required to eliminate any projected monitored ozone exceedances, while the same is not true in the unmonitored area test.
   b) EPA recommends that the reasons behind any unmonitored area test exceedances be understood and explained.

To facilitate the implementation of EPA's recommended ozone projections approach, EPA has developed the Modeled Attainment Test Software (MATS; Abt, 2009) that codifies the EPA recommended projection approach. EPA's MATS tool includes observed ozone data from which DVCs can be calculated along with several options that can be specified in making the ozone projections.

4.5.4.2.1. Issues Associated with Applying EPA's MATS Procedures to Southwest Wyoming

There are several issues associated with using the EPA-recommended ozone projection procedure for making future year projections in southwest (SW) Wyoming. These issues are primarily related to the fact that EPA's procedures were designed for making projections for

ozone State Implementation Planning (SIP) modeling that in the past occurred primarily in urban areas where there are relatively dense monitoring networks for ozone. The MATS software includes ozone Design Value data that is used to construct DVCs for monitors in the region of interest. The monitoring network is relatively sparse in SW Wyoming (see Table 2-1 and Figure 4-2) and for many of these monitors the monitoring history is relatively short. For example, many of the WDEQ SW Wyoming industrial monitoring sites started operation from late 2004 through 2007 and therefore do not have the five year record needed to construct the EPA default DVCs. For CD-C, the EPA projection procedure was therefore adapted to use additional available data to construct the DVC field.

In addition to the scarcity of monitoring data and the short data record for some SW Wyoming monitors, another issue that needs to be addressed in making the DVC calculations projections is the portion of the calendar year to be included in the analysis. The WDEQ-AQD has determined that the simulation of high winter ozone (as has been measured in the Jonah Pinedale area that is approximately 100 miles from the CD-C development area) is a research area that is not appropriate for inclusion in a NEPA analysis (WDEQ-AQD, 2009). Therefore, modeled winter ozone was not analyzed as part of the CD-C EIS. However, the regulatory definition of the ozone Design Values is based on the three-year average of the *annual* fourth highest daily maximum 8-hour ozone concentrations that includes the high winter ozone concentrations for the affected monitors. In developing the 2008 DVC values, we have used data for the full year in calculating the DVCs at the monitors. However, for construction the RRFs and the unmonitored areas (i.e. grid cells that do not contain a monitor), the model output-based gradients that were used to interpolate ozone Design Values between monitors use data from the April 1 - October 31 ozone season only.

4.5.4.2.2. Enhanced Ozone Projection Approach

In order to address the issues noted in the previous section, the following approach was used to develop 2008 DVCs in the 4 km CD-C domain for evaluation against the NAAQS. DVCs were calculated using relaxed requirements regarding length of data record and including additional WDEQ industrial monitors and CASTNet monitoring sites not present in the default EPA database used in MATS. These additional monitors are listed in Table 4-12 along with the default monitors. DVCs were calculated using data from the full year, but in unmonitored grid cells, modeling results from April 1 - October 31 were used to derive DVCs based on the MATS interpolation procedure that uses gradients in the modeled ozone output.

MATS was then applied using the CAMx 2008 baseline and 2022 future year modeling results for the 2005 and 2006 meteorological years using a 60 ppb floor. As noted above, the EPA 2007 Guidance in effect at the time of the CD-C modeling used a 70 ppb floor for the 85 ppb NAAQS; however, EPA recommended lowering the floor to 60 ppb to address the 75 ppb NAAQS that was in effect when the CD-C modeling took place in 2012 (B. Timin, personal communication). DVFs were calculated at southwest Wyoming monitors and a UAA was performed for the future year.

Table 4-12. Monitors used in the 2008 CD-C Baseline modeling analysis. 4th high DM8 values (blue shading) and Design Value (DVC) data used in MATS (gray shading) for the CD-C 4 km modeling domain. Winter ozone values are in bold with the date provided as a footnote.

Site	Name	Begin Date	End Date	4th High Value					Design Value		
				2006	2007	2008	2009	2010	2008	2009	2010
08_013_7002	Boulder7002	20070301	20071231		77						
08_069_0011	Ft. Collins W.	20060512	20061231	87							
		20070101	20071231		85						
		20080101	20081231			76			82		
		20090101	20091231				73			78	
		20100101	20101231					75			74
08_069_0012	Larimer0012	20090514	20091231				69			69	
		20100101	20101231					71			70
08_069_1004	Ft. Collins	20060101	20061231	78							
		20070101	20071221		69						
		20080103	20081231			66			71		
		20090101	20091231				63			66	
		20100101	20101231					66			65
49_003_0003	Box Elder 0003	20060501	20060930	78							
		20070501	20070930		78						
		20080413	20080930			72			76		
		20090422	20090930				67			72	
		20100501	20100930					67			68
49_003_7001	Box Elder 7001	20060503	20061031	76							
		20070401	20070930		78						
		20080501	20080930			73			75		
		20090501	20090831				62			71	
		20100501	20101231					67			67
49_005_0004	Cache0004	20060101	20061231	73							
		20070101	20071231		77						
		20080101	20081231			66			72		
		20090101	20091231				61			68	
		20100101	20100930					61			62
49_011_0004	Davis 0004	20060501	20060930	82							
		20070501	20070930		82						
		20080403	20080930			78			80		
		20090413	20090930				71			77	
		20100501	20100930					67			72
49_035_0003	Salt lake 0003	20060501	20060930	84							
		20070501	20070930		82						
		20080501	20080930			80			82		
		20090423	20090930				71			77	
		20100501	20100930					72			74
49_035_2004	Salt lake 2004	20060501	20060930	82							
		20070501	20070930		82						
		20080421	20080930			74			79		
		20090429	20090930				74			76	
		20100501	20100930					67			71
49_035_3006	Salt lake 3006	20060101	20061231	82							
		20070101	20071231		79						
		20080101	20081231			75			78		

Site	Name	Begin Date	End Date	4th High Value					Design Value		
				2006	2007	2008	2009	2010	2008	2009	2010
		20090101	20091231				75			76	
		20100101	20100630					63			71
49_035_3007	Salt lake 3007	20060501	20060930	80							
		20070501	20070930		80						
49_035_3008	Salt lake 3008	20060501	20060930	82							
		20070501	20070930		79						
49_045_0003	Tooele 0003	20060501	20060930	79							
		20070501	20070930		77						
		20080501	20080930			70			75		
		20090428	20090930				70			72	
		20100501	20100930					67			69
49_049_0002	Utah 0002	20060501	20060930	74							
		20070501	20070930		75						
		20080501	20081231			74			74		
		20090101	20091231				68			72	
		20100101	20100930					69			70
49_049_5008	Utah 5008	20060501	20060930	77							
		20070501	20070930		78						
		20080410	20080930			71			75		
		20090409	20090930				69			72	
		20100501	20100930					68			69
49_049_5010	Utah 5010	20060501	20060930	79							
		20070501	20070930		77						
		20080409	20080930			72			76		
		20090423	20090930				69			72	
		20100501	20100930					70			70
49_057_0002	Weber 0002	20090101	20091231				69			71	
		20100101	20100930					73			72
49_057_0007	Weber 0007	20060501	20060930	83							
		20070501	20070930		80						
49_057_1003	Weber 1003	20060501	20060930	83							
		20070501	20070930		82						
		20080501	20080930			75			80		
		20090408	20090930				72			76	
		20100501	20100930					66			71
56_005_0456	South Campbell	20060101	20061231	65							
		20070101	20071231		72						
		20080101	20081231			64			67		
		20090101	20091231				60			65	
		20100101	20100930					61			61
56_007_0099	Atlantic Rim	20080101	20081231			70			59		
		20090101	20090224				50			56	
56_007_0100	Sun Dog	20100101	20100930					66			56
56_013_0099	South Pass	20070312	20071231		72						
		20080101	20081231			67			69		
		20090101	20091231				**80**[5]			73	
		20100101	20100930					68			71

[5] Winter ozone: 3/13/2009

Site	Name	Begin Date	End Date	4th High Value					Design Value		
				2006	2007	2008	2009	2010	2008	2009	2010
56_013_0232	Spring Creek	20090205	20091231				60			60	
		20100101	20100930					63			61
56_035_0098	Jonah	20060101	20061231	69							
		20070101	20071231		68						
		20080101	20080423			**82**[6]			73		
56_035_0099	Boulder	20060101	20061231	72							
		20070101	20071231		67						
		20080101	20081231			**102**[7]			80		
		20090101	20091231				**66**[8]			78	
		20100101	20100930					67			78
56_035_0100	Daniel	20060101	20061231	74							
		20070101	20071231		66						
		20080101	20081231			**74**[9]			71		
		20090101	20091231				62			67	
		20100101	20100930					63			66
56_035_0101	Pinedale North	20100101	20100930					62			59
56_035_1002	Juel Spring	20100101	20100930					64			64
56_037_0200	Wamsutter	20060307	20061231	67							
		20070101	20071231		65						
		20080101	20081231			64			65		
		20090101	20091231				62			63	
		20100101	20100930					67			64
56_037_0300	Moxa Arch	20100528	20100930					66			66
56_037_0898	OCI	20070101	20071231		66						
		20080101	20081231			72			69		
		20090101	20090930				60			66	
56_041_0101	Murphy Ridge	20070101	20071231		70						
		20080101	20081231			64			67		
		20090101	20091231				60			64	
		20100101	20100930					65			63
56_021_0100	Cheyenne Ncore	20106027	20100930					64			64
56_005_0123	Thunder Basin	20060101	20060930	72							
		20070101	20070930		72						
		20080101	20080930			66			70		
		20090101	20090930				64			67	
		20100101	20100930					63			64

[6] Winter ozone: 2/15/2008
[7] Winter ozone: 2/22/2008
[8] Winter ozone: 3/13/2009
[9] Winter ozone: 3/10/2008

4.5.4.3. MATS Ozone Design Value Results

In this section, we present MATS current and future year Design Values using CAMx results for the 2008 and 2022 emissions scenarios with 2005 and 2006 meteorology. The DVC and DVF are compared with the 70 ppb ozone NAAQS. An 8-hour ozone Design Value attains the NAAQS if it is 70 ppb or lower. 8-hour ozone Design Values are expressed to the nearest ppb and the EPA convention is to truncate to the nearest ppb; therefore, exceedances of the 8-hour ozone NAAQS occur when ozone is 71.0 ppb or higher and attainment is achieved with 8-hour ozone Design Values of 70.9 ppb or lower.

Table 4-13 shows the results of the MATS ozone analysis at monitors within the 4 km domain. Orange shading indicates Design Values ≥71 ppb in the 2008 baseline or 2022 future year. All monitors in the 4 km domain attain the 70 ppb NAAQS in both the 2008 and 2022 emissions scenarios except the Boulder monitor in Sublette County, WY, the South Pass monitor in Fremont County, WY and the Rocky Mountain National Park monitors in Colorado

The Boulder monitor fails to attain the 70 ppb NAAQS for both Proposed Action and No Action scenarios in both the 2022met05 and 2022met06 runs. The high winter ozone measurements influence the Boulder 2008 DVC so that high winter ozone affects both the 2008 DVC and 2022 DVF, since the 2022 DVF values are projected from the 2008 DVC values. The 2008 DVC at Boulder was estimated by MATS to be 78.7 ppb (see step 1 in the EPA MATS methodology section above for a description of the MATS DVC calculation). The highest 2022 DVF at Boulder was projected by MATS to be 77.7 ppb with 2006 meteorology for both the Proposed Action and No Action emission scenarios. At the Boulder, WY monitor, the difference in 2022 DVF between the Proposed Action and No Action scenarios is 0.0 ppb for both meteorological years, indicating that any differences in impacts on the 2022 DVF by the Proposed Action compared to the No Action scenario at Boulder are too small (<0.1 ppb) to be estimated using MATS. Therefore, the influence of the CD-C Proposed Action emissions on the modeled exceedance at the Boulder monitor is negligible.

The 2008 DVCs for South Pass and Rocky Mountain National Park Collocated monitors exceed the 70 ppb NAAQS, but both monitors have 2022 DVFs that are below 71 ppb and attain the NAAQS for both the Proposed Action and No Action Alternative scenarios. The Rocky Mountain National Park monitor exceeds 71 ppb for both the 2008 DVC and the 2022 DVF for the Proposed Action and No Action Alternative scenarios. The difference in 2022 DVF between the Proposed Action and No Action scenarios is 0.0 ppb for both meteorological years at the Rocky Mountain monitor. Therefore, any differences in impacts on the 2022 DVF by the Proposed Action compared to the No Action scenario are too small (<0.1 ppb) to be estimated using MATS. The Rocky Mountain monitor is influenced by the Fort Collins Metropolitan Area plume and the impact of CD-C Project Alternative emissions on the 2022 DVF exceedance of the 70 ppb NAAQS is negligible.

The largest difference in 2022 DVF between the Proposed Action and No Action scenario occurs at the Atlantic Rim monitor and is 0.3 ppb with 2005 meteorology and 0.5 ppb with 2006 meteorology. The only monitors that show differences in MATS (i.e. ≥ 0.1 ppb) in the 2022 DVF due to the Proposed Action compared to the No Action scenarios are: Atlantic Rim, Sun Dog,

Wamsutter, and Centennial, these monitors are located close or downwind of the CD-C Project Area.

Table 4-13. MATS 2008 DVC and MATS-projected 2022 DVF at ozone monitors in the 4 km domain for 2005 (2022met05) and 2006 (2022met06) meteorological years. Results are shown for the CD-C Proposed Action and the CD-C No Action scenarios, and the difference between the two scenarios. Orange shading indicates DV>70 ppb.

Site ID	Site Name	2008 DVC (ppb)	2022 DVF (ppb)					
			Proposed Action		No Action		Proposed Action – No Action	
			met05	met06	met05	met06	met05	met06
560070099	Atlantic Rim	70	69.6	68.9	69.3	68.4	0.3	0.5
560070100	Sun Dog	66	65.4	65	65.2	64.7	0.2	0.3
560130099	South Pass	71	69.7	70.5	69.7	70.5	0.0	0.0
560130232	Spring Creek	60.5	59.8	59.4	59.8	59.4	0.0	0.0
560350098	Jonah	68	66.5	67.3	66.5	67.3	0.0	0.0
560350099	Boulder	78.7	77.2	77.7	77.2	77.7	0.0	0.0
560350100	Daniel	68	66.9	67.4	66.9	67.4	0.0	0.0
560350101	Pinedale North	62	60.7	61.4	60.7	61.4	0.0	0.0
560351002	Juel Spring	64	62.7	63.3	62.7	63.3	0.0	0.0
560370200	Wamsutter	64	63.2	62.8	63.1	62.7	0.1	0.1
560370300	Moxa Arch	66	65.3	64.1	65.3	64.1	0.0	0.0
560370898	OCI	67	66.2	65.2	66.2	65.2	0.0	0.0
560410101	Murphy Ridge	64.7	62.1	62.9	62.1	62.9	0.0	0.0
CNT169	Centennial	67.7	66.7	66.5	66.6	66.4	0.1	0.1
PND165	Pinedale	64.7	63.1	64.3	63.1	64.3	0.0	0.0
ROM206	Rocky Mtn NP Collocated	72.3	70.4	70.6	70.4	70.6	0.0	0.0
ROM406	Rocky Mtn NP	74.3	72.3	72.5	72.3	72.5	0.0	0.0

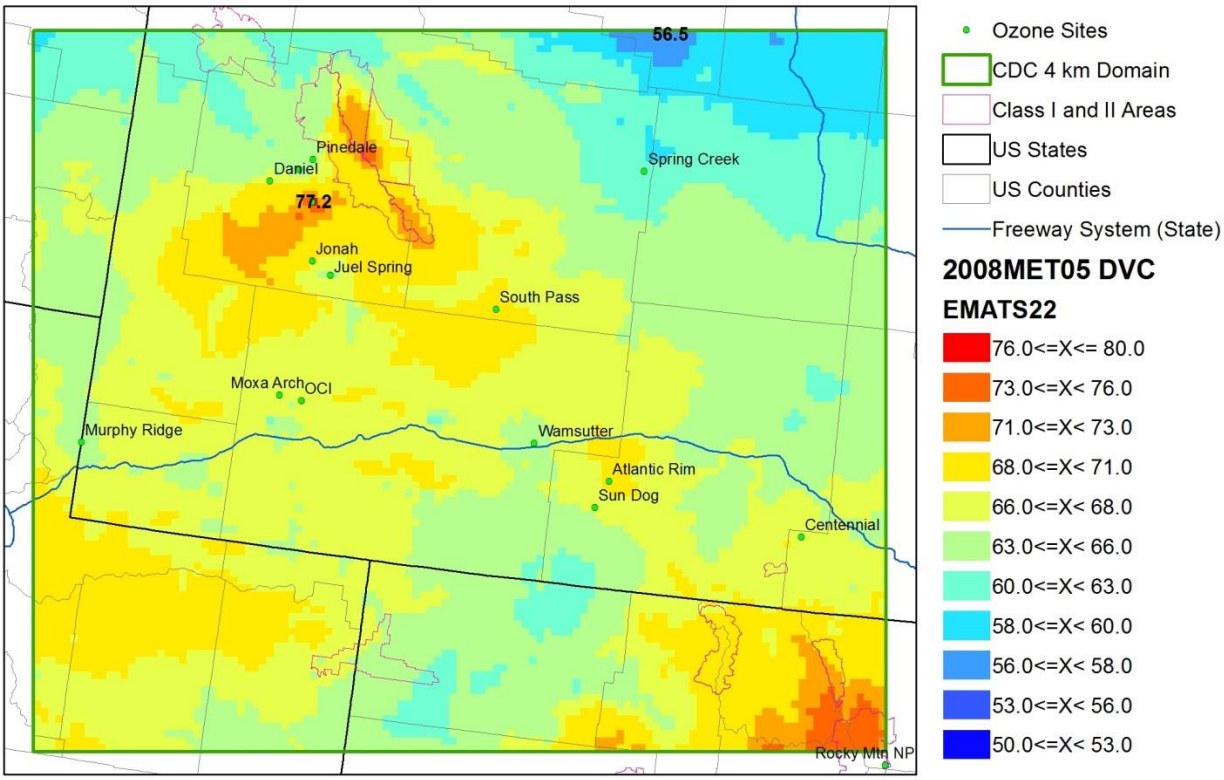

Figure 4-27. Unmonitored area analysis. 2008 ozone DVC for 2005 meteorology (ppb).

In Figures 4-27 through 4-34, we present the results of the unmonitored area analysis. The MATS 2008 DVC results using 2005 meteorology (Figure 4-27) show the highest ozone Design Values in regions of high terrain (Uinta Mountains and the high elevation areas of the Bridger and Fitzpatrick Wilderness Areas), in the Upper Green River Basin in Sublette County and in the vicinity of the urban areas of Salt Lake City, UT and Fort Collins, CO. There are three areas where exceedances of the 70 ppb NAAQS occur: in Sublette County near Boulder, high elevation terrain of eastern Sublette and western Fremont Counties and in northern Colorado in the vicinity of the Fort Collins Metropolitan Area. The exceedances in the Upper Green River Basin in Sublette County are influenced by high winter ozone values measured at the Boulder monitor. DVCs higher than 70 ppb are found across a large area of the Upper Green River Basin; this is an area of intensive oil and gas development. The lowest Design Values are found in the northeastern portion of the 4 km domain and in the rural areas of northwestern Colorado. DVCs in the vicinity of the CD-C Project are in the 60-69 ppb range and do not exceed the 70 ppb NAAQS.

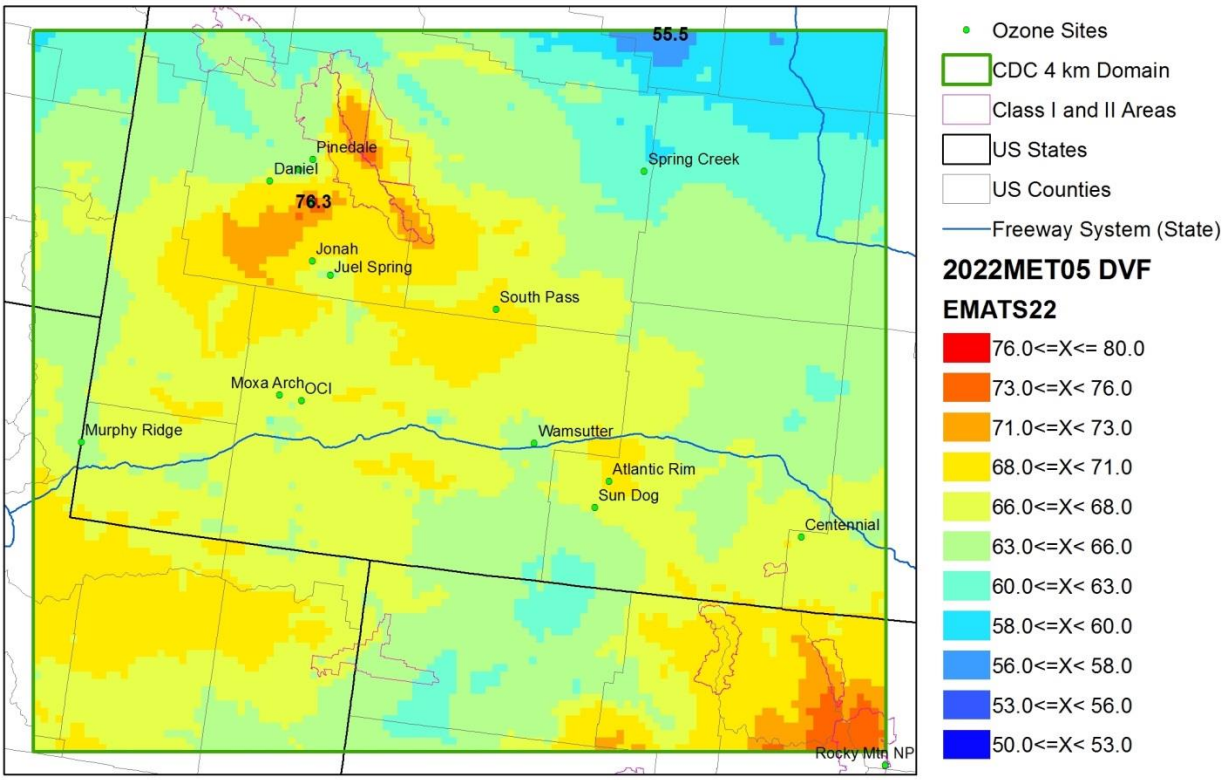

Figure 4-28. Unmonitored area analysis. 2022 Proposed Action Alternative ozone DVF for 2005 meteorology (ppb).

The spatial pattern of the projected 2022 ozone Design Values using the 2005 meteorology is similar to 2008, with the 70 ppb ozone NAAQS exceeded only in Sublette County, in the high elevation terrain of eastern Sublette and western Fremont Counties and in northern Colorado in the vicinity of the Fort Collins Metropolitan Area. (Figure 4-28). As in the 2008met05 scenario, DVFs in the vicinity of the CD-C Project are in the 60-69 ppb range and do not exceed the 70 ppb NAAQS.

Figure 4-29 shows the difference (2022-2008) between current and future year Design Values using 2005 meteorological conditions. Design values show a general decrease from 2008 to 2022 except near large EGUs such as Jim Bridger (Sweetwater County, WY) and Naughton (Lincoln County, WY), trona processing facilities in western Sweetwater County, and regions of oil and gas development surrounding the CD-C project area and in Sublette County. Increases in the 2022 DVFs relative to 2008 DVCs in the vicinity of the CD-C project are less than 0.5 ppb. Changes in the 2022 DVFs relative to 2008 in the vicinity of the exceedance (near Boulder in Sublette County) are in the range -1 ppb to 1 ppb, with most grid cells showing a decrease in Design Values. Note that Design Value changes between 2008 and 2022 are due to changes in the regional emission inventories and 12 km grid boundary conditions as well as changes in emissions from the CD-C Project Area.

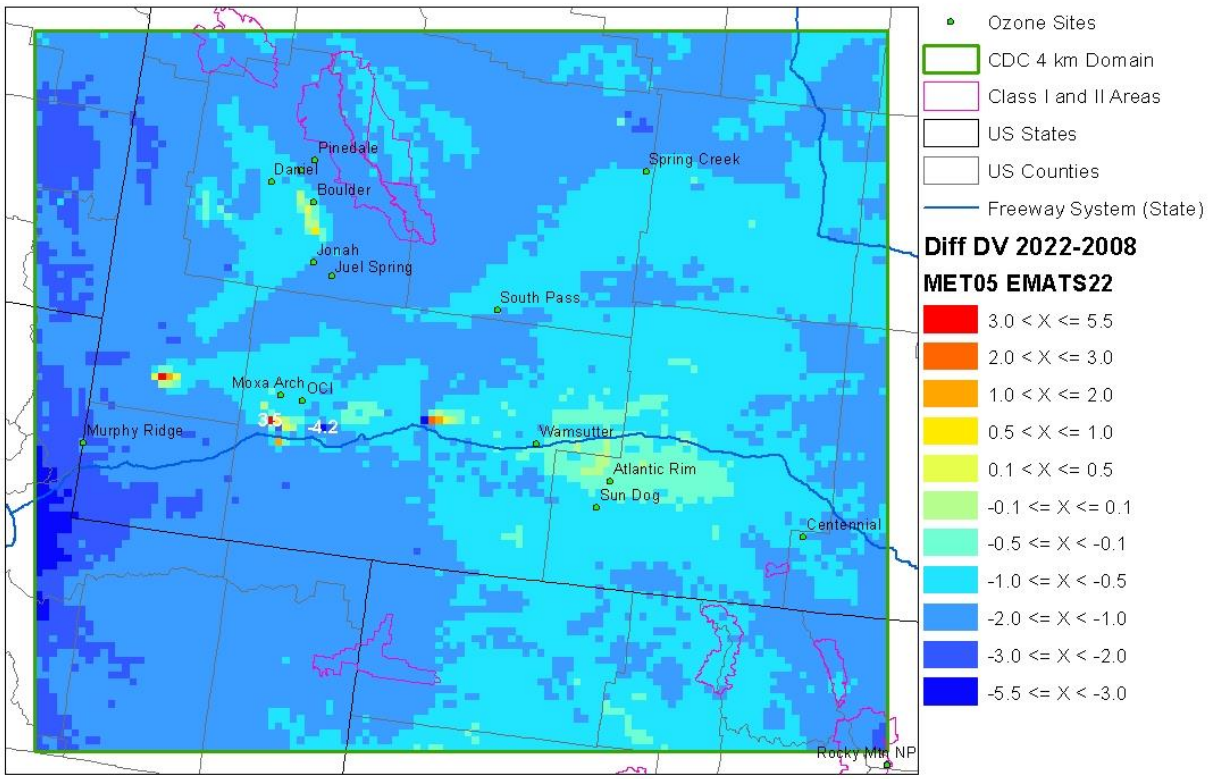

Figure 4-29. Unmonitored area analysis. Difference in Design Values: 2022 Proposed Action Alternative ozone DVF - 2008 ozone DVC, for the 2005 meteorological year (ppb).

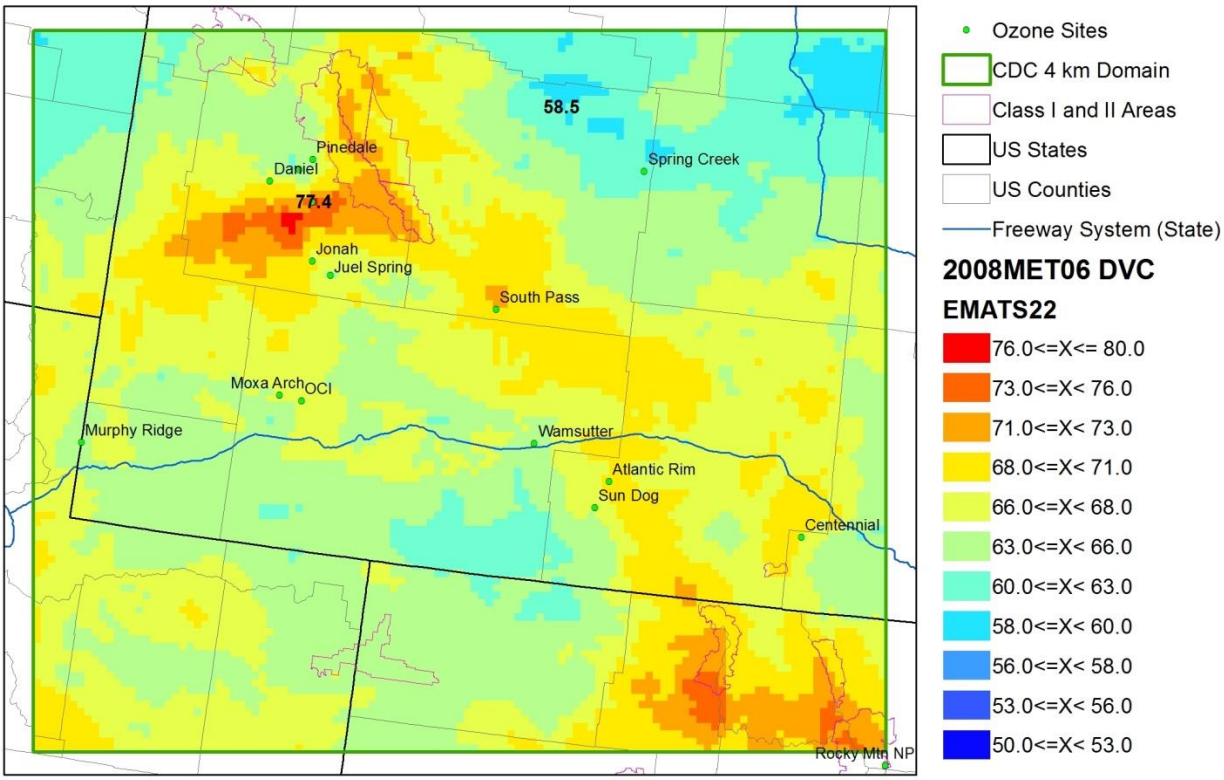

Figure 4-30. Unmonitored area analysis. 2008 ozone DVC for 2006 meteorology (ppb).

