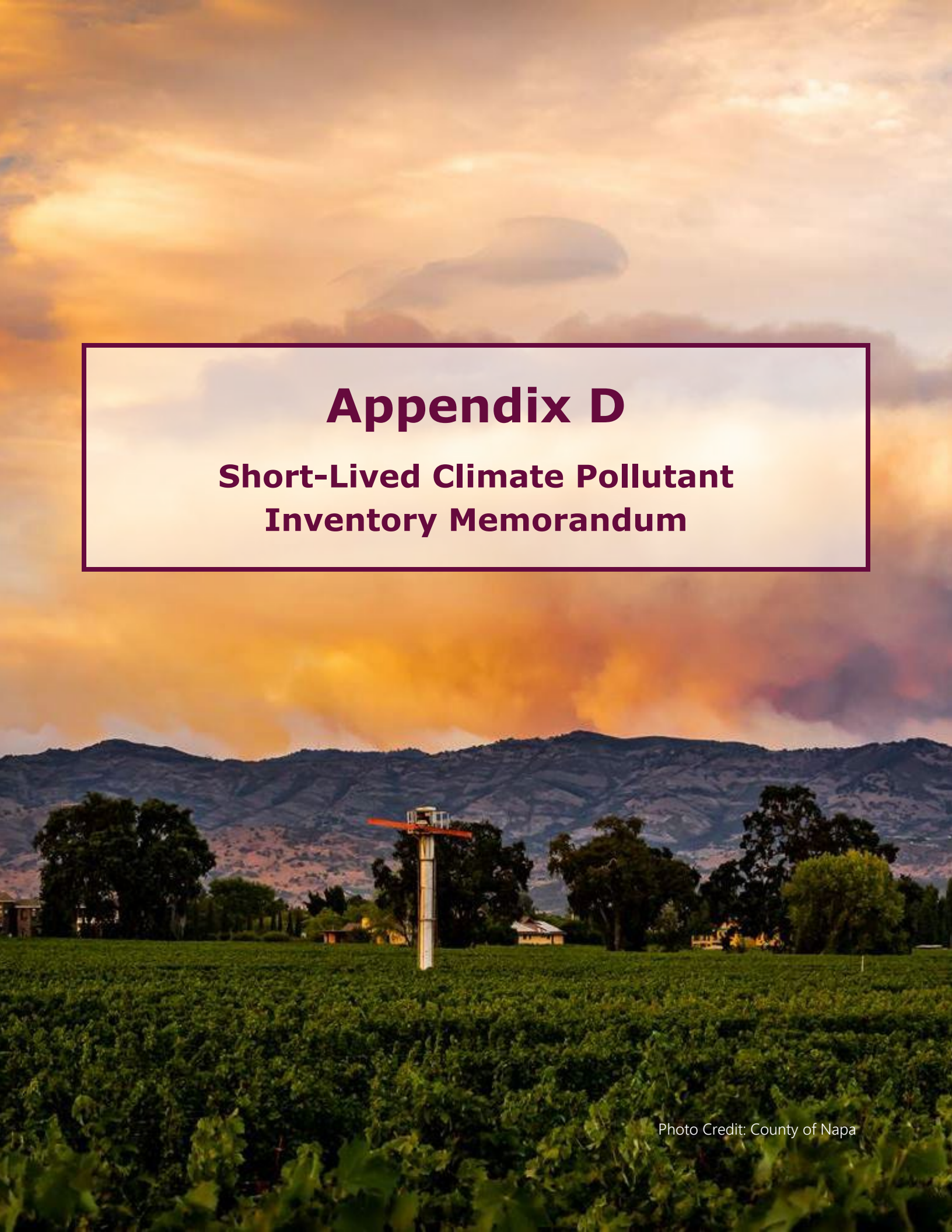
Appendix D

Short-Lived Climate Pollutant Inventory Memorandum



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Memo

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Date: August 27, 2024

To: David Morrison (County of Napa)

From: Brenda Hom and Honey Walters (Ascent Inc.)

