3.7 Air Quality and Climate Change

This section describes the existing conditions and environmental consequences for air quality and climate change under the Proposed Acquisition and the No-Action Alternative. Compared to the No-Action Alternative, the Proposed Acquisition would result in increases in rail traffic on some rail lines in the combined CPKC system, and increased activities at some rail yards and intermodal facilities that would exceed the thresholds for air quality analysis set forth in the Board's environmental regulations (49 C.F.R. § 1105.7(e)(5)). In addition, the Applicants plan to make certain capital improvements within the rail ROW to support the projected increase in rail traffic. Because the increased rail traffic would be diverted from other rail lines and from trucks, OEA does not expect that the Proposed Acquisition would result in an overall net increase in air pollutant and greenhouse gas (GHG) emissions when measured at the national level. In fact, the Proposed Acquisition could result in an overall net decrease in emissions due to the expected diversion of freight from truck to rail transportation and the resulting removal of approximately 64,000 trucks per year from highways. However, OEA expects that localized emissions of air pollutants from locomotives would increase along certain specific rail line segments, which could affect air quality along those rail lines.

3.7.1 Air Quality and Greenhouse Gas Emissions

This section describes the approach, existing conditions, and environmental consequences for air quality and GHGs. Air quality is an area of concern because air pollutants, such as emissions from locomotives, can affect human health and the environment. GHG emissions are also a concern because they contribute to climate change (the impacts of climate change on the CPKC system and adaptation approaches are further discussed in *Section 3.7.2*, below). The Proposed Acquisition would result in a projected increase in rail traffic on rail lines and activities at rail yards and intermodal facilities within the CPKC system. Conversely, the increased freight carried in the CPKC system would result in decreased rail traffic on other rail lines, decreased truck traffic on highways, and decreased activities at other rail yards/intermodal facilities. OEA expects that, relative to the No-Action Alternative, the increases in emissions in the CPKC system associated with the Proposed Acquisition would be offset by these decreases in emissions, including GHGs, elsewhere. However, the Proposed Acquisition would affect locales where emissions associated with CPKC activities occur.

3.7.1.1 Approach

The air quality study area includes the counties in which the projected increase in rail traffic on rail lines or activities at rail yards or intermodal facilities under the Proposed Acquisition would exceed the thresholds for environmental analysis at 49 C.F.R. § 1105.7(e) (see **Table 3.7-1**). The study area also includes counties in which the Applicants intend to make capital improvements in the rail ROW to support the projected increase in rail traffic.

Table 3.7-1 summarizes the thresholds that initiate air quality analysis. To define the study area, OEA compared the projected levels of rail traffic on rail lines and activities at rail yards and intermodal facilities in the analysis year 2027 to these thresholds. **Figure 2.2-1**, **Figure 2.2-2**

and **Table 2.2-1** through **Table 2.2-3** in *Chapter 2, Proposed Action and Alternatives*, present additional information about the thresholds for environmental review, including maps of where those thresholds would be met or exceeded.

To analyze the impacts of GHG emissions on climate change that would occur under the Proposed Acquisition in the U.S., OEA used CEQ's *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*, which provides direction on how to apply NEPA to the analysis of GHG emissions and climate change (2016). Per CEQ's guidance, OEA considered GHG emissions as a proxy for assessing the Proposed Acquisition's impact on climate change. For its analysis, OEA also quantified the tons of GHG emissions per year that it projects would occur under the Proposed Acquisition as well as the No-Action Alternative (see **Table 3.7-4**). The study area for GHG emissions is the same as described above and detailed in **Table 3.7-1** below.

Table 3.7-1. Board Air Quality Analysis Thresholds

Activity	The Board's Threshold
Attainment Areas	
Rail line segment	An increase in rail traffic of at least 100 percent (measured in gross ton-miles annually) or an increase of at least eight trains per day
Rail yard	An increase in rail yard activity of at least 100 percent (measured by carload activity)
Intermodal facility	An average increase in truck traffic of more than 10 percent of the average daily traffic or 50 vehicles per day
Nonattainment and Class I Areas	
Rail line segment	An increase in rail traffic of at least 50 percent (measured in gross ton-miles annually) or an increase of at least three trains per day
Rail yard	An increase in rail yard activity of at least 20 percent (measured by carload activity)
Intermodal facility	An average increase in truck traffic of more than 10 percent of the average daily traffic or 50 vehicles per day

Source: 49 C.F.R. § 1105.7

3.7.1.2 Regulatory Background

In assessing the potential impacts of the Proposed Acquisition on air quality, OEA considered the Clean Air Act (CAA), as amended; EPA guidelines; and the Board's environmental regulations.

The CAA amendments codify the approach for attainment of the National Ambient Air Quality Standards (NAAQS). The CAA requires EPA to set NAAQS (40 C.F.R. Part 50) for six criteria pollutants: carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2). NAAQS standards are based on human health criteria to protect public health (primary standards), on environmental criteria to prevent environmental and property damage, and to protect public welfare (secondary standards). **Table K.3-1** in **Appendix K** presents the current NAAQS.

EPA classifies each county in the U.S. as being in "attainment" or "nonattainment" for each criteria pollutant. A county is in attainment for a specific pollutant when the pollutant concentration is below the NAAQS. A county is in nonattainment for a specific pollutant when the pollutant concentration exceeds the NAAQS. Some nonattainment pollutants (such as O_3, CO, and PM_{10}) are further classified by the degree to which they exceed the NAAQS. For ozone, these classifications are rank based on severity, in the order of "Marginal," "Moderate," "Serious," "Severe," and "Extreme." A county can be in attainment for some pollutants and in nonattainment for other pollutants. A third category, "maintenance area," is an area that was formerly in nonattainment but has reduced pollutant concentrations to be in attainment of the NAAQS. EPA bases its attainment status designations on ongoing air monitoring studies and the number of times specific criteria pollutants exceed NAAQS. EPA uses a fourth category, "unclassifiable," for areas with insufficient data to make an attainment determination. EPA treats unclassifiable areas like attainment areas.

EPA uses the term "*de minimis*" across a variety of contexts to describe impacts that are too small or trivial for consideration by regulatory authorities. Under EPA's Transportation Conformity (40 C.F.R. Part 93, Subpart A) and General Conformity (40 C.F.R. Part 93, Subpart B) regulations, federal agencies compare the total estimated annual emissions from their projects to *de minimi*s emissions thresholds to determine whether additional analysis and consultation are appropriate. The Transportation Conformity regulations pertain to highway and transit projects under the jurisdiction of the U.S. Department of Transportation and thus do not apply to Board actions. In consultation with EPA, OEA has determined that certain emissions from Board actions, such as emissions from construction activities related to the jurisdictional construction of a new line of railroad, are subject to the General Conformity regulations because those meet the definition of direct or indirect emissions set forth at 40 C.F.R. § 93.152. However, emissions related to projected increases in rail operations on rail lines or projected increases in activities at rail yards and intermodal facilities resulting from Board decisions are not subject to General Conformity regulations because the Board does not exercise continuing program responsibility over and cannot practically control rail operations on rail lines or activities at rail yards and intermodal facilities (STB 2021). Accordingly, emissions from projected increases in rail traffic and increased activities at rail yards and intermodal facilities resulting from the Proposed Acquisition are not subject to General Conformity regulations. Nevertheless, OEA has compared those emissions to the *de minimis* thresholds to contextualize the potential air quality impacts of the Proposed Acquisition (presented in **Table K.3-2** in **Appendix K**).

The CAA establishes a list of federal lands with special air quality protections from major stationary sources (40 C.F.R. Part 52 Subpart 21, 40 C.F.R. Part 81). These areas primarily include national parks, federal wilderness areas, and national monuments. The CAA divides the lands into Class I, II, or III, where restrictions on emissions are most severe in Class I areas and are progressively more lenient in Class II and III areas. Mandatory Class I areas include all federal wilderness areas exceeding 5,000 acres and national parks exceeding 6,000 acres (NPS 2020). Although locomotives are a mobile source of emissions rather than a major stationary source, OEA considered the potential impact of the Proposed Acquisition on Class I areas in response to comments that EPA submitted during scoping requesting such an analysis. Consistent with EPA guidance, OEA identified Class I areas within 100 kilometers (62 miles) of the air quality study area and considered the effects of emissions from increased rail traffic and activities on air quality related values (AQRVs) of the Class I areas. OEA did not evaluate short-term emissions associated with implementation of the planned capital improvements since they are temporary, lasting up to approximately three weeks as estimated by OEA. **Appendix K** further describes AQRVs for Class I areas.

Federal approaches that address GHG emissions include EPA programs that require GHG permitting and reporting for certain facilities. As a result of a 2007 U.S. Supreme Court ruling finding that GHGs are air pollutants under the CAA, EPA proposed the Endangerment Finding and the Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the CAA, which covers six main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrogen dioxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6) (EPA 2009a). While these findings do not directly impose any industry regulations, they have established the required legal foundation for regulating GHG emissions from sources including vehicles, power plants, and industrial facilities.