The DVC pattern using 2008 emissions and 2006 meteorology (Figure 4-30) is similar to that obtained with 2005 meteorology. The highest values of the DVC are found in Sublette and Fremont counties in Wyoming and in the vicinity of the Fort Collins metropolitan area. Exceedances of the 70 ppb NAAQS occur across a broad swath of Sublette County and extend into Lincoln and Fremont Counties. High DVC values near Boulder are influenced by high observed winter ozone at the Boulder monitor. Other areas of Wyoming that exceed the 70 ppb NAAQS are a small area of Fremont County near the South Pass monitor and several high elevation Wyoming grid cells near the Colorado border in Carbon County. These grid cells are located just north of a Colorado region with DVC exceeding 70 ppb. In Colorado, there are exceedances of the 70 ppb NAAQS over the high elevation terrain in Routt and Jackson Counties and in the vicinity of the Fort Collins Metropolitan Area.

As with 2005 meteorology, the lowest values of the DVC using 2006 meteorology are found in southeastern Sweetwater County, northwestern Colorado and in the northeastern area of the 4 km domain. 2008 ozone DVC are generally higher in Sublette County with 2006 meteorology than with 2005 meteorology, and show more grid cells that exceed the 70 ppb NAAQS.

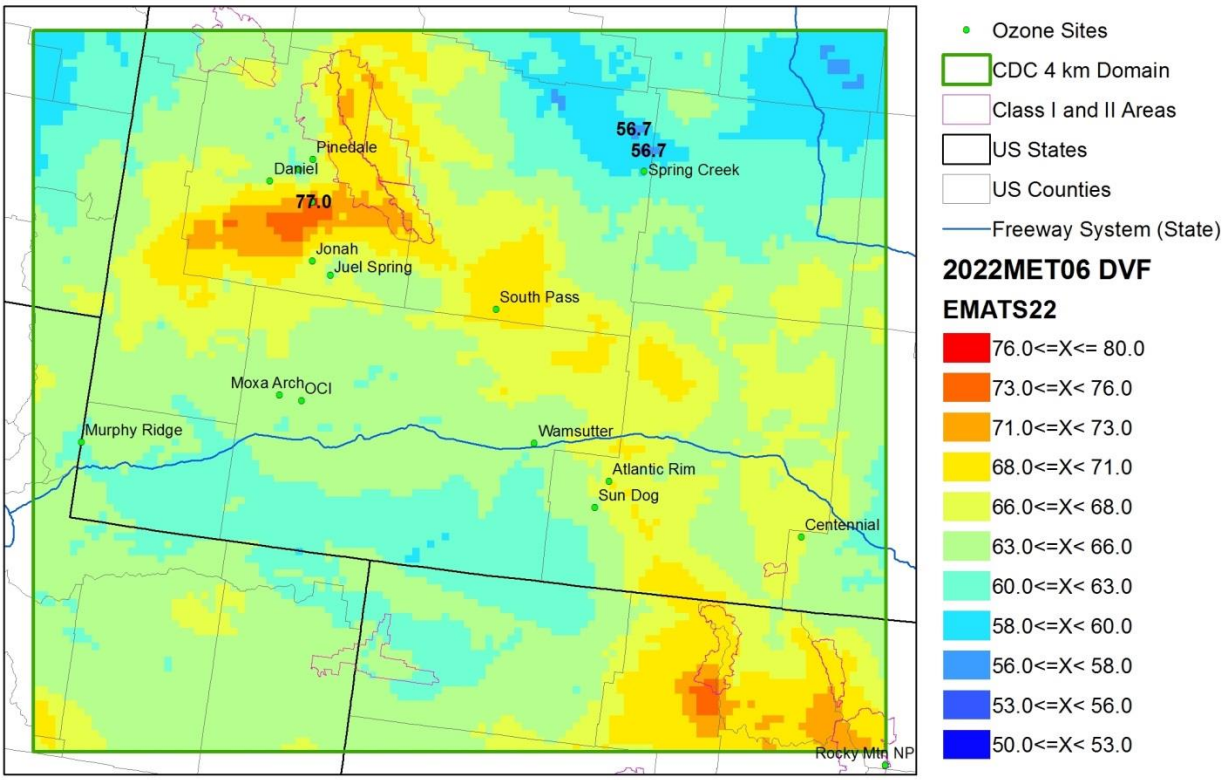

Figure 4-31. Unmonitored area analysis. 2022 Proposed Action Alternative ozone DVF for 2006 meteorology (ppb).

Similar to the 2005 meteorology case, the DVF with 2022 emissions and 2006 meteorology (Figure 4-31) have maxima in Sublette and Fremont counties and northern Colorado. The NAAQS are exceeded only in Sublette and Fremont Counties in Wyoming. In Colorado, there are exceedances of the 70 ppb NAAQS over the high elevation terrain in Routt and Jackson Counties and in the vicinity of the Fort Collins Metropolitan Area. DVF are in the 60-69 ppb range in the vicinity of the CD-C Project and do not exceed the 70 ppb NAAQS. Ozone DVFs are higher in Sublette County using 2006 meteorology than with 2005 meteorology, but are generally lower in the CD-C Project area.

Figure 4-32 shows the difference (2022-2008) between current and future year Design Values for 2006 meteorology. Comparison of Figures 4-29 and 4-32 shows that the difference patterns for DVF(2022)-DVC(2008) are similar for 2005 and 2006 meteorology, with ozone Design Values generally decreasing within the 4 km domain except near large EGUs, trona sources and the oil and gas production region in Sublette County. The 2005 meteorology case shows increases in ozone in the CD-C Project area, while the 2006 meteorology case shows decreases of between 0.5 to 2 ppb throughout the region surrounding the CD-C Project area. Note that changes in the DVs in Figures 4-29 and 4-32 are due to all regional emissions sources and 12 km grid boundary conditions as well as to changes in emissions from the CD-C project.

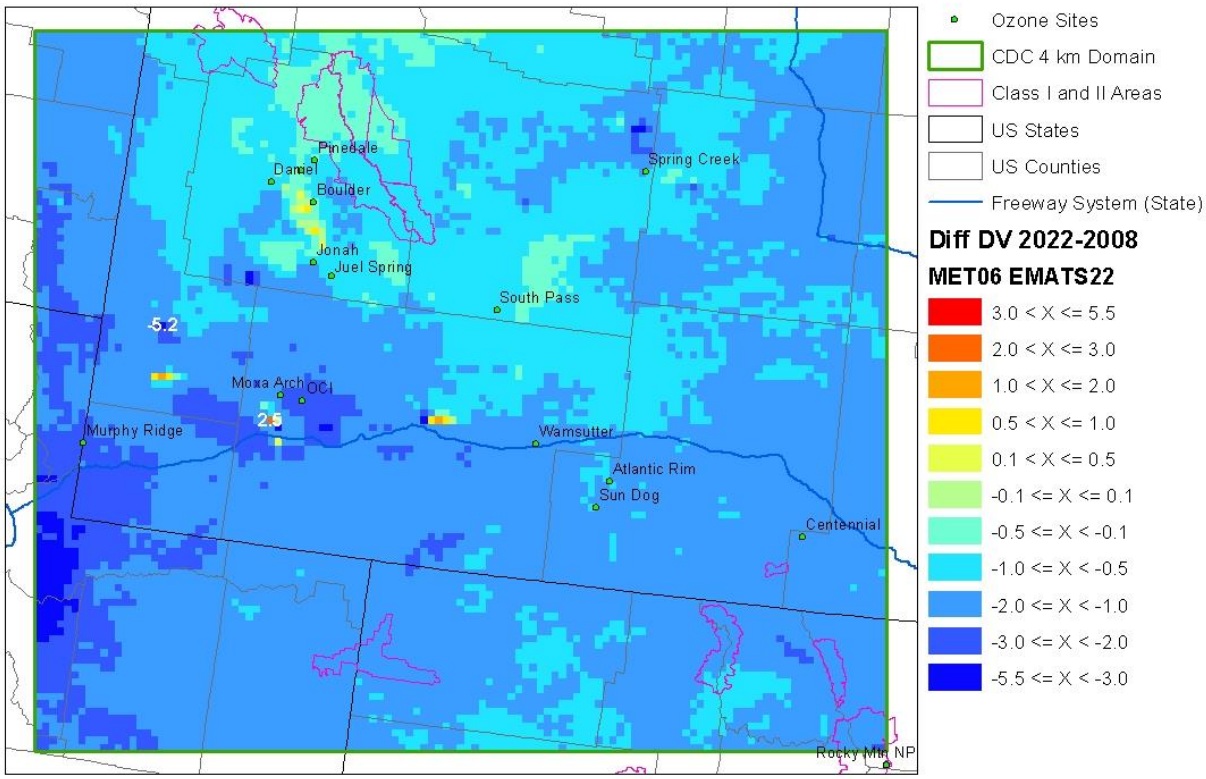

Figure 4-32. Unmonitored area analysis. Difference in Design Values: 2022 Proposed Action Alternative ozone DVF - 2008 ozone DVC, for the 2006 meteorological year (ppb).

CD-C Contribution to the MATS Design Values

The effect of CD-C Proposed Action Alternative and No Action Alternative emissions on ozone Design Values was assessed with EPA's MATS. The CD-C Project contribution to Design Values in all grid cells in the 4 km domain was isolated using the CAMx APCA source apportionment capability. MATS was run initially using the full CAMx 2022 run output that accounts for the effects of all emissions sources and boundary conditions as well as the CD-C Proposed Action Alternative emissions, results are shown in Figures 4-28 and Figures 4-31, for 2005 and 2006 meteorology, respectively. Next, the APCA contribution from the CD-C Proposed Action Alternative was subtracted from the full CAMx 2022 run output. MATS was then run a second time to produce a set of Design Values for DVF(Base - CD-C Proposed Action). The contribution from the CD-C Proposed Action Alternative was obtained by taking the difference:

DVF(CD-C Proposed Action) = DVF(All Emis) - DVF(All Emis - CD-C Proposed Action).

An analogous procedure was followed to get the contribution from the CD-C No Action Alternative emissions.

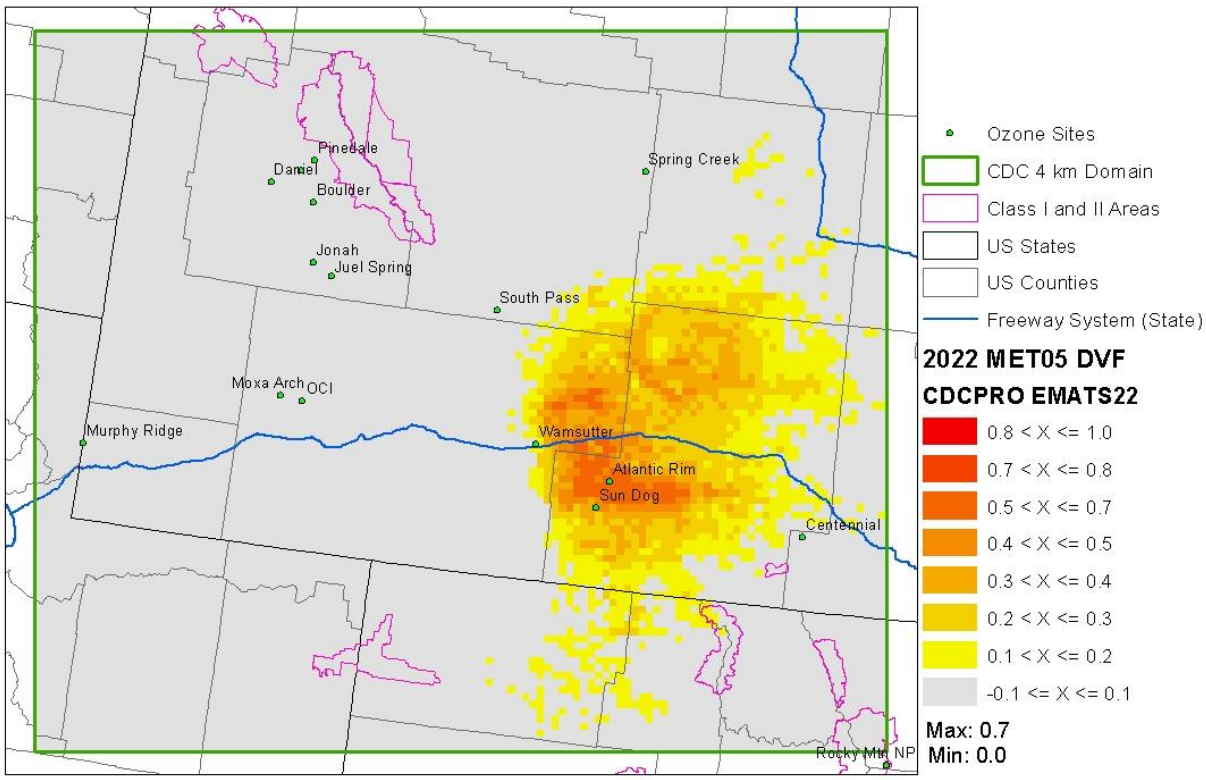

Figure 4-33. Impact of CD-C Proposed Action Project emissions on DVF: 2022met05.

The CD-C contributions to the DVFs for the 2022met05 and 2022met06 scenarios are shown in Figures 4-33 and 4-34, respectively. In both scenarios, the CD-C impacts are largest within and to the east of the CD-C Project Area, although the 2022met05 shows more ozone transport to the south and 2022met06 shows more transport to the northwest. The maximum CD-C Project impact on ozone DVFs is 0.8 ppb in 2022met06 and 0.7 ppb in 2022met05. In both the 2022met05 and the 2022met06 scenarios, CD-C Project impacts on DVFs in the non-attainment areas in Sublette, Lincoln, and Sweetwater counties in Wyoming are too small to be visible on this scale.

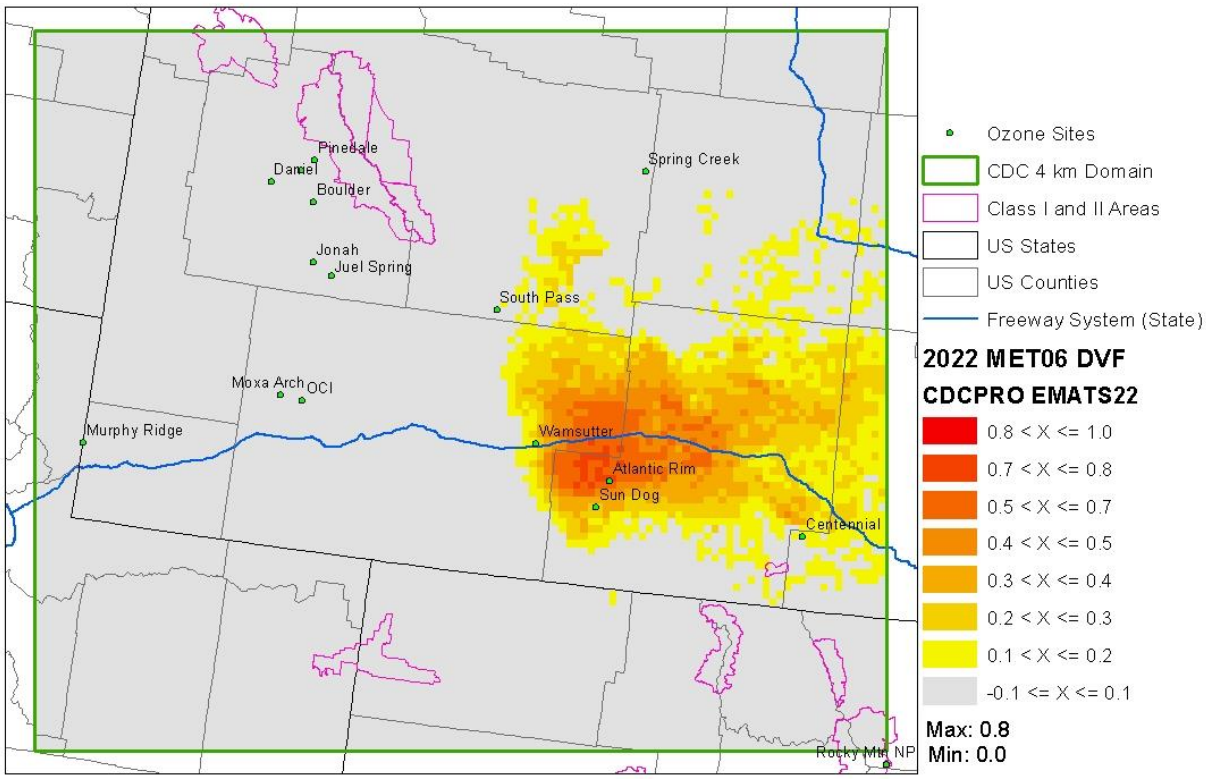

Figure 4-34. Impact of CD-C Proposed Action Project emissions on DVF: 2022met06.

Summary of Ozone MATS Results

<u>MATS Results at Monitors:</u>

- 2008 DVC attain the 70 ppb 2015 ozone NAAQS at all monitors in the 4 km domain except the South Pass and Boulder monitors in Wyoming and the Rocky Mount NP monitor and Rocky Mountain NP Collocated monitor in Colorado for both the 2005 and 2006 meteorological modeling years.
- 2022 DVF for all monitors in the 4 km domain attain the 70 ppb 2015 ozone NAAQS except the Boulder, WY monitor and the Rocky Mountain NP monitor for both the 2005 and 2006 meteorological modeling years for the CD-C Proposed Action and No Action emissions scenarios.
- The 70 ppb ozone NAAQS is exceeded at the Boulder, WY monitor for the 2008 DVC and the 2022 DVF for both the Proposed Action and the No Action scenarios, using both 2005 and 2006 meteorology. These exceedances are influenced by high winter ozone measurements that contribute to the DVC value. Differences in DVF impacts between the Proposed Action scenario and the No Action scenario on the 2022 DVF at the Boulder, WY monitor are less than 0.1 ppb, which is the smallest DVF difference that can be diagnosed using MATS. Therefore, the influence of the CD-C Proposed Action emissions on the modeled future year exceedance at the Boulder monitor is negligible.
- At the Rocky Mountain monitor, the difference in 2022 DVF between the Proposed Action and No Action scenarios is <0.1 ppb for both meteorological years. The Rocky

Mountain monitor is influenced by the Fort Collins Metropolitan Area plume and the impact of CD-C Project Alternative emissions on the 2022 DVF exceedance of the 70 ppb NAAQS is negligible.

- The largest difference in 2022 DVF between the Proposed Action and No Action scenario occurs at the Atlantic Rim monitor with 2006 meteorology and is 0.5 ppb; other differences in 2022 DVF between the CD-C Proposed Action and No Action scenarios are less than or equal to 0.3 ppb.
- The following monitors have differences ≥0.1 ppb between the CD-C Proposed Action and No Action scenario 2022 DVFs: Atlantic Rim, Sun Dog, Wamsutter, and Centennial. 0.1 ppb is the smallest DVF difference that can be diagnosed using MATS.

MATS Unmonitored Area Analysis Results:

- For the Proposed Action scenario, the 70 ppb ozone NAAQS is attained throughout the 4 km domain in 2022 except in Sublette and Fremont Counties in Wyoming and in northern Colorado for both meteorological years. (Figures 4-28 and 4-31). The NAAQS exceedances in Sublette County are influenced by high observed winter ozone measurements that affect the DVC value for the Boulder, WY monitor.
- Examination of the spatial scale and magnitude of the CD-C project contribution to ozone DVFs within the 4 km domain shows that exceedances of the ozone NAAQS in the 2022 future-year modeling would not result from emissions from the CD-C project.
- Projected Design Values for 2022 in the vicinity of the CDC project are in the range of 60 – 69 ppb, and attain the 70 ppb 2015 NAAQS (Figures 4-28 and 4-31).
- Ozone DVs generally decrease within the 4 km domain in 2022 relative to 2008 except for increases near the Jim Bridger and Naughton EGUs, trona facilities in western Sweetwater County, and in regions where oil and gas development is occurring (e.g. Sublette County). (Figure 4-29 and 4-32).
- The CAMx source apportionment capability was used to isolate the contribution of CD-C Proposed Action Alternative emissions to 2022 DVFs, and this was determined to be 0.8 ppb or less.
- CD-C Proposed Action Alternative impacts on DVFs were highest within and east (generally downwind) of the CD-C Project area.
- Projected impacts on 2022 DVFs from the CD-C Proposed Action emissions in the non-attainment areas designated under the 2008 75 ppb NAAQS in Sublette, Lincoln, and Sweetwater counties in Wyoming were < 0.1 ppb.

4.5.4.4. Absolute Modeling Results

In the previous section, the modeled ozone results were used together with the EPA MATS tool to calculate current year (2008) and future year (2022) Design Values based on observed ozone at southwest Wyoming monitors and modeled ozone fields. In this section, we present the absolute CAMx modeling results for 2008 and 2022. The 4th highest daily maximum 8-hour average ozone value (DM8) was computed for each grid cell from the CAMx runs for both the 2005 and 2006 meteorological years. Only modeled data from the Wyoming ozone season (April 1-October 31) were used in this calculation, per the WDEQ-AQD (see Section 1.2.2.1). This is consistent with the processing of the CAMx modeling results used in the MATS analysis.

The left hand panel of Figure 4-35 shows the 4th highest DM8 results for the 2008 emissions scenario for the 2005 meteorological year. The middle panel shows the 2022 results for the 2005 meteorological year and the right hand panel shows the 2022-2008 difference in the 4th highest DM8.

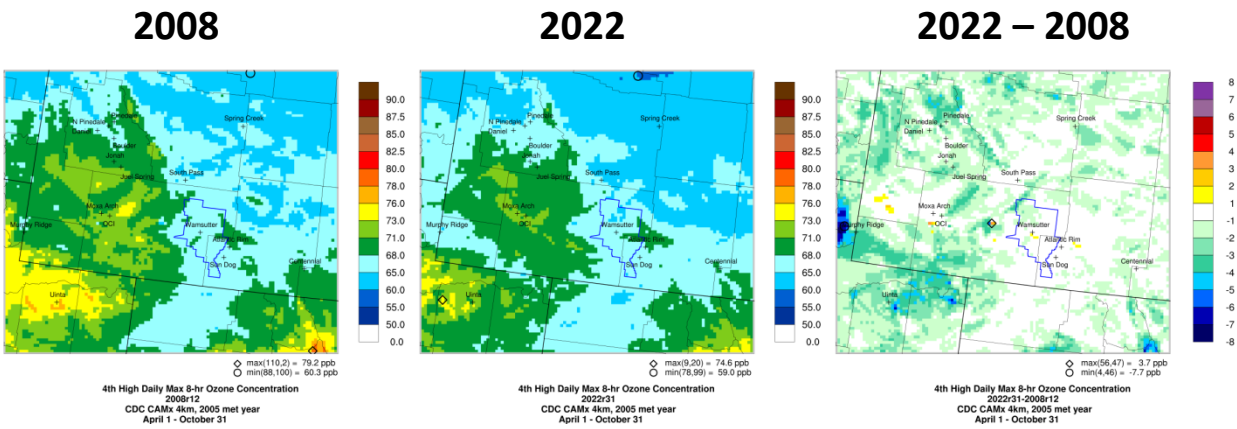

Figure 4-35. 4th highest daily maximum 8-hour average ozone: met05.

The 2008 4th highest DM8 results are similar in spatial pattern to the 2008 MATS DVC results shown in Figure 4-27 in that relatively high ozone values are shown in the Fort Collins metropolitan area and over the high terrain of the Uinta Mountains in northeastern Utah. Values for 2008 in Sublette County are higher in the MATS analysis than the absolute model results analysis because the Design Values for the MATS analysis include values from the full year, while the absolute model results only draw from the April 1-October 31, 2005 period. The ozone DVC in the MATS analysis in Sublette County is driven by monitored winter ozone events. In both the MATS and absolute modeling results for 4th high DM8, ozone is lower in the northeastern region of the 4 km domain and in the rural area south of the CD-C Project Area. In 2008, the 4th high DM8 results show exceedances of the 70 ppb ozone NAAQS across a broad area of southwestern Wyoming with values higher than 70 ppb in Uinta, Lincoln, Sublette, Fremont and Sweetwater Counties. There are also exceedances of the 70 ppb NAAQS in the vicinity of the Fort Collins metropolitan area in Colorado and east of Salt Lake City in Utah.

Compared to 2008, there are fewer exceedances of the NAAQS in 2022 within the 4 km domain. For example, in Sublette County, there are only a few grid cells with 4th high DM8> 70 ppb near the southern border with Lincoln County, and there is only one grid cell with 4th high DM8>70 ppb in Fremont County.

The 4th high DM8 ozone difference plot in Figure 4-35 for 2005 meteorology shows many areas of decreasing ozone in the 4 km grid in 2022 relative to 2008. The largest ozone increases occur near EGUs and the Sweetwater County trona facilities. There are areas of 1-1.5 ppb increase near CD-C Project Area (see Figure 4-36 for expanded view of the 2022-2008 difference in the CD-C Project Area for 2005 meteorology).

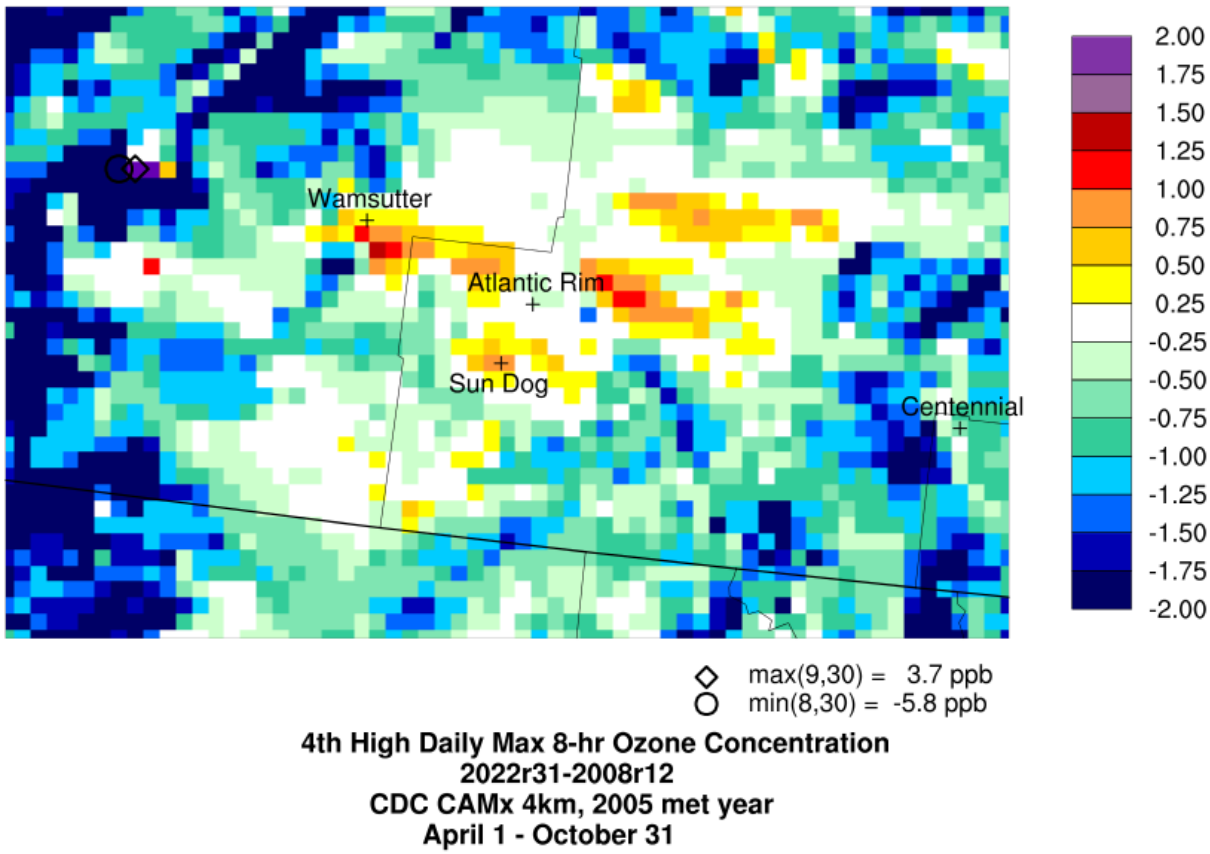

Figure 4-36. 4th high daily maximum 8-hour average ozone (ppb) surrounding the CD-C Project Area for met05.

Absolute modeling results for the 4th highest DM8 for the 2022met06 scenario are presented in Figure 4-37. For both the 2008 and 2022 emissions scenarios, modeled ozone is generally higher in the 4 km domain using 2006 meteorology than with 2005 meteorology. With 2006 meteorology, much of the 4 km domain has 4th high DM8 greater than 68 ppb in both 2008 and 2022, while with 2005 meteorology, much of the northeastern part of the domain has 4th High DM8 <68 ppb. In southwestern Wyoming, ozone is generally higher with 2006 meteorology than with 2005 meteorology. In 2022, the 70 ppb NAAQS is exceeded across broad areas of Sublette, Lincoln, Sweetwater and Fremont counties. The 70 ppb NAAQS is exceeded within the CD-C Project Area using 2006 meteorology; the maximum value of the 4th highest DM8 within the CD-C Project Area is 72.9 ppb.

The 2022-2008 difference plot in the right hand panel of Figure 4-37 shows many areas in the 4 km grid where the 4th high DM8 decreases going from 2008 to 2022. There are both large

increases and large decreases in the DM8 in the Jonah-Pinedale area of Sublette County. There are no increases >1.0 ppb in the CD-C Project Area or its vicinity using 2006 meteorology.