Subject: Updated Final Napa County Regional 2019 Greenhouse Gas Short-Lived Climate Pollutant Inventory Memorandum

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This version of the Napa County Regional 2019 Greenhouse Gas Short-Lived Climate Pollutant (SLCP) Inventory Memorandum updates the final version released to the public on August 17, 2023. This update addresses comments received in Fall 2023 and additional revisions. These revisions are summarized as follows:

- Updated global warming potential (GWP) factors to use factors from the Intergovernmental Panel on Climate Change's Sixth Assessment Report (AR6), rather than the Fourth Assessment Report factors.
- Removed Oil and Gas sector emissions (e.g., refineries/drilling) from the fugitive methane sector because these activities do not occur within Napa County.
- Removed wildfire emissions from the short-lived climate pollutants inventory to be consistent with the California Air Resources Board's (CARB) approach in the *2022 Scoping Plan for Achieving Carbon Neutrality*. CARB excludes non-anthropogenic sources of black carbon from the state's GHG inventory (CARB 2022a:229). Wildfire emissions are addressed for informational purposes only.
- Updated wildfire emissions because the previous modeling was based on a 2017 base year. Wildfire emissions were updated to be based on 2019 wildfire activity levels. Wildfire emissions were revised by scaling the original modeled emissions by the difference in 2017 and 2019 wildfire acreages in Napa County.

1 INTRODUCTION

As part of the Napa County region's (region) 2019 Greenhouse Gas (GHG) Inventory update, this document presents a separate 2019 SLCP inventory for the region. SLCPs include GHGs with a strong temporary presence in the atmosphere contributing to short-term climate effects. Many of these GHGs have high GWP values, especially in the short term (within 20 years), that can be up to thousands of times more potent than carbon dioxide (CO_2). SLCPs include methane (CH_4), black carbon (BC), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfuryl hexafluoride (SF_6), described below.

The State acknowledges the contribution of SLCPs to climate change and has adopted the SLCP Reduction Strategy under Senate Bill (SB) 1383. SB 1383 requires the California Air Resources Board (CARB) to develop and implement a strategy to reduce statewide SLCP emissions (CalRecycle 2016). Additionally, as part of Assembly Bill (AB) 32, CARB enacted the Refrigerant Management Program for reducing hydrofluorocarbon refrigerants with high GWPs (CARB

2009). The SLCP Reduction Strategy established targets to reduce specific SLCP sources (e.g., landfill methane). Under the 2022 Scoping Plan, CARB outlines the pollutant-specific strategies for achieving those targets. However, it specifically excludes black carbon from the state's main GHG inventory as it was not included in the State's original 1990 inventory on which the State's GHG reduction targets are based (CARB 2022a).

The focus on SLCPs is crucial because reducing these emissions can have a rapid and significant impact on combating climate change in California, especially given the high GWP levels of SLCPs. The SLCP inventory presented in this memorandum is intended to inform the region of the magnitude and distribution of SLCP emissions and possible opportunities for and challenges with reducing these emissions. This document addresses the following five pollutants of concern, as categorized in CARB's SLCP Reduction Strategy, presented in order of increasing GWP:

- Fugitive Methane – Fugitive methane is natural gas that escapes into the atmosphere from drilling sites, processing plants, storage facilities, and pipelines that transfer natural gas from areas of supply to areas of demand. Aging pipelines and distribution infrastructure are common sources of leaks in urban environments (Union of Concerned Scientists 2014). Given that no oil and gas production occurs in Napa County, fugitive methane in the region is primarily from natural gas pipeline leakage from the import of natural gas into the region. Methane (CH_4) is 28 times more potent than carbon dioxide (CO_2) over a 100-year timeframe (World Resources Institute [WRI] 2013). Though CH_4 represents only about nine percent of state GHG emissions, it is a significant driver of short-term warming, and reducing methane emissions can help slow the rise in global temperatures (CARB 2022b). These emissions were not originally in the regional GHG inventory because the regional jurisdictions do not have control over these emissions.
- Other Methane – Other methane emissions are methane emissions generated from energy consumption, transportation (on-road vehicles and off-road equipment), landfills, wastewater processes, and agriculture (livestock and farming practices) in the region. These methane emissions are quantified in the regional 2019 GHG inventory. As explained above in the description of fugitive methane, the high GWP and shorter atmospheric presence of methane compared to carbon dioxide categorize it as an SLCP.
- Black Carbon – BC or soot is part of fine particulate matter emissions with a diameter of 2.5 microns or less ($PM_{2.5}$). It is formed by the incomplete combustion of fossil fuels, wood, and other fuels in transportation, agriculture, or cooking processes including wildfire events. Black carbon is a short-lived climate pollutant with a lifetime of only days to weeks after release in the atmosphere. During this short time, black carbon can have significant direct and indirect impacts on the climate (Climate and Clean Air Coalition [CCA Coalition] n.d.[a]). IPCC's AR6 report does not give estimates for BC GWP factors due to the variability of effects depending on the type of surface on which BC is deposited (e.g., ice vs. land). However, the IPCC's Fifth Assessment Report estimates that BC is the third most important individual contributor to warming after CO_2 and methane. This warming effect results from BC's high GWP of 900 over a 100-year time frame, and 3,200 over a 20-year time frame (IPCC 2013). The 2022 Scoping Plan distinguishes between the anthropogenic and non-anthropogenic sources of BC emissions, including only the BC emissions from anthropogenic sources in the State's black carbon inventory. Wildfire emissions are considered non-anthropogenic. (CARB 2022a).
- Hydrofluorocarbon – HFCs are a group of industrial chemicals primarily used for cooling and refrigeration. HFCs were developed to replace stratospheric ozone-depleting substances (ODS) which are currently being phased out under the Montreal Protocol and the Clean Air Act Amendments of 1990. Many HFCs are powerful GHGs and can persist in the atmosphere for up to 30 years. Though HFCs represent a small proportion of total GHGs, their impact on global warming can be hundreds to thousands of times greater than that of CO_2 per unit of mass (CCA Coalition n.d.[b]). Because HFCs and PFCs are the primary replacement for ODS, these are collectively known as "ODS substitutes."
- Perfluorinated compounds – PFCs differ from HFCs based on their fluorine content. Otherwise, like HFCs, the emissions of PFCs have been increasing as they are phased in as ODS substitutes. Emissions of ODS substitutes occur when they are intentionally released into the atmosphere during product use (e.g., from fire extinguishers

or aerosol cans), when they leak out of equipment such as refrigerators and air conditioning units, or upon disposal and destruction of equipment at end-of-life. Estimating these emissions is difficult because the sources are scattered, and the emissions occur over an equipment's lifetime (CARB 2016a). PFCs have GWP levels that are several thousand times higher than CO_2.

- **Sulfur hexafluoride (SF_6)** – SF_6 is a synthetic fluorinated compound with an extremely stable molecular structure. Because of its unique dielectric properties, electric utilities rely heavily on SF_6 in electric power systems for voltage electrical insulation, current interruption, and arc quenching in the transmission and distribution of electricity. It is also the most potent GHG known to date. SF_6 has a 20-year and 100-year GWP factor of 18,300 and 22,800, respectively, making it tens of thousands of times more effective at trapping infrared radiation than an equivalent amount of CO_2. Thus, a small amount of SF_6 can significantly impact global climate change. SF_6 is used in several different industries including electrical transmission and distribution equipment, the manufacture of electronics/semiconductors, and the production of magnesium (EPA 2022b).

The regional SLCP inventory relies on the best available and most up-to-date data and calculation methodologies to provide a foundation for the County of Napa (County), the incorporated areas (i.e., American Canyon, Calistoga, the City of Napa, St. Helena, and Yountville), and other relevant stakeholders to coordinate on reducing regional GHG emissions, specifically SLCPs. Quantification of the 2019 regional SLCP inventory is based on the methodologies used in CARB's GHG SLCP Inventory in the 2000-2020 GHG Inventory - 2022 Edition (CARB 2022b). Based on the modeling conducted, it was estimated that the region's SLCP emissions contributed 1,113,680 metric tons of carbon dioxide equivalent ($MTCO_2e$), using 20-year GWP factors, and 395,691 $MTCO_2e$, using 100-year GWP factors, in 2019.