Pollutant Descriptions and Effects

In the impact analysis, OEA identified pollutants to consider and summarized their effects on human health and the environment based on EPA regulations and EPA databases. **Appendix K** describes the various pollutants OEA analyzed and their potential effects on human health or the environment. These descriptions include criteria pollutants, hazardous air pollutants (HAPs), and GHGs.

Emissions Inventory

OEA evaluated the environmental consequences of the Proposed Acquisition and the planned capital improvements by comparing predicted air emissions under the Proposed Acquisition to the No-Action Alternative at the county, nonattainment area, and system-wide (national) levels. OEA estimated emissions for nitrogen oxides (NO_X), volatile organic compounds (VOC), PM_{10}, $PM_{2.5}$, SO_2, CO, carbon dioxide equivalent (CO_2e), CH_4, N_2O, and HAPs. OEA calculated CO_2e by deriving CO_2, CH_4, and N_2O emissions and applying global warming potentials (EPA 2021a). As appropriate, OEA quantified potential reductions in emissions from the projected diversion of freight from truck transportation to rail transportation (truck-to-rail diversions). Additional information on OEA's system-wide analysis and likely truck-to-rail diversions is available in **Appendix K**.

OEA also assessed potential impacts of the planned capital improvements. The planned capital improvements assessment included quantifying air quality impacts of the construction equipment, as well as fugitive dust associated with the general construction sitework and earthwork. **Appendix K** presents additional information on the approach for analysis.

3.7.1.3 Affected Environment

OEA characterized the affected environment in terms of the attainment status of the counties in the study area and proximity of the study area to Class I Areas.

Criteria Pollutant Attainment Status

Most counties in the study area are in attainment for all NAAQS. **Table 3.7-2** presents the counties that are in nonattainment or maintenance areas for O_3. In addition, Muscatine County, Iowa and Jackson County, Missouri, are both in nonattainment for SO_2 and Wayne County, Michigan is in maintenance for $PM_{2.5}$. **Table K.4-1** in **Appendix K** describes the status for all counties in the study area.

Since the publication of the Draft EIS, EPA has reclassified the ozone attainment status of some of the counties in the study area. Specifically, EPA reclassified the nonattainment status of Collin, Denton, Fort Bend, Harris, Liberty and Tarrant Counties in Texas from “serious” to “severe” effective as of November 7, 2022.

Table 3.7-2. Ozone Nonattainment Status of Affected Counties

State	County	O_3 Criteria Pollutant
Illinois	Cook[1]	NA-Serious[2]
Illinois	DuPage[1]	NA-Serious[2]
Illinois	Kane[1]	NA-Serious[2]
Michigan	Wayne[3]	NA-Marginal[2]
Missouri	Jackson	M[4]
Texas	Collin	NA-Severe~~Serious~~[2]
Texas	Denton	NA-Severe~~Serious~~[2]
Texas	Fort Bend	NA-Severe~~Serious~~[2]
Texas	Harris	NA-Severe~~Serious~~[2]
Texas	Jefferson	M[5]
Texas	Liberty	NA-Severe~~Serious~~[2]
Texas	Orange	M[5]
Texas	Tarrant	NA-Severe~~Serious~~[2]

Source: EPA 2021b

Note: M = Maintenance; NA = Nonattainment; O_3 = Ozone.

[1] This county is a former maintenance area for the revoked 1997 Annual $PM_{2.5}$ standard. Areas that have been redesignated to attainment are not required to make transportation or general conformity determinations.

[2] Ozone nonattainment designations are ranked by the severity of their exceedance of the NAAQS. The affected counties have “severe,” “serious,” and “marginal” designations which affect the *de minimis* thresholds used to assess the Proposed Acquisition’s emissions. The classifications in the Final EIS reflect EPA's ozone reclassifications that became effective on November 7, 2022.

[3] This county is a former maintenance area for the respective pollutant. The 20-year maintenance plan has expired, as such transportation and general conformity are no longer applicable.

[4] This county is a former maintenance area for the revoked 1979 1-hour Ozone standard. Areas that have been redesignated to attainment are not required to make transportation or general conformity determinations.

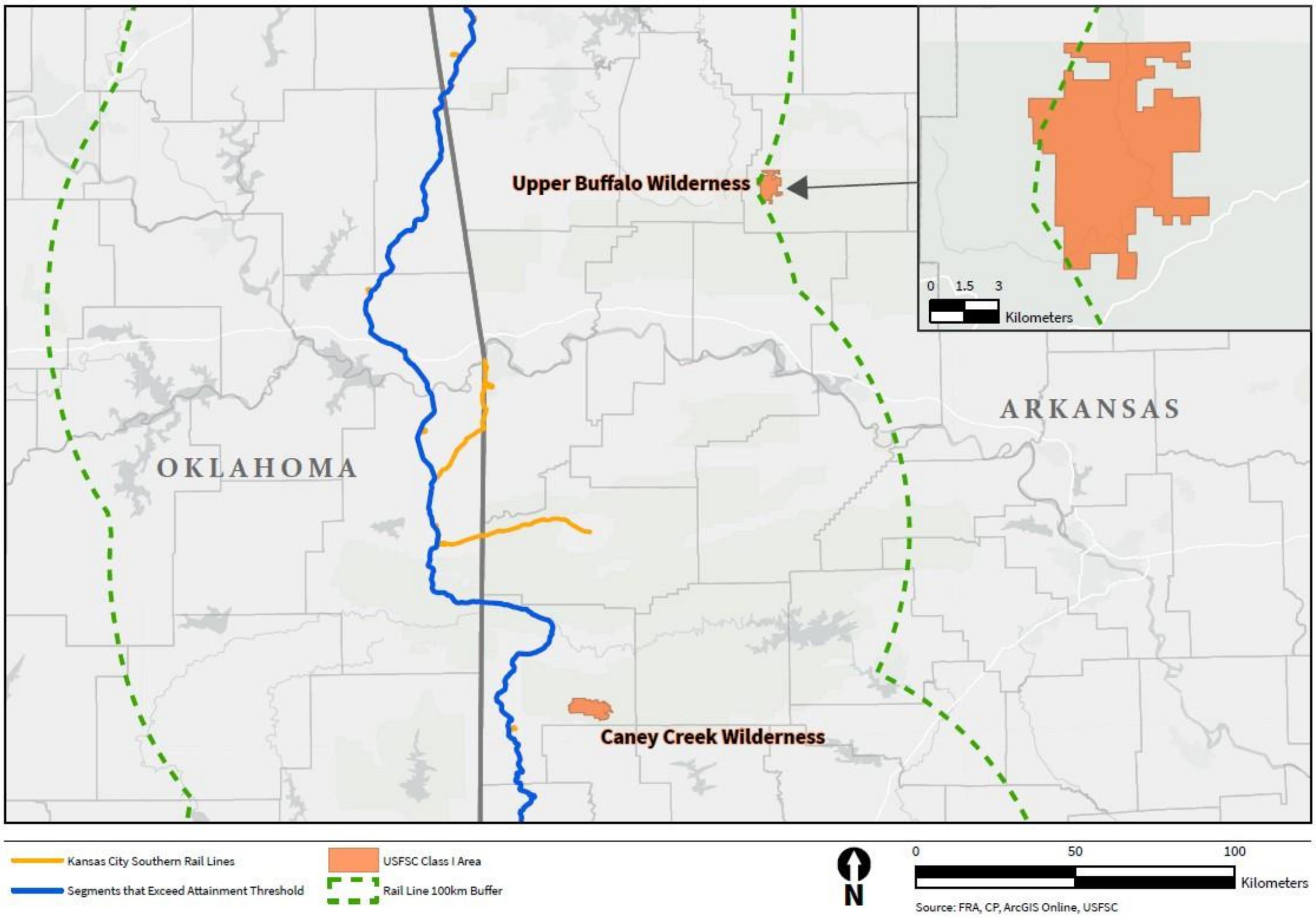
[5] This county is a former maintenance area for the revoked 1997 8-hour Ozone standard. As a result of the South Coast Air Quality Management District v. EPA court case, these areas are considered “orphan areas” and are still subject to conformity requirements under their maintenance plans.

Class I Areas

Two Class I Areas qualify for restrictive special air quality protections under the CAA (40 C.F.R. Part 52 Subpart 21; 40 C.F.R. Part 81) and are within 100 kilometers of the study area (see **Figure 3.7-1**). Both areas are under U.S. Forest Service jurisdiction.

- Caney Creek Wilderness in Arkansas is approximately 18 kilometers at the closest point to the Proposed Acquisition's affected rail line segment. All rail line segments within 100 kilometers include K-HEAV-02, K-HEAV-03, K-SHREV-01, K-SHREV-02 and K-SHREV-03; and
- Upper Buffalo Wilderness in Arkansas is approximately 100 kilometers at the closest point to rail line segments (K-HEAV-01 and K-HEAV-02).