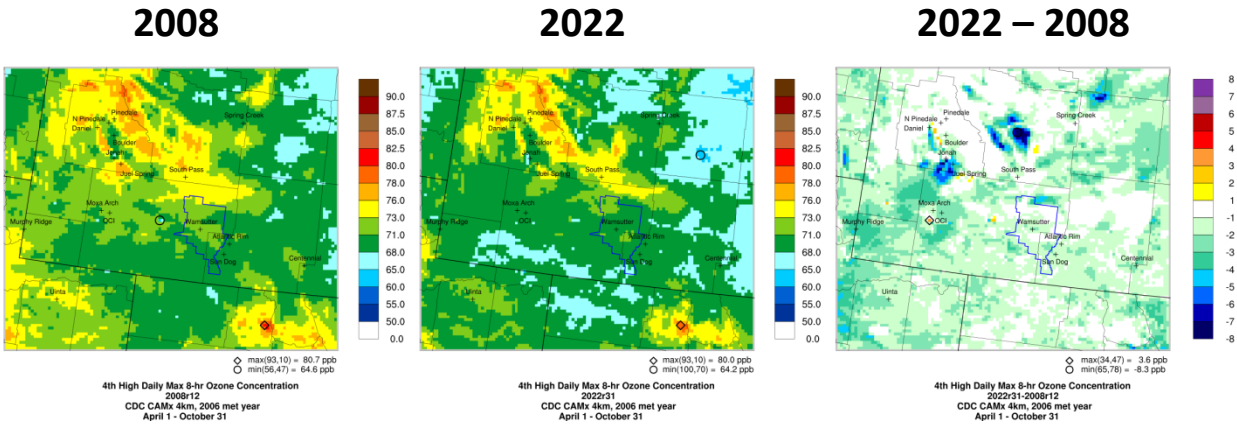

Figure 4-37. 4th highest daily maximum 8-hour average ozone: met06.

Figure 4-38 is similar to Figures 4-35 and 4-37, but shows the results of the average of the 2005 and 2006 meteorological year results. The 2005-2006 average is an approximation to a Design Value produced with the two available years of absolute modeling results, instead of three as required for a Design Value, and is compared with the MATS Design Values in Figures 4-27 through 4-32. The middle panel of Figure 4-38a shows that the 70 ppb NAAQS is exceeded in Sublette, Lincoln, Uinta, Teton and Sweetwater Counties in 2022 using the absolute modeling results. Using the average of the 2005 and 2006 meteorological year results, the highest value of the 4th highest DM8 within the CD-C Project Area is 70.1 ppb. Using EPA's method for calculating Design Values, this corresponds to a Design Value of 70 ppb, which attains the 2015 NAAQS. There are no increases in the 2-year average 4th high DM8 in the in CD-C Project area greater than 0.5 ppb (Figure 4-38b). Note that changes in the 2-year average 4th high DM8 in Figure 4-38b are due to regional emissions sources and the 12 km boundary conditions as well as changes in emissions from the CD-C project.

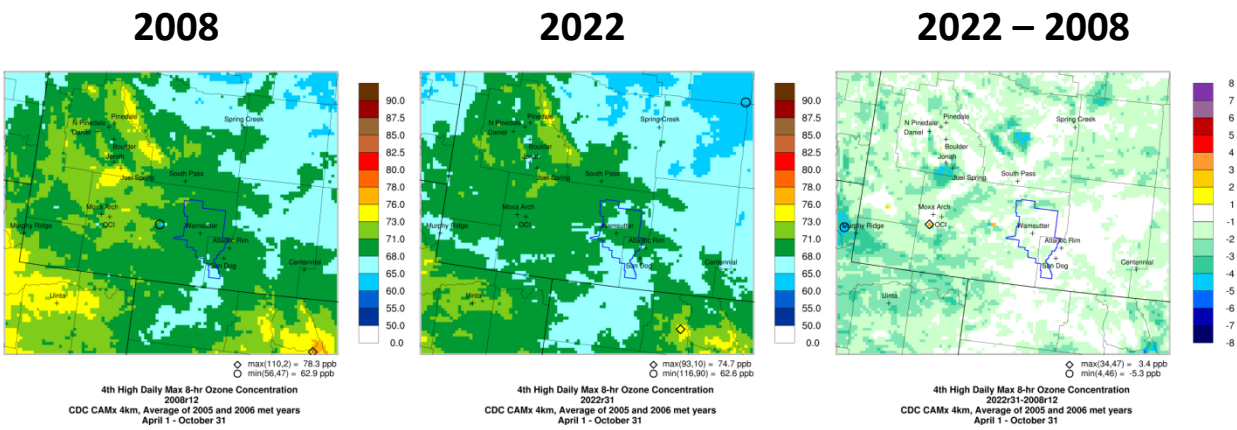

Figure 4-38a. 4th highest daily maximum 8-hour average ozone: average of met05 and met06.

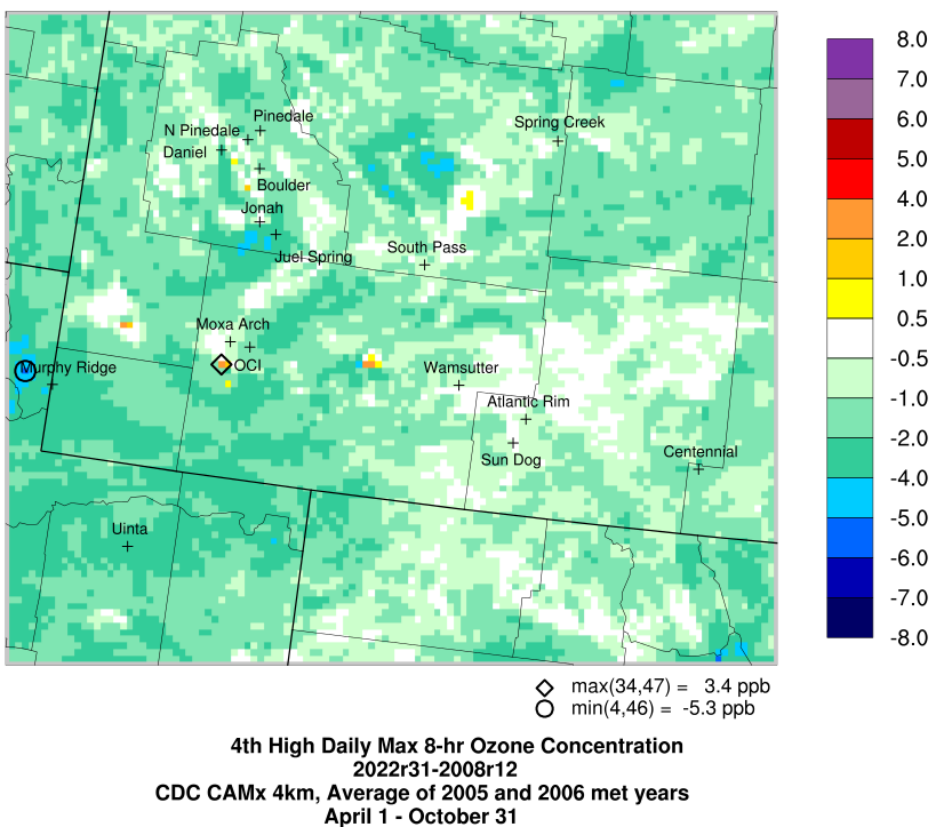

Figure 4-38b. 2022 – 2008 4th highest daily maximum 8-hour average ozone: average of met05 and met06. Rescaled to 0.5 ppb at lowest values.

4.5.4.5 Impact of the CD-C Project Alternative Emissions on Southwest Wyoming 8-Hour Ozone

The CAMx absolute modeled concentrations can be used to determine the impact of CD-C Proposed Action and No Action Alternative emissions to 4th high DM8 ozone on days with high observed and/or modeled ozone.

The APCA source apportionment tool can isolate the contribution of the CD-C Project Alternative emissions to total ozone at each grid cell and time step. To assess the CD-C Project Alternatives' impact on the 4th high DM8, we calculate the 4th high DM8 at each grid cell using the APCA ozone contributions from 2 different sets of emissions. First, we calculate the 4th high DM8 using the ozone contribution from all emissions sources including the CD-C Project Alternative emissions. Next, we calculate the 4th high DM8 using the ozone contribution from the total emissions minus the CD-C Project Alternative emissions as quantified by the APCA source apportionment tool. The first calculation represents the CAMx-predicted 4th high DM8 for the emissions scenario, including development of the proposed CD-C Project, and the second calculation represents the CAMx-predicted 4th high DM8 assuming no development of the CD-C Project Alternatives. The difference between scenario 1 and 2 gives the impact of the CD-C Project Alternatives on the 4th high DM8 over the modeling domain. The difference is paired in space but not in time.

CD-C Project Impact on 4th high DM8 ozone =

4th High DM8 of (All Emis) – 4th High DM8 of (All Emis – CD-C Project Emis)

Note that this impact is different from the CD-C contribution to the total emissions DM8 on the day of the 4th high DM8 of the total emissions, and better reflects the impact the CD-C Project would have on ozone Design Values. It is different because the 2 different scenarios, in general, experience the 4th high DM8 on different days throughout the modeling year. In most cases, the difference method defined above gives a similar or smaller impact for the CD-C Project than the contribution of the CD-C Project to DM8 on the day of the 4th highest DM8.

CD-C Proposed Action Alternative impacts on the DM8 throughout the 4 km domain are shown in Figures 4-39 and 4-40 for the 2022met05 and 2022met06 scenarios, respectively. In the 2022met05 scenario (Figure 4-39), the highest Proposed Action Alternative impacts are 1.7 ppb in the vicinity of the CD-C Project Area. CD-C Project impacts are largest in the vicinity of the Project Area and to the east (generally downwind) of the Project Area. While there are some areas of impacts in the 0.25-0.75 ppb range in Fremont County, impacts in Sublette, western Sweetwater and Lincoln counties are <0.1 ppb (not shown).

The 2022met06 results (Figure 4-40) show that CD-C Proposed Action Alternative impacts reach a maximum of 2.3 ppb in the vicinity of the CD-C Project Area. Impacts are more strongly focused to the east of the Project Area than in the 2022met05 case, although there is an area of impacts in Fremont County that occurs due to an isolated northerly transport event (see Appendix I). As with 2005 meteorology, CD-C Proposed Action Alternative impacts on the 4th highest DM8 are <0.02 ppb in Sublette, northwestern Sweetwater and Lincoln counties (not shown).

The two year average of the Proposed Action Alternative impacts for 2022met05 and 2022met06 is shown in Figure 4-41. The maximum impact of the CD-C Proposed Action Alternative is 1.7 ppb and the impacts are highest in the vicinity of the Project area and to its east. CD-C Proposed Action Alternative impacts on the 4th highest DM8 are <0.04 ppb in Sublette, northwestern Sweetwater and Lincoln counties (not shown).

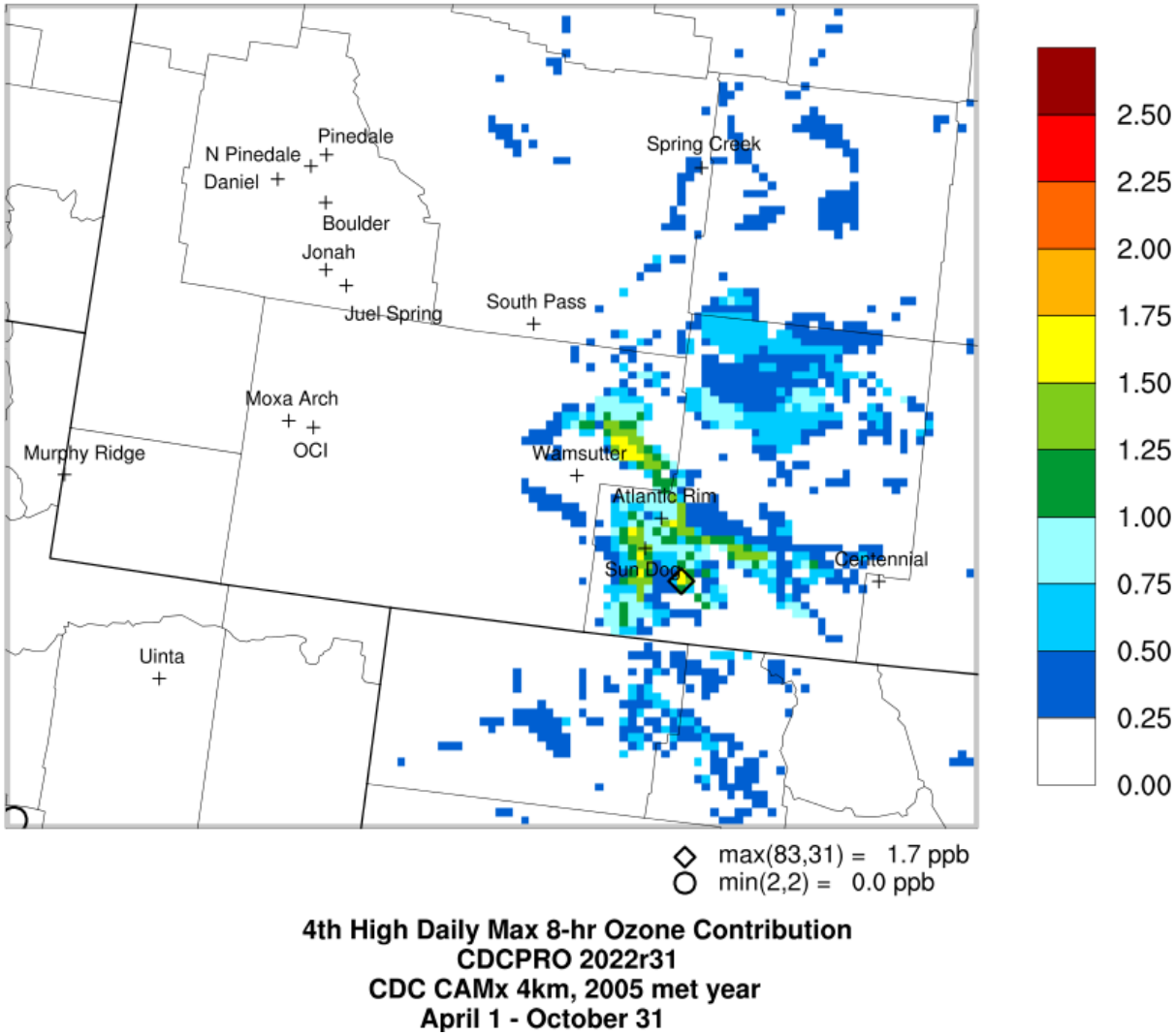

Figure 4-39. Impact of CD-C Proposed Action Alternative emissions on the 4th highest daily maximum 8-hour average ozone: 2022met05.

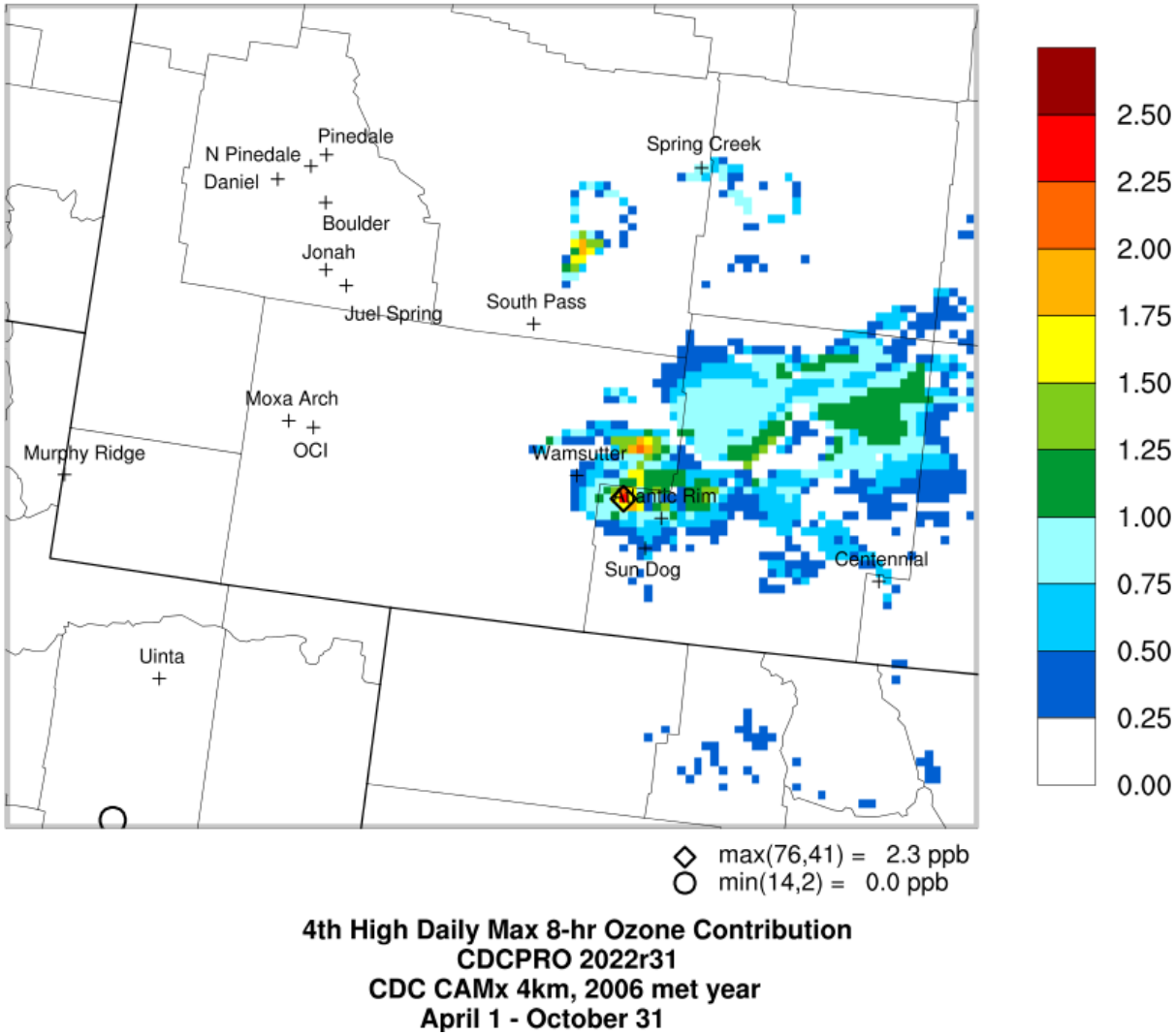

Figure 4-40. Impact of CD-C Proposed Action emissions on the 4th highest daily maximum 8-hour average ozone: 2022met06.

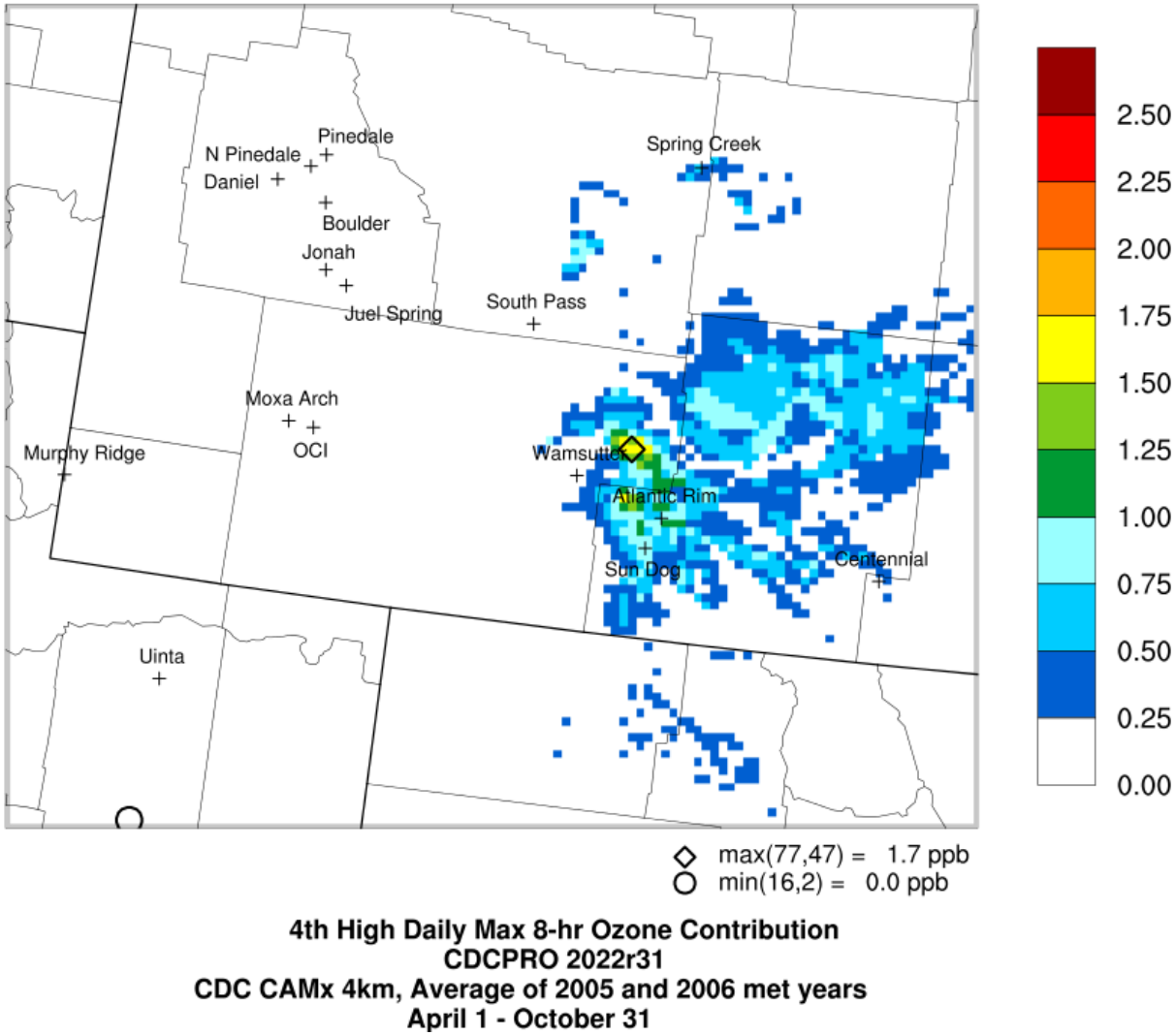

Figure 4-41. Impact of CD-C Proposed Action emissions on the 4th highest daily maximum 8-hour average ozone: Two year average 2022met05 and 2022met06.

The No Action Alternative impacts on the 4th high DM8 are shown in Figures 4-42 and 4-43, for 2005 meteorology and 2006 meteorology, respectively. Impacts show a similar spatial pattern to the Proposed Action Alternative but have smaller magnitude, with highest met05 impact of 1.1 ppb and highest met06 impact of 1.2 ppb. Figure 4-44 shows the average of the 2005 meteorology and 2006 meteorology results and approximates the form of the NAAQS as a two year average instead of a three year average for the No Action Alternative emissions; highest impacts are 0.8 ppb.

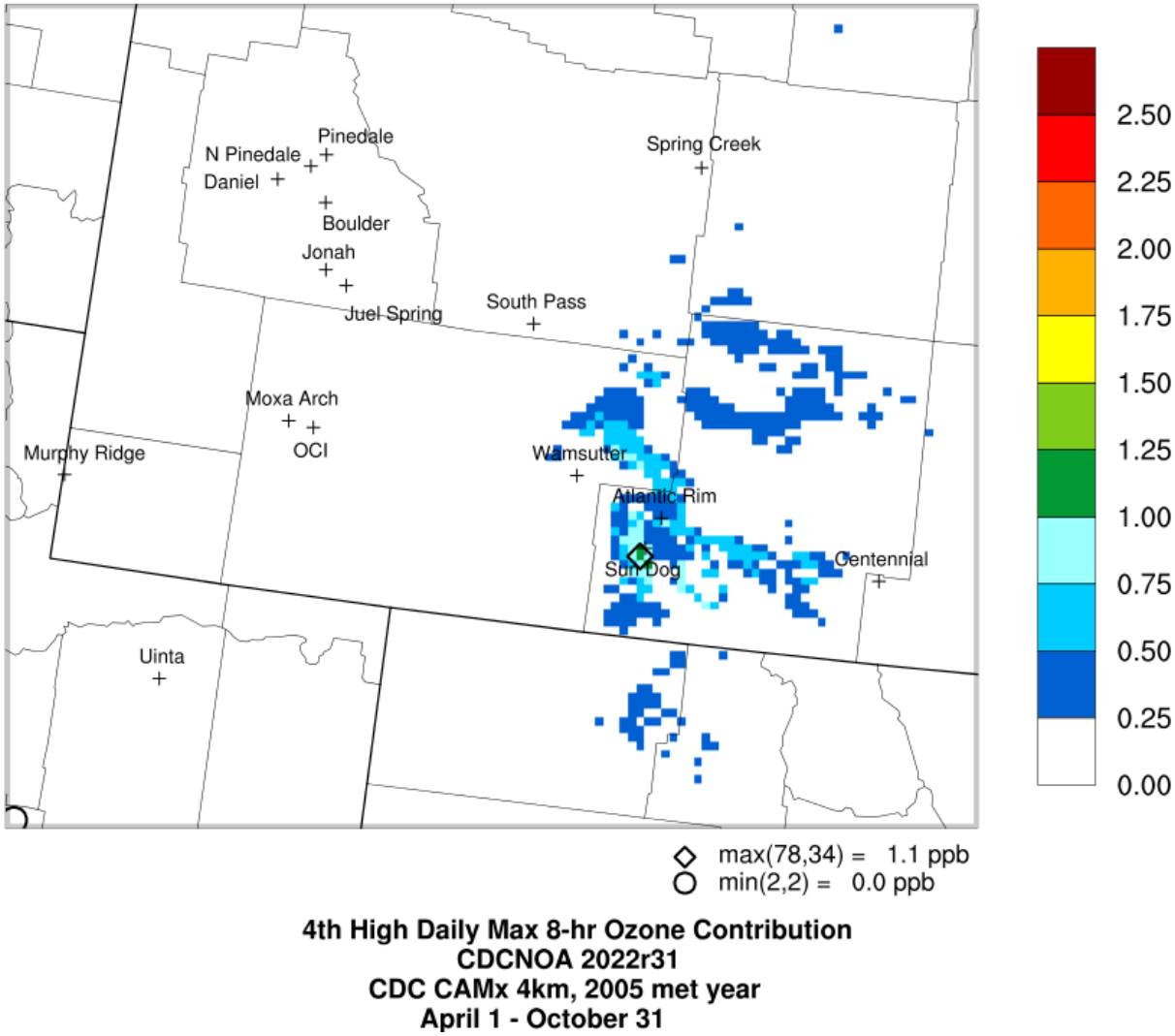

Figure 4-42. Impact of CD-C No Action Alternative emissions on the 4th highest daily maximum 8-hour average ozone: 2022met05.

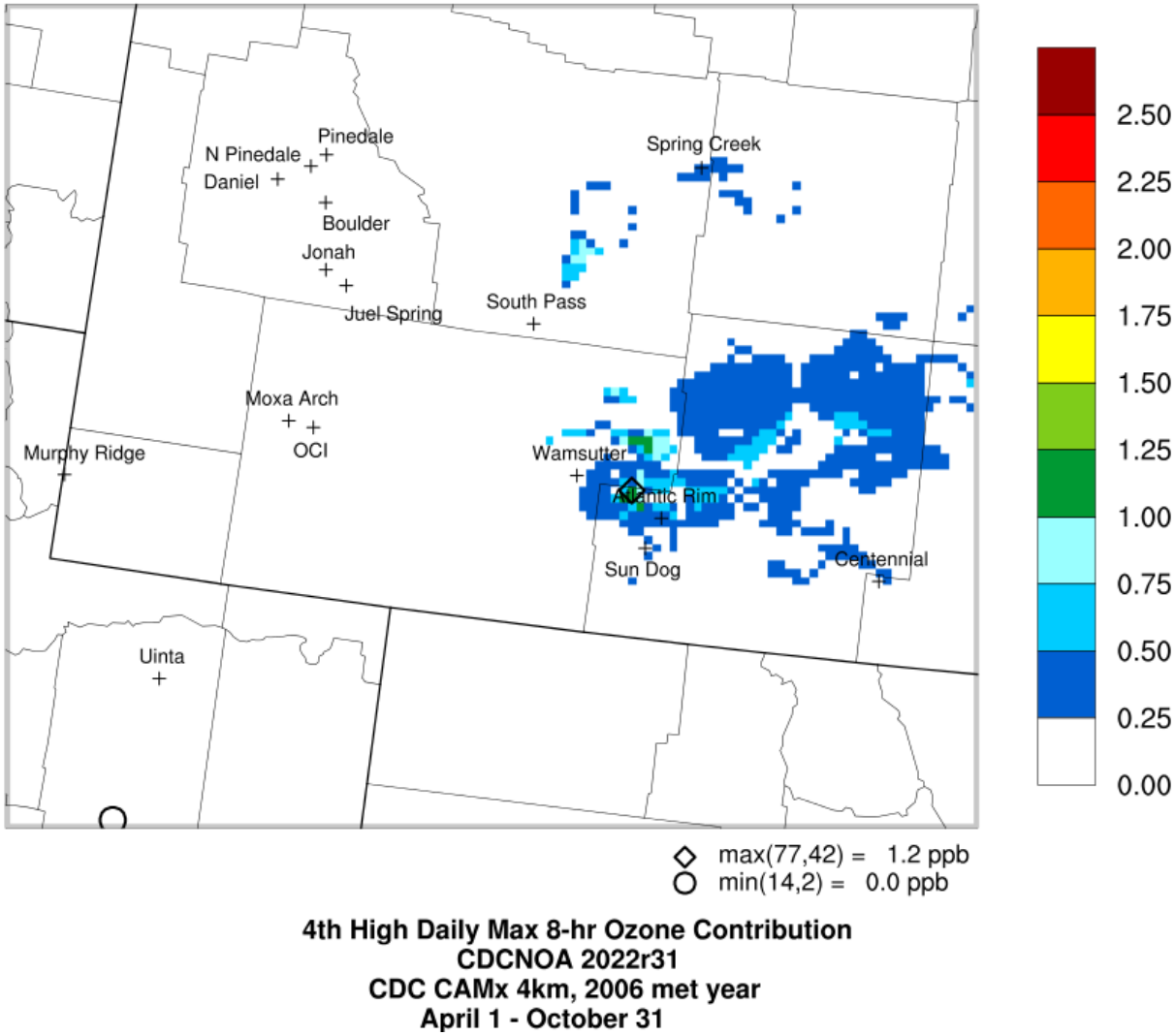

Figure 4-43. Impact of CD-C No Action Alternative emissions on the 4th highest daily maximum 8-hour average ozone: 2022met06.