Additionally, BC from wildfires accounted for 81,771 $MTCO_2e$, using the 20-year GWP factor, and 22,998 $MTCO_2e$, using the 100-year GWP factor. CARB considers wildfires as a non-anthropogenic source of emissions and excludes them from the state's GHG inventory (CARB 2022a:229). As such, BC emissions from wildfires are not included in the region's SLCP inventory. Wildfire emissions are shown in this inventory only for informational purposes due to the scale of these emissions relative to all BC emissions in the region.

2 ORGANIZATION OF THIS MEMORANDUM

This memorandum consists of three parts:

- Section 1: **Sources of SLCP Emissions in the Napa County Region** summarizes the overall sources of SLCP Emissions and their applicability in the region.
- Section 2: **Summary of Inventory Results by Pollutant** summarizes the 2019 regional SLCP emissions inventory.
- Section 3: **Data, Methods, and Assumptions** presents the methods and data used to develop the 2019 inventory. This includes details on what sources the inventory includes and excludes.

3 SUMMARY OF INVENTORY RESULTS BY POLLUTANTS

Based on the modeling conducted, the region generated approximately 1,113,680 $MTCO_2e$ SLCPs in 2019. To reflect the short-lived nature of these SLCPs, this analysis presents emissions in $MTCO_2e$ using 20-year GWP factors (see section 4.1 Global Warming Potentials for details). As shown in Figure 1, most SLCPs in 2019 were from non-fugitive methane (70 percent) (e.g., energy consumption, on- and off-road transportation, landfills, wastewater processes, and agriculture). Other pollutants include HFCs (17 percent), black carbon (12 percent), fugitive methane (one percent), sulfur hexafluoride (<1 percent), and PFCs (<1 percent). Table 1 details the emissions results from the 2019 SLCP inventory update for the region. A detailed explanation of the 34 different sources and processes (e.g., industrial processes) that contribute to the emissions addressed in this memorandum is given in Attachment A.

Table 1 also compares the State's per-capita SLCP emissions to the region. The comparison shows that the region's SLCP emissions per capita are 50 percent higher than the State's, likely due to the large share of landfill-related methane emissions. At the state level, methane accounts for nearly 25 percent of SLCP emissions and HFCs account for nearly 75 percent, with the remaining SLCPs accounting for a small percentage (CARB 2022b). The region houses two landfills, the Clover Flat Landfill (active) and the American Canyon Landfill (closed), which are known sources of methane emissions. As discussed in the Regional 2019 GHG inventory and shown in Table 4, 75 percent of methane emissions in the region are from the solid waste sector, both emissions generated from decomposing waste accumulated in landfills over time and from the decomposition of waste generated in 2019.

Table 1 2019 Napa County Regional GHG SLCP Inventory by Pollutant ($MTCO_2e$/year) [1] and comparison with State SLCP emissions ($MTCO_2e$/year)

Pollutant	Emissions using 20-year GWP factors (Percent Share)	Emissions using 100-year GWP factors ($MTCO_2e$/year)
Other Methane[2]	774,410 (70%)	266,084 (67%)
Hydrofluorocarbon	189,896 (17%)	85,927 (22%)
Black Carbon	132,804 (12%)	37,351 (9%)
Fugitive Methane	15,953 (1%)	5,481 (1%)
Sulfur Hexafluoride	615 (<1%)	847 (<1%)
Perfluorinated compounds	2 (<1%)	0.78 (<1%)
Total	**1,113,680 (100%)**	**395,691 (100%)**
SLCP Emissions per capita – **Napa County Region**	7.98	2.83
SLCP Emissions per capita – **State**	5.15	1.86
Black Carbon Emissions from Wildfire[3] – **Napa County Region**	81,771	22,998