Figure 3.7-1. Class I Areas within 100 Kilometers of the Proposed Rail System



Acid Deposition

Acid deposition occurs when sulfur oxides (SO_x) and NO_x are released from various sources and combine in the atmosphere to form acidic substances. These sulfuric and nitric acids damage soil, vegetation, and water quality, particularly the acid-neutralizing capacity of lakes. EPA Clean Air Status and Trends Network (CASTNET)[1] monitors closest to the Caney Creek and Upper Buffalo Wilderness areas are the Caddo Valley and Cherokee Nation monitors. Data from both monitors show that acid deposition levels have declined or remained generally the same over the latest 10 years of available data (2009-2019). **Table 3.7-3** presents total average sulfuric

[1] CASTNET is a national monitoring network established to assess trends in pollutant concentrations, atmospheric deposition, and ecological effects due to changes in air pollutant emissions.

and nitric acid deposition at the two monitors. Generally, sulfuric and nitric acid deposition of less than five kilograms/hectare/year would not negatively affect soil and vegetation. Historical annual acid deposition at the Cherokee Nation site exceeds this value for nitrogen. However, the annual acid deposition levels are less than the 12 kilograms/hectare/year at which increased toxicity would occur in soils.

Table 3.7-3. Historical Average Acid Deposition at Class I Areas

	Total Average Annual Deposition (kg/ha/year)	
Monitoring Site	**Sulfur (Dry and Wet)**	**Nitrogen (Dry and Wet)**
Caddo Valley, AK	1.95	4.21
Cherokee Nation, OK	1.78	5.87

Source: EPA 2021g, EPA 2021h

Visibility

The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a network established by EPA to monitor atmospheric aerosols and visibility degradation issues at Class I areas throughout the U.S. The data from IMPROVE monitors for the Caney Creek and Upper Buffalo Wilderness areas report an overall decline in the haze index for over a decade, indicating that visibility is improving in these areas. The data also indicate that the average haze index over the latest 10 years of available data (2009-2019) are:

- Caney Creek Wilderness: 20.98 deciviews/year[2] on the haziest days and 8.73 deciviews/year on the clearest days
- Upper Buffalo Wilderness: 20.69 deciviews/year on the haziest days and 8.87 deciviews/year on the clearest days

Greenhouse Gas Emissions

GHG emissions are a key driver of climate change. In the U.S., most GHG emissions are composed of CO_2 emissions and originate from the combustion of fossil fuels (EPA 2021). Transportation is the leading source of U.S. emissions from fossil fuels, attributable largely to passenger cars, sport utility vehicles (SUVs), and other light trucks (EPA 2021). Emissions from these vehicles have increased 14 percent since 1990 (EPA 2021), due in part to increased popularity in SUVs and light trucks that have lower fuel economy than other passenger vehicles (EPA 2021; USDOT 2017) as well as an increase in vehicle miles traveled as a result of population growth, suburban expansion, and economic growth. Although emissions in the U.S. have generally risen over the past 30 years, periods of decreased economic activity (such as the COVID-19 pandemic) have correlated to a reduction in emissions (Liu et al. 2020). Other key contributors to emissions include other energy-related activities, agriculture, forestry, waste, and other land uses.

2 A deciview is the unit of measurement for quantifying in a standard manner the human perception of visibility.

3.7.1.4 Environmental Consequences

The following subsections describe the potential environmental impacts of the Proposed Acquisition and the No-Action Alternative.

Proposed Acquisition

As noted above, OEA expects that the Proposed Acquisition may not result in an overall net increase in emissions of air pollutants or GHGs when measured at the national level. As discussed in *Chapter 2, Proposed Action and Alternatives*, the Applicants project that the Proposed Acquisition would increase rail traffic on the combined CPKC system as a result of the diversion of rail traffic from other rail lines and the diversion of freight from truck transportation to rail. Freight shipments that currently must stop in rail yards to change carriers would be handled as a single, long-haul movement on the combined network. Stopping, idling, and switching are less fuel efficient and cause increased GHG emissions. Therefore, OEA expects that emissions related to projected increases in rail traffic on rail lines and projected increases in activities at rail yards and intermodal facilities may be offset by decreased emissions elsewhere. Because the Proposed Acquisition would likely result in the diversion of freight from truck transportation to rail transportation and from other rail lines, OEA expects that the net effect of the Proposed Acquisition could be similar to the No-Action Alternative or a reduction in air emissions when measured at the system-wide or national scale.

Table 3.7-4 shows the total air emissions that would be associated with the Proposed Acquisition across the study area (those areas that meet the Board's thresholds for environmental review). Since the study area only includes those areas which experience large increases in activity, the summarized emissions show an increase. When considering the entire national rail network (including rail lines owned by other railroads and portions of the CPKC network where increased rail traffic would not meet the thresholds for environmental review), the Proposed Acquisition may result in reduced emissions due to the diversion of freight from truck to rail transportation, as well as potential operational efficiencies, such as allowing for fewer interchanges and more long-haul movements. The table includes locomotive emissions from increased rail traffic; emissions from increased vehicular delay at at-grade roadway/rail crossings (grade crossings); and emissions from trucks, cranes, and other equipment related to increased activities at rail yards and intermodal facilities that would occur under the Proposed Acquisition. The table also shows the estimated reduction in emissions that would result from the diversion of freight from truck transportation to rail transportation under the Proposed Acquisition.

As **Table 3.7-4** shows, NO_x is the air pollutant of greatest concern from locomotive emissions, and OEA estimates that increased rail traffic on rail lines in the study area would result in the emission of approximately 5,703 tons of NO_x each year. OEA expects that these NO_x emissions could be offset by lower NO_x emissions on other rail lines outside of the CPKC network. **Table K.5-1** in **Appendix K** provides additional information regarding study area-wide emissions.

Table 3.7-4. Summary of Study Area-Wide Emissions Estimates

Pollutant	Locomotive Emissions	Rail Yards	Intermodal Facilities	Grade Crossings	CPKC Total Emissions
Criteria Pollutants (tons/year)					
NO_X	5,702.5	7.8	14.4	0.1	5,724.9
VOC	239.7	0.5	0.7	0.0	240.9
PM_{10}	152.3	0.2	0.3	0.0	152.8
$PM_{2.5}$	147.7	0.2	0.3	0.0	148.2
SO_2	3.8	0.0	0.0	0.0	3.8
CO	1,083.2	1.1	3.9	0.6	1,088.8
Greenhouse Gases (tons/year)					
CO_2e[1]	416,787	420	5,752	123	423,083
Hazardous Air Pollutants (tons/year)					
Acetaldehyde	18.77	0.04	0.03	0.00	18.84
Acrolein	3.84	0.01	0.00	0.00	3.85
Benzene	5.39	0.01	0.01	0.00	5.41
1,3-Butadiene	0.45	0.00	0.00	0.00	0.45
Ethyl Benzene	0.92	0.00	0.00	0.00	0.93
Formaldehyde	53.46	0.11	0.06	0.00	53.63
Napthalene	0.65	0.00	0.00	0.00	0.66
POM	0.67	0.00	0.00	0.00	0.67

Notes:
[1] CO_2e values were calculated using the 100-year potential global warming potential (GWP) values from the IPCC Fourth Assessment Report (IPCC 2007).

Note: Values of zero indicate emissions were smaller than 0.05 or 0.005 tons per year, respective to the number of decimal places presented.
NO_x = Oxides of Nitrogen; VOC = Volatile Organic Compounds; PM_{10} = Particulate Matter 10 microns or less in diameter; $PM_{2.5}$ = Particulate Matter 2.5 microns or less in diameter; SO_2 = Sulfur Dioxide; CO = Carbon Monoxide; CO_2e = Carbon Dioxide Equivalent; POM = Polycyclic Organic Matter.

Table K.6-2 in **Appendix K** presents the county-level HAPs emissions estimates by county. The largest increase in total HAPs emissions of 4.5 tons per year would occur in Caddo Parish, Louisiana. This increase is primarily composed of a 2.8 ton-per-year increase of formaldehyde. These increases of HAPS are relatively small. By comparison, a stationary emissions source would need to either emit more than 10 tons per year of any single HAP or more than 25 tons per year of all combined HAPs to be required to obtain a Title V air quality permit (EPA 2021k).[4]

To minimize the potential impacts on air quality from locomotive emissions, the Applicants have proposed voluntary mitigation measures that, if imposed by the Board, would require the Applicants to develop an anti-idling policy for construction equipment used in the planned capital improvements as well as ongoing operations for use in communities within the study area (Voluntary Mitigation [VM]-Air-05), develop GHG reduction targets (VM-Air-01), and comply with EPA emissions standards for locomotives when purchasing and rebuilding locomotives.

Class I Area Assessment

Agencies typically only assess air quality impacts on Class I Areas for major stationary sources, pursuant to the Prevention of Significant Deterioration (PSD) requirements of the CAA. Although rail lines are not major stationary sources that are subject to the PSD requirements of the CAA, EPA recommended in comments submitted during the scoping process that OEA consider potential air quality impacts of the Proposed Acquisition on Class I Areas. In response, OEA has quantified air pollutant emissions near Class I Areas for informational purposes. Although the Proposed Acquisition would not result in any new air emissions within any Class I Areas, changes in rail traffic would result in emissions near Class I Areas. There are two Class I Areas located within 100 kilometers of rail lines where OEA expects that increased rail traffic would meet or exceed the Board's thresholds for environmental review. There are no Class I Areas within 100 kilometers of rail yards or intermodal facilities where increases in activities would meet the thresholds for environmental review.