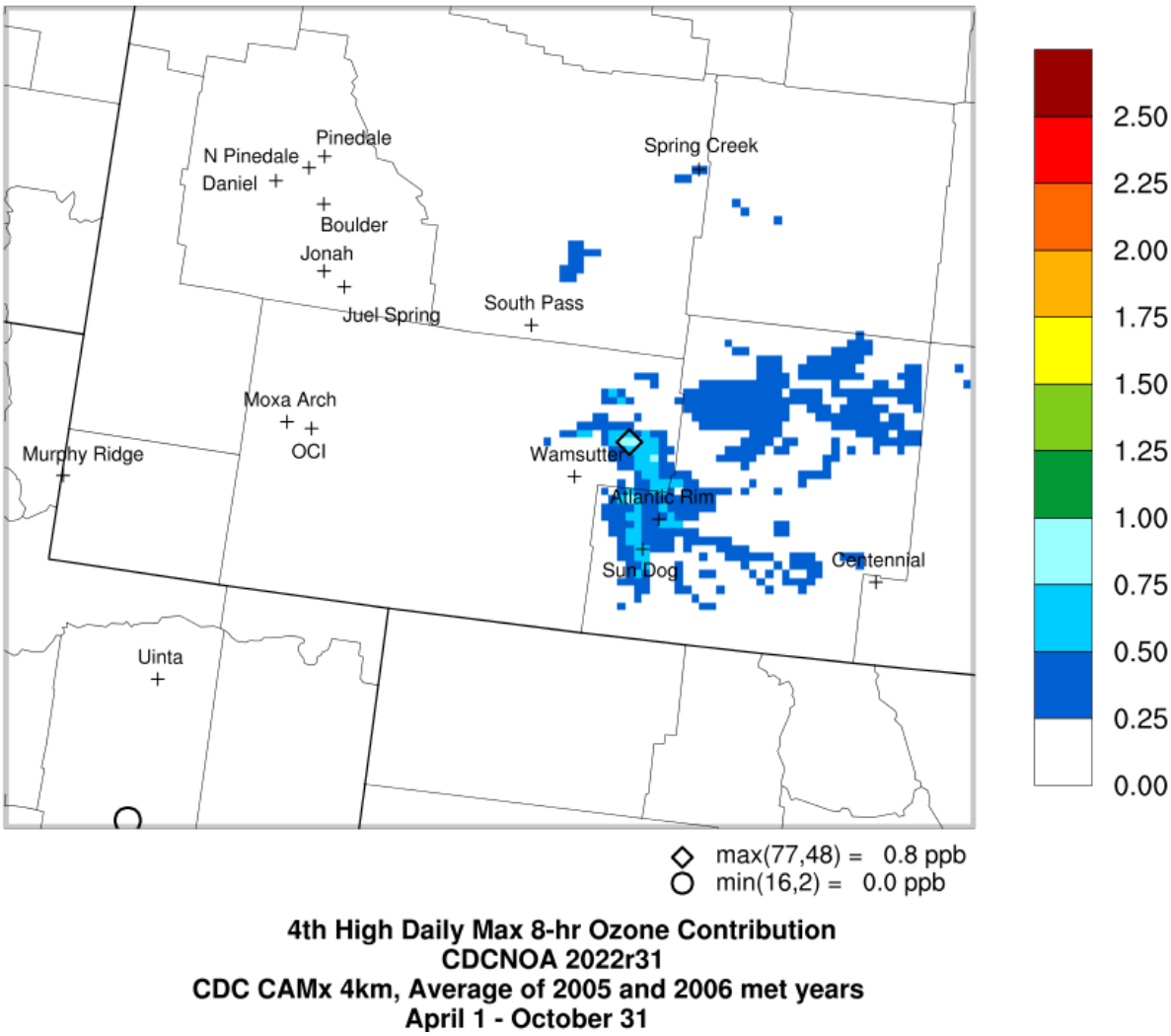

Figure 4-44. Impact of CD-C No Action Alternative emissions on the 4th highest daily maximum 8-hour average ozone: Two year average 2022met05 and 2022met06.

Contribution of CD-C Project Emissions to High Ozone Days in Southwest Wyoming

We now seek to understand whether the peak CD-C Project ozone impacts come during periods of high regional ozone. To address this issue, we examine times when the contribution of the CD-C Project Alternative emissions to the DM8 is ≥1 ppb, and determine the magnitude of the total DM8 at that time/location. Contributions were determined using the absolute modeling results. We also assess the ozone impacts of the CD-C Project Alternative emissions when the observed and/or modeled DM8 is high at a monitor; we define DM8>70 ppb to be the threshold for high ozone, corresponding to the 2015 NAAQS.

Figure 4-45 shows the contribution of the CD-C Proposed Action Alternative emissions to the DM8 at all ozone monitors within the 4 km domain. Each point represents one day at one monitor. The plot shows all monitors and all days from April 1-October 31 for the 2022met05 and 2022met06 simulations. Figure 4-45 indicates that the CD-C Proposed Action contributes ≤ 1.3 ppb (as a 1-year average) to the DM8 when DM8 >70 ppb at any monitor in the 4 km domain. The CD-C Proposed Action contribution is at its maximum when the DM8<60 ppb. Similarly, Figure 4-46a shows the contribution of the CD-C No Action Alternative emissions to

the DM8 at all ozone monitors within the 4 km domain, the distribution of impacts is similar to that of the Proposed Action Alternative, but the impacts are smaller. Likewise, Figure 4-46b shows the contribution of the CD-C Proposed Action minus the No Action Alternative emissions to the DM8 at all ozone monitors within the 4 km domain. The distribution of impacts is again similar to that of the Proposed Action Alternative, but the impacts are smaller.

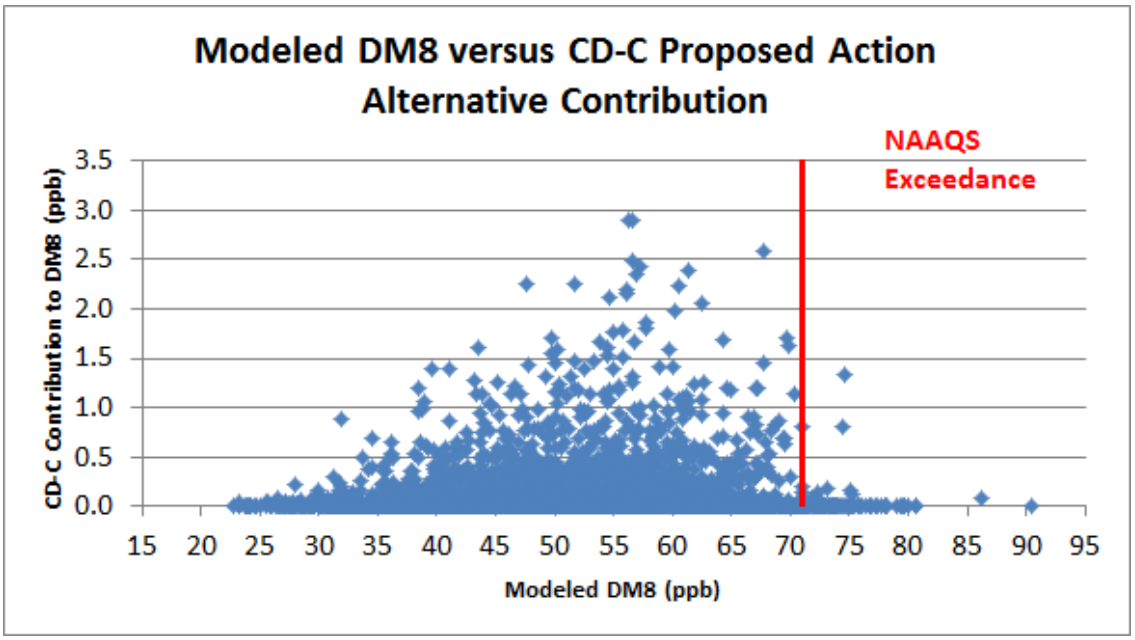

Figure 4-45. Contribution of CD-C Proposed Action Alternative emissions to modeled daily max 8-hour ozone at Southwest Wyoming monitors.

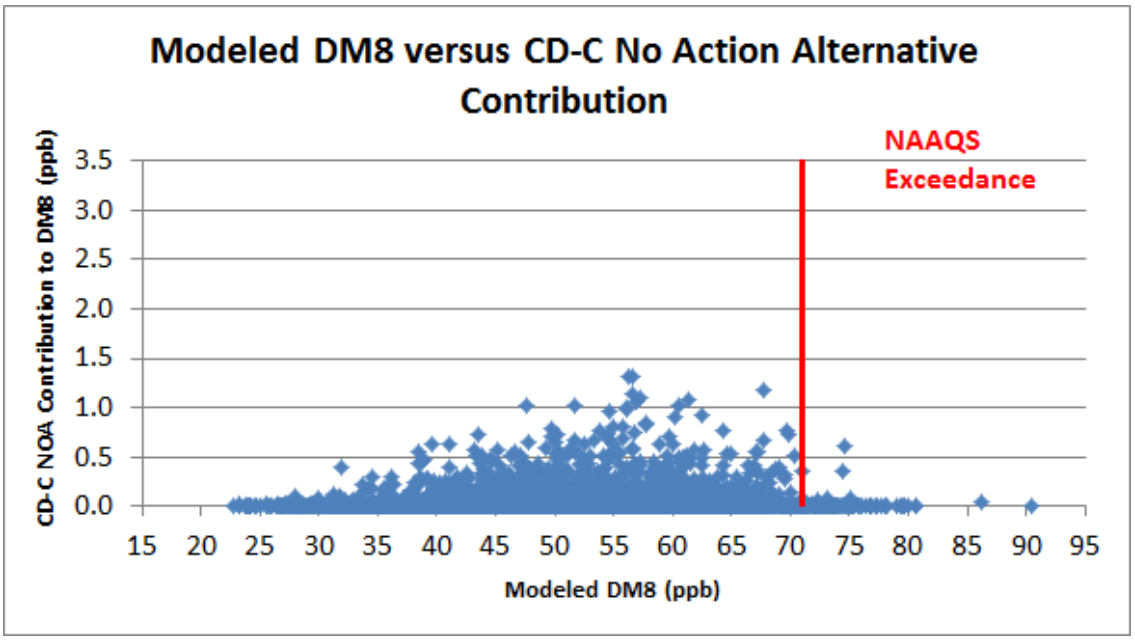

Figure 4-46a. Contribution of CD-C No Action Alternative emissions to modeled daily max 8-hour ozone at Southwest Wyoming monitors.

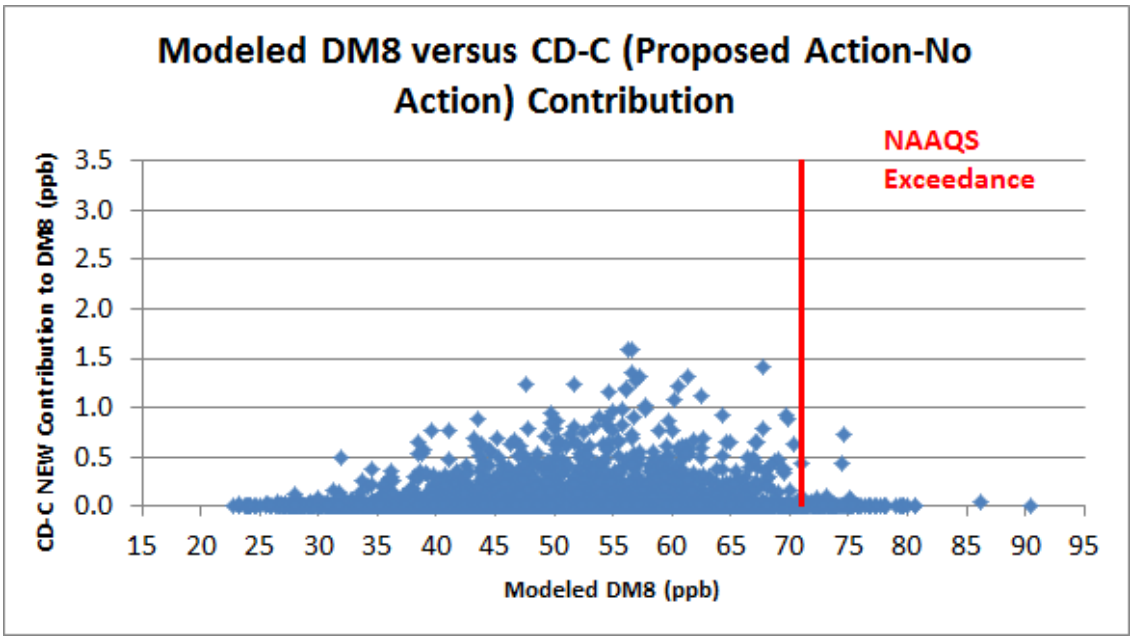

Figure 4-46b. Contribution of CD-C new wells on Federal lands (Proposed Action - No Action Alternative) emissions to modeled daily max 8-hour ozone at Southwest Wyoming monitors.

Table 4-14 lists the days during 2005 and 2006 when a monitor within the 4 km domain had an observed value of the DM8>70 ppb. For each of these days, the modeled contribution of the CD-C Proposed Action Alternative and No Action Alternative emissions is shown as an absolute value and as a percentage of the observed DM8 at that monitor. During 2005-2006 period, the Boulder, Pinedale, Jonah, Daniel and Centennial monitors measured ambient DM8 over 70 ppb during the April 1-October 31 ozone season. None of these monitors is in the immediate vicinity of the CD-C Project Area, and Boulder, Jonah, Daniel and Pinedale are typically upwind of the CD-C Project Area given the prevailing westerly winds. On high ozone days at these monitors, the CD-C Proposed Action Alternative and No Action Alternative emissions contribute ≤ 0.06 ppb (≤ 0.1%) to the modeled DM8 ozone.

Table 4-14. CD-C Proposed Action Alternative and No Action Alternative emission impacts on days (April 1 – October 31) with high observed daily max 8-hour ozone (days with observed DM8>70 ppb).

Year	Site ID	Site Name	Date	Observed Daily Max 8-hr Ozone (ppb)	Modeled Daily Max 8-hr Ozone (ppb)	CD-C Proposed Action Contribution (ppb)	CD-C Proposed Action Contribution (% of Modeled DM8)	CD-C No Action Contribution (ppb)	CD-C No Action Contribution (% of Modeled DM8)
2005	56_035_0098	Jonah	4/13/2005	74	50	0.0001	0.0003%	0.0001	0.0001%
2005	Centennial	Centennial	5/11/2005	88	55	0.0059	0.0108%	0.0027	0.0049%
2005	Jonah	Jonah	6/27/2005	73	67	0.0000	0.0000%	0.0000	0.0000%
2005	Boulder	Boulder	6/27/2005	72	66	0.0000	0.0000%	0.0000	0.0000%
2005	Pinedale	Pinedale	6/27/2005	76	65	0.0000	0.0000%	0.0000	0.0000%

Year	Site ID	Site Name	Date	Observed Daily Max 8-hr Ozone (ppb)	Modeled Daily Max 8-hr Ozone (ppb)	CD-C Proposed Action Contribution (ppb)	CD-C Proposed Action Contribution (% of Modeled DM8)	CD-C No Action Contribution (ppb)	CD-C No Action Contribution (% of Modeled DM8)
2005	Boulder	Boulder	7/7/2005	74	64	0.0000	0.0000%	0.0000	0.0000%
2006	Centennial	Centennial	4/21/2006	73	65	0.0031	0.0048%	0.0014	0.0022%
2006	Boulder	Boulder	4/21/2006	80	66	0.0001	0.0001%	0.0000	0.0001%
2006	Daniel	Daniel	4/21/2006	74	66	0.0001	0.0001%	0.0000	0.0001%
2006	Pinedale	Pinedale	4/21/2006	80	65	0.0001	0.0001%	0.0000	0.0001%
2006	Centennial	Centennial	4/22/2006	73	59	0.0000	0.0000%	0.0000	0.0000%
2006	Centennial	Centennial	5/2/2006	73	59	0.0486	0.0824%	0.0221	0.0374%
2006	Boulder	Boulder	5/2/2006	75	61	0.0000	0.0000%	0.0000	0.0000%
2006	Daniel	Daniel	5/2/2006	75	59	0.0000	0.0000%	0.0000	0.0000%
2006	Pinedale	Pinedale	5/2/2006	73	64	0.0000	0.0000%	0.0000	0.0000%
2006	Boulder	Boulder	6/1/2006	72	66	0.0633	0.0960%	0.0288	0.0436%
2006	Boulder	Boulder	6/18/2006	79	60	0.0000	0.0000%	0.0000	0.0000%
2006	Daniel	Daniel	6/18/2006	72	62	0.0000	0.0000%	0.0000	0.0000%

In Tables 4-15a and 4-15b, the CD-C Proposed Action Alternative and No Action Alternative contributions to the DM8 on days with high modeled ozone (DM8>70 ppb) are shown in terms of their absolute magnitude and the percentage of the modeled DM8 at the monitor. Table 4-15a shows results for the 2022 future year with 2005 meteorology, and Table 4-15b shows results for the 2022 future year with 2006 meteorology. The results displayed in Tables 4-15a and 4-15b indicate that modeled ozone was higher at the southwest Wyoming monitors using 2006 meteorology than 2005 meteorology (consistent with the absolute modeling results shown in Figures 4-35 and 4-37). The CD-C Proposed Action Alternative emissions contributed 1.33 ppb or less (1.8% or less) to monitors with high modeled ozone while the CD-C No Action Alternative emissions contributed 0.61 ppb or less (0.81% or less). The monitors with the largest contribution from CD-C Project Alternative emissions are those in closest proximity to the Project Area and most frequently downwind of it: Wamsutter, Atlantic Rim, Sun Dog and Spring Creek.

Table 4-15a. CD-C Proposed Action emission impacts on 2005 days with high modeled daily max 8-hour ozone (days with modeled DM8>70 ppb).

Year	Site ID	Site Name	Date	Modeled Daily Max - 8hr Ozone	CD-C Proposed Action Contribution (ppb)	CD-C Proposed Action Contribution (% of modeled)	CD-C No Action Contribution (ppb)	CD-C No Action Contribution (% of modeled)
2005	56_007_0099	Atlantic_Rim	7/17/2005	73	0.1844	0.2519%	0.0837	0.1144%
2005	56_007_0100	Sun_Dog	7/17/2005	72	0.1453	0.2011%	0.0660	0.0913%
2005	56_037_0200	Wamsutter	7/6/2005	75	0.1230	0.1635%	0.0559	0.0742%
2005	CNT169	Centennial	8/31/2005	70	0.0917	0.1291%	0.0416	0.0586%
2005	56_007_0099	Atlantic_Rim	6/27/2005	72	0.0828	0.1147%	0.0376	0.0521%
2005	56_037_0200	Wamsutter	7/17/2005	75	0.0168	0.0224%	0.0076	0.0102%

Year	Site ID	Site Name	Date	Modeled Daily Max - 8hr Ozone	CD-C Proposed Action Contribution (ppb)	CD-C Proposed Action Contribution (% of modeled)	CD-C No Action Contribution (ppb)	CD-C No Action Contribution (% of modeled)
2005	56_037_0200	Wamsutter	6/27/2005	74	0.0164	0.0220%	0.0075	0.0100%
2005	49_047_1002	Uintah1002	5/25/2005	70	0.0057	0.0080%	0.0026	0.0036%
2005	CNT169	Centennial	8/5/2005	70	0.0042	0.0059%	0.0019	0.0027%
2005	49_047_2002	Uintah2002	5/25/2005	72	0.0039	0.0053%	0.0018	0.0024%
2005	56_037_0898	OCI	5/25/2005	71	0.0007	0.0010%	0.0003	0.0005%
2005	56_037_0300	Moxa_Arch	5/25/2005	71	0.0005	0.0007%	0.0002	0.0003%
2005	56_013_0099	South_Pass	6/27/2005	72	0.0001	0.0001%	0.0000	0.0001%
2005	56_035_1002	Juel_Spring	5/25/2005	72	0.0000	0.0000%	0.0000	0.0000%
2005	56_035_0098	Jonah	5/25/2005	72	0.0000	0.0000%	0.0000	0.0000%
2005	56_035_0099	Boulder	5/25/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	49_047_1002	Uintah1002	7/7/2005	72	0.0000	0.0000%	0.0000	0.0000%
2005	UIN162	Uinta	5/26/2005	71	0.0000	0.0000%	0.0000	0.0000%
2005	56_035_0101	Pinedale_North	5/25/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	56_035_0100	Daniel	5/25/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	PND165	Pinedale	5/25/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	56_041_0101	Murphy_Ridge	5/25/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	UIN162	Uinta	5/25/2005	71	0.0000	0.0000%	0.0000	0.0000%
2005	UIN162	Uinta	7/8/2005	70	0.0000	0.0000%	0.0000	0.0000%
2005	56_037_0898	OCI	7/17/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	56_037_0300	Moxa_Arch	7/17/2005	72	0.0000	0.0000%	0.0000	0.0000%
2005	56_037_0300	Moxa_Arch	6/26/2005	75	0.0000	0.0000%	0.0000	0.0000%
2005	56_037_0898	OCI	6/26/2005	74	0.0000	0.0000%	0.0000	0.0000%
2005	UIN162	Uinta	6/26/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	56_037_0898	OCI	6/27/2005	72	0.0000	0.0000%	0.0000	0.0000%
2005	56_037_0300	Moxa_Arch	6/27/2005	71	0.0000	0.0000%	0.0000	0.0000%
2005	49_047_1002	Uintah1002	6/27/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	56_041_0101	Murphy_Ridge	6/26/2005	76	0.0000	0.0000%	0.0000	0.0000%
2005	56_035_1002	Juel_Spring	7/17/2005	71	0.0000	0.0000%	0.0000	0.0000%
2005	UIN162	Uinta	6/27/2005	76	0.0000	0.0000%	0.0000	0.0000%
2005	56_041_0101	Murphy_Ridge	6/27/2005	72	0.0000	0.0000%	0.0000	0.0000%
2005	49_047_2002	Uintah2002	6/27/2005	73	0.0000	0.0000%	0.0000	0.0000%
2005	49_047_2003	Uintah2003	6/27/2005	72	0.0000	0.0000%	0.0000	0.0000%
2005	UIN162	Uinta	8/30/2005	77	0.0000	0.0000%	0.0000	0.0000%

Table 4-15b. CD-C Proposed Action emission impacts on 2006 days with high modeled daily max 8-hour ozone (days with modeled DM8>70 ppb).

Year	Site ID	Site Name	Date	Modeled Daily Max - 8hr Ozone	CD-C Proposed Action Contribution (ppb)	CD-C Proposed Action Contribution (% of modeled)	CD-C No Action Contribution (ppb)	CD-C No Action Contribution (% of modeled)
2006	56_037_0200	Wamsutter	7/29/2006	74	1.3333	1.7859%	0.6053	0.8108%
2006	56_013_0232	Spring_Creek	4/22/2006	71	0.8092	1.1393%	0.3674	0.5172%
2006	56_007_0099	Atlantic_Rim	8/14/2006	74	0.8047	1.0819%	0.3653	0.4912%
2006	CNT169	Centennial	8/15/2006	70	0.1930	0.2721%	0.0876	0.1235%
2006	56_007_0100	Sun_Dog	8/14/2006	75	0.1705	0.2270%	0.0774	0.1031%
2006	56_037_0200	Wamsutter	7/28/2006	70	0.1361	0.1918%	0.0618	0.0871%
2006	56_037_0200	Wamsutter	8/14/2006	86	0.0900	0.1045%	0.0409	0.0474%
2006	56_007_0099	Atlantic_Rim	5/10/2006	71	0.0788	0.1098%	0.0358	0.0498%
2006	49_047_2002	Uintah2002	7/29/2006	70	0.0093	0.0131%	0.0042	0.0060%
2006	PND165	Pinedale	5/6/2006	71	0.0077	0.0108%	0.0035	0.0049%
2006	56_013_0099	South_Pass	8/15/2006	79	0.0075	0.0094%	0.0034	0.0043%
2006	49_047_2003	Uintah2003	5/10/2006	74	0.0074	0.0099%	0.0033	0.0045%
2006	49_047_2002	Uintah2002	5/10/2006	70	0.0065	0.0091%	0.0029	0.0041%
2006	56_035_0098	Jonah	8/19/2006	74	0.0037	0.0049%	0.0017	0.0022%
2006	56_035_1002	Juel_Spring	8/19/2006	75	0.0035	0.0047%	0.0016	0.0021%
2006	56_035_0099	Boulder	8/19/2006	75	0.0026	0.0034%	0.0012	0.0016%
2006	56_013_0232	Spring_Creek	8/14/2006	73	0.0018	0.0024%	0.0008	0.0011%
2006	56_035_0100	Daniel	8/19/2006	76	0.0015	0.0020%	0.0007	0.0009%
2006	56_013_0099	South_Pass	8/20/2006	73	0.0013	0.0018%	0.0006	0.0008%
2006	56_035_0098	Jonah	8/14/2006	76	0.0012	0.0016%	0.0006	0.0007%
2006	56_035_1002	Juel_Spring	8/14/2006	79	0.0012	0.0015%	0.0005	0.0007%
2006	56_035_1002	Juel_Spring	4/9/2006	71	0.0012	0.0016%	0.0005	0.0007%
2006	56_035_0100	Daniel	4/9/2006	71	0.0010	0.0014%	0.0005	0.0007%
2006	CNT169	Centennial	5/10/2006	71	0.0008	0.0012%	0.0004	0.0005%
2006	56_013_0099	South_Pass	8/14/2006	79	0.0007	0.0008%	0.0003	0.0004%
2006	56_035_0101	Pinedale_North	8/19/2006	75	0.0005	0.0007%	0.0002	0.0003%
2006	56_013_0232	Spring_Creek	8/15/2006	72	0.0005	0.0007%	0.0002	0.0003%
2006	08_103_0006	Rio_Blanco0006	5/11/2006	72	0.0003	0.0005%	0.0002	0.0002%
2006	49_047_1002	Uintah1002	5/11/2006	72	0.0003	0.0004%	0.0001	0.0002%
2006	PND165	Pinedale	8/19/2006	77	0.0003	0.0003%	0.0001	0.0001%
2006	56_035_0099	Boulder	8/14/2006	77	0.0002	0.0003%	0.0001	0.0001%
2006	56_035_0100	Daniel	8/14/2006	75	0.0002	0.0003%	0.0001	0.0001%
2006	56_035_0101	Pinedale_North	8/14/2006	78	0.0002	0.0002%	0.0001	0.0001%
2006	PND165	Pinedale	8/14/2006	80	0.0002	0.0002%	0.0001	0.0001%
2006	56_037_0898	OCI	8/14/2006	75	0.0002	0.0002%	0.0001	0.0001%
2006	56_037_0300	Moxa_Arch	8/14/2006	73	0.0002	0.0002%	0.0001	0.0001%
2006	49_047_2002	Uintah2002	5/11/2006	73	0.0001	0.0002%	0.0001	0.0001%
2006	49_047_2003	Uintah2003	5/11/2006	75	0.0001	0.0001%	0.0000	0.0001%

Year	Site ID	Site Name	Date	Modeled Daily Max - 8hr Ozone	CD-C Proposed Action Contribution (ppb)	CD-C Proposed Action Contribution (% of modeled)	CD-C No Action Contribution (ppb)	CD-C No Action Contribution (% of modeled)
2006	56_041_0101	Murphy_Ridge	8/19/2006	76	0.0001	0.0001%	0.0000	0.0000%
2006	PND165	Pinedale	8/20/2006	74	0.0000	0.0001%	0.0000	0.0000%
2006	56_037_0898	OCI	8/18/2006	73	0.0000	0.0001%	0.0000	0.0000%
2006	56_035_0101	Pinedale_North	8/20/2006	70	0.0000	0.0000%	0.0000	0.0000%
2006	49_047_2002	Uintah2002	7/14/2006	73	0.0000	0.0000%	0.0000	0.0000%
2006	08_103_0006	Rio_Blanco0006	7/14/2006	70	0.0000	0.0000%	0.0000	0.0000%
2006	56_037_0300	Moxa_Arch	8/18/2006	74	0.0000	0.0000%	0.0000	0.0000%
2006	49_047_1002	Uintah1002	7/14/2006	72	0.0000	0.0000%	0.0000	0.0000%
2006	56_035_1002	Juel_Spring	8/18/2006	78	0.0000	0.0000%	0.0000	0.0000%
2006	49_047_2003	Uintah2003	7/14/2006	74	0.0000	0.0000%	0.0000	0.0000%
2006	PND165	Pinedale	8/18/2006	80	0.0000	0.0000%	0.0000	0.0000%
2006	56_035_0098	Jonah	8/18/2006	78	0.0000	0.0000%	0.0000	0.0000%
2006	PND165	Pinedale	8/13/2006	73	0.0000	0.0000%	0.0000	0.0000%
2006	56_035_0099	Boulder	8/18/2006	90	0.0000	0.0000%	0.0000	0.0000%
2006	UIN162	Uinta	7/14/2006	71	0.0000	0.0000%	0.0000	0.0000%
2006	49_047_2003	Uintah2003	7/15/2006	70	0.0000	0.0000%	0.0000	0.0000%
2006	UIN162	Uinta	5/11/2006	73	0.0000	0.0000%	0.0000	0.0000%
2006	56_041_0101	Murphy_Ridge	5/11/2006	72	0.0000	0.0000%	0.0000	0.0000%
2006	56_035_0101	Pinedale_North	8/18/2006	80	0.0000	0.0000%	0.0000	0.0000%
2006	56_035_0100	Daniel	8/18/2006	79	0.0000	0.0000%	0.0000	0.0000%
2006	UIN162	Uinta	7/13/2006	71	0.0000	0.0000%	0.0000	0.0000%
2006	56_037_0898	OCI	7/14/2006	71	0.0000	0.0000%	0.0000	0.0000%
2006	56_013_0099	South_Pass	5/10/2006	75	0.0000	0.0000%	0.0000	0.0000%
2006	PND165	Pinedale	8/31/2006	72	0.0000	0.0000%	0.0000	0.0000%
2006	56_035_0101	Pinedale_North	8/31/2006	71	0.0000	0.0000%	0.0000	0.0000%
2006	56_035_0100	Daniel	8/31/2006	72	0.0000	0.0000%	0.0000	0.0000%
2006	UIN162	Uinta	6/14/2006	77	0.0000	0.0000%	0.0000	0.0000%

Table 4-16a. Number of Days with CD-C Proposed Action Contribution to the daily maximum 8-hour average ozone > 1 ppb.