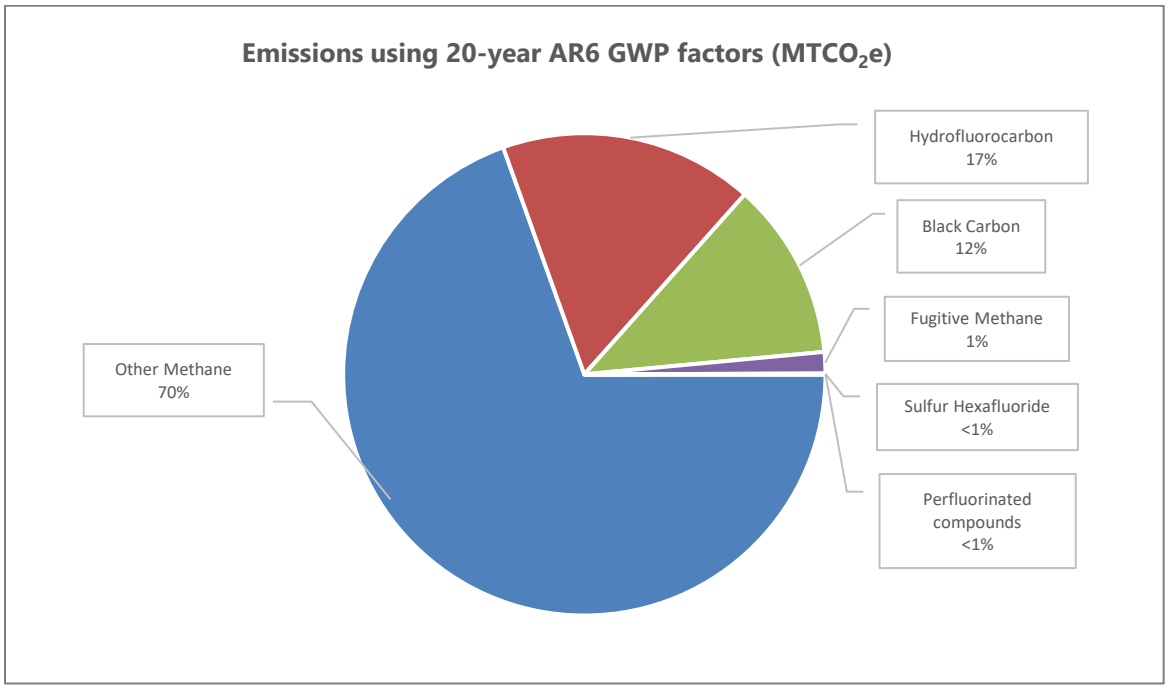
Notes: GWP = global warming potential; $MTCO_2e$/year = metric tons of carbon dioxide equivalent per year; NA= Not applicable; SLCP= short-lived climate pollutant.

[1] Totals may not add up due to rounding.

[2] Other methane emissions generated from energy consumption, transportation (on-road vehicles and off-road equipment), landfills, wastewater processes, and agriculture (livestock and farming practices). These are estimated in the Napa County Regional 2019 Community Greenhouse Gas Inventory.

[3] Black carbon emissions from wildfires are not included in the total SLCP emissions estimates. These are added here for informational purposes only because wildfires are a big contributor to non-anthropogenic black carbon emissions in the region.

Source: Prepared by Ascent in 2024.



Source: Prepared by Ascent in 2024.

Figure 1 2019 Napa County Regional SLCP Emissions Inventory by Pollutant

4 DATA, METHODS, AND ASSUMPTIONS

The SLCP inventory is subject to the limitations of the certainty of the data and the availability of accurate methods. Research on more accurate methods of estimating SLCPs is ongoing. The more sophisticated methods used for the national and State inventories do not apply at the county level. The methods used in this inventory are based on the best available data and the most applicable methods at the time of writing. This inventory uses a variety of methodologies and assumptions for each SLCP, many of which rely on the GHG inventory already performed for the region or based on top-down approaches. The following section describes the process of estimating SLCP emissions in the region.

An overview of calculation input for each emissions source, along with the description, assumptions (if any), and data sources, is shown in Table 2. Detailed methods are described in the sections following Table 2.