Table 3.7-8 presents operational emissions from project rail segments within 100 kilometers of the Class I areas. Upper Buffalo Wilderness in Arkansas is approximately 100 kilometers at the closest point to rail line segments (K-HEAV-01 and K-HEAV-02). This distance is at the threshold for assessing impacts for a Class I area. The rail line segments within 100 kilometers of the Upper Buffalo Wilderness Class I area spans 69 miles. OEA concluded that emissions resulting from operations on these rail line segments would have no adverse impacts because the locomotive emissions would be spread out across this extended distance which spans multiple states and counties and would not be emitted close enough to the Upper Buffalo Wilderness to affect air quality in that Class I area.

Caney Creek Wilderness in Arkansas is approximately 18 kilometers from the closest rail line that would experience increased rail traffic as a result of the Proposed Acquisition. Rail line segments within 100 kilometers of Caney Creek Wilderness include K-HEAV-02, K-HEAV-03, K-SHREV-01, K-SHREV-02, and K-SHREV-03. Arkansas has established State Implementation Plan provisions under its Regional Haze Program to protect AQRVs in the state's Class I Areas. Under these State Implementation Plan provisions, Arkansas has

[4] Note that the criteria pollutant thresholds for Title V air quality permitting are generally similar to the *de minimis* thresholds.

established a NO_x emissions budget of 9,210 tons per year for 2018 and beyond under the updated Cross State Air Pollution Rule (Arkansas Department of Environmental Quality 2017). NO_x emissions on rail line segments in Arkansas associated with the Proposed Acquisition would represent approximately 8 percent of this total budget. Moreover, emissions from locomotives would be spread over a large geographic area representing 202 miles of track that primarily travel north-south, parallel to the wilderness area. The Class I area also must be downwind from the locomotives for emissions to result in negative impacts. Based on the geometry shown in **Figure 3.7-1**above, there is no one wind condition (for example, from the east) that would result in all estimated rail emissions presented in **Table 3.7-8** being upwind of Caney Creek Wilderness at the same time. Emissions from the rail line span a large geographic area and are not emanating from a single point (for example, directly west of the Caney Creek Wilderness). For these reasons, OEA concluded that emissions resulting from the Proposed Acquisition's rail operations would not adversely affect this Class I area and that emissions resulting from operations on these rail line segments would have no adverse effects on Caney Creek Wilderness.

Table 3.7-8. Emissions within 100 Kilometers of Class I Areas

Class I Area	Project Element	Track Length (miles)	Acquisition-related Emissions (tons/yr)				
			NO_X	VOC	PM_{10}	$PM_{2.5}$	SO_2
Upper Buffalo	Rail Segments	69	277.1	11.6	7.4	7.2	0.2
Caney Creek	Rail Segments	202	809.8	34.0	21.6	21.0	0.5

Short-Term Impacts

OEA estimated emissions of criteria pollutants, GHGs, and HAPs for activities in both attainment and nonattainment areas that relate to the 25 planned capital improvement sites. OEA compared emissions in nonattainment areas to *de minimis* thresholds, as presented in **Table 3.7-9**. OEA determined that only the Blue Valley capital improvement site in Kansas City would partially occur in a nonattainment area, which is a SO_2 nonattainment area. All other planned capital improvements would be located in attainment areas. In addition, OEA projects that emissions of all criteria pollutants and GHGs within attainment areas would be relatively small. **Table K.12-1** in **Appendix K** presents all county-level criteria pollutant emission estimates. OEA also projects HAPs emissions to be small, with the largest single HAP emission being 0.0008 tons of formaldehyde per year occurring in Adair County, Oklahoma.

The Applicants have proposed voluntary mitigation measures that would minimize the air quality impacts associated with the planned capital improvements. These measures include a commitment to develop an anti-idling policy that would pertain to idling of construction equipment (VM-Air-05), a commitment to implement appropriate fugitive dust suppression controls during construction activities related to the planned capital improvements (VM-Air-06), a commitment to work with contractors to ensure that construction equipment would be properly maintained to limit construction-related emissions (VM-Air-07), and a commitment to begin revegetation as soon as practicable following the completion of the capital improvements to minimize impacts of wind erosion and fugitive dust (VM-Air-08). The anti-idling and properly maintained equipment would help to mitigate the SO_2 emissions.

No-Action Alternative

Under the No-Action Alternative, the Board would not authorize the Proposed Acquisition and CP would not acquire KCS. Therefore, the projected increase in rail traffic on rail lines in the combined CPKC system and the projected increase in operational activities at rail yards and intermodal facilities would not occur as a result of the Proposed Acquisition. In addition, the Applicants would not add the 25 planned capital improvements as a result of the Proposed Acquisition. Therefore, air emissions would not increase along rail lines in the study area as a result of the Proposed Acquisition and air emissions would not decrease as a result of the diversion of freight from other rail lines or from truck transportation to rail transportation. However, the Applicants expect that rail traffic could increase in the future on rail lines in the study area under the No-Action Alternatives due to changing market conditions, including general economic growth. Similarly, CP or KCS could make capital improvements along their rail lines in the future without seeking Board authority if needed to support each carrier's rail operations.

Table 3.7-9. Summary of Capital Improvement Criteria Pollutant and GHG Emissions

				Acquisition-Related Emissions (tons/yr) County Totals							*de minimis* Threshold (tons/yr)					
State	**County**	**Nonattainment Pollutant**	**Site(s)**	**NO_x**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO**	**CO_2e[1]**	**NO_X**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO**
Arkansas	Benton		Gentry	0.02	0.00	2.13	0.21	0.00	0.01	15.88	-	-	-	-	-	-
Arkansas	Polk		Mena	0.02	0.00	1.87	0.19	0.00	0.01	13.99	-	-	-	-	-	-
Illinois	Ogle		Monroe	0.02	0.00	1.96	0.20	0.00	0.01	15.88	-	-	-	-	-	-
Iowa	Clayton		Turkey River	0.02	0.00	1.99	0.20	0.00	0.01	14.90	-	-	-	-	-	-
Iowa	Clinton		Camanche Deer Creek	0.02	0.00	1.70	0.17	0.00	0.01	12.67	-	-	-	-	-	-
Iowa	Jackson		Bellevue	0.02	0.00	1.63	0.16	0.00	0.01	12.21	-	-	-	-	-	-
Iowa	Louisa		Letts	0.00	0.00	0.20	0.02	0.00	0.00	1.49	-	-	-	-	-	-
Iowa	Monroe		Moravia	0.02	0.00	1.76	0.18	0.00	0.01	13.13	-	-	-	-	-	-
Iowa	Wapello		Ottumwa	0.00	0.00	0.36	0.04	0.00	0.00	2.69	-	-	-	-	-	-
Iowa	Washington		Washington	0.02	0.00	1.66	0.17	0.00	0.01	12.38	-	-	-	-	-	-
Louisiana	Beauregard		Singer	0.01	0.00	0.84	0.09	0.00	0.00	6.31	-	-	-	-	-	-
Louisiana	De Soto		Mansfield	0.02	0.00	1.51	0.15	0.00	0.01	11.30	-	-	-	-	-	-
Missouri	Grundy		Laredo	0.00	0.00	0.45	0.04	0.00	0.00	3.33	-	-	-	-	-	-
Missouri	Jackson	SO_2	Blue Valley	0.02	0.00	1.59	0.16	0.00	0.01	11.88	-	-	-	-	100	-
Missouri	Jackson		Grandview	0.02	0.00	2.00	0.20	0.00	0.01	14.92	-	-	-	-	-	-
Missouri	Jasper		Asbury	0.02	0.00	1.70	0.17	0.00	0.01	12.74	-	-	-	-	-	-
Missouri	Livingston		Dawn	0.02	0.00	1.67	0.17	0.00	0.01	12.45	-	-	-	-	-	-
Missouri	McDonald		Goodman	0.01	0.00	0.82	0.08	0.00	0.00	6.14	-	-	-	-	-	-
Missouri	Sullivan		Newtown	0.00	0.00	0.34	0.03	0.00	0.00	2.52	-	-	-	-	-	-
Oklahoma	Adair		Baron (MP247) Cave Springs	0.04	0.00	3.28	0.33	0.00	0.01	24.54	-	-	-	-	-	-
Oklahoma	Le Flore		Spiro Heavener	0.02	0.00	1.45	0.15	0.00	0.01	10.84	-	-	-	-	-	-

Notes:
[1] CO_2e values were calculated using the 100-year potential GWP values from the IPCC Fourth Assessment Report (IPCC 2007). Values of zero indicate emissions were smaller than 0.005 tons per year.
NA = Nonattainment; NO_x = Nitrogen oxides; VOC = Volatile organic compounds; PM_{10} = Particulate matter 10 microns or less in diameter; $PM_{2.5}$ = Particulate matter 2.5 microns or less in diameter; SO_2 = Sulfur dioxide; CO = Carbon Monoxide; CO_2e = Carbon dioxide equivalent; - = *de minimis* threshold not applicable due to attainment status.