Monitor	2005				2006			
	Number of Days >= 1ppb	Max CD-C Proposed Action Contribution (ppb)	Max CD-C Proposed Action Contribution (% DM8)	Max Modeled DM8 on those Days	Number of Days >= 1ppb	Max CD-C Proposed Action Contribution (ppb)	Max CD-C Proposed Action Contribution (% DM8)	Max Modeled DM8 on those Days
Rio Blanco0006	0	--	--	--	0	--	--	--
Uintah2003	0	--	--	--	0	--	--	--
Uintah2002	0	--	--	--	0	--	--	--
Uintah1002	0	--	--	--	0	--	--	--
Uinta	0	--	--	--	0	--	--	--
Centennial	0	--	--	--	1	1.2	1.8	64
Sun Dog	15	2.9	5.1	67	23	2.4	4.7	70
Atlantic Rim	17	2.9	5.1	69	20	2.5	4.4	69
Murphy Ridge	0	--	--	--	0	--	--	--
Wamsutter	3	2.4	4.2	57	10	2.1	3.8	74
Moxa Arch	0	--	--	--	0	--	--	--
OCI	0	--	--	--	0	--	--	--
South Pass	0	--	--	--	1	1.1	2.6	43
Juel Spring	0	--	--	--	0	--	--	--
Jonah	0	--	--	--	0	--	--	--
Boulder	0	--	--	--	0	--	--	--
Daniel	0	--	--	--	0	--	--	--
Pinedale North	0	--	--	--	0	--	--	--
Spring Creek	0	--	--	--	0	--	--	--
Pinedale	0	--	--	--	0	--	--	--

Tables 4-16a, 4-16b and 4-16c show the number of days at each monitor in the 4 km domain when the CD-C Proposed Action Alternative, No Action Alternative and difference between the Proposed Action and No Alternative contributions to the DM8 at that monitor was greater than 1 ppb, respectively. The results in these tables indicate that the maximum ozone contributions generally come on days when regional ozone is low at those monitors.

Table 4-16b. Number of Days with CD-C No Action Contribution to the daily maximum 8-hour average ozone > 1 ppb.

Monitor	2005				2006			
	Number of Days >= 1ppb	Max CD-C No Action Contribution (ppb)	Max CD-C No Action Contribution (% DM8)	Max Modeled DM8 on those Days	Number of Days >= 1ppb	Max CD-C No Action Contribution (ppb)	Max CD-C No Action Contribution (% DM8)	Max Modeled DM8 on those Days
Rio Blanco0006	0	--	--	--	0	--	--	--
Uintah2003	0	--	--	--	0	--	--	--
Uintah2002	0	--	--	--	0	--	--	--
Uintah1002	0	--	--	--	0	--	--	--
Uinta	0	--	--	--	0	--	--	--
Centennial	0	--	--	--	0	--	--	--
Sun Dog	2	1.3	2.3	67	2	1.1	2.2	61
Atlantic Rim	1	1.3	2.3	56	4	1.1	2.0	60
Murphy Ridge	0	--	--	--	0	--	--	--
Wamsutter	1	1.1	1.9	57	0	--	--	--
Moxa Arch	0	--	--	--	0	--	--	--
OCI	0	--	--	--	0	--	--	--
South Pass	0	--	--	--	0	--	--	--
Juel Spring	0	--	--	--	0	--	--	--
Jonah	0	--	--	--	0	--	--	--
Boulder	0	--	--	--	0	--	--	--
Daniel	0	--	--	--	0	--	--	--
Pinedale North	0	--	--	--	0	--	--	--
Spring Creek	0	--	--	--	0	--	--	--
Pinedale	0	--	--	--	0	--	--	--

Table 4-16c. Number of Days with CD-C Proposed Action minus No Action Contribution to the daily maximum 8-hour average ozone > 1 ppb.

Monitor	2005				2006			
	Number of Days >= 1ppb	Max CD-C Prop-NoAct Contribution (ppb)	Max CD-C Prop-NoAct Contribution (% DM8)	Max Modeled DM8 on those Days	Number of Days >= 1ppb	Max CD-C Prop-NoAct Contribution (ppb)	Max CD-C Prop - NoAct Contribution (% DM8)	Max Modeled DM8 on those Days
Rio Blanco0006	0	--	--	--	0	--	--	--
Uintah2003	0	--	--	--	0	--	--	--
Uintah2002	0	--	--	--	0	--	--	--
Uintah1002	0	--	--	--	0	--	--	--
Uinta	0	--	--	--	0	--	--	--
Centennial	0	--	--	--	0	--	--	--
Sun Dog	2	1.6	2.8	67	6	1.3	2.6	62
Atlantic Rim	1	1.6	2.8	56	4	1.4	2.4	60
Murphy Ridge	0	--	--	--	0	--	--	--
Wamsutter	1	1.3	2.3	57	2	1.2	2.1	57
Moxa Arch	0	--	--	--	0	--	--	--
OCI	0	--	--	--	0	--	--	--
South Pass	0	--	--	--	0	--	--	--
Juel Spring	0	--	--	--	0	--	--	--
Jonah	0	--	--	--	0	--	--	--
Boulder	0	--	--	--	0	--	--	--
Daniel	0	--	--	--	0	--	--	--
Pinedale North	0	--	--	--	0	--	--	--
Spring Creek	0	--	--	--	0	--	--	--
Pinedale	0	--	--	--	0	--	--	--

<u>Summary of the absolute ozone modeling impacts</u>

1) The highest 2-year average value of the 4th highest DM8 ozone for the 2008 base case was 78.3 ppb.
2) The highest 2-year average value of the 4th highest DM8 ozone for the 2022 cumulative case was 74.4 ppb.
3) The largest increase in 2022 4th highest DM8 relative to the 2008 4th highest DM8 averaged over the 2005 and 2006 meteorological years was 3.4 ppb.
4) The highest Proposed Action impacts on the 4th highest MDA8 ozone were 1.7 ppb, 2.3 ppb and 1.7 ppb, for 2022met05, 2022met06, and average of 2022met05 and 2022met06, respectively.
5) The highest No Action impacts on the 4th highest MDA8 ozone were 1.1 ppb, 1.2 ppb and 0.8 ppb, for 2022met05, 2022met06, and average of 2022met05 and 2022met06, respectively.

6) The increase in the 2-year average of the 4th highest MDA8 ozone between 2022 and 2008 in the vicinity of the CD-C Project area was 0.5 ppb or less.
7) The CD-C Proposed Action contribution to the total MDA8 value is 1.3 ppb or less on days with observed total MDA8 values in excess of 70 ppb (during the April 1-October 31 ozone season), at the monitors in the 4 km modeling domain.

Summary of Ozone Modeling Results

The MATS results and absolute modeling results for ozone are in general agreement with respect to spatial pattern of the 2022 future year ozone concentrations. Both projections of future ozone predict that the 70 ppb NAAQS will be attained throughout most of the 4 km modeling domain with regions of higher ozone concentrations that exceed the NAAQS occurring at high elevations in the Wind River Range as well as in northern Colorado (southeast corner of the 4 km modeling domain) and in Sublette County. The two sets of ozone modeling results differ in their prediction of future year ozone concentrations in Sublette County, WY. The MATS projections for 2022 show a more extensive regions where DVFs > 70 ppb in the vicinity of Sublette County, while the 2 year average 4th high DM8 that approximates a DVF in the absolute modeling results shows a smaller region where values are >70 ppb. The MATS results are influenced by high winter ozone at the Boulder monitor and the absolute modeling results are restricted to lower ozone values that occurred during the modeled April – October Wyoming ozone season. The two sets of model results also differ over the Uinta Mountains in northwest Utah (southwest corner of the 4 km modeling domain), with the absolute modeling results showing 2-year average 4th high DM8 values > 70 ppb, while the MATS DVFs are < 70 ppb.

Future year ozone Design Values in the vicinity of the CD-C Project Area are projected by MATS to be in the range 60-69 ppb and to attain the 70 ppb 2015 NAAQS. The absolute CAMx model concentrations show values of the future year 4th high DM8 exceeding 70 ppb in the CD-C Project Area using 2006 meteorology (maximum value of 72.9 ppb); however, all values of future year 4th high DM8 in the CD-C Project Area are less than 70 ppb using 2005 meteorology. The 2-year average 4th high DM8 that approximates a Design Value in the absolute modeling results shows a maximum value of 70.1 ppb within the CD-C Project Area. Using the EPA convention for calculating Design Values, this corresponds to a Design Value of 70 ppb, which is less than 71 ppb and therefore does not exceed the NAAQS. The 2-year average CAMx concentration results are consistent with the MATS results that show no ozone Design Values exceeding the NAAQS in the CD-C Project Area.MATS estimates that the maximum impact of the CD-C Proposed Action on 2022 DVFs is less than or equal to 0.8 ppb for both 2005 and 2006 meteorological years. Using the absolute model results, the highest Proposed Action impacts on the 4th highest DM8 ozone were 1.7 ppb, 2.3 ppb and 1.7 ppb, for met05, met06, and average of met05 and met06, respectively. The CD-C Project Alternatives contribute <1.3 ppb (as a 1-year average) to the DM8 when the DM8 >70 ppb at any monitor in the 4 km domain. The CD-C contribution is at its maximum when the DM8<60 ppb. Both the MATS results and the absolute modeling results show very small impacts from the Proposed Action in the Wyoming counties designated an ozone non-attainment area under the 2008 NAAQS: Sublette and portions of Sweetwater and Lincoln counties. Impacts were less than the minimum possible reportable difference of 0.1 ppb in MATS and < 0.04 ppb in the absolute modeling results. The MATS future year projection method uses DVC values that are anchored in observed values and

are therefore less influenced by model biases than the absolute model concentration results; they are more reliable than the absolute model concentrations in determining future year ozone and CD-C Project Alternative ozone impacts (EPA, 2014d).

4.5.5. Summary of Criteria Pollutant Modeling Results

Table 4-17 summarizes the results of the comparison of CAPs concentrations within the 4 km modeling domain to the NAAQS, CAAQS, and WAAQS. Refer back to Table 4-5 for details on the particular forms of the averages. Exceedances of ambient air quality standards are noted for 8-hour CO, 8-hour ozone, 24-hour PM_{10}, and 1-hour SO_2.

For all pollutants except ozone, the modeling results show attainment throughout the 4 km domain except in the immediate vicinity of point sources unrelated to the CD-C Project. Exceedances of the CO, and PM_{10} standards are the result of impacts from 2005 fire in Lincoln County, and the SO_2 exceedances are highly localized and due to emissions from a Fremont County source and a source in western Sweetwater County. For the Proposed Action Alternative modeling scenario, the MATS results showed that the 70 ppb 2015 ozone NAAQS is attained throughout the study area in 2022 except in Sublette and Fremont Counties in Wyoming and in northern Colorado for both 2005 and 2006 meteorological years. The NAAQS exceedances in Sublette County are influenced by high observed winter ozone measurements that affect the DVC value for the Boulder, WY monitor. Exceedances in northern Colorado occur in the vicinity of the Fort Collins Metropolitan Area. The contribution of the CD-C Project emissions to 2022 DVF exceedances of the 70 ppb NAAQS at monitors in the study area is <0.1 ppb. Examination of the spatial extent and magnitude of the CD-C Proposed Action Alternative and No Action Alternative contributions to DVFs within the study area shows that none of the exceedances of the 70 ppb NAAQS in the 2022 future year modeling have significant contributions from emissions from the CD-C Project.

Using the absolute modeling results, the CD-C Proposed Action Alternative emissions contributed 1.3 ppb or less (1.8% or less) to monitors in the study area with high modeled ozone (>70 ppb). The monitors with the largest contribution from CD-C Project Alternative emissions are those in closest proximity to the Project Area and most frequently downwind of it: Wamsutter, Atlantic Rim, Sun Dog and Spring Creek. In Sublette County, ozone impacts due to the CD-C Proposed Action Alternative are less than or equal to 0.04 ppb.

Table 4-17. Comparison of modeled concentrations within the 4 km grid in the 2022 future year simulation with ambient air quality standards. Red shading indicates that the ambient air quality standard was exceeded.

Pollutant/ Averaging Time	NAAQS	CAAQS	WAAQS	2022 CAMx All 4 km Grid Cells
CO ($\mu g\ m^{-3}$)				
1-hour	40,000	40,000	40,000	24,838
8-hour	10,000	10,000	10,000	18,949[1]
NO_2 ($\mu g\ m^{-3}$)				
1-hour	188	188	188	123.3
Annual	100	100	100	32.2

O_3 (ppb)				
8-hour	70	70	75	75-77[2]
PM_{10} (µg m^{-3})				
24-hour	150	150	150	458[3]
Annual	--	--	50	27.6
PM_{25} (µg m^{-3})				
24-hour	35	35	35	20.3
Annual	12	12	12	9.6
SO_2 (µg m^{-3})				
1-hour	196	196	196	230[4]
3-hour	1,300	700	1,300	216
24-hour	--	365	--	126
Annual	--	80	--	48.3

1. Exceedance is due to a wildfire, and is not related to CD-C Project emissions
2. For the ozone analysis, MATS results estimate 77 ppb and absolute model results predict 75 ppb.
75-77 ppb = 147-151 µg m^{-3} at 25°C. MATS value of 77 ppb occurs in the Boulder, WY area, and is not related to CD-C Project emissions
3. Exceedance is due to wildfire and is not related to CD-C Project emissions.
4. Exceedance region is highly localized and near major SO_2 point sources and distant from the CD-C Project area. CD-C Project emissions do not play any role in the SO_2 exceedance.

4.6 AIR QUALITY-RELATED VALUES

The results of the 2022 CAMx model simulations were evaluated to assess the AQ and AQRVs impacts of the peak year CD-C Project emissions and the cumulative impacts of the 2022 CD-C Proposed Action Alternative and No Action Alternative emissions each taken together with the impacts of all other 2022 regional emissions. In this Section, the CAMx-estimated AQRV impacts due to CD-C Project emissions sources at Class I and sensitive Class II areas and sensitive lakes are compared with visibility thresholds, deposition thresholds, and lake acid neutralizing capacity (ANC) thresholds.

The Class I areas and sensitive Class II areas analyzed are:

- Bridger Wilderness Area, Wyoming (Class I);
- Fitzpatrick Wilderness Area, Wyoming (Class I);
- Savage Run Wilderness Area, Wyoming (Federal Class II, Wyoming Class I)
- Mount Zirkel Wilderness Area, Colorado (Class I);
- Rawah Wilderness Area, Colorado (Class I);
- Rocky Mountain National Park, Colorado (Class I);
- Flat Tops Wilderness Area, Colorado (Class I);
- Eagles Nest Wilderness Area, Colorado (Class I);
- Popo Agie Wilderness Area , Wyoming (Class II);
- Gros Ventre Wilderness Area, Wyoming (Class II);
- Wind River Roadless Area, Wyoming (Class II); and
- Dinosaur National Monument, Colorado-Utah (Federal Class II, Colorado Class I (SO_2 only).

In addition, 19 lakes that are designated as acid sensitive and are located within the sensitive Class I and Class II Wilderness areas are assessed for potential changes in lake acid neutralizing capacity as a result of atmospheric acid deposition. These lakes are:

- Deep Lake in the Bridger Wilderness Area, Wyoming;
- Black Joe Lake in the Bridger Wilderness Area, Wyoming;
- Hobbs Lake in the Bridger Wilderness Area, Wyoming;
- Upper Frozen Lake in the Bridger Wilderness Area, Wyoming;
- Lazy Boy Lake in the Bridger Wilderness Area, Wyoming;
- Booth Lake in the Eagles Nest Wilderness Area, Colorado;
- Upper Willow Lake in the Eagles Nest Wilderness Area, Colorado;
- Ross Lake in the Fitzpatrick Wilderness Area, Wyoming;
- Ned Wilson Lake in the Flat Tops Wilderness Area, Colorado;
- Upper Ned Wilson Lake in the Flat Tops Wilderness Area, Colorado;
- Lower Packtrail Pothole in the Flat Tops Wilderness Area, Colorado;
- Upper Packtrail Pothole in the Flat Tops Wilderness Area, Colorado;

- Lower Saddlebag Lake in the Popo Agie Wilderness Area, Wyoming;
- Lake Elbert in the Mount Zirkel Wilderness Area, Colorado;
- Seven Lakes in the Mount Zirkel Wilderness Area, Colorado;
- Summit Lake in the Mount Zirkel Wilderness Area, Colorado;
- Kelly Lake in the Rawah Wilderness Area, Colorado;
- Island Lake in the Rawah Wilderness Area, Colorado; and
- Rawah Lake #4 in the Rawah Wilderness Area, Colorado.

The grid cells covering the Class I and sensitive Class II receptor areas are shown in Figure 4-47 below. In general, the maximum incremental concentration, deposition or visibility impact in any CAMx grid cell that intersects with the Class I or II receptor area of interest was used to represent the impact at that receptor area. The CAMx incremental concentration and deposition output was post-processed in order to:

- Analyze visibility impacts and compare against visibility thresholds.
- Determine total nitrogen and sulfur deposition impacts and compare to deposition analysis thresholds.
- Analyze changes in Acid Neutralizing Capacity (ANC) at sensitive lakes in the region.

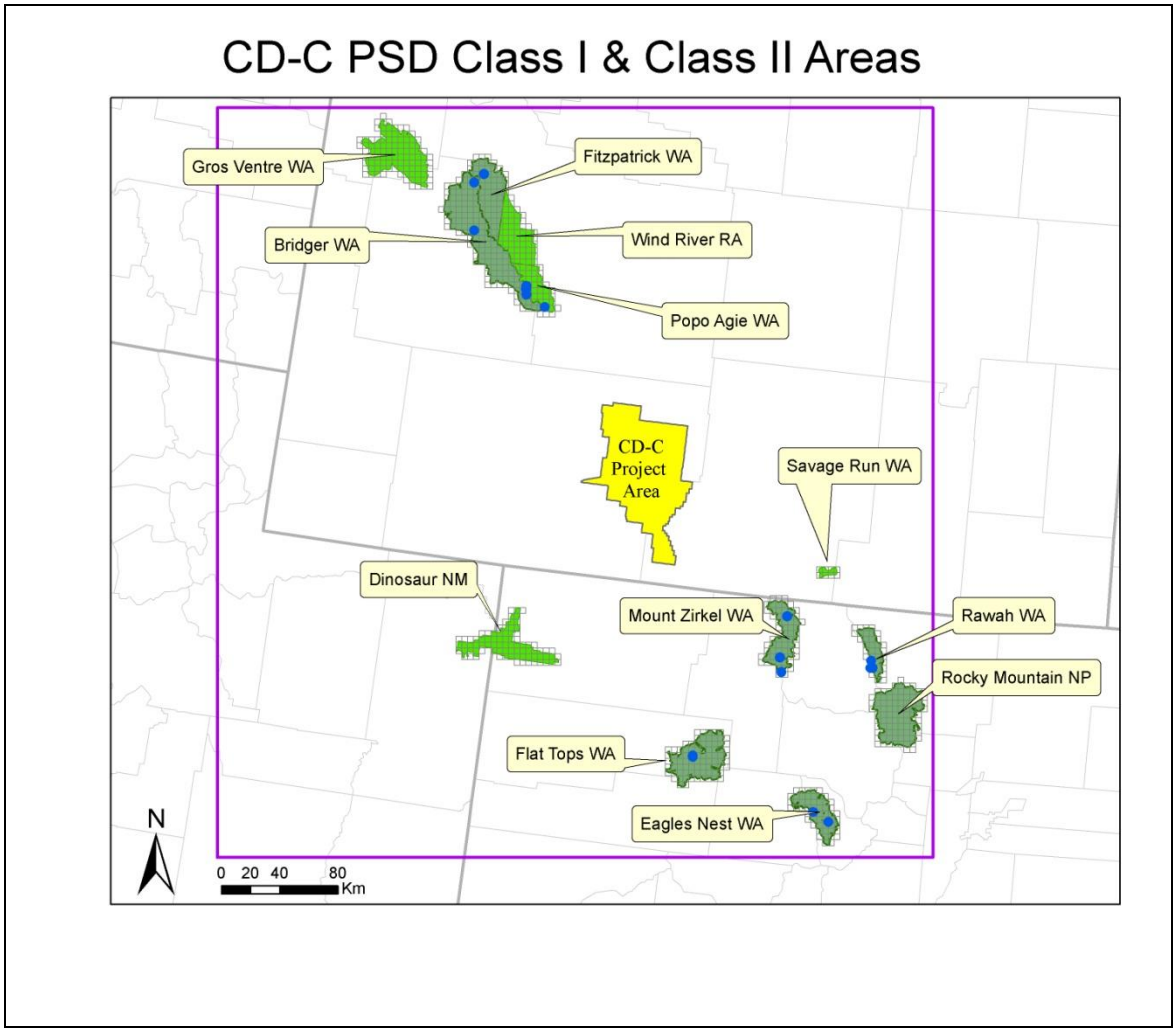

Figure 4-47. Locations of CAMx grid cells that contain Class I and sensitive Class II receptors. Blue circles indicate the locations of sensitive lakes. The purple box shows the extent of the 12 km grid cells extracted in order to perform the impact analysis for Class I/II areas outside the 4 km domain.

4.6.1 Visibility

4.6.1.1 Overview of Approach

Visibility impacts were calculated for CD-C Proposed Action Alternative emissions sources and for CD-C No Action Alternative emissions sources. The assessment of potential visibility impacts due to CD-C Project emission sources is based on the incremental concentrations as quantified by the CAMx PSAT tool. The changes in light extinction from CAMx PSAT incremental concentrations were calculated for each day and for all grid cells that intersect Class I and sensitive Class II areas within the 4 km modeling domain (Figure 4-43).

The visibility evaluation metric used in this analysis is the Haze Index which is measured in deciview (dv) units and is defined as follows:

$$HI = 10 \times \ln[b_{ext}/10]$$

b_{ext} is the atmospheric light extinction measured in inverse megameters (Mm^{-1}) and is calculated primarily from atmospheric concentrations of particulates. b_{ext} is related to the visual range (VR) measured in km, by the formula $VR = 3912 / b_{ext.}$ The Haze Index is the visibility metric that is used in the EPA's Regional Haze Rule, and is designed so that equal deciview changes correspond to approximately equal changes in perceived haze over the full range of visibility conditions, from pristine to highly impaired.

To evaluate increased haze due to a project's emissions compared to background conditions, incremental project concentrations are added to background concentrations in the extinction equation (b_{ext}) and the difference between the Haze Index with added project concentrations and the Haze Index based solely on background concentrations is calculated. The change in Haze Index is reported in "delta deciviews" (Δdv):

$$\Delta dv = 10 \times \ln[b_{ext(Project+background)}/10] - 10 \times \ln[b_{ext(background)}/10]$$

$$\Delta dv = 10 \times \ln[b_{ext(Project+background)}/b_{ext(background)}]$$

Here $b_{ext(project+background)}$ refers to atmospheric light extinction due to project plus background concentrations, and $b_{ext(background)}$ refers to atmospheric light extinction due to background concentrations only.

Estimated visibility degradation at the Class I and sensitive Class II areas is presented in terms of the number of days that exceed a threshold change in (Δdv), relative to background conditions. Although procedures and thresholds have not been established for sensitive Class II areas, BLM is including these areas in its visibility analysis. In the next section we describe the method for calculating the extinction, b_{ext}.

4.6.1.2 Revised IMPROVE Equation for Evaluating Light Extinction

The FLAG procedure for evaluating visibility impacts at Class I areas uses the revised IMPROVE reconstructed mass extinction equation to convert PM species in µg m^{-3} to light extinction (b_{ext}) in inverse megameters (Mm^{-1}) as follows:

$$b_{ext} = b_{SO4} + b_{NO3} + b_{EC} + b_{OCM} + b_{Soil} + b_{CM} + b_{SeaSalt} + b_{Rayleigh} + b_{NO2}$$

where

$$b_{SO4} = 2.2 \times f_S(RH) \times [\text{Small Sulfate}] + 4.8 \times f_L(RH) \times [\text{Large Sulfate}]$$

$$b_{NO3} = 2.4 \times f_S(RH) \times [\text{Small Nitrate}] + 5.1 \times f_L(RH) \times [\text{Large Nitrate}]$$

$$b_{OCM} = 2.8 \times [\text{Small Organic Mass}] + 6.1 \times [\text{Large Organic Mass}]$$

$$b_{EC} = 10 \times [\text{Elemental Carbon}]$$

$$b_{Soil} = 1 \times [\text{Fine Soil}]$$

$$b_{CM} = 0.6 \times [\text{Coarse Mass}]$$

$$b_{SeaSalt} = 1.7 \times f_{SS}(RH) \times [\text{Sea Salt}]$$

$$b_{Rayleigh} = \text{Rayleigh Scattering (Site-specific)}$$

$$b_{NO2} = 0.33 \times [NO_2\,(\text{ppb})] \; \{\text{or as: } 0.1755 \times [NO_2\,(\mu g/m_3)]\}$$

The f(RH) values are relative humidity adjustment factors that account for the fact that sulfate and nitrate aerosols are hygroscopic and are more effective at scattering radiation at higher relative humidities. FLAG (2010) recommends using monthly average f(RH) values rather than the hourly averages recommended in the previous FLAG (2000) guidance document in order to moderate the effects of extreme weather events on the visibility results.

The revised IMPROVE equation treats "large sulfate" and "small sulfate" separately because large and small aerosols affect an incoming beam of light differently. However, the IMPROVE measurements do not separately measure large and small sulfate; they measure only the total $PM_{2.5}$ sulfate. Similarly, CAMx reports a single concentration of particulate sulfate for each grid cell. Part of the definition of the new IMPROVE equation is a procedure for calculating the large and small sulfate contributions based on the magnitude of the sulfate concentrations; the procedure is documented in FLAG (2010). The sulfate concentration magnitude is used as a surrogate for distinguishing between large and small sulfate concentrations. For a given grid cell, the large and small sulfate contributions are calculated from the model output sulfate (which is the "Total Sulfate" referred to in the FLAG 2010 guidance) as:

For Total Sulfate < 20 µg/m3:

$$[\text{Large Sulfate}] = ([\text{Total Sulfate}] / 20\ \mu g/m3) \times [\text{Total Sulfate}]$$

For Total Sulfate ≥ 20 µg/m3:

[Large Sulfate] = [Total Sulfate]

For all values of Total Sulfate:

[Small Sulfate] = [Total Sulfate] – [Large Sulfate]

The procedure is identical for nitrate and organic mass.

Sulfate, nitrate and organic mass concentrations for a single oil and gas development project are expected to be relatively small (<< 20 µg/m3), so most of the mass for each species will be found in the small size regime.

4.6.1.3. CAMx Species Used in Visibility Analysis

Table 4-18 gives the species mapping between the species used in the CAMx APCA and PSAT ozone and PM source apportionment probing tools and those in the IMPROVE reconstructed mass extinction equation given above. The IMPROVE equation assumes that sufficient ammonium is present to completely neutralize sulfate and nitrate. This means that if a quantity of sulfate (SO_4) is present in a grid cell, we assume there is enough ammonium present to completely convert the sulfate to ammonium sulfate ($[NH_4]_2SO_4$) so that the visibility impairment due to ammonium is assigned to SO_4. The ratio of the molecular weights of SO_4 to $[NH_4]_2SO_4$ is 1.375, so the sulfate concentration output of CAMx must be scaled by 1.375 to produce the sulfate input to the IMPROVE equation in the visibility impact assessment. A similar procedure is performed for nitrate, in which it is assumed that sufficient ammonium is present to fully convert NO_3 to ammonium nitrate (NH_4NO_3). The CAMx nitrate (NO_3) concentration is scaled by the factor 1.290 prior to use in the IMPROVE equation to account for this neutralization. The assumption that there is sufficient ammonium to neutralize both sulfate and nitrate is conservative (i.e. overestimates actual impacts). Although CAMx explicitly models ammonium (NH_4), the CAMx estimated NH_4 concentration is not considered in the visibility impact analysis because of the large uncertainty in the modeled ammonium estimates. Ammonia emissions are highly uncertain and have a large impact on the NO_3 equilibrium. There may also be additional crustal basic compound available to form particulate NO_3 that are not fully accounted for in the modeling (e.g., sodium).