Table 2 2019 Napa County Regional GHG SLCP Quantification Methods by Pollutant

Pollutant/ Source	Input	Description	Assumptions	Data Sources
Other Methane				
Energy Consumption Transportation (on-road and off-road), Solid Waste, Wastewater processes, Agriculture	Refer to the Napa County Regional 2019 Community Greenhouse Gas Inventory memorandum			
HFCs				
Residential HFCs	California residential HFC estimations by equipment type	Emissions originating from the use of ODS substitutes are divided into residential and commercial emissions	-	California's High GWP Gases Emission Inventory -Emission Inventory Methodology and Technical Support Document (CARB 2016a)
	Number of households in California and the region		-	Demographic Profiles from California Department of Finance (Department of Finance 2012)
Commercial HFCs	California *commercial* HFC Estimations by equipment type		-	California's High GWP Gases Emission Inventory -Emission Inventory Methodology and Technical Support Document (CARB 2016a)
	Commercial square footage in California and the region		-	-
Black Carbon				
Combustion processes	Particulate Matter (PM) emissions from combustion	BC is the carbonaceous fraction of PM[2]	-	Napa County Regional emissions from CEPAM[1] 2019v1.03 Emission Projection Data (CARB 2017)
	Fraction of Elemental Carbon (EC) in PM in the state	EC measurements are commonly used as a proxy for BC for inventory purposes[2]	Fraction of EC for the region is equal to the fraction EC for the state	California's Black Carbon Emission Inventory (CARB 2016b)
Wildfires[3]	Particulate Matter (PM) emissions from combustion	BC is the carbonaceous fraction of PM[2]	-	Napa County Regional emissions from CEPAM[1] 2019v1.03 Emission Projection Data (CARB 2017)
	Fraction of Elemental Carbon (EC) in PM in the state	EC measurements are commonly used as a proxy for BC for inventory purposes[2]	Fraction of EC for the region is equal to the fraction EC for the state	California's Black Carbon Emission Inventory (CARB 2016b)
	Acres burned	Based on acres burned in different years due to wildfire events, the emissions are updated for the baseline year	Emissions generated per burned acre are the same every year	2019 Incident Archive (CAL FIRE 2019); Exploring The Devastating 2017 Napa, California Fires (Kirk, L. 2022)

Pollutant/ Source	Input	Description	Assumptions	Data Sources
Fugitive Methane				
Pipeline	Transmission Pipeline Leaks - Fugitive	Emissions are calculated based on emission factor and miles of transmission pipeline.	-	Fugitive emission data from PG&E
	Transmission Pipeline Blowdown - Vented	Venting natural gas to the atmosphere results in methane emissions[4]	-	Fugitive emission data from PG&E
	Distribution Main & Service Pipeline Leaks - Fugitive	Emissions generated from distribution main & service pipeline leaks are compiled in PG&E's Methane Emission Map[5]	-	Fugitive emission data from PG&E (Melendez, pers. comm., 2023).
Sulfur Hexafluoride				
Electricity Transmission	The region's total electricity consumption	-	-	Napa County Regional inventory prepared by Ascent
	Sulfur hexafluoride emission factor	-	-	Parameters and Constants in California 2000-2020 GHG Inventory query tool (CARB 2022b)
PFCs				
Use of electrical equipment	Total SLCP emissions in the region (excluding PFC emissions); Share of PFCs in total SLCP emissions in California	-	Share of PFCs to total SLCP emissions in the region is equal to the share of PFCs compared to total SLCP emissions in California	Calculated
Fire suppressant				

Notes: BC= black carbon; CARB = California Air Resources Board; EC= elemental carbon; GHG= greenhouse gas; HFCs = hydrofluorocarbons; ODS= ozone-depleting substances; PFC= perfluorinated compound; PG&E = Pacific Gas and Electric Company; PM = particulate matter; SLCP= short-lived climate pollutant; GWP = global warming potential

[1] CEPAM: California Emissions Projection Analysis Model

[2] Source: CARB 2016b.

[3] Emissions from wildfires are added for informational purposes only and are not included in the total BC emissions estimates.

[4] Pipeline blowdowns are routine operations on natural gas transmission and distribution systems to allow operators to safely perform maintenance, inspections, construction, and emergency response. This practice involves isolating and depressurizing a section of the pipeline and typically venting the natural gas into the atmosphere, which can result in methane emissions.