3.7.2 Climate Change and Adaptation

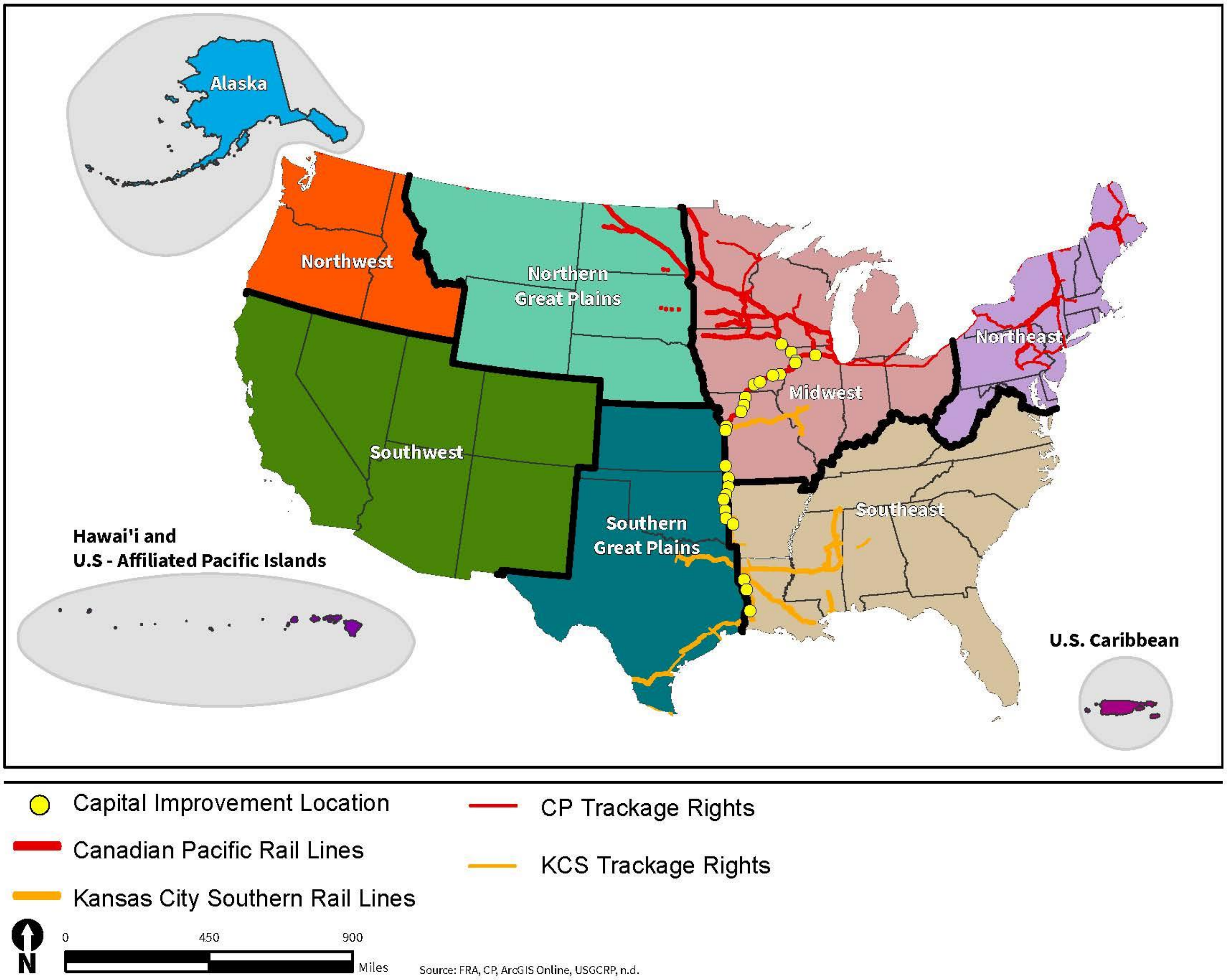
Many factors can affect global climate change, including changes in atmospheric composition due to GHG emissions, as described in *Section 3.7.1, Air Quality and Greenhouse Gas Emissions*. Climate change adaptation or climate adaptation means taking action to prepare for and adjust to both the current and projected impacts of climate change (EPA 2021). This section analyzes how climate change could affect the rail lines in the integrated CPKC system in the U.S., including the 25 planned capital improvements. It describes the existing conditions and anticipated impacts of climate change in specific regions in which the 25 planned capital improvements would be located, as well as regions in which CP and KCS rail lines are located.

3.7.2.1 Approach

The study area for climate change encompasses the five U.S. regions in which the CP and KCS rail lines are located. In its analysis and assessment, OEA used regions established by the *Fifth National Climate Assessment* (NCA5), which the U.S. Global Change Research Program (USGCRP) is developing and anticipates releasing in 2023. The merged system under the Proposed Acquisition would travel through five of the ten NCA5 regions: the Northeast, the Midwest, Southern Great Plains, Northern Great Plains, and the Southeast. To assess existing climate change conditions, OEA reviewed key climate trends in each of the five regions in which the CP and KCS rail lines are located, including the three regions in which the 25 planned capital improvements would occur. See **Figure 3.7-2** for additional detail.

To evaluate climate change impacts on the Proposed Acquisition, OEA reviewed the U.S. Geological Survey (USGS) National Climate Change Viewer and the USGCRP's most recent assessment, *Fourth National Climate Assessment* (NCA4), published in 2018. NCA4 summarizes current and future impacts of climate change in the U.S. OEA based its analysis of predicted climate change outcomes on future scenarios often used in climate change research, called Representative Concentration Pathways (RCPs). RCPs estimate factors such as emissions, GHG concentrations, and particulate matter; various climate models use these data to predict future climate outcomes (USGCRP 2018). Specifically, OEA assessed outcomes under the RCP4.5 and RCP8.5 scenarios. The RCP4.5 is considered a lower scenario with less warming, in which lower population growth, more technological innovation, and lower carbon intensity occur (USGCRP 2018). The RCP8.5 is associated with more warming and higher population growth, less technological innovation, and higher carbon intensity (USGCRP 2018). OEA also applied the U.S. Department of Transportation's (USDOT) Climate Change Sensitivity Matrix (USDOT 2014) to evaluate climate change impacts on the Proposed Acquisition. This tool presents the relationship between climate stressors (such as flooding and extreme heat) and impacts on transportation systems, including railroads.

Figure 3.7-2. CP and KCS Rail Lines within NCA5 Climate Regions



OEA also reviewed the *CP Climate Strategy*, which outlines CP's approach to addressing climate change impacts on its rail infrastructure. The *CP Climate Strategy* organizes CP's actions across five strategic pillars (Canadian Pacific 2021): understand climate-related risks and opportunities; reduce carbon footprint; respond to physical risks from climate change; integrate climate factors across business; and engage with stakeholders.

3.7.2.2 Affected Environment

This section summarizes recent and projected climate conditions in the regions where the CP and KCS rail lines are located: the Northeast, Midwest, Southern Great Plains, Northern Great Plains, and Southeast (planned capital improvements would be located in the Midwest, Southern Great Plains, and Southeast regions). This section provides temperature and precipitation trends and projections for each region and details anticipated climate change conditions in these regions.

Northeast

The Northeast has already begun to experience the effects of climate change throughout the region. NCA4 projects that by 2035, under both RCP4.5 and RCP8.5 scenarios, the Northeast will warm more than 3.6 degrees Fahrenheit on average as compared to the preindustrial era, which is typically referred to as the time period 1850-1900. This temperature increase would be the greatest increase in the contiguous U.S. The Northeast is also particularly susceptible to threats from sea level rise and has experienced some of the highest rates of sea level rise and ocean warming in the country. Sea level rise, as well as storm surges, recurrent coastal flooding, and erosion threaten marshes, fisheries, ecosystems, and coastal infrastructure in the Northeast. Specifically, industrial and commercial development in New England historically occurred along water bodies such as rivers, canals, and coasts; thus, some of these areas encompass a higher density of contaminated sites as well as waste management and petroleum storage facilities that are more susceptible to flooding given their proximity to adjacent waterways. Flooding in these areas could spread contaminants further into waterways and soils, jeopardizing ecosystem health, as well as the health of animals and humans (USGCRP 2018).

The Northeast has already begun experiencing milder, warmer winters and earlier spring conditions, which NCA4 projects as a key climate trend that would continue under the RCP8.5 scenario. This change in seasonality will affect aquatic ecosystems, forest productivity, agriculture, and resource-based industries such as forest-based industries and water dependent resources (Rustad et al. 2012). Notably, as late winters and early springs warm, plants could lose their tolerance to cold temperatures and start blooming earlier; early blooms followed by hard freezes have already contributed to the widespread loss of fruit crops in the Northeast (USGCRP 2018). These temperature changes may also increase populations of certain species, such as white-tailed deer and nutria. Warmer winters could also result in insects emerging earlier in the year and expanding their geographic range and population size. This can in turn harm other species, such as moose, which have already experienced higher death rates and infections from parasites and ticks (Janowiak et al. 2018).