The NO_2 concentration is approximated by using the CAMx NO_X species in the ozone source apportionment APCA tool. This is a conservative assumption equivalent to saying that all NO_X is composed entirely of NO_2 for the purposes of the visibility calculation. Although sodium and particulate chloride are treated in the CAMx core model, these species are not carried in the CAMx PSAT tool; neglecting sea salt in the visibility calculations in the 4 km domain does not compromise the accuracy of the analysis as IMPROVE measurements show that sea salt concentrations are extremely small in this inland area and there would be no sea salt associated with the CD-C Project emissions.

Table 4-18. Mappings of species from the CAMx source apportionment to the IMPROVE visibility equation.

IMPROVE Component	Name	CAMx Species
$[SO_4]$ (as $[NH_4]_2SO_4$)	Sulfate (as $[NH_4]_2SO_4$)	PS4*1.375
$[NO_3]$ (as NH_4NO_3)	Nitrate (as NH_4NO_3)	PN3*1.290
[EC]	Elemental Carbon	PEC
[OCM]	Organic Mass	POA
[Soil]	Fine Soil	PFC+PFN
[CM]	Coarse Mass	PCC+PCS
$[NO_2]$	Nitrogen Dioxide	NOX
Sea Salt	Sea Salt	None

4.6.1.4. CD-C Project-Specific Visibility Impact Analysis

Incremental daily average modeled concentrations due to CD-C Proposed Action Alternative emissions sources and CD-C No Action Alternative emissions sources on all grid cells covering the Class I and sensitive Class II areas were processed using the revised IMPROVE reconstructed mass extinction equation and the Haze index equation to estimate visibility impacts at each Class I and sensitive Class II area.

The methodology follows recommendations in the Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report – Revised 2010, hereafter referred to as FLAG 2010. Incremental changes in Haze Index (Δdv) are compared to 0.5 dv and 1.0 dv thresholds. A 1.0 dv change in Haze Index corresponds to a change in visibility impairment that is just perceptible to the human eye (Pitchford and Malm, 1994).

FLAG 2010 Screening Method for Visibility Impact Analysis

The FLAG Screening Method uses the revised IMPROVE equation together with annual average natural conditions (Table 6; FLAG, 2010) and monthly relative humidity factors for each Class I area (Tables 7-9; FLAG, 2010). The FLAG 2010 approach for visibility is summarized in Table 4-19. The Δdv was calculated for each grid cell that overlaps a Class I/II area and for each day of each annual CAMx run and the highest Δdv across all grid cells overlapping a Class I/II area was selected to represent the daily value at that area. The number of days in each annual run for CD-C Project emissions sources with Δdv values greater than 0.5 dv and 1.0 dv, and the maximum and 98th percentile (8th highest day) Δdv values are reported.

Table 4-19. Summary of FLAG (2010) method for assessing project-specific visibility impacts.

Method	Background Data	Relative Humidity Factor f(RH)	Calculation Method for bext	Delta Deciview Calculation
FLAG 2010	Annual Average	Monthly	Revised IMPROVE Equation	$\Delta dv = 10 x \ln[b_{ext(project+background)}/b_{ext(background)}]$

Results of Project-Specific Visibility Impact Analysis

The tables in this section summarize Project-specific visibility impacts at Class I and sensitive Class II areas within the 4 km domain using 2005 and 2006 meteorology and 2022 Project emissions. For each of the meteorological years, and both the Proposed Action Alternative and the No Action Alternative, two tables are presented, with the 5 left-most columns in the two tables being identical. The remaining columns differ in the presentation of the components of the extinction; these data are located under the green bar. f(RH) and extinction components shown in Tables 4-20, 4-22, 4-24 and 4-28 refer to the 98th percentile (8th high) value of b_{ext}, while those in Tables 4-21, 4-23, 4-25, and 4-27 refer to the maximum (highest) value of b_{ext}.

F(RH)_l is the relative humidity factor for large particles and f(RH)_s is the relative humidity for small particles. These factors vary by month and by Class I and sensitive Class II area. b_src refers to the calculated light extinction attributable to the CD-C Project emissions. Back_bext refers to the background extinction at the Class I or sensitive Class II area on that particular day. b_so4 and b_no3 are the components of the CD-C Project light extinction attributable to ammonium sulfate, and ammonium nitrate, respectively. b_other is the CD-C Project light extinction attributable to all the other contributing species combined, except the Rayleigh scattering term. b_so4, b_no3 and b_other add up to b_src, although small discrepancies can occur due to numerical rounding.

Tables 4-20 and 4-21 summarize the results of the Proposed Action Alternative using 2005 meteorology. Mount Zirkel WA, Savage Run WA and Dinosaur NM are the only areas with visibility impacts due to the CD-C Proposed Action Alternative emissions sources that are >0.5 dv. There are a total of 7 days with visibility impacts >0.5 dv at these areas. There are no days with visibility impacts >1.0 dv due to the CD-C Proposed Action Alternative emissions sources at any Class I or sensitive Class II area. The largest visibility impacts occurred on winter days. Inspection of the components of the extinction shows that nitrate extinction was larger than that of sulfate for all areas. This is reasonable considering that CD-C Project NO_X emissions are much larger than CD-C Project SO_2 emissions, due to the fact that the reservoirs to be accessed do not contain sour gas.

Table 4-20. 2022met05 CD-C Proposed Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the 98th percentile b_{ext}.

CDC Proposed Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv percentile	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to 98th percentile delta dv							
Bridger WA	0	0	0.160	0.024	1/4/2005	2.220	2.780	0.033	13.969	0.001	0.027	0.005
Fitzpatrick WA	0	0	0.146	0.015	5/15/2005	1.940	2.440	0.020	13.787	0.003	0.006	0.011
Mount Zirkel	0	1	0.632	0.190	3/21/2005	1.890	2.310	0.252	13.173	0.016	0.150	0.086
Rawah WA	0	0	0.222	0.108	2/27/2005	1.960	2.390	0.143	13.213	0.006	0.121	0.016
Dinosaur NM	0	5	0.675	0.325	2/23/2005	1.990	2.440	0.438	13.238	0.042	0.237	0.158
Popo Agie WA	0	0	0.174	0.022	5/15/2005	1.950	2.450	0.030	13.792	0.004	0.015	0.012
Savage Run WA	0	1	0.576	0.196	2/15/2005	1.990	2.440	0.262	13.238	0.012	0.185	0.065
Wind River RA	0	0	0.136	0.019	5/14/2005	1.950	2.450	0.027	13.792	0.002	0.019	0.006
Rocky Mountain	0	0	0.152	0.046	2/6/2005	1.850	2.240	0.067	14.310	0.001	0.060	0.005
Eagles Nest WA	0	0	0.204	0.047	11/27/2005	1.960	2.420	0.061	12.920	0.003	0.042	0.017
Flat Tops WA	0	0	0.181	0.091	10/23/2005	1.720	2.060	0.116	12.730	0.005	0.093	0.018
Gros Ventre WA	0	0	0.216	0.017	4/24/2005	1.950	2.430	0.023	13.783	0.001	0.018	0.004

Table 4-21. 2022met05 CD-C Proposed Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the maximum value of b_{ext}.

CDC Proposed Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv tile Ddv	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to Maximum delta dv							
Bridger WA	0	0	0.160	0.024	2/7/2005	2.100	2.600	0.223	13.875	0.008	0.181	0.034
Fitzpatrick WA	0	0	0.146	0.015	12/18/2005	2.160	2.680	0.205	13.918	0.003	0.193	0.009
Mount Zirkel WA	0	1	0.632	0.190	11/19/2005	1.970	2.410	0.863	13.223	0.019	0.757	0.087
Rawah WA	0	0	0.222	0.108	11/20/2005	1.940	2.370	0.296	13.203	0.004	0.271	0.021
Dinosaur NM	0	5	0.675	0.325	12/18/2005	1.950	2.370	0.921	13.203	0.037	0.722	0.162
Popo Agie WA	0	0	0.174	0.022	2/7/2005	2.100	2.600	0.244	13.875	0.009	0.198	0.037
Savage Run WA	0	1	0.576	0.196	2/8/2005	1.990	2.440	0.785	13.238	0.033	0.604	0.148
Wind River RA	0	0	0.136	0.019	12/18/2005	2.160	2.680	0.190	13.918	0.002	0.180	0.008
Rocky Mountain	0	0	0.152	0.046	11/20/2005	1.840	2.230	0.219	14.310	0.003	0.202	0.014
Eagles Nest WA	0	0	0.204	0.047	11/20/2005	1.960	2.420	0.266	12.920	0.004	0.245	0.018
Flat Tops WA	0	0	0.181	0.091	11/19/2005	1.970	2.420	0.237	12.920	0.005	0.211	0.021
Gros Ventre WA	0	0	0.216	0.017	12/18/2005	2.160	2.680	0.304	13.918	0.004	0.285	0.014

Tables 4-22 and 4-23 show the Proposed Action Alternative visibility impacts for the 2022met06 simulation. There are fewer days exceeding the 0.5 dv threshold than in the 2022met05 scenario; there is only one day (at Dinosaur NM) with impacts >0.5 dv. There are no days with impacts >1.0 dv. As for the 2022met05 scenario, nitrate impacts are larger than sulfate impacts.

Table 4-22. 2022met06 CD-C Proposed Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the 98th percentile b_{ext}.

CDC Proposed Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv percentile	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to 98th percentile delta dv							
Bridger WA	0	0	0.187	0.024	3/12/2006	2.040	2.550	0.034	13.847	0.002	0.023	0.008
Fitzpatrick WA	0	0	0.107	0.027	3/19/2006	2.040	2.540	0.037	13.842	0.001	0.033	0.003
Mount Zirkel	0	0	0.408	0.224	11/1/2006	1.970	2.410	0.299	13.223	0.012	0.222	0.065
Rawah WA	0	0	0.174	0.085	1/12/2006	1.910	2.310	0.112	13.173	0.005	0.080	0.027
Dinosaur NM	0	1	0.812	0.230	2/19/2006	1.990	2.440	0.307	13.238	0.011	0.258	0.038
Popo Agie WA	0	0	0.210	0.025	3/12/2006	2.040	2.550	0.034	13.847	0.002	0.025	0.007
Savage Run WA	0	0	0.266	0.190	12/23/2006	1.950	2.370	0.253	13.203	0.011	0.192	0.051
Wind River RA	0	0	0.095	0.036	3/3/2006	2.040	2.550	0.050	13.847	0.001	0.047	0.002
Rocky Mountain	0	0	0.091	0.059	12/25/2006	1.760	2.080	0.084	14.230	0.002	0.071	0.011
Eagles Nest WA	0	0	0.138	0.057	12/25/2006	1.970	2.420	0.074	12.920	0.002	0.061	0.011
Flat Tops WA	0	0	0.279	0.127	12/21/2006	2.030	2.510	0.165	12.960	0.012	0.108	0.045
Gros Ventre WA	0	0	0.112	0.026	4/8/2006	1.950	2.430	0.036	13.783	0.002	0.026	0.008

Table 4-23. 2022met06 CD-C Proposed Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the maximum value of b_{ext}.

CDC Proposed Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv tile Ddv	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to Maximum delta dv							
Bridger WA	0	0	0.187	0.024	3/21/2006	2.040	2.550	0.262	13.847	0.012	0.195	0.055
Fitzpatrick WA	0	0	0.107	0.027	3/18/2006	2.040	2.540	0.149	13.842	0.005	0.127	0.017
Mount Zirkel WA	0	0	0.408	0.224	2/16/2006	1.990	2.440	0.551	13.238	0.019	0.420	0.112
Rawah WA	0	0	0.174	0.085	2/16/2006	1.960	2.390	0.232	13.213	0.008	0.186	0.038
Dinosaur NM	0	1	0.812	0.230	2/18/2006	1.990	2.440	1.120	13.238	0.043	0.877	0.201
Popo Agie WA	0	0	0.210	0.025	3/21/2006	2.040	2.550	0.294	13.847	0.013	0.224	0.057
Savage Run WA	0	0	0.266	0.190	2/3/2006	1.990	2.440	0.357	13.238	0.017	0.255	0.084
Wind River RA	0	0	0.095	0.036	3/11/2006	2.040	2.550	0.132	13.847	0.007	0.097	0.028
Rocky Mountain	0	0	0.091	0.059	1/16/2006	1.770	2.090	0.130	14.240	0.005	0.093	0.031
Eagles Nest WA	0	0	0.138	0.057	11/29/2006	1.960	2.420	0.180	12.920	0.005	0.153	0.021
Flat Tops WA	0	0	0.279	0.127	11/29/2006	1.970	2.420	0.365	12.920	0.015	0.267	0.084
Gros Ventre WA	0	0	0.112	0.026	2/18/2006	2.100	2.600	0.156	13.875	0.003	0.146	0.007

Tables 4-24 through 4-27 show the visibility impacts for 2005 and 2006 meteorology and 2022 CD-C No Action Alternative emissions source. There are no days with impacts over 0.5 dv at any of the Class I or sensitive Class II areas, for either meteorological year. As for the Proposed Action Alternative emissions sources, the largest impacts occur on winter days, nitrate extinction is larger than that of sulfate for all Class I/sensitive Class II Areas, and impacts are highest at Dinosaur NM.

Table 4-24. 2022met05 CD-C No Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the 98th percentile b_{ext}.

CDC No Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv percentile	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to 98th percentile delta dv							
Bridger WA	0	0	0.073	0.011	1/4/2005	2.220	2.780	0.015	13.969	0.001	0.012	0.002
Fitzpatrick WA	0	0	0.067	0.007	5/15/2005	1.940	2.440	0.009	13.787	0.002	0.003	0.005
Mount Zirkel	0	0	0.291	0.087	3/21/2005	1.890	2.310	0.114	13.173	0.007	0.068	0.039
Rawah WA	0	0	0.101	0.049	2/27/2005	1.960	2.390	0.065	13.213	0.003	0.055	0.007
Dinosaur NM	0	0	0.311	0.149	2/23/2005	1.990	2.440	0.199	13.238	0.019	0.108	0.072
Popo Agie WA	0	0	0.079	0.010	5/15/2005	1.950	2.450	0.014	13.792	0.002	0.007	0.005
Savage Run WA	0	0	0.265	0.090	2/15/2005	1.990	2.440	0.119	13.238	0.005	0.084	0.030
Wind River RA	0	0	0.062	0.009	5/14/2005	1.950	2.450	0.012	13.792	0.001	0.008	0.003
Rocky Mountain	0	0	0.069	0.021	2/6/2005	1.850	2.240	0.030	14.310	0.001	0.027	0.002
Eagles Nest WA	0	0	0.093	0.022	11/27/2005	1.960	2.420	0.028	12.920	0.001	0.019	0.008
Flat Tops WA	0	0	0.083	0.041	10/23/2005	1.720	2.060	0.053	12.730	0.002	0.042	0.008
Gros Ventre WA	0	0	0.099	0.008	4/24/2005	1.950	2.430	0.011	13.783	0.001	0.008	0.002

Table 4-25. 2022met05 CD-C No Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the maximum value of b_{ext}.

CDC No Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv percentile	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to Maximum delta dv							
Bridger WA	0	0	0.073	0.011	2/7/2005	2.100	2.600	0.101	13.875	0.004	0.082	0.015
Fitzpatrick WA	0	0	0.067	0.007	12/18/2005	2.160	2.680	0.093	13.918	0.001	0.088	0.004
Mount Zirkel	0	0	0.291	0.087	11/19/2005	1.970	2.410	0.391	13.223	0.009	0.343	0.039
Rawah WA	0	0	0.101	0.049	11/20/2005	1.940	2.370	0.134	13.203	0.002	0.123	0.009
Dinosaur NM	0	0	0.311	0.149	12/18/2005	1.950	2.370	0.418	13.203	0.017	0.327	0.074
Popo Agie WA	0	0	0.079	0.010	2/7/2005	2.100	2.600	0.111	13.875	0.004	0.090	0.017
Savage Run WA	0	0	0.265	0.090	2/8/2005	1.990	2.440	0.356	13.238	0.015	0.274	0.067
Wind River RA	0	0	0.062	0.009	12/18/2005	2.160	2.680	0.086	13.918	0.001	0.082	0.003
Rocky Mountain	0	0	0.069	0.021	11/20/2005	1.840	2.230	0.099	14.310	0.001	0.092	0.006
Eagles Nest WA	0	0	0.093	0.022	11/20/2005	1.960	2.420	0.121	12.920	0.002	0.111	0.008
Flat Tops WA	0	0	0.083	0.041	11/19/2005	1.970	2.420	0.107	12.920	0.002	0.096	0.010
Gros Ventre WA	0	0	0.099	0.008	12/18/2005	2.160	2.680	0.138	13.918	0.002	0.130	0.007

Table 4-26. 2022met06 CD-C No Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the 98th percentile b_{ext}.

CDC No Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv percentile	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to 98th percentile delta dv							
Bridger WA	0	0	0.086	0.011	3/12/2006	2.040	2.550	0.015	13.847	0.001	0.011	0.004
Fitzpatrick WA	0	0	0.049	0.012	3/19/2006	2.040	2.540	0.017	13.842	0.001	0.015	0.001
Mount Zirkel	0	0	0.187	0.102	11/1/2006	1.970	2.410	0.136	13.223	0.005	0.101	0.030
Rawah WA	0	0	0.080	0.039	1/12/2006	1.910	2.310	0.051	13.173	0.002	0.036	0.012
Dinosaur NM	0	0	0.376	0.105	2/19/2006	1.990	2.440	0.140	13.238	0.005	0.117	0.017
Popo Agie WA	0	0	0.096	0.011	3/12/2006	2.040	2.550	0.016	13.847	0.001	0.011	0.003
Savage Run WA	0	0	0.122	0.087	12/23/2006	1.950	2.370	0.115	13.203	0.005	0.087	0.023
Wind River RA	0	0	0.043	0.016	3/3/2006	2.040	2.550	0.023	13.847	0.000	0.021	0.001
Rocky Mountain	0	0	0.041	0.027	12/25/2006	1.760	2.080	0.038	14.230	0.001	0.032	0.005
Eagles Nest WA	0	0	0.063	0.026	12/25/2006	1.970	2.420	0.034	12.920	0.001	0.028	0.005
Flat Tops WA	0	0	0.128	0.058	12/21/2006	2.030	2.510	0.075	12.960	0.005	0.049	0.021
Gros Ventre WA	0	0	0.051	0.012	4/8/2006	1.950	2.430	0.016	13.783	0.001	0.012	0.004

Table 4-27. 2022met06 CD-C No Action visibility impacts using FLAG (2010) screening method. Data reported under green bar refer to the maximum value of b_{ext}.

CDC No Action Alternative												
Class I or Class II Area	#days > 1.0	#days > 0.5	Max Δdv	98th Δdv percentile	day	frh_l	frh_s	b_src	back_bext	b_so4	b_no3	b_other
					Refers to Maximum delta dv							
Bridger WA	0	0	0.086	0.011	3/21/2006	2.040	2.550	0.119	13.847	0.006	0.089	0.025
Fitzpatrick WA	0	0	0.049	0.012	3/18/2006	2.040	2.540	0.068	13.842	0.002	0.058	0.007
Mount Zirkel	0	0	0.187	0.102	2/16/2006	1.990	2.440	0.250	13.238	0.009	0.190	0.051
Rawah WA	0	0	0.080	0.039	2/16/2006	1.960	2.390	0.106	13.213	0.003	0.085	0.017
Dinosaur NM	0	0	0.376	0.105	2/18/2006	1.990	2.440	0.507	13.238	0.019	0.397	0.091
Popo Agie WA	0	0	0.096	0.011	3/21/2006	2.040	2.550	0.134	13.847	0.006	0.102	0.026
Savage Run WA	0	0	0.122	0.087	2/3/2006	1.990	2.440	0.162	13.238	0.008	0.116	0.038
Wind River RA	0	0	0.043	0.016	3/11/2006	2.040	2.550	0.060	13.847	0.003	0.044	0.013
Rocky Mountain	0	0	0.041	0.027	1/16/2006	1.770	2.090	0.059	14.240	0.002	0.042	0.014
Eagles Nest WA	0	0	0.063	0.026	11/29/2006	1.960	2.420	0.082	12.920	0.002	0.070	0.010
Flat Tops WA	0	0	0.128	0.058	11/29/2006	1.970	2.420	0.166	12.920	0.007	0.121	0.038
Gros Ventre WA	0	0	0.051	0.012	2/18/2006	2.100	2.600	0.071	13.875	0.001	0.066	0.003

Summary of CD-C Project-Specific Visibility Impacts

The largest visibility impacts due to the Proposed Action are at Dinosaur NM, Mount Zirkel WA and Savage Run WA. The areas with impacts over the 0.5 dv threshold are:

- Mount Zirkel: 1 day > 0.5 dv during the two year simulation period, no days > 1.0 dv
- Dinosaur: 6 days > 0.5 dv during the two year simulation period, no days > 1.0 dv
- Savage Run: 1 day > 0.5 dv during the two year simulation period, no days > 1.0 dv

No other Class I or sensitive Class II area has any day with visibility impacts >0.5 dv due to the CD-C Proposed Action emissions. The No Action Alternative emissions scenario had no days >0.5 dv for any Class I or sensitive Class II area.

4.6.1.5. Cumulative Visibility Impact Analysis

In order to assess cumulative impacts as required under NEPA for the CD-C Project, a visibility analysis was performed that considers the impacts of CD-C Project emissions sources taken together with impacts of all other sources in the region. In the past, such EIS visibility impacts were estimated using the CALPUFF Lagrangian puff model. To determine the Project-specific visibility impacts, CALPUFF was run using only the EIS Project-specific emissions. Daily visibility impacts were estimated at Class I/II areas using the IMPROVE equation, and the number of days that exceeded the 0.5 and 1.0 deciview (dv) thresholds were reported. Cumulative visibility impacts were defined to be those of the Project taken together with those of other sources in its vicinity. To determine other sources for inclusion in the cumulative modeling, industrial sources and oil and gas wells permitted within a defined time frame through state air quality regulatory agencies and state oil and gas permitting agencies were researched. The subset of these sources which had begun operation as of a defined inventory end-date were classified as state-permitted sources, and those not yet in operation were classified as Reasonably Foreseeable Future Actions (RFFA). The undeveloped portions of projects proposed under NEPA were classified as Reasonably Foreseeable Development (RFD). These three categories (state-permitted, RFFA and RFD) of emissions sources comprised the cumulative source inventory.

These analyses were undertaken because it is possible that there could be a number of proposed developments occurring in a region; while each development may have a relatively small impact, the visibility impacts from all developments taken together may be significant. To estimate cumulative visibility impacts, CALPUFF was run with emissions for the EIS Project as well as RFD, RFFA, and recent state-permitted sources and the resultant visibility impacts were compared against the 0.5 and 1.0 dv thresholds for the cumulative visibility analysis.

For the CD-C EIS, the CAMx photochemical grid model (PGM) is being used to estimate ozone, far-field air quality and AQRVs (i.e., visibility and deposition). Unlike CALPUFF, PGMs simulate the effects of all emission sources in the region as well as sources outside of the study region through boundary conditions. The availability of PGM modeling results for all sources means that a different approach to cumulative visibility analysis may be used. This approach was developed by the United States Department of the Interior (USDI) Fish and Wildlife Service (FWS) and National Park Service (NPS) and is documented in a letter sent on February 10, 2012 to the Wyoming Department of Environmental Quality – Air Quality Division (FWS and NPS,

2012). The approach follows the approach used in the EPA Regional Haze Rule. In the section below, we provide a brief description of the method, and present the results of its application to the CD-C modeling.

Regional Haze Rule Metric Approach

The approach used for the cumulative visibility assessment is derived from the Regional Haze Rule (RHR) method. The RHR goal is to achieve natural visibility conditions at Class I areas by 2064 and the demonstration of progress toward this goal uses two metrics:

- Improvement in visibility for the 20% worst visibility days
- No worsening in visibility for the 20% best visibility days

The first RHR State Implementation Plan (SIP), which was due to EPA in 2007, demonstrates progress toward natural conditions in 2064 at Class I areas through the achievement of reasonable progress toward that goal by 2018. To demonstrate reasonable progress for the first RHR metric, a visibility Glide Path is constructed for the 20% worst visibility days in dv from the 2000-2004 observed 20% worst baseline conditions to 20% worst natural conditions in 2064; the value where that Glide Path crosses 2018 is called the uniform rate of progress. The second RHR goal is demonstrated by showing that 2018 visibility for the best 20% days is no worse than the 2000-2004 baseline visibility for the best 20% days.

The RHR SIPs used PGM modeling for a 2002 calendar year and performed a 2002 base case simulation and model performance evaluation. Emissions were then projected to 2018 and the PGM was exercised for the 2018 base case. The PGM 2002 and 2018 modeling results were used to project the observed 20% worst and 20% best days from the 2000-2004 baseline to 2018 following EPA's procedures[10] and the resulting projected 2018 visibility at Class I areas was compared to the 2018 reasonable progress goals.

The RHR method uses the peer-reviewed EPA MATS tool that is designed to reduce the effects of model bias in projecting future year visibility impacts. This is because the model results are used in a relative sense, so that the projected visibility impacts are rooted in observations and calculated based on model changes between base and future years rather than on the absolute modeled concentrations.

Below, we present cumulative visibility impacts using the two RHR visibility metrics - the 20% best and 20% worst days. MATS was used with the CD-C 2008 and 2022 CAMx modeling results to project the observed visibility for the 20% worst and 20% best days for the baseline years with and without the contributions of CD-C Project emissions. Note that this type of analysis cannot conflict with any state's RHR SIP 2018 reasonable progress goal; this analysis is completely separate from and is not directly comparable to the states' RHR SIP reasonable progress visibility projections for the following reasons:

- The RHR SIP used projections to the 2018 year versus 2022 for the CD-C EIS.

[10] http://www.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf

- The RHR SIP started with a 2000-2004 observed visibility baseline versus a 2006-2010 observed visibility baseline for the CD-C EIS.
- The RHR SIP uses a 2018 emission projection for estimated actual emissions, whereas the CD-C EIS has future year state-permitted and RFD maximum project development emissions so will overstate the 2022 future year actual emissions.

For these reasons, the CD-C 2022 visibility projections are not comparable to any state's RHR SIP 2018 visibility projections.

The CAMx 2008 and 2022 model outputs were used to project the observed visibility conditions at IMPROVE sites within the 4 km domain from the baseline period (2006-2010) to 2022 for the worst 20% and best 20% days. 2022 visibility projections for the worst 20% and best 20% days were also made without the CD-C Project emissions and without the combined effects of the CD-C Project emissions and RFD sources. This allows an assessment of the effects of emissions from the CD-C Project emissions and the combined CD-C Project emission plus RFD emissions on the RHR visibility metrics.

To carry out the projections, EPA's Modeled Attainment Test Software (MATS) was run in the following configuration:

- Revised IMPROVE Equation
- Use model grid cells at IMPROVE Class I/II area centroid
- 7 x 7 grid cells for 4 km resolution
- Start monitor year = 2006
- End model year = 2010
- Base Year = 2008
- Minimum years required for valid monitor = 3

Results of the cumulative visibility assessment are shown in Tables 4-28 through 4-31. The third column from the left in these tables reports the MATS-projected visibility for the 2022 future year, including the effects of all regional emissions as well as transport (through boundary conditions) and assuming development of the Proposed Action Alternative. The next column to the right reports the MATS-projected visibility for the 2022 future year, accounting for the effects of all regional and transport and assuming the CD-C Project Area development is restricted to the No Action Alternative. The next column to the right reports the MATS-projected visibility for the 2022 future year, based on the same emissions as the other projections except that the impacts of the Proposed Action Alternative emissions and the RFD emissions are excluded. This MATs run is performed so that the results can be compared to the results including the Proposed Action Alternative emissions and RFD emissions to assess the contribution to haze from these two sources combined.

Differences between the CD-C Proposed Action Alternative cumulative 2022 visibility and the CD-C No Action Alternative cumulative 2022 visibility (column 6) are often too small to be accurately assessed with this method due to the precision available within MATS. MATS reports projected future year haze in deciviews to two decimal places. Since the Proposed Action

Alternative emissions sources and No Action Alternative emissions sources contribute only a small fraction to the total regional emissions and a correspondingly small fraction to the total atmospheric particulate concentrations, the MATS-projected future year visibility for those two Alternatives reported at 2 decimal places is almost identical at most Class I areas. Note that differences of up to 0.1 dv could potentially be numerical rounding artifacts and not represent actual 0.1 dv differences.

The results indicate that visibility improves in 2022 relative to the baseline years, since the 2022 cumulative haze index (in dv) is lower than the 2006 - 2010 baseline years haze index, for both the Proposed Action Alternative and No Action Alternative, for each meteorological year and for the best 20% days and the worst 20% days. Therefore, both RHR metrics are satisfied. The difference between Proposed Action Alternative cumulative 2022 visibility and No Action Alternative cumulative 2022 visibility is ≤ 0.1 dv at all Class I/II areas for each meteorological year and for both 20% best and 20% worst days, except for Dinosaur NM, where the Proposed Action Alternative cumulative 2022 visibility ranges from 0.1 – 0.2 dv higher than the No Action Alternative cumulative 2022 visibility.

The Proposed Action Alternative plus RFD contributions to 2022 haze (rightmost column in Tables 4-28 through 4-31) on the 20% best days and 20% worst days in the Class I/II areas range from 0.01 to 0.18 dv. The areas that are most affected are Popo Agie WA, Savage Run WA, Flat Tops WA and Rocky Mountain NP, each with at least one exceedance of 0.15 dv.