[5] PG&E maintained Methane Emission Map

Source: Compiled by Ascent in 2023.

4.1 GLOBAL WARMING POTENTIALS

Consistent with the Napa County Regional 2019 Community Greenhouse Gas Inventory, the 2019 GHG SLCP Inventory uses GWP factors published in the Sixth Assessment Report from IPCC for a 20-year time horizon and a 100-year time horizon. Table 3 shows the GWP factors used in the SLCP inventory.

Table 3 Global Warming Potentials used in the 2019 Napa County Regional GHG SLCP Inventory

Pollutant	GWP for 20-year timeframe	GWP for 100-year timeframe	Source
Fugitive Methane	81	28	IPCC AR6 GWP factors
Methane (non-fugitive)	81	28	IPCC AR6 GWP factors
Black Carbon	3,200	900	CARB 2016b
Hydrofluorocarbon	3,978	1,800	Estimated using IPCC AR6 GWP factors
Perfluorinated compounds	5,868	8,248	Estimated using IPCC AR6 GWP factors
Sulfur Hexafluoride	18,300	25,200	IPCC AR6 GWP factors

Notes: AR = assessment report; CARB = California Air Resources Board; GHG = greenhouse gas; GWP = global warming potential; IPCC = Intergovernmental Panel on Climate Change; SLCP= short-lived climate pollutant.

Source: IPCC 2021, Compiled by Ascent in 2024.

Consistent with the state's SLCP inventory, this section discusses emissions estimations using the 20-year GWP factors. Unless otherwise stated, the data and figures presented in this memorandum are estimations using the 20-year GWP factors.

5 OTHER METHANE

Methane emissions generated from energy consumption, transportation (on-road vehicles and off-road equipment), landfills, wastewater processes, and agriculture (livestock and farming practices) accounted for 9,537 MT CH_4 or 774,410 $MTCO_2e$, which is 70 percent of the total SLCP emissions. These are estimated in the regional 2019 Community Greenhouse Gas Inventory memo. The 20-year GWP factor used for fugitive methane is 81. GWP factors are presented in Table 3. Table 4 presents other methane emissions in the region.

Table 4 2019 Napa County Regional Methane Emissions

Emission Sources	Methane emissions from other sources (MT)	Methane emissions from other sources ($MTCO_2e$)	Share of Methane (Non-Fugitive) Emissions by Emission Sources (%)
Landfills from waste in place	4,108	333,557	43%
Landfills from waste generation	3,019	245,181	32%
Wastewater processes	1,639	133,099	17%
Agriculture (livestock)	650	52,759	7%
Off-road sector	71	5,741	1%
On-road sector	26	2,071	0.27%
Energy consumption	21	1,685	0.22%
Agriculture (farming practices)	3.47	282	0.04%
Imported Water	0.43	35	0.0045%
Total (MT)	**9,537**	**774,410**	**100%**

Notes: CO_2e= carbon dioxide equivalent; MT = metric tons

Source: Modelling by Ascent in 2023.

6 HYDROFLUOROCARBONS

Based on modeling conducted, approximately 48 MT of HFCs were emitted in 2019. This is equivalent to 189,896 $MTCO_2e$ or 17 percent of total SLCP emissions. The HFC compounds estimated in CARB's GHG SLCP Inventory in the 2000-2020 GHG Inventory – 2022 Edition (CARB 2022b) are detailed in Table A-3 alongside their sources in Attachment A. Through the California's High Global Warming Potential Gases Emission Inventory, CARB provides HFC emissions estimates by equipment type (e.g., "Residential A/C," "Refrigeration Large Centralized System ≥ 907.2 kg (2,000 lbs.)").

For residential emissions, CARB presented HFC emissions by equipment type for all residential uses across the state. These emissions are scaled to the region level by applying a ratio of the countywide households to the statewide households, using household data for 2019.