NCA4 also projects a continuation of the recent trend in intense precipitation throughout the Northeast. Increases in precipitation are expected during the winter and spring and extending into the summer season. The agriculture industry would likely benefit from this increased precipitation as it would lead to greater productivity over a longer growing season (Wolfe et al. 2017). However, excess moisture can also lead to crop loss as well as increased soil erosion and agricultural runoff which could adversely impact water bodies (USGCRP 2018).

Table 3.7-10 below includes information about projected temperature and precipitation changes in the six states where CP and KCS rail lines are located within the Northeast region.

Table 3.7-10. Projected Temperature and Precipitation Changes in the Northeast under the RCP4.5 and RCP8.5 Scenarios

State	Projected Temperature Change[1] (degrees Fahrenheit)	Projected Precipitation Change[2] (inches per month)
RCP4.5		
Massachusetts	+2.89	+0.18
Maine	+3.07	+0.18
New Jersey	+2.82	+0.14
New York	+3.11	+0.15
Pennsylvania	+3.02	+0.14
Vermont	+3.12	+0.17
RCP8.5		
Massachusetts	+3.21	+0.20
Maine	+3.45	+0.22
New Jersey	+3.08	+0.19
New York	+3.45	+0.18
Pennsylvania	+3.32	+0.18
Vermont	+3.50	+0.20

Source: Alder and Hostetler 2013g-l

[1] Change is the difference in mean annual temperature between historical data (1981-2010) and the future climatology period from 2025-2049.

[2] Change is the difference in mean annual precipitation (measured in inches per month) between historical data (1981-2010) and the future climatology period from 2025-2049.

Midwest

Daily minimum temperatures in the Midwest recently have increased in all seasons due to increasing humidity; similarly, the region has seen an increase in precipitation from April through June over the past 30 years (USGCRP 2018). Increasing absolute humidity has resulted in higher precipitation amounts during the warm season and a decreased temperature difference between days and nights; increased humidity and precipitation have also eroded soils and created more favorable conditions for pests (USGCRP 2018). **Table 3.7-11** below details projected temperature and precipitation changes in states where 16 planned capital improvements would be located, in Iowa, Illinois, and Missouri:

- Iowa: Deer Creek, Camanche, Letts, MP 24 (Bellevue), Moravia, MP 255 (Washington), MP 71 (Turkey River), Ottumwa
- Illinois: MP 75 (Monroe)
- Missouri: Asbury, Blue Valley, Grandview (IFG), Laredo, MP 186, MP 431 (Dawn), Newtown

It also includes information about projected temperature and precipitation changes in the other five states where CP and KCS rail lines are located within the Midwest region (although no planned capital improvements would be located in these states): Minnesota, Wisconsin, Michigan, Indiana, and Ohio.

Table 3.7-11. Projected Temperature and Precipitation Changes in the Midwest under the RCP4.5 and RCP8.5 Scenarios

State	Projected Temperature Change[1] (degrees Fahrenheit)	Projected Precipitation Change[2] (inches per month)
RCP4.5		
Iowa	+3.25	+0.07
Illinois	+3.18	+0.08
Missouri	+2.98	+0.04
Minnesota	+3.46	+0.10
Wisconsin	+3.37	+0.09
Michigan	+3.25	+0.10
Indiana	+3.07	+0.11
Ohio	+3.04	+0.12
RCP8.5		
Iowa	+3.66	+0.10
Illinois	+3.49	+0.10
Missouri	+3.38	+0.07
Minnesota	+3.88	+0.12
Wisconsin	+3.78	+0.14
Michigan	+3.63	+0.14
Indiana	+3.40	+0.13
Ohio	+3.33	+0.14

Source: Alder and Hostetler 2013a-c, 2013q-u

[1] Change is the difference in mean annual temperature between historical data (1981-2010) and the future climatology period from 2025-2049.

[2] Change is the difference in mean annual precipitation (measured in inches per month) between historical data (1981-2010) and the future climatology period from 2025-2049.

NCA4 projects that warm-season temperatures in coming years will increase more in the Midwest than any other region in the U.S. and that, under RCP8.5, the frost-free season will increase by one month by 2070-2099, as compared to the period from 1976-2005. NCA4 also projects that rainfall will increase, along with humidity, through the middle of the 21st century.

Increased risk of flooding is a projected climate trend in the Midwest. For example, Anderson et al. project that the flood risk in the Cedar River Basin watershed in Iowa, through which existing CP rail lines are located, will shift from a 1 percent chance flood (100-year flood) in the 20th century to a 4 percent chance flood (25-year flood) in the 21st century (2015). With the projected increase in flooding and humidity also comes the increased chance of soil erosion. Other projected climate change impacts include more frequent drought conditions in the late growing season, increases in lake surface temperature, and a decline in lake ice cover (USGCRP 2018).

Southern Great Plains

Climate conditions in the Southern Great Plains are diverse and can be intense. The region is subject to extreme weather such as hurricanes, flooding, drought, heat waves, tornadoes, blizzards, ice storms, and heavy winds. The Southern Great Plains encompasses a varied landscape, with high-elevation borders and mountainous terrain to the west and humid states in the Mississippi River Valley to the east (USGCRP 2018). Average annual precipitation is also variable, with 2010 data showing less than 10 inches in the western area of the region and over 60 inches in the southeastern area. Historically, the region has been prone to periods of drought (1910s, 1930s, 1950s, and 2010-2015), as well as periods of high precipitation (1980s and early 1990s). The annual average temperature has also increased by 1 to 2 degrees Fahrenheit since the early 20th century. Overall, the region has seen swings between extreme drought followed by flooding for the past 50 years. This type of weather variation, along with high temperatures, are linked to the increased number of wildfires in the region (USGCRP 2018).

Table 3.7-12 details projected temperature and precipitation changes in Oklahoma, the state of four planned capital improvements: Cave Springs, Heavener, MP 247 (Baron), and Spiro. It also includes information about projected temperature and precipitation changes in Texas and Kansas, where CP and KCS rail lines are located, although no planned capital improvements would be located in these states.

Table 3.7-12. Projected Temperature and Precipitation Changes in the Southern Great Plains under the RCP4.5 and RCP8.5 Scenarios

State	Projected Temperature Change[1] (degrees Fahrenheit)	Projected Precipitation Change[2] (inches per month)
RCP4.5		
Oklahoma	***+2.84***	***-0.01***
Texas	+2.66	-0.02
Kansas	+2.92	+0.02
RCP8.5		
Oklahoma	+3.23	+0.01
Texas	+3.03	-0.02
Kansas	+3.37	+0.02

Source: Alder and Hostetler 2013d, 2013o, 2013p

[1] Change is the difference in mean annual temperature between historical data (1981-2010) and the future climatology period from 2025-2049.

[2] Change is the difference in mean annual precipitation (measured in inches per month) between historical data (1981-2010) and the future climatology period from 2025-2049.

Projected climate change impacts could include more intense and frequent events of extreme heat, drought, flooding, and severe storms (USGCRP 2018). According to NCA4, by the middle of the 21st century, annual average temperatures in the region would increase by 3.6 to 5.1 degrees Fahrenheit compared to the period from 1976-2005. Severe storms may vary across the region, with some data suggesting the possibility for an increase in the instances of larger hail sizes by 2040. Although the chance for more intense and frequent heavy precipitation would occur later in the 21st century, average annual precipitation projections indicate small changes overall. Climate change would worsen arid conditions in this region, primarily caused by drying soils as a result of increased evapotranspiration (the evaporation of water on land and loss of water from plants) due to higher temperatures. As temperatures rise, the risk of wildfires could also increase throughout the region, as will the duration of the fire season (USGCRP 2018).

Northern Great Plains

Climate conditions in the Northern Great Plains are markedly diverse and variable between sub-regions. The eastern edge of the region experiences more precipitation than the west and includes the Red River Valley, through which CP's existing rail network is located, and where there is often flooding (USGCRP 2018). The central part of the Northern Great Plains is defined by an arid to semiarid basin where temperatures and rates of evapotranspiration are very high (USGCRP 2018). The far western part of the region is mountainous and supports forests and other native ecosystems.

Given the region's distance from the coasts, the climate system here is prone to dramatic fluctuations, especially the Upper Missouri River Basin, which has seen variability in extreme flooding or drought approximately every decade for the past century (Livneh and Hoerling 2016). NCA4 projects that this variability is likely to become more common as the climate continues to warm. There is also high variability in the amount of precipitation that reaches streams each year, as well as a high frequency of extreme events (such as heavy rainfall and droughts) which makes managing water resources in the region challenging.