Table 4-28. Best 20% days for CD-C Proposed Action Alternative, No Action Alternative, and No Proposed Action nor RFD sources. Proposed Action Alternative plus RFD impacts (rightmost column). Using 2005 meteorology.

Best 20% Days - 2005 Meteorology						
Class I or Class II Area	**Baseline Visibility (2006-2010) (dv)**	**Proposed Action Alternative (Cumulative 2022 Visibility) (dv)**	**No Action Alternative (Cumulative 2022 Visibility) (dv)**	**No Proposed Action and No RFD Sources (Cumulative 2022 Visibility) (dv)**	**Difference Between Proposed Action Alternative and No Action Alternative (dv)**	**Difference Between Proposed Action Alternative and No Proposed Action and No RFD Sources (dv)**
Bridger WA	**1.39**	1.17	1.17	1.14	0.00	0.03
Fitzpatrick WA	**1.39**	1.19	1.19	1.16	0.00	0.03
Mount Zirkel WA	**0.95**	0.74	0.74	0.66	0.00	0.08
Rawah WA	**0.95**	0.67	0.67	0.58	0.00	0.09
Dinosaur NM	**0.95**	0.82	0.81	0.76	0.01	0.06
Popo Agie WA	**1.39**	1.28	1.28	1.15	0.00	0.13
Savage Run WA	**0.95**	0.62	0.61	0.49	0.01	0.13
Wind River RA	**1.39**	1.17	1.17	1.13	0.00	0.04
Rocky Mountain NP	**1.91**	1.77	1.77	1.61	0.00	0.16
Eagles Nest WA	**0.69**	0.48	0.48	0.47	0.00	0.01
Flat Tops WA	**0.69**	0.41	0.41	0.30	0.00	0.11
Gros Ventre WA	**1.39**	1.18	1.18	1.16	0.00	0.02

Table 4-29. Worst 20% days for CD-C Proposed Action Alternative, No Action Alternative, and No Proposed Action nor RFD sources. Proposed Action Alternative plus RFD impacts (rightmost column). Using 2005 meteorology.

Worst 20% Days - 2005 Meteorology						
Class I or Class II Area	Baseline Visibility (2006-2010) (dv)	Proposed Action Alternative (Cumulative 2022 Visibility) (dv)	No Action Alternative (Cumulative 2022 Visibility) (dv)	No Proposed Action and No RFD Sources (Cumulative 2022 Visibility) (dv)	Difference Between Proposed Action Alternative and No Action Alternative (dv)	Difference Between Proposed Action Alternative and No Proposed Action and No RFD Sources (dv)
Bridger WA	**10.58**	10.28	10.28	10.23	0.00	0.05
Fitzpatrick WA	**10.58**	10.27	10.27	10.24	0.00	0.03
Mount Zirkel WA	**9.36**	9.09	9.09	9.01	0.00	0.08
Rawah WA	**9.36**	9.05	9.05	8.95	0.00	0.10
Dinosaur NM	**9.36**	9.09	9.07	9.02	0.02	0.07
Popo Agie WA	**10.58**	10.45	10.45	10.29	0.00	0.16
Savage Run WA	**9.36**	8.97	8.97	8.83	0.00	0.14
Wind River RA	**10.58**	10.26	10.26	10.21	0.00	0.05
Rocky Mountain NP	**12.04**	11.89	11.89	11.73	0.00	0.16
Eagles Nest WA	**8.68**	8.34	8.33	8.32	0.01	0.02
Flat Tops WA	**8.68**	8.48	8.48	8.33	0.00	0.15
Gros Ventre WA	**10.58**	10.31	10.31	10.29	0.00	0.02

Table 4-30. Best 20% days for CD-C Proposed Action Alternative, No Action Alternative, and No Proposed Action nor RFD sources. Proposed Action Alternative plus RFD impacts (rightmost column). Using 2006 meteorology.

Best 20% Days - 2006 Meteorology						
Class I or Class II Area	Baseline Visibility (2006-2010) (dv)	Proposed Action Alternative (Cumulative 2022 Visibility) (dv)	No Action Alternative (Cumulative 2022 Visibility) (dv)	No Proposed Action and No RFD Sources (Cumulative 2022 Visibility) (dv)	Difference Between Proposed Action Alternative and No Action Alternative (dv)	Difference Between Proposed Action Alternative and No Proposed Action and No RFD Sources (dv)
Bridger WA	**1.39**	1.22	1.22	1.19	0.00	0.03
Fitzpatrick WA	**1.39**	1.24	1.23	1.22	0.01	0.02
Mount Zirkel WA	**0.95**	0.75	0.75	0.67	0.00	0.08
Rawah WA	**0.95**	0.68	0.68	0.59	0.00	0.09
Dinosaur NM	**0.95**	0.85	0.84	0.80	0.01	0.05
Popo Agie WA	**1.39**	1.34	1.34	1.21	0.00	0.13
Savage Run WA	**0.95**	0.66	0.66	0.53	0.00	0.13
Wind River RA	**1.39**	1.21	1.21	1.17	0.00	0.04
Rocky Mountain NP	**1.91**	1.80	1.80	1.65	0.00	0.15
Eagles Nest WA	**0.69**	0.52	0.52	0.50	0.00	0.02
Flat Tops WA	**0.69**	0.48	0.48	0.36	0.00	0.12
Gros Ventre WA	**1.39**	1.24	1.23	1.22	0.01	0.02

Table 4-31. Worst 20% days for CD-C Proposed Action Alternative, No Action Alternative, and No Proposed Action nor RFD sources. Proposed Action Alternative plus RFD impacts (rightmost column). Using 2006 meteorology.

Worst 20% Days - 2006 Meteorology						
Class I or Class II Area	Baseline Visibility (2006-2010) (dv)	Proposed Action Alternative (Cumulative 2022 Visibility) (dv)	No Action Alternative (Cumulative 2022 Visibility) (dv)	No Proposed Action and No RFD Sources (Cumulative 2022 Visibility) (dv)	Difference Between Proposed Action Alternative and No Action Alternative (dv)	Difference Between Proposed Action Alternative and No Proposed Action and No RFD Sources (dv)
Bridger WA	**10.58**	10.30	10.30	10.28	0.00	0.02
Fitzpatrick WA	**10.58**	10.32	10.32	10.31	0.00	0.01
Mount Zirkel WA	**9.36**	9.16	9.16	9.05	0.00	0.11
Rawah WA	**9.36**	9.11	9.11	8.99	0.00	0.12
Dinosaur NM	**9.36**	9.10	9.08	9.02	0.02	0.08
Popo Agie WA	**10.58**	10.56	10.55	10.40	0.01	0.16
Savage Run WA	**9.36**	9.01	9.00	8.83	0.01	0.18
Wind River RA	**10.58**	10.27	10.27	10.24	0.00	0.03
Rocky Mountain NP	**12.04**	11.68	11.68	11.53	0.00	0.15
Eagles Nest WA	**8.68**	8.29	8.29	8.26	0.00	0.03
Flat Tops WA	**8.68**	8.37	8.36	8.20	0.01	0.17
Gros Ventre WA	**10.58**	10.32	10.32	10.31	0.00	0.01

Summary of CD-C Cumulative Visibility Impact Analysis Results

The cumulative visibility assessment estimates improved visibility in 2022 compared to the 2006 – 2010 baseline years at all the Class I and Class II areas for both the Proposed Action Alternative and the No Action Alternative for both the best and worst 20% days. Differences in visibility impacts between the Proposed Action Alternative and No Action Alternative are generally too small to be computed with the precision available in the MATS tool for all Class I and Class II areas. The one exception is Dinosaur NM, where a 0.01 to 0.02 dv increase for the Proposed Action Alternative is predicted over the No Action Alternative. Impacts from the Proposed Action Alternative plus RFD sources on 2022 haze are estimated to vary between 0.01 dv and 0.18 dv among the Class I and Class II areas.

As noted above, the CD-C analysis is designed so that the results are specific to this EIS and are not appropriate for comparison to any existing RHR SIP analysis performed by the States because of differences in base year, emission inventories, and methodology.

4.6.2 Deposition

The effects of atmospheric deposition of nitrogen and sulfur compounds on terrestrial and aquatic ecosystems are well-documented and have been shown to cause leaching of nutrients from soils, acidification of surface waters, injury to high elevation vegetation, and changes in nutrient cycling and species composition. FLAG (2010) recommends that applicable sources assess impacts of nitrogen and sulfur deposition at Class I areas. Although the CD-C Project is not an “applicable source” under New Source Review, BLM is analyzing nitrogen and sulfur deposition impacts attributable to the CD-C Project at Class I and sensitive Class II areas.

4.6.2.1 Overview of Approach

CAMx-predicted wet and dry fluxes of sulfur- and nitrogen-containing species were processed to estimate total annual sulfur (S) and nitrogen (N) deposition at each Class I and sensitive Class II area and at each acid sensitive lake. The maximum annual S and N deposition from any grid cell that intersects a Class I or Class II receptor area was used to represent deposition for that area. The average annual deposition of all grid cells that intersect a Class I or Class II receptor area are also presented. Maximum and average predicted S and N deposition impacts were estimated for the Proposed Action Alternative, the No Action Alternative, and for the cumulative effects of all sources (including the Proposed Action Alternative sources) in the region.

Nitrogen deposition impacts were calculated by taking the sum of the nitrogen contained in the fluxes of all nitrogen species modeled by CAMx. CAMx species used in the nitrogen deposition flux calculation are: reactive gaseous nitrogen species, RGN (NO_X, NO_3, HONO, N_2O_5), TPN (PAN, PANX, PNA), organic nitrates (NTR), particulate nitrate formed from primary emissions plus secondarily formed nitrate (PN3), gaseous nitric acid (HN3), gaseous ammonia (NH3) and particulate ammonium (PN4). CAMx species used in the sulfur deposition calculation are primary sulfur dioxide emissions (SO_2) and particulate sulfate ion from primary emissions plus secondarily formed sulfate (PS4).

FLAG (2010) recommends that applicable sources assess impacts of nitrogen and sulfur deposition at Class I areas. This guidance recognizes the importance of establishing critical deposition loading values ("critical loads") for each specific Class I area as these critical loads are completely dependent on local atmospheric, aquatic and terrestrial conditions and chemistry. Critical load thresholds are essentially a level of atmospheric pollutant deposition below which negative ecosystem effects are not likely to occur. FLAG (2010) does not include any critical load levels for specific Class I areas and refers to site-specific critical load information on FLM websites for each area of concern. This guidance does, however recommend the use of deposition analysis thresholds (DATs) developed by the National Park Service and the Fish and Wildlife Service (NPS, 2002). The DATs represent screening level values for nitrogen and sulfur deposition from project alone emission sources below which estimated impacts are considered negligible. The DAT established for both nitrogen and sulfur in western Class I areas is 0.005 kilograms per hectare per year (kg/ha/yr). As a screening analysis, results for project alone sources were compared to these thresholds.

In addition to the project-specific analysis results from cumulative emission sources were compared to critical load thresholds established for the Rocky Mountain region to assess total deposition impacts. The NPS has provided recent information on nitrogen critical load values applicable for Wyoming and Colorado Class I and sensitive Class II areas (NPS, 2014). For Class I and sensitive Class II areas in Wyoming, a critical load value of 2.2 kg/ha/yr for nitrogen deposition (estimated from a wet deposition critical load value of 1.4 kg N/ha/yr) is applicable, based on research conducted by Saros et. al. (2010) in the eastern Sierra Nevada and Greater Yellowstone ecosystems. This is a critical load value that is protective of high elevation surface waters. For Colorado Class I and sensitive Class II areas (with the exception of Dinosaur National Monument) a critical load value of 2.3 kg N/ha/yr is applicable for total nitrogen deposition, based on research conducted by Jill Baron (Baron 2006) that estimated 1.5 kg/ha/yr as a critical loading value for wet nitrogen deposition for high-elevation lakes in Rocky

Mountain National Park, Colorado. For Dinosaur National Monument, which is an arid region, a nitrogen deposition critical load value is based on research conducted by Pardo et al. (2011) which concluded that the cumulative critical load necessary to protect shrub lands and lichen communities in Dinosaur NM is 3 kg N/ha/year.

For sulfur deposition, the critical load threshold published by Fox et al. (Fox 1989) for total sulfur deposition of 5 kg/ha/yr, for the Bob Marshall Wilderness Area in Montana and Bridger Wilderness Area in Wyoming, was used as a critical load threshold for each of the Class I and sensitive Class II areas.

For nitrogen and sulfur, we report both the average deposition as well as the maximum deposition, although only the maximum deposition is compared with the applicable level of concern.

4.6.3.2 Project-Specific Nitrogen Deposition Impacts

Table 4-32 shows the incremental 2022 nitrogen deposition impacts of the CD-C Proposed Action Alternative emissions sources for the 2005 and 2006 meteorological years.

Table 4-32. CD-C Proposed Action Alternative nitrogen deposition impacts for 2022met05 and 2022met06.

	CD-C Proposed Action Alternative			
	Total Deposition Met 2005		Total Deposition Met 2006	
Class I or Class II Area	Nitrogen- Max (kgN/ha)	Nitrogen- Avg (kgN/ha)	Nitrogen- Max (kgN/ha)	Nitrogen- Avg (kgN/ha)
Bridger WA	0.0012	0.0006	0.0019	0.0011
Fitzpatrick WA	0.0006	0.0004	0.0012	0.0008
Mount Zirkel WA	0.0116	0.0079	0.0148	0.0105
Rawah WA	0.0078	0.0058	0.0125	0.0086
Dinosaur NM	0.0116	0.0063	0.0126	0.0069
Popo Agie WA	0.0015	0.0008	0.0027	0.0016
Savage Run WA	0.0154	0.0135	0.0197	0.0168
Wind River RA	0.0007	0.0005	0.0011	0.0009
Gros Ventre WA	0.0006	0.0004	0.0014	0.0008
Rocky Mountain NP	0.0050	0.0034	0.0074	0.0044
Eagles Nest WA	0.0022	0.0019	0.0023	0.0020
Flat Tops WA	0.0040	0.0026	0.0057	0.0032

The largest nitrogen deposition impacts occur at Savage Run WA, Rawah WA, Mount Zirkel WA, Rocky Mountain NP, Flat Tops WA and Dinosaur NM, which are the areas that are closest to and/or generally downwind of the CD-C Project Area. These areas exceed the DAT of 0.005 kg/ha/yr.

The corresponding results for the No Action Alternative and the difference between the Proposed Action and the No Action Alternative are shown in Tables 4-33a and 4-33b, respectively. The largest nitrogen deposition impacts occur at Savage Run WA, Rawah WA, Mount Zirkel WA and Dinosaur NM. All of these sites exceed the DAT of 0.005 kg/ha/yr in at least one of the two meteorological years for both the No Action Alternative and the Proposed Action – No Action Alternative difference.

Table 4-33a. CD-C No Action Alternative nitrogen deposition impacts for 2022met05 and 2022met06.

Class I or Class II Area	CD-C No Action Alternative			
	Total Deposition Met 2005		Total Deposition Met 2006	
	Nitrogen- Max (kgN/ha)	Nitrogen- Avg (kgN/ha)	Nitrogen- Max (kgN/ha)	Nitrogen- Avg (kgN/ha)
Bridger WA	0.0005	0.0003	0.0009	0.0005
Fitzpatrick WA	0.0003	0.0002	0.0005	0.0004
Mount Zirkel WA	0.0053	0.0036	0.0067	0.0047
Rawah WA	0.0035	0.0026	0.0057	0.0039
Dinosaur NM	0.0053	0.0028	0.0057	0.0031
Popo Agie WA	0.0007	0.0004	0.0012	0.0007
Savage Run WA	0.0070	0.0061	0.0089	0.0076
Wind River RA	0.0003	0.0002	0.0005	0.0004
Gros Ventre WA	0.0003	0.0002	0.0007	0.0004
Rocky Mountain NP	0.0023	0.0015	0.0033	0.0020
Eagles Nest WA	0.0010	0.0009	0.0010	0.0009
Flat Tops WA	0.0018	0.0012	0.0026	0.0015

Table 4-33b. CD-C nitrogen deposition impacts for new CD-C wells on Federal lands (Proposed Action - No Action Alternative) for 2022met05 and 2022met06.

Class I or Class II Area	CD-C Proposed Action - No Action Alternative			
	Total Deposition Met 2005		Total Deposition Met 2006	
	Nitrogen- Max (kgN/ha)	Nitrogen- Avg (kgN/ha)	Nitrogen- Max (kgN/ha)	Nitrogen- Avg (kgN/ha)
Bridger WA	0.0006	0.0003	0.0011	0.0006
Fitzpatrick WA	0.0003	0.0002	0.0006	0.0004
Mount Zirkel WA	0.0063	0.0043	0.0081	0.0057
Rawah WA	0.0043	0.0032	0.0068	0.0047
Dinosaur NM	0.0063	0.0034	0.0069	0.0038
Popo Agie WA	0.0008	0.0004	0.0015	0.0009
Savage Run WA	0.0084	0.0074	0.0107	0.0092
Wind River RA	0.0004	0.0003	0.0006	0.0005
Gros Ventre WA	0.0003	0.0002	0.0008	0.0005
Rocky Mountain NP	0.0027	0.0019	0.0040	0.0024
Eagles Nest WA	0.0012	0.0010	0.0012	0.0011
Flat Tops WA	0.0022	0.0014	0.0031	0.0018

4.6.2.3 Project-Specific Sulfur Deposition Impacts

Table 4-34 shows the incremental sulfur deposition impacts of the 2022 CD-C Proposed Action Alternative emissions sources for the 2005 and 2006 meteorological years. The largest sulfur deposition impacts occur at Savage Run WA, Rawah WA, Dinosaur NM, Rocky Mountain NP, and Mount Zirkel WA; however, no area exceeds the DAT of 0.005 kg/ha/yr. The same is true for the No Action Alternative emissions sources (Table 4-35a) and the CD-C new wells on Federal lands [(Proposed Action – No Action Alternative) difference] (Table 4-35b).

Table 4-34. CD-C Proposed Action Alternative sulfur deposition impacts for 2022met05 and 2022met06.

Class I or Class II Area	CD-C Proposed Action Alternative			
	Total Deposition Met 2005		Total Deposition Met 2006	
	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)
Bridger WA	0.0000	0.0000	0.0000	0.0000
Fitzpatrick WA	0.0000	0.0000	0.0000	0.0000
Mount Zirkel WA	0.0002	0.0001	0.0004	0.0002
Rawah WA	0.0001	0.0001	0.0003	0.0002
Dinosaur NM	0.0001	0.0001	0.0003	0.0001
Popo Agie WA	0.0000	0.0000	0.0001	0.0000
Savage Run WA	0.0002	0.0002	0.0002	0.0002
Wind River RA	0.0000	0.0000	0.0000	0.0000
Gros Ventre WA	0.0000	0.0000	0.0000	0.0000
Rocky Mountain NP	0.0001	0.0000	0.0002	0.0001
Eagles Nest WA	0.0000	0.0000	0.0000	0.0000
Flat Tops WA	0.0001	0.0000	0.0001	0.0000

Table 4-35a. CD-C No Action Alternative sulfur deposition impacts for 2022met05 and 2022met06.

Class I or Class II Area	CD-C No Action Alternative			
	Total Deposition Met 2005		Total Deposition Met 2006	
	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)
Bridger WA	0.0000	0.0000	0.0000	0.0000
Fitzpatrick WA	0.0000	0.0000	0.0000	0.0000
Mount Zirkel WA	0.0001	0.0000	0.0002	0.0001
Rawah WA	0.0001	0.0000	0.0001	0.0001
Dinosaur NM	0.0001	0.0000	0.0001	0.0000
Popo Agie WA	0.0000	0.0000	0.0000	0.0000
Savage Run WA	0.0001	0.0001	0.0001	0.0001
Wind River RA	0.0000	0.0000	0.0000	0.0000
Gros Ventre WA	0.0000	0.0000	0.0000	0.0000
Rocky Mountain NP	0.0000	0.0000	0.0001	0.0000
Eagles Nest WA	0.0000	0.0000	0.0000	0.0000
Flat Tops WA	0.0000	0.0000	0.0000	0.0000

Table 4-35b. CD-C Proposed Action - No Action Alternative sulfur deposition impacts for 2022met05 and 2022met06.

Class I or Class II Area	CD-C Proposed Action - No Action Alternative			
	Total Deposition Met 2005		Total Deposition Met 2006	
	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)
Bridger WA	0.0000	0.0000	0.0000	0.0000
Fitzpatrick WA	0.0000	0.0000	0.0000	0.0000
Mount Zirkel WA	0.0001	0.0001	0.0002	0.0001
Rawah WA	0.0001	0.0000	0.0002	0.0001
Dinosaur NM	0.0001	0.0000	0.0002	0.0001
Popo Agie WA	0.0000	0.0000	0.0000	0.0000
Savage Run WA	0.0001	0.0001	0.0001	0.0001
Wind River RA	0.0000	0.0000	0.0000	0.0000
Gros Ventre WA	0.0000	0.0000	0.0000	0.0000
Rocky Mountain NP	0.0000	0.0000	0.0001	0.0000
Eagles Nest WA	0.0000	0.0000	0.0000	0.0000
Flat Tops WA	0.0000	0.0000	0.0001	0.0000

4.6.2.4 Cumulative Nitrogen Deposition Impacts

Table 4-36 shows the maximum and average total nitrogen deposition impacts from all emissions sources, including the CD-C Proposed Action Alternative emissions, for year 2022 for both the 2005 and 2006 meteorological years. Estimated maximum cumulative nitrogen deposition impacts at all Class I and sensitive Class II areas within the 4 km domain, with the exception of the Eagles Nest WA, are above the critical load thresholds for both the 2022met05 and 2022met06 scenarios. The largest impacts occur at Rawah WA, Mount Zirkel WA, Gros Ventre WA, Rocky Mountain NP, and Dinosaur NM.

Table 4-36. All emissions sources nitrogen deposition impacts for 2022met05 and 2022met06.

Class I or Class II Area	Total Deposition Met 2005		Total Deposition Met 2006		Nitrogen Critical Load
	Nitrogen- Max (kgN/ha/yr)	Nitrogen- Avg (kgN/ha/yr)	Nitrogen- Max (kgN/ha/yr)	Nitrogen- Avg (kgN/ha/yr)	(kgN/ha/yr)
Bridger WA	2.7353	2.1652	2.8497	2.1761	2.2
Fitzpatrick WA	2.3482	1.9292	3.1655	2.5343	2.2
Mount Zirkel WA	4.2035	3.2899	5.3972	3.7190	2.3
Rawah WA	3.2132	2.5934	4.4318	3.4495	2.3
Dinosaur NM	4.4678	2.5312	5.9186	2.9802	3.0
Popo Agie WA	2.5567	2.1771	3.6249	2.8170	2.2
Savage Run WA	2.5066	2.2064	2.6662	2.1332	2.2
Wind River RA	2.2597	1.8856	3.4945	2.5278	2.2
Gros Ventre WA	3.3894	2.2032	4.8252	2.7870	2.2
Rocky Mountain NP	3.7335	2.3201	5.8610	3.1288	2.3
Eagles Nest WA	1.8991	1.6117	1.7168	1.4867	2.3
Flat Tops WA	2.8602	2.2820	3.3589	2.4833	2.3

Table 4-37 shows the 2022-2008 change in maximum and average nitrogen deposition at all Class I/II areas. All areas show a reduction in nitrogen deposition in 2022 relative to the 2008 baseline run using 2005 and 2006 meteorology.

Table 4-37. Change in nitrogen deposition from all emissions sources 2022-2008 for 2022met05 and 2022met06

Absolute Change in Deposition

Class I or Class II Area	Total Deposition Met 2005		Total Deposition Met 2006	
	Nitrogen-Max (kgN/ha)	Nitrogen-Avg (kgN/ha)	Nitrogen-Max (kgN/ha)	Nitrogen-Avg (kgN/ha)
Bridger WA	-0.3221	-0.2465	-0.3104	-0.2355
Fitzpatrick WA	-0.2674	-0.2002	-0.3118	-0.2399
Mount Zirkel WA	-0.4775	-0.3805	-0.6458	-0.4433
Rawah WA	-0.3260	-0.2762	-0.5373	-0.3840
Dinosaur NM	-0.4022	-0.2290	-0.5890	-0.2910
Popo Agie WA	-0.2906	-0.2395	-0.3619	-0.3028
Savage Run WA	-0.2691	-0.2232	-0.2901	-0.2199
Wind River RA	-0.2498	-0.1888	-0.3039	-0.2357
Gros Ventre WA	-0.3499	-0.2431	-0.4639	-0.2756
Rocky Mountain	-0.4910	-0.3610	-0.9541	-0.5796
Eagles Nest WA	-0.2281	-0.2515	-0.2125	-0.2350
Flat Tops WA	-0.3241	-0.3114	-0.5193	-0.3833

Percentage Change in Deposition

Class I or Class II Area	Total Deposition Met 2005		Total Deposition Met 2006	
	Nitrogen-Max (%)	Nitrogen-Avg (%)	Nitrogen-Max (%)	Nitrogen-Avg (%)
Bridger WA	-10.54%	-10.22%	-9.82%	-9.76%
Fitzpatrick WA	-10.22%	-9.40%	-8.97%	-8.65%
Mount Zirkel WA	-10.20%	-10.37%	-10.69%	-10.65%
Rawah WA	-9.21%	-9.62%	-10.81%	-10.02%
Dinosaur NM	-8.26%	-8.30%	-9.05%	-8.90%
Popo Agie WA	-10.21%	-9.91%	-9.08%	-9.71%
Savage Run WA	-9.69%	-9.19%	-9.81%	-9.34%
Wind River RA	-9.95%	-9.10%	-8.00%	-8.53%
Gros Ventre WA	-9.36%	-9.94%	-8.77%	-9.00%
Rocky Mountain	-11.62%	-13.46%	-14.00%	-15.63%
Eagles Nest WA	-10.72%	-13.50%	-11.01%	-13.65%
Flat Tops WA	-10.18%	-12.01%	-13.39%	-13.37%

4.6.2.5 Cumulative Sulfur Deposition Impacts

Table 4-38 shows the maximum and average total sulfur deposition impacts from all emissions sources, including the CD-C Proposed Action Alternative emissions, for year 2022 for both the 2005 and 2006 meteorological years. Estimated cumulative sulfur deposition impacts are below the 5.0 kg/ha/yr threshold at all the analyzed areas for both the 2022met05 and 2022met06 scenarios.

Table 4-38. All emissions sources sulfur deposition impacts for 2022met05 and 2022met06.

Class I or Class II Area	Total Deposition Met 2005		Total Deposition Met 2006	
	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)	Sulfur- Max (kgS/ha)	Sulfur- Avg (kgS/ha)
Bridger WA	1.6060	1.0779	1.4238	0.9284
Fitzpatrick WA	1.1800	0.8021	1.6627	1.1887
Mount Zirkel WA	2.0720	1.6030	3.2482	2.0465
Rawah WA	1.6033	1.1064	2.6735	1.8302
Dinosaur NM	2.9751	1.1369	4.0346	1.5612
Popo Agie WA	1.1352	0.8799	1.9540	1.3831
Savage Run WA	1.1134	1.0159	1.2412	0.9228
Wind River RA	1.2438	0.7831	2.0418	1.2523
Gros Ventre WA	2.0108	1.0557	2.8548	1.4432
Rocky Mountain NP	2.0752	1.0512	3.8012	1.6888
Eagles Nest WA	0.7370	0.5744	0.5175	0.4433
Flat Tops WA	1.5752	1.0328	2.0690	1.2227

Table 4-39 shows the 2022-2008 change in maximum and average sulfur deposition at all Class I/II areas. All areas show a reduction in sulfur deposition in 2022 relative to the 2008 baseline run using 2005 and 2006 meteorology.

Table 4-39. Change in sulfur deposition from all emissions sources 2022-2008 for 2022met05 and 2022met06.

Absolute Change in Deposition

Class I or Class II Area	Total Deposition Met 2005		Total Deposition Met 2006	
	Sulfur-Max (kgS/ha)	Sulfur-Avg (kgS/ha)	Sulfur-Max (kgS/ha)	Sulfur-Avg (kgS/ha)
Bridger WA	-0.2726	-0.1941	-0.1578	-0.1247
Fitzpatrick WA	-0.1755	-0.0858	-0.1189	-0.0965
Mount Zirkel WA	-0.2679	-0.1934	-0.3921	-0.2535
Rawah WA	-0.1871	-0.1172	-0.3077	-0.2106
Dinosaur NM	-0.2589	-0.1173	-0.4281	-0.1622
Popo Agie WA	-0.2254	-0.1476	-0.1604	-0.1384
Savage Run WA	-0.1073	-0.1081	-0.1355	-0.1052
Wind River RA	-0.1146	-0.0913	-0.1439	-0.1044
Gros Ventre WA	-0.2658	-0.1391	-0.2850	-0.1530
Rocky Mountain	-0.1855	-0.1061	-0.3590	-0.1872
Eagles Nest WA	-0.0872	-0.0658	-0.0747	-0.0657
Flat Tops WA	-0.1896	-0.1337	-0.3127	-0.1818

Percentage Change in Deposition

Class I or Class II Area	Total Deposition Met 2005		Total Deposition Met 2006	
	Sulfur-Max (%)	Sulfur-Avg (%)	Sulfur-Max (%)	Sulfur-Avg (%)
Bridger WA	-14.51%	-15.26%	-9.98%	-11.84%
Fitzpatrick WA	-12.95%	-9.67%	-6.67%	-7.51%
Mount Zirkel WA	-11.45%	-10.77%	-10.77%	-11.02%
Rawah WA	-10.45%	-9.58%	-10.32%	-10.32%
Dinosaur NM	-8.00%	-9.35%	-9.59%	-9.41%
Popo Agie WA	-16.57%	-14.37%	-7.59%	-9.10%
Savage Run WA	-8.79%	-9.62%	-9.84%	-10.23%
Wind River RA	-8.44%	-10.44%	-6.58%	-7.70%
Gros Ventre WA	-11.68%	-11.64%	-9.08%	-9.58%
Rocky Mountain	-8.20%	-9.17%	-8.63%	-9.98%
Eagles Nest WA	-10.58%	-10.28%	-12.62%	-12.90%
Flat Tops WA	-10.75%	-11.46%	-13.13%	-12.94%

4.6.2.6 Summary of Deposition Impacts

For the CD-C Proposed Action Alternative, the DAT for nitrogen was exceeded at Savage Run WA, Rawah WA, Mount Zirkel WA, Rocky Mountain NP, and Dinosaur NM, which are the areas that are closest to and/or generally downwind of the CD-C Project Area. For the No Action Alternative, the DAT for nitrogen was exceeded at Savage Run WA, Rawah WA, Mount Zirkel WA and Dinosaur NM. There were no sulfur deposition impacts that exceeded the DAT for either the CD-C Proposed Action Alternative or the No Action Alternative. For all areas, nitrogen deposition impacts from the CD-C Proposed Action Alternative were larger than sulfur deposition impacts. This is consistent with the low levels of SO_2 emissions relative to NO_X emissions from the CD-C Project sources. Maximum cumulative nitrogen deposition impacts in 2022 due to all emissions sources, including the CD-C Proposed Action Alternative sources, exceed the nitrogen deposition thresholds at all Class I and sensitive Class II areas, with the

exception of the Eagles Nest WA, for both meteorological years. Cumulative sulfur deposition impacts in 2022 due to all emissions sources are below the 5.0 kg/ha/yr threshold at all the analyzed areas. Deposition due to all emissions sources in 2022 - including emissions transported from outside the 36 km grid through the boundary conditions - decreased for both nitrogen and sulfur in all Class I/II areas relative to 2008. Nitrogen deposition is between 8 and 16% lower in 2022 than 2008, and sulfur deposition is between 6 and 17% lower in 2022 than 2008, across the Class I and Class II area.

4.6.3 ANC at Sensitive Lakes

This analysis estimates the potential changes in the Acid Neutralizing Capacity (ANC) of sensitive lakes due to atmospheric deposition from: (1) Proposed Action Alternative emission sources; (2) No Action Alternative emissions sources; (3) cumulative emission sources. ANC is a measure of the ability of water to neutralize acid inputs; lakes with low ANC have poor acid buffering capacity and are susceptible to becoming acidified, whereas lakes with high ANC can maintain a neutral pH even with additional acid rain input. The estimate of potential changes in ANC was made by following the procedure developed by the USDA Forest Service Rocky Mountain Region (USDA FS 2000). The procedure gives a simplistic step-by-step process and is a conservative screening methodology; as such, the method can be used to determine if a proposed source does not have the potential to impact a wilderness area lake.

Predicted changes in ANC for each case were compared to the FS Level of Acceptable Change (LAC) thresholds of:

1. No more than 10 % for lakes with existing ANC values 25 ueq/l or greater
2. No more than 1 ueq/l for lakes with existing ANC values less than 25 ueq/l

The most recent lake chemistry background ANC data were obtained from the Visibility Information Exchange Web System (VIEWS, 2014) for each of the sensitive lakes. The 10th percentile lowest ANC values were calculated for each lake following procedures provided from the FS. The lowest 10 % values are used as the baseline lake ANC value since they represent the most sensitive conditions that may occur at a lake on an episodic or seasonal basis. The baseline ANC values and the number of samples used in the calculation of the 10th percentile lowest ANC values are provided in Table 4-40. Annual precipitation at each lake was obtained from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) (PRISM, 2014) climate mapping system database, based on the 30 year normal dataset for long-term average precipitation over the 1981 – 2010 time period.

Table 4-40. Sensitive lakes ANC analysis: lake parameters.

CD-C Sensitive Lakes							
Wilderness Area	Lake	Latitude (Deg N, NAD27)	Longitude (Deg W, NAD27)	Elev. (m)	10th Percentile Lowest ANC Value (µeq/L)	# of Samples	Period of Monitoring
Bridger	Black Joe	42º44'22"	109º10'16"	3128.0	62.6	78	1984-2009
Bridger	Deep	42º43'9"	109º10'19"	3202.8	57.7	68	1984-2009
Bridger	Hobbs	43º02'06"	109º40'23"	3068.0	69.9	80	1984-2009
Bridger	Lazy Boy	43º19'57"	109º43'44"	3535.7	9.1	5	1997-2009
Bridger	Upper Frozen	42º41'13"	109º09'40"	3486.9	7.5	12	1997-2009
Eagles Nest	Booth	39º41'55"	106º18'18"	3493.0	86.8	49	1993-2010
Eagles Nest	Upper Willow	39º38'45"	106º10'29"	3469.0	134.1	52	1990-2011
Fitzpatrick	Ross	43º23'35"	109º39'29"	2950.6	53.0	61	1989-2010
Flat Tops	Ned Wilson	39º57'41"	107º19'26"	3385.0	39.0	191	1981-2007
Flat Tops	Upper Ned Wilson	39º57'46"	107º19'25"	3386.0	12.9	143	1983-2007
Flat Tops	L. Packtrail Pothole	39º58'5"	107º19'27"	3378.7	29.7	96	1987-2007
Flat Tops	U. Packtrail Pothole	39º57'56"	107º19'26"	3380.2	48.7	96	1987-2007
Mount Zirkel	Lake Elbert	40º38'03"	106º42'25"	3291.8	56.6	67	1985-2007
Mount Zirkel	Seven Lakes-LG East	40º53'45"	106º40'55"	3273.3	36.2	67	1985-2007
Mount Zirkel	Summit	40º32'43"	106º40'55"	3144.3	48.0	107	1985-2007
Popo Agie	Lower Saddlebag	42º37'24"	108º59'42"	3432.7	54.6	64	1989-2010
Rawah	Island	40º37'38"	105º56'28"	3392.0	71.0	30	1995-2010
Rawah	Kelly	40º37'32"	105º57'34"	3293.0	179.9	30	1995-2010
Rawah	Rawah #4	40º40'16"	105º57'28"	3497.0	41.3	30	1995-2010

CD-C Project Emission Sources ANC Impacts

Tables 4-41 and 4-42 show that no lake undergoes a ΔANC that exceeds the applicable LAC threshold due to the impact of the CD-C Proposed Action Alternative emissions in either the 2022met05 or 2022met06 scenarios. The largest applicable ΔANC (%) impact over the two years occurs at Seven Lakes (LG East) and is 0.266%, and the largest applicable absolute change over the two years is 0.027µeq/l at Upper Ned Lake, both are well below the threshold values. For the No Action Alternative, Tables 4-43 and 4-44 show that changes in ANC of the sensitive lakes are less than under the Proposed Action Alternative, therefore impacts of the No Action Alternative are also well below the threshold values.

Table 4-41. Sensitive lakes ANC analysis: CD-C Proposed Action for 2022met05.

CDC Proposed Action Alternative: 2005 Meteorology									
Lake	Baseline 10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (ueq/l)*	USFS LAC Threshold	Below Threshold?	2022 Predicted 10th Percentile Lowest ANC Value (µeq/L)
Black Joe Lake	62.62	9.52E-06	6.97E-04	0.85	0.014%	0.009	<10%	yes	62.61
Deep Lake	57.67	1.10E-05	7.54E-04	0.94	0.015%	0.009	<10%	yes	57.66
Hobbs Lake	69.87	8.47E-06	5.32E-04	0.93	0.009%	0.006	<10%	yes	69.86
Lazy Boy Lake	9.08	5.96E-06	4.24E-04	0.89	0.057%	0.005	<1(µeq/L)	yes	9.07
Upper Frozen Lake	7.47	1.22E-05	9.30E-04	0.92	0.146%	0.011	<1(µeq/L)	yes	7.45
Booth Lake	86.78	2.10E-05	1.92E-03	0.88	0.027%	0.024	<10%	yes	86.76
Upper Willow Lake	134.10	1.28E-05	1.73E-03	0.74	0.019%	0.025	<10%	yes	134.07
Ross Lake	53.00	7.02E-06	3.90E-04	0.88	0.009%	0.005	<10%	yes	53.00
Ned Wilson Lake	39.00	2.41E-05	2.34E-03	1.18	0.055%	0.021	<10%	yes	38.98
Upper Ned Wilson Lake	12.88	2.41E-05	2.34E-03	1.18	0.166%	0.021	<1(µeq/L)	yes	12.86
Lower Packtrail Pothole	29.65	2.41E-05	2.34E-03	1.18	0.072%	0.021	<10%	yes	29.63
Upper Packtrail Pothole	48.70	2.41E-05	2.34E-03	1.18	0.044%	0.021	<10%	yes	48.68
Lake Elbert	56.58	1.04E-04	7.45E-03	1.73	0.082%	0.047	<10%	yes	56.53
Seven Lakes (LG East)	36.24	1.22E-04	9.79E-03	1.55	0.188%	0.068	<10%	yes	36.17
Summit Lake	48.00	1.11E-04	7.26E-03	1.39	0.117%	0.056	<10%	yes	47.94
Lower Saddlebag Lake	54.61	1.95E-05	1.04E-03	1.09	0.019%	0.010	<10%	yes	54.60
Island Lake	71.03	7.71E-05	5.39E-03	1.07	0.077%	0.055	<10%	yes	70.97
Kelly Lake	179.85	7.71E-05	5.39E-03	1.07	0.030%	0.055	<10%	yes	179.80
Rawah Lake #4	41.29	8.04E-05	5.80E-03	1.10	0.138%	0.057	<10%	yes	41.23

* Forest Service methodology reports both Delta ANC calculations and LAC thresholds as positive quantities, however they reflect a decrease in lake ANC.

Table 4-42. Sensitive lakes ANC analysis: CD-C Proposed Action for 2022met06.

CDC No Action Alternative: 2006 Meteorology									
Lake	Baseline 10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (ueq/l)*	USFS LAC Threshold	Below Threshold?	2022 Predicted 10th Percentile Lowest ANC Value (µeq/L)
Black Joe Lake	62.62	5.44E-05	1.56E-03	0.85	0.032%	0.020	<10%	yes	62.59
Deep Lake	57.67	6.10E-05	1.75E-03	0.94	0.035%	0.020	<10%	yes	57.64
Hobbs Lake	69.87	2.30E-05	1.18E-03	0.93	0.020%	0.014	<10%	yes	69.86
Lazy Boy Lake	9.08	1.19E-05	7.05E-04	0.89	0.095%	0.009	<1(µeq/L)	yes	9.07
Upper Frozen Lake	7.47	4.47E-05	1.86E-03	0.92	0.296%	0.022	<1(µeq/L)	yes	7.44
Booth Lake	86.78	1.20E-05	2.02E-03	0.88	0.028%	0.025	<10%	yes	86.76
Upper Willow Lake	134.10	1.19E-05	1.84E-03	0.74	0.020%	0.027	<10%	yes	134.07
Ross Lake	53.00	1.41E-05	6.66E-04	0.88	0.016%	0.008	<10%	yes	52.99
Ned Wilson Lake	39.00	3.41E-05	3.00E-03	1.18	0.070%	0.027	<10%	yes	38.97
Upper Ned Wilson Lake	12.88	3.41E-05	3.00E-03	1.18	0.213%	0.027	<1(µeq/L)	yes	12.85
Lower Packtrail Pothole	29.65	3.41E-05	3.00E-03	1.18	0.092%	0.027	<10%	yes	29.62
Upper Packtrail Pothole	48.70	3.41E-05	3.00E-03	1.18	0.056%	0.027	<10%	yes	48.67
Lake Elbert	56.58	2.77E-04	1.10E-02	1.73	0.123%	0.069	<10%	yes	56.51
Seven Lakes (LG East)	36.24	3.17E-04	1.37E-02	1.55	0.266%	0.096	<10%	yes	36.14
Summit Lake	48.00	1.48E-04	9.00E-03	1.39	0.145%	0.070	<10%	yes	47.93
Lower Saddlebag Lake	54.61	6.38E-05	2.12E-03	1.09	0.039%	0.021	<10%	yes	54.59
Island Lake	71.03	1.76E-04	8.08E-03	1.07	0.116%	0.082	<10%	yes	70.94
Kelly Lake	179.85	1.76E-04	8.08E-03	1.07	0.046%	0.082	<10%	yes	179.77
Rawah Lake #4	41.29	1.93E-04	8.85E-03	1.10	0.212%	0.088	<10%	yes	41.20

* Forest Service methodology reports both Delta ANC calculations and LAC thresholds as positive quantities, however they reflect a decrease in lake ANC.

Table 4-43. Sensitive lakes ANC analysis: CD-C No Action for 2022met05.

CDC No Action Alternative: 2005 Meteorology									
Lake	Baseline 10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (ueq/l)*	USFS LAC Threshold	Below Threshold?	2022 Predicted 10th Percentile Lowest ANC Value (µeq/L)
Black Joe Lake	62.62	4.32E-06	3.17E-04	0.85	0.006%	0.004	<10%	yes	62.61
Deep Lake	57.67	4.97E-06	3.42E-04	0.94	0.007%	0.004	<10%	yes	57.66
Hobbs Lake	69.87	3.85E-06	2.42E-04	0.93	0.004%	0.003	<10%	yes	69.87
Lazy Boy Lake	9.08	2.71E-06	1.92E-04	0.89	0.026%	0.002	<1(µeq/L)	yes	9.08
Upper Frozen Lake	7.47	5.53E-06	4.22E-04	0.92	0.066%	0.005	<1(µeq/L)	yes	7.46
Booth Lake	86.78	9.53E-06	8.74E-04	0.88	0.012%	0.011	<10%	yes	86.77
Upper Willow Lake	134.10	5.79E-06	7.87E-04	0.74	0.008%	0.011	<10%	yes	134.09
Ross Lake	53.00	3.19E-06	1.77E-04	0.88	0.004%	0.002	<10%	yes	53.00
Ned Wilson Lake	39.00	1.09E-05	1.06E-03	1.18	0.025%	0.010	<10%	yes	38.99
Upper Ned Wilson Lake	12.88	1.09E-05	1.06E-03	1.18	0.075%	0.010	<1(µeq/L)	yes	12.87
Lower Packtrail Pothole	29.65	1.09E-05	1.06E-03	1.18	0.033%	0.010	<10%	yes	29.64
Upper Packtrail Pothole	48.70	1.09E-05	1.06E-03	1.18	0.020%	0.010	<10%	yes	48.69
Lake Elbert	56.58	4.71E-05	3.38E-03	1.73	0.037%	0.021	<10%	yes	56.56
Seven Lakes (LG East)	36.24	5.54E-05	4.45E-03	1.55	0.086%	0.031	<10%	yes	36.21
Summit Lake	48.00	5.02E-05	3.30E-03	1.39	0.053%	0.026	<10%	yes	47.97
Lower Saddlebag Lake	54.61	8.84E-06	4.72E-04	1.09	0.009%	0.005	<10%	yes	54.60
Island Lake	71.03	3.50E-05	2.45E-03	1.07	0.035%	0.025	<10%	yes	71.00
Kelly Lake	179.85	3.50E-05	2.45E-03	1.07	0.014%	0.025	<10%	yes	179.83
Rawah Lake #4	41.29	3.65E-05	2.63E-03	1.10	0.063%	0.026	<10%	yes	41.26

* Forest Service methodology reports both Delta ANC calculations and LAC thresholds as positive quantities, however they reflect a decrease in lake ANC.

Table 4-44. Sensitive lakes ANC analysis: CD-C No Action for 2022met06.

CDC No Action Alternative: 2006 Meteorology									
Lake	Baseline 10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (ueq/l)*	USFS LAC Threshold	Below Threshold?	2022 Predicted 10th Percentile Lowest ANC Value (µeq/L)
Black Joe Lake	62.62	2.47E-05	7.07E-04	0.85	0.015%	0.009	<10%	yes	62.61
Deep Lake	57.67	2.77E-05	7.94E-04	0.94	0.016%	0.009	<10%	yes	57.66
Hobbs Lake	69.87	1.05E-05	5.37E-04	0.93	0.009%	0.006	<10%	yes	69.86
Lazy Boy Lake	9.08	5.40E-06	3.20E-04	0.89	0.043%	0.004	<1(µeq/L)	yes	9.08
Upper Frozen Lake	7.47	2.03E-05	8.46E-04	0.92	0.134%	0.010	<1(µeq/L)	yes	7.45
Booth Lake	86.78	5.43E-06	9.17E-04	0.88	0.013%	0.011	<10%	yes	86.77
Upper Willow Lake	134.10	5.41E-06	8.37E-04	0.74	0.009%	0.012	<10%	yes	134.09
Ross Lake	53.00	6.38E-06	3.02E-04	0.88	0.007%	0.004	<10%	yes	53.00
Ned Wilson Lake	39.00	1.55E-05	1.36E-03	1.18	0.032%	0.012	<10%	yes	38.99
Upper Ned Wilson Lake	12.88	1.55E-05	1.36E-03	1.18	0.097%	0.012	<1(µeq/L)	yes	12.87
Lower Packtrail Pothole	29.65	1.55E-05	1.36E-03	1.18	0.042%	0.012	<10%	yes	29.64
Upper Packtrail Pothole	48.70	1.55E-05	1.36E-03	1.18	0.026%	0.012	<10%	yes	48.69
Lake Elbert	56.58	1.26E-04	5.00E-03	1.73	0.056%	0.032	<10%	yes	56.55
Seven Lakes (LG East)	36.24	1.44E-04	6.21E-03	1.55	0.121%	0.044	<10%	yes	36.20
Summit Lake	48.00	6.72E-05	4.09E-03	1.39	0.066%	0.032	<10%	yes	47.97
Lower Saddlebag Lake	54.61	2.90E-05	9.64E-04	1.09	0.018%	0.010	<10%	yes	54.60
Island Lake	71.03	7.99E-05	3.67E-03	1.07	0.053%	0.037	<10%	yes	70.99
Kelly Lake	179.85	7.99E-05	3.67E-03	1.07	0.021%	0.037	<10%	yes	179.81
Rawah Lake #4	41.29	8.76E-05	4.02E-03	1.10	0.096%	0.040	<10%	yes	41.25

* Forest Service methodology reports both Delta ANC calculations and LAC thresholds as positive quantities, however they reflect a decrease in lake ANC.

Cumulative Emission Sources ANC Impacts

To assess cumulative changes in the ANC of sensitive lakes in the 2022 future year relative to the 2008 baseline year, the ANC calculations were performed using the 2022-2008 differences in total annual deposition. As shown in Tables 4-45 and 4-46 for the 2005 and 2006 meteorological years, respectively, sulfur and nitrogen deposition is represented as a negative value since all lakes receive less total sulfur and nitrogen deposition in 2022 than in 2008 due to reductions in the region-wide emissions inventories. The negative sulfur and nitrogen deposition translates to a negative change in ANC (i.e. negative delta ANC), which corresponds to greater ANC within the lakes in 2022 compared to the baseline years, since the definition of delta ANC is that positive delta ANC represents a decrease in ANC , and vice versa. In this case, comparing the baseline ANC values and the 2022 predicted ANC in Tables 4-45 and 4-46, shows improvement in the lake acid buffering capabilities since the ANC in the 2022 future year is higher than in the baseline year.

Table 4-45. Sensitive lakes ANC analysis for 2022met05. Cumulative impacts due to all emissions sources calculated using 2022 – 2008 CAMx deposition differences in each grid cell that intersects a Class I/II Area.

Cumulative Impacts 2022 - 2008 emissions: 2005 Meteorology									
Lake	Baseline 10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (ueq/l)*	USFS LAC Threshold	Below Threshold?	2022 Predicted 10th Percentile Lowest ANC Value (µeq/L)
Black Joe Lake	62.62	-1.3E-01	-2.3E-01	0.85	-6.92%	-4.33	<10%	yes	66.95
Deep Lake	57.67	-1.5E-01	-2.5E-01	0.94	-7.44%	-4.29	<10%	yes	61.96
Hobbs Lake	69.87	-2.2E-01	-2.7E-01	0.93	-7.68%	-5.37	<10%	yes	75.24
Lazy Boy Lake	9.08	-7.8E-02	-2.1E-01	0.89	-36.25%	-3.29	<1(µeq/L)	yes	12.37
Upper Frozen Lake	7.47	-2.0E-01	-2.9E-01	0.92	-72.79%	-5.43	<1(µeq/L)	yes	12.90
Booth Lake	86.78	-7.3E-02	-2.6E-01	0.88	-4.50%	-3.90	<10%	yes	90.68
Upper Willow Lake	134.10	-4.5E-02	-2.1E-01	0.74	-2.66%	-3.57	<10%	yes	137.67
Ross Lake	53.00	-6.5E-02	-2.0E-01	0.88	-5.88%	-3.11	<10%	yes	56.11
Ned Wilson Lake	39.00	-1.3E-01	-3.1E-01	1.18	-9.90%	-3.86	<10%	yes	42.86
Upper Ned Wilson Lake	12.88	-1.3E-01	-3.1E-01	1.18	-29.97%	-3.86	<1(µeq/L)	yes	16.74
Lower Packtrail Pothole	29.65	-1.3E-01	-3.1E-01	1.18	-13.02%	-3.86	<10%	yes	33.51
Upper Packtrail Pothole	48.70	-1.3E-01	-3.1E-01	1.18	-7.93%	-3.86	<10%	yes	52.56
Lake Elbert	56.58	-2.1E-01	-4.6E-01	1.73	-7.02%	-3.97	<10%	yes	60.55
Seven Lakes (LG East)	36.24	-2.1E-01	-4.2E-01	1.55	-11.46%	-4.15	<10%	yes	40.39
Summit Lake	48.00	-1.9E-01	-4.6E-01	1.39	-9.88%	-4.74	<10%	yes	52.74
Lower Saddlebag Lake	54.61	-1.6E-01	-2.7E-01	1.09	-7.37%	-4.03	<10%	yes	58.63
Island Lake	71.03	-1.2E-01	-3.2E-01	1.07	-6.02%	-4.27	<10%	yes	75.30
Kelly Lake	179.85	-1.2E-01	-3.2E-01	1.07	-2.38%	-4.27	<10%	yes	184.12
Rawah Lake #4	41.29	-1.3E-01	-3.3E-01	1.10	-10.33%	-4.27	<10%	yes	45.56

* Forest Service methodology reports both Delta ANC calculations and LAC thresholds as positive quantities, however they reflect a decrease in lake ANC. Negative values for Delta ANC (%) and Delta ANC (ueq/l) represent an increase in lake ANC.

Table 4-46. Sensitive lakes ANC analysis for 2022met06. Cumulative impacts due to all emissions sources calculated using 2022 – 2008 CAMx deposition differences in each grid cell that intersects a Class I/II Area.

Cumulative Impacts 2022 - 2008 emissions: 2006 Meteorology									
Lake	Baseline 10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (ueq/l)*	USFS LAC Threshold	Below Threshold?	2022 Predicted 10th Percentile Lowest ANC Value (µeq/L)
Black Joe Lake	62.62	-1.53E-01	-3.12E-01	0.85	-8.956%	-5.608	<10%	yes	68.22
Deep Lake	57.67	-1.83E-01	-3.36E-01	0.94	-9.756%	-5.626	<10%	yes	63.29
Hobbs Lake	69.87	-1.42E-01	-2.57E-01	0.93	-6.268%	-4.379	<10%	yes	74.25
Lazy Boy Lake	9.08	-7.59E-02	-2.34E-01	0.89	-39.691%	-3.604	<1(µeq/L)	yes	12.68
Upper Frozen Lake	7.47	-1.96E-01	-3.57E-01	0.92	-82.025%	-6.123	<1(µeq/L)	yes	13.59
Booth Lake	86.78	-6.96E-02	-2.42E-01	0.88	-4.229%	-3.670	<10%	yes	90.45
Upper Willow Lake	134.10	-5.23E-02	-2.09E-01	0.74	-2.730%	-3.662	<10%	yes	137.76
Ross Lake	53.00	-9.15E-02	-2.48E-01	0.88	-7.545%	-3.999	<10%	yes	57.00
Ned Wilson Lake	39.00	-1.72E-01	-3.61E-01	1.18	-11.865%	-4.627	<10%	yes	43.63
Upper Ned Wilson Lake	12.88	-1.72E-01	-3.61E-01	1.18	-35.927%	-4.627	<1(µeq/L)	yes	17.51
Lower Packtrail Pothole	29.65	-1.72E-01	-3.61E-01	1.18	-15.607%	-4.627	<10%	yes	34.28
Upper Packtrail Pothole	48.70	-1.72E-01	-3.61E-01	1.18	-9.502%	-4.627	<10%	yes	53.33
Lake Elbert	56.58	-3.06E-01	-5.69E-01	1.73	-9.132%	-5.167	<10%	yes	61.75
Seven Lakes (LG East)	36.24	-3.11E-01	-5.17E-01	1.55	-15.023%	-5.444	<10%	yes	41.68
Summit Lake	48.00	-2.52E-01	-5.42E-01	1.39	-12.150%	-5.832	<10%	yes	53.83
Lower Saddlebag Lake	54.61	-1.77E-01	-3.33E-01	1.09	-8.704%	-4.753	<10%	yes	59.36
Island Lake	71.03	-2.51E-01	-4.58E-01	1.07	-9.529%	-6.768	<10%	yes	77.79
Kelly Lake	179.85	-2.51E-01	-4.58E-01	1.07	-3.763%	-6.768	<10%	yes	186.62
Rawah Lake #4	41.29	-2.57E-01	-4.79E-01	1.10	-16.551%	-6.834	<10%	yes	48.12

* Forest Service methodology reports both Delta ANC calculations and LAC thresholds as positive quantities, however they reflect a decrease in lake ANC. Negative values for Delta ANC (%) and Delta ANC (ueq/l) represent an increase in lake ANC.

Summary of Sensitive Lakes Impacts

The FS conservative screening methodology predicts no exceedances of the LAC thresholds for either the CD-C Proposed Action Alternative or the No Action Alternative emissions scenarios in either the met05 or met06 simulations. Therefore, neither the Proposed Action Alternative nor No Action Alternative emissions are predicted to impact the sensitive lakes in a significant and adverse manner. In addition, the cumulative assessment shows that nitrogen and sulfur deposition into the sensitive lakes in 2022 will be lower than in 2008 due to regional emissions reductions. This results in an increase in ANC of the sensitive lakes over this time frame, with the lakes becoming more resilient to acid deposition in future years than during the baseline period.

4.6.4 Summary of Air Quality-Related Values Impacts

The visibility analysis for the CD-C Proposed Action Alternative predicts a total of 8 days with impacts > 0.5 dv and zero days > 1.0 dv due to the Proposed Action emissions over the course of the 2 year simulation throughout all the Class I and sensitive Class II areas. The areas with

visibility impacts exceeding 0.5 dv are: Savage Run WA, Dinosaur NM and Mount Zirkel WA. The cumulative visibility analysis shows that: (1) visibility improves at all Class I and sensitive Class II areas in 2022 compared to 2008 for the Proposed Action Alternative on the 20% best and 20% worst days; and (2) average visibility impairment on the 20% best and 20% worst days due to Proposed Action Alternative and RFD emissions sources (combined) ranges from 0.01 to 0.18 dv, over the Class I and sensitive Class II areas. Improvement in visibility occurs due to region-wide emissions reductions unrelated to the CD-C Project alternatives.

For the No Action Alternative, zero days > 0.5 dv are predicted throughout the Class I and sensitive Class II areas over the two year simulation due to No Action Alternative emissions contributions to regional haze. The cumulative visibility results for the No Action Alternative are almost identical to the Proposed Action Alternative results.

The DAT for nitrogen was exceeded at 5 Class I or sensitive Class II areas near/downwind of CD-C Project Area due to emissions from the Proposed Action Alternative sources and at 4 areas due to emissions from the No Action Alternative. The DAT for sulfur was not exceeded at any Class I or sensitive Class II area due to either the Proposed Action Alternative or No Action Alternative emissions.

Maximum cumulative nitrogen deposition in 2022 due to all regional emissions sources, including the Proposed Action Alternative emissions, exceeds the nitrogen deposition thresholds at all Class I and sensitive Class II areas, with the exception of the Eagles Nest WA, for both meteorological years. Sulfur deposition in 2022 due to all emissions sources is below the 5.0 kg/ha/yr threshold at all Class I and sensitive Class II areas for both meteorology years.

There were no ANC changes exceeding the USFS LAC thresholds due to emissions from the Proposed Action Alternative sources or the No Action Alternative sources.

4.7 MID-FIELD IMPACTS

CAMx-estimated criteria pollutant impacts within the CD-C Project Area from Proposed Action Alternative sources, No Action Alternative sources, and all emissions sources are shown in Table 4-47. The purpose of the mid-field analysis is to supplement the AERMOD near-field analysis by providing CAMx-estimated impacts within the CD-C Project Area using the complete CAMx emissions inventory for CD-C Project emissions and cumulative emissions, since AERMOD impacts are based on emissions from a subset of CD-C Project sources. The mid-field analysis treats all CD-C sources during/near their year of maximum total emissions, and is intended to be a supplemental analysis that provides an additional ambient air quality standard compliance demonstration. The isolated CD-C Project impacts are below the PSD Class II Increments.

The cumulative impacts resulting from all emissions sources are below the applicable ambient air quality standards, except for ozone. Using the absolute modeling results, there is no exceedance of the 70 ppb NAAQS in the 2022 future year using 2005 meteorology (Figure 4-48), but there are exceedances of the NAAQS during the 2022 future year using 2006 meteorology (maximum value of 72.9 ppb; Figure 4-49). Figure 4-50 shows the results of the average of the 2005 and 2006 meteorological year results. The 2005-2006 average is an approximation to a Design Value produced with the two available years of absolute modeling results, instead of three as required for a Design Value, and is compared with the MATS Design Values. In the two