In addition to this annual variability, climate models indicate consistent warming in the Northern Great Plains over the next two to three decades with temperatures rising steadily (USGCRP 2018). The lower, RCP4.5 scenario projects that temperature increases in the Northern Great Plains will be between 2 to 4 degrees Fahrenheit by 2050, which would likely result in more drought and heat waves. Models also project more heavy precipitation events in most of the region and more days when the maximum temperature exceeds 90 degrees Fahrenheit. Changes of this sort are likely to impact agriculture, energy production, human health, streamflows, snowmelt, and fires (USGCRP 2018). Losses in snowpack resulting from higher temperatures and higher evapotranspiration rates may also contribute to a reduced amount of water availability. Further, although the RCP8.5 scenario projects an increase in winter and spring precipitation of 10 to 30 percent by the end of the century, summer precipitation is expected to reduce by 10 to 20 percent and warmer temperatures are expected to increase evaporation, leading to more frequent and severe droughts in some parts of the region (USGCRP 2017). Other parts of the region that could experience warmer and wetter conditions may see declining crop yields due to higher temperatures during critical pollination and grain fill periods, an increase in weeds and invasive species, longer growing season at higher latitudes, and a decrease in the forage available for livestock (USGCRP 2018).

Table 3.7-13 below includes information about projected temperature and precipitation changes in the two states where CP and KCS rail lines are located within the Northern Great Plains region.

Table 3.7-13. Projected Temperature and Precipitation Changes in the Northern Great Plains under the RCP4.5 and RCP8.5 Scenarios

State	Projected Temperature Change[1] (degrees Fahrenheit)	Projected Precipitation Change[2] (inches per month)
RCP4.5		
North Dakota	+3.39	+0.06
South Dakota	+3.20	+0.06
RCP8.5		
North Dakota	+3.78	+0.10
South Dakota	+3.60	+0.09

Source: Alder and Hostetler 2013m, 2013n

[1] Change is the difference in mean annual temperature between historical data (1981-2010) and the future climatology period from 2025-2049.

[2] Change is the difference in mean annual precipitation (measured in inches per month) between historical data (1981-2010) and the future climatology period from 2025-2049.

Southeast

Historically, the Southeast has experienced a fluctuation in annual average temperatures. In the 1920s and 1930s, the region saw high average annual temperatures, followed by cooler temperatures for the next three decades. In the 1970s, average annual temperatures warmed again, surpassing levels in the 1930s, and the time period from 2010-2017 was the warmest in all seasons for average daily minimum temperature (USGCRP 2018).

The Southeast has also experienced an increase in the number of extreme rainfall events; the 1990s, 2000s, and 2010s had more days with precipitation above three inches than any other decade during the 1900-2016 time period (USGCRP 2018).

Future climate models indicate regional increases in temperature and extreme precipitation for both the RCP4.5 and RCP8.5 scenarios. **Table 3.7-14** below details projected temperature and precipitation changes in Arkansas and Louisiana, states of five planned capital improvements: Gentry, MP 377 (Mena), Loring, Mansfield, and Singer.

It also includes information about projected temperature and precipitation changes in the other three states where CP and KCS rail lines are located within the Southeast region (although no planned capital improvements would be located in these states): Mississippi, Alabama, and Tennessee.

Table 3.7-14. Projected Temperature and Precipitation Changes in the Southeast under the RCP4.5 and RCP8.5 Scenarios

State	Projected Temperature Change[1] (degrees Fahrenheit)	Projected Precipitation Change[2] (inches per month)
RCP4.5		
Arkansas	+2.77	+0.01
Louisiana	+2.43	-0.02
Mississippi	+2.57	+0.01

Table 3.7-14. Projected Temperature and Precipitation Changes in the Southeast under the RCP4.5 and RCP8.5 Scenarios

State	Projected Temperature Change[1] (degrees Fahrenheit)	Projected Precipitation Change[2] (inches per month)
Alabama	+2.42	-0.01
Tennessee	+2.69	+0.04
RCP8.5		
Arkansas	+3.10	+0.06
Louisiana	+2.64	-0.05
Mississippi	+2.79	+0.03
Alabama	+2.68	+0.09
Tennessee	+2.99	+0.13

Source: Alder and Hostetler 2013e, 2013f, 2013v-x

[1] Change is the difference in mean annual temperature between historical data (1981-2010) and the future climatology period from 2025-2049.

[2] Change is the difference in mean annual precipitation (measured in inches per month) between historical data (1981-2010) and the future climatology period from 2025-2049.

Longer, more frequent heat waves, flooding in coastal and low-lying regions, and modified ecosystems are the primary climate change impacts expected in the Southeast region. Currently occurring heat waves are expected to worsen in many southeastern areas. The combination of sea level rise and more extreme rainfall events are attributable to climate change effects in this region (USGCRP 2018).

Industry and CP's Current Climate Change Response

The CP Climate Strategy outlines CP's approach to address climate change and incorporate adaptation measures into its business planning processes. Specifically, CP's goals to account for and report GHG emissions, identify and manage climate-related risks and opportunities, and evaluate emerging technologies (such as hydrogen-powered locomotives) guide its strategy to reduce its carbon footprint (Canadian Pacific 2021). The American Railway Engineering and Maintenance-of-Way Association (AREMA), which sets industry standards and publishes recommended practices for railway infrastructure design, construction, and maintenance, also provides guidance for rail network resiliency in response to climate change. AREMA's *Climate Resilient Railroads: Vulnerability Assessment Methodologies and Solutions* (2021) recommends performance-based resilience solutions to supplement code-level design standards. The assessment recommends that railroads focus on site-specific elements (such as bridge geometries and aging infrastructure materials) that are vulnerable to climate change shocks and stresses by implementing physical improvements to mitigate future impacts to people, assets, operations, and revenue. Specifically, it recommends strategies such as flood-resistant backup power systems, flood walls and pressure slabs, and continuous waterproofing (AREMA 2021).

CP's management processes, work practices, and use of innovative technology help maintain the resiliency of its rail infrastructure and allow its network to operate safely and efficiently, according to the CP Corporate Sustainability Report (2020, p.32). Regular and timely investment in strategic network and infrastructure hardening improvements is critical to maintaining resilient rail operations. CP utilizes scenario analysis to evaluate how climate change could amplify network resiliency risks at critical points along its ROW. Further described below are efforts that CP has undertaken, specifically to address the physical risks posed by climate change.

Given the increased likelihood and ongoing impacts of flooding across portions of its network, CP is improving rail corridors, raising track, and adding rip-rap stones to mitigate water erosion and flood damage in higher-risk areas. CP has made portions of its network more resilient to climate-related impacts through these and other infrastructure-hardening efforts. CP typically spends more than $1 billion (Canadian dollars) annually in capital upgrades to the network, with the majority going to resiliency projects. In 2020, CP invested over $1 billion (Canadian dollars) to renew track and roadway assets (namely rail, ties, ballast, signals, and bridges) to ensure system reliability.

CP's main rail corridor in Davenport, Iowa, experienced major flooding from the Mississippi River in 2019. As part of an emergency response, CP raised 3 miles of track by approximately 3 feet, successfully keeping trains operational and on schedule during the highest and longest duration flood event recorded at this location.

Following this incident, CP performed a risk-based review of flood risks across the region and identified locations where river flows may impact operations. As part of a resilient strategy, CP invested in rail infrastructure upgrades in response to anticipated future flood events. Some examples of these improvements include:

- CP raised a bridge on the Turkey River (Iowa) by an additional 1.5 feet to allow greater clearance for future ice and peak water flows.
- CP raised a rail bridge over the Maquoketa River (Iowa) and nearby track by approximately 1.5 feet to accommodate increased variability in streamflow.
- CP replaced three wooden structures along CP's Kansas City Subdivision with raised steel and concrete structures to minimize impacts from future flooding events.

3.7.2.3 Environmental Consequences

This section presents the environmental consequences climate change would have on the Proposed Acquisition and No-Action Alternative.

Proposed Acquisition

Increased Precipitation and Flooding

OEA expects an increased risk of flooding as a result of climate change in regions where CP and KCS rail lines are located. Whether inland flooding in valleys or coastal flooding due to sea level rise and storm surges, flooding causes a serious risk to railroad infrastructure, and under the Proposed Acquisition, there would potentially be impacts to bridges, tracks, ties, and ballast. Rail infrastructure in low-lying, flood-prone areas is at risk of damage from washout (USDOT 2014). Wood ties immersed in water from floodwater inundation can weaken the ties' ability to support tracks because the water softens and expands the wood (USDOT 2014). This in turn can lead to derailments and dangerous accidents (Rossetti 2002). Flooded areas can also cause track segments to become misaligned (Palin et al. 2021). Rail lines and infrastructure located near rivers are at risk of flooding if heavy rains cause the river to exceed its banks (FTA 2011). Heavy flooding may place debris within the ROW, causing disruptions and potential delays. Electrical equipment is also prone to damage from flooding. Electrical shortages from flood inundation can cause rail sensor failure, as well as failures in switches, gates, and signals (Agarwal and Wickersham 2010; OFCM 2002; Rossetti 2002; FTA 2011). Floodwaters are also capable of inundating locomotive motors, causing damage that requires repair (USDOT 2014), and flash flooding can submerge track segments, making them impassable (Rossetti 2002).

Extreme Heat and Increased Drought

All regions along the combined CPKC system would experience increased temperatures and heat events, potentially impacting the rail lines and supporting infrastructure, including the 25 planned capital improvements. The urban heat island effect—a phenomenon in which the heat absorbed and emitted by features such as buildings and asphalt intensifies heat in urban centers and makes them warmer than their surroundings—would also contribute to extreme heat conditions within the project area (USGCRP 2018). The degree of warming, however, would vary widely by location and would not be possible to precisely quantify. During heat events, electric utility brownouts can occur, affecting signal systems. Electrical equipment is susceptible to overheating and malfunction, particularly at ambient air temperatures of 90 degrees Fahrenheit or greater (OFCM 2002). Overheating may lead to electronics melting or temporary shutdown in cases for which temperature thresholds result in an automatic shutdown. The possibility of malfunction within track and signal sensors also increases with higher air temperatures.

Rail that experiences temperatures of 110 degrees Fahrenheit are more likely to buckle, which occurs when the metal in the track expands beyond the capacity of the supporting infrastructure (OFCM 2002). If the metal cannot expand within the confines of the track support, it will buckle either vertically or horizontally, requiring replacement. Continuous welded rail is particularly susceptible to temperature-related buckling (Agarwal and Wickersham 2010; OFCM 2002; Rossetti 2002, 2007; Peterson et al. 2008; U.S. CCSP 2008; Bipartisan Policy Center 2009; Zeman et al. 2009; EC 2012). Buckled tracks remove rail lines from service until damaged sections can be replaced. High heat can also affect service buildings such as maintenance garages and rail yard buildings, as well as service personnel (FTA 2011; NJTC 2012). Heat indices above 105 degrees Fahrenheit increase health and safety risks for rail personnel, potentially leading to operational delays (OFCM 2002).

Heat index values at or greater than 105 degrees Fahrenheit and ambient temperatures above 90 degrees Fahrenheit exacerbate the risk of rail expansion and increase the risk for derailment. In response to public comments on the Draft EIS raising concerns about this risk, OEA evaluated the frequency of days in the Southern Great Plains region projected to exceed 100 degrees Fahrenheit. In Adair and Le Flore counties, Oklahoma, where planned capital improvements would be located, the number of days projected with a maximum temperature greater than 100 degrees Fahrenheit in the 2030 decade are 14.5 under a higher emissions scenario and 12.9 under a lower emissions scenario for Adair (NOAA 2022a), and 24.2 (higher scenario) and 21.9 (lower scenario) in Le Flore (NOAA 2022b). OEA also evaluated these events in cities in Texas and Kansas, the two other states comprising the Southern Great Plains region and through which KCS rail lines run. In Harris County, Texas, where Houston is located, the number of days projected with a maximum temperature greater than 100 degrees Fahrenheit in the 2030 decade are 10.6 under a higher emissions scenario and 10 under a lower emissions scenario (NOAA

2022c). In Crawford County, Kansas, where Pittsburg is located, the number of days projected with a maximum temperature greater than 100 degrees Fahrenheit in the 2030 decade are 20.7 under a higher emissions scenario and 17.8 under a lower emissions scenario (NOAA 2022d). However, it would not be possible to precisely predict where and when extreme temperatures would occur in the future or what the effects of such events on rail infrastructure would be in specific locations. Best practice for rail operations is typically to reduce speeds when ambient temperatures exceed the limits for that particular track, resulting in decreased efficiency. Rules for temperature that warrants reductions in speed vary with each rail line (OFCM 2002; Agarwal and Wickersham 2010; Bipartisan Policy Center 2009; U.S. CCSP 2008; NJTC 2012; FTA 2011).

Increased Wildfires

The USGCRP (2018) projects that higher temperatures and more arid conditions will occur, increasing the risk of potential wildfires in the Southern Great Plains region. Wildfires pose a serious risk to rail infrastructure. Wooden bridges can burn down from direct exposure to fires and metal bridges can warp depending on the temperature and severity of the fire (USDOT 2014). Similarly, wooden rail ties can combust from fire (FTC 2011; NRC 2008) and metal components can warp or melt. Wildfires can also damage electrical equipment used to operate and maintain the railroad (USDOT 2014). Smoke from wildfires may reduce visibility for train operators.

Increased Soil Erosion

Climate models project that the five regions in which CP and KCS rail lines are located will experience increases in precipitation, including more intense and frequent heavy rain events, in the future. Increased precipitation tends to increase the potential for soil erosion. Erosion can wash away sediment around piers and abutments during storm events, compromising the structural integrity of features. The erosion of supporting systems (such as ballast and other nearby ground) can threaten track stability. Loss of embankment support due to gradual or sudden inundation-related erosion is also a risk (Rossetti 2002). Erosion rates vary greatly but tracks on gravel ballast are less likely to erode nearby substrate since the gravel itself is a permeable surface and allows water and other liquids to pass through it.

Severe Storms

Due to climate change, more frequent and severe storms would occur in the Southern Great Plains. This includes events such as tornadoes, hailstorms, and severe thunderstorms. Although impacts would vary widely across the region, these events may impact the merged system that would occur under the Proposed Acquisition. High winds that accompany tornadoes and storms can damage rail structures and threaten the stability of rail bridges (Agarwal and Wickersham 2010; NJTC 2012). High winds can also blow down trees, potentially damaging infrastructure in wooded areas and blowing debris into the railroad ROW (NJTC 2012), blocking the passage of trains. Winds can damage or destroy exposed electrical equipment such as signals and at-grade crossing gates or knock these elements over (OFCM 2002). In addition, strong crosswinds have been known to topple rail cars over or cause trains to collide (Peterson et al. 2008; USDOT 2014). Lightning strikes from thunderstorms present a risk to switching equipment (Rossetti

2002) and could cause electrical outages. Hailstorms may damage rail cars or reduce visibility for train operators.

Mitigation

CP has taken steps to improve resiliency of its system, including rail lines and supporting infrastructure, to impacts from climate change, as discussed in the CP Climate Strategy, and OEA expects that CPKC would continue this effort. As a voluntary mitigation measure, the Applicants have also committed to undertaking an in-depth climate scenario analysis to understand how a changing climate would impact CPKC and have further committed to improving the resiliency of the combined network to the physical risks of climate change (VM 21). These activities would help address the potential impact of climate change on the planned capital improvements and on the CPKC network as a whole.

No-Action Alternative

Under the No-Action Alternative, the Board would not approve the Proposed Acquisition and CP would not acquire KCS; the projected changes associated with the 25 planned capital improvements would not occur. The changes to the affected environment of the CP and KCS networks resulting from climate change would occur even if the Board denied the Proposed Acquisition.

3.7.3 Conclusion

OEA concludes that the Proposed Acquisition would not adversely affect air quality or climate change except for air quality impacts in three nonattainment areas where emissions would be accounted for in the State Implementation Plan budgets. The Proposed Acquisition would result in increased average rail traffic on certain rail lines in the combined CPKC system and increased operational activities at some rail yards and intermodal facilities. Increased rail traffic on rail lines and increased activities at rail yards and intermodal facilities would result in air emissions from locomotives and from other vehicles and loading equipment. However, because the projected increase in rail traffic would be due to the diversion of traffic from other rail lines and from other transportation modes, OEA expects that any increase in air emissions may be offset by decreased emissions on other rail lines and at other rail yards and intermodal facilities outside of the study area. In addition, since OEA expects that the Proposed Acquisition would result in the diversion of freight from trucks to rail, the Proposed Acquisition could reduce overall emissions because rail transportation is more fuel efficient than truck transportation. Further, the Applicants have committed to voluntary mitigation measures that would further reduce air emissions from locomotives (see *Chapter 4, Mitigation*).

Although OEA expects that the Proposed Acquisition may not result in an increase in overall air emissions and could result in an overall decrease in emissions, the Proposed Acquisition would change the local distribution of emissions. OEA found that the projected increase in rail traffic would result in an increase in NO_x emission that would exceed EPA's *de minimis* thresholds within the Chicago Ozone Nonattainment Area, the Houston-Galveston-Brazoria Ozone Nonattainment Area, the Dallas-Fort Worth Ozone Nonattainment Area, and the Beaumont-Port Arthur Ozone Maintenance Area. Emissions associated with changes in rail traffic are not subject to the General Conformity regulations because the Board does not exercise continuing program responsibility and cannot practically control emissions from rail operations. The anticipated increases in emissions due to rail activity in these nonattainment areas should be accounted for in future State Implementation Plan inventories, which could include offsets in emissions budgets in order to achieve the required reductions in emissions from the base year inventories. However, the estimated NO_x emissions from rail operations related to the Proposed Acquisition would be less than 1 percent of the total applicable emissions budget for mobile sources in each ozone nonattainment area. Emissions from the 25 planned capital improvements would be temporary, minor, and well below any applicable *de minimis* thresholds; the Applicants have also committed to voluntary mitigation measures that would minimize the temporary emissions associated with the planned capital improvements.

OEA expects that the Proposed Acquisition would result in an overall decrease in GHG emissions of approximately 127,113 tons of CO_2e per year by removing approximately 64,000 trucks from highways each year. OEA expects that climate change would affect the 25 planned capital improvements, but that the Applicants would incorporate climate change resiliency into final engineering and design of the capital improvements. In addition, the Applicants have committed to voluntary mitigation measures that would reduce GHG emissions and adapt to climate change.