Non-residential emissions are estimated based on CARB's estimate of HFC emissions by user type. For example, 77 percent of HFC emissions from Refrigeration Large Centralized Systems over 2,000 lb are estimated to be emitted by the commercial sector and 23 percent by industrial (CARB 2016a). Based on the CARB HFC inventory, regional commercial and industrial emissions are estimated by using an average statewide factor of 0.000131 lb of HCFs per kWh. This factor is estimated by dividing statewide commercial and industrial HCF emissions by statewide commercial and industrial energy consumption (Energy Information Administration [EIA] 2021). This factor is then applied to total non-residential electricity consumption in the region to estimate regionwide non-residential HFC emissions. Table 5 presents residential and non-residential (commercial and industrial) emissions in the region.

A weighted GWP value for HFCs is estimated based on the distribution of HFC compounds in the state's inventory to account for the various GWP values across HFCs. The resulting estimated 20-year GWP factor used for HFCs is 3,978, as presented in Table 3. HFC-23 emissions are excluded from the region's SLCP inventory and weighted GWP calculation as they are typically used in semiconductor manufacturing, which is not present in the region.

Table 5 2019 Napa County Regional HFC Emissions

Emission Category	HFC emissions (MT)	HFC emissions ($MTCO_2e$)	Share of HFC Emissions by Emission Category (%)
Residential	12	48,876	26%
Non-residential (Commercial and Industrial)	35	141,021	74%
Total	**48**	**189,896**	**100%**

Notes: CO_2e= carbon dioxide equivalent; HFC = hydrofluorocarbon; MT = metric tons.

Source: Modelling by Ascent in 2024.

7 BLACK CARBON

Based on modeling conducted, BC emissions in 2019 resulted in 42 MT or 132,804 $MTCO_2e$. This is 12 percent of total SLCP emissions. These emissions account for anthropogenic BC emissions from incomplete burning of organic materials in sectors, such as transportation, agriculture, cooking, etc. Non-anthropogenic, or natural, sources of BC are excluded from this inventory. These include emissions from wildfire, which resulted in the emissions of 26 MT BC or 81,771 $MTCO_2e$ BC in 2019. This is consistent with CARB's approach in the 2022 Scoping Plan, where wildfire and other non-anthropogenic emissions are excluded from the state's SLCP inventory (CARB 2022a:229). However, non-anthropogenic BC is presented in this memorandum as an informational item.

For this SLCP inventory, BC emissions are based on scaling of the state's estimate of the existing $PM_{2.5}$ emissions in Napa County combined with speciation profiles that define the BC fraction of $PM_{2.5}$ (CARB 2016b). According to the state's inventory, Elemental Carbon (EC) measurements are commonly used as a proxy for BC. EC portions of $PM_{2.5}$ can vary between 0 percent (for dust) and 61 percent (for diesel exhaust), because $PM_{2.5}$ is a category of size rather than chemical compound. For the regional level inventory, the California Emissions Projection Analysis Model (CEPAM) is used to estimate $PM_{2.5}$ emissions for the region for 2017, the most recent year for which $PM_{2.5}$ emissions data is available (CARB 2017). CEPAM includes over 50 different combustion processes, and the individual estimated contributions of those processes queried for Napa County are shown in Attachment A. The proportion of BC in these combustion processes is derived from CARB's BC inventory modeled in CEPAM.

Based on the CEPAM outputs, agricultural activities generated 33 percent of regional BC emissions, off-road transportation generated 16 percent, on-road transportation 17 percent, and residential fuel combustion 15 percent. All other sources generated less than 12 percent of BC emissions. The 20-year GWP factor used for BC is 3,200. GWP factors are presented in Table 3. Table 6 summarizes BC emissions estimated for the region by sector for 2019.

Table 6 2019 Napa County Regional Black Carbon Emissions

Emissions Sector	Black Carbon Emissions (MT per year)	Black Carbon Emissions ($MTCO_2e$ per year)	Share of Black Carbon Emissions by Combustion Processes Categories (%)
Agricultural	13.82	44,224	33%
Off-Road Transportation	9.53	30,496	23%
On-Road Transportation	7.04	22,528	17%
Residential Fuel Combustion	6.28	20,096	15%
Prescribed Fires	2.97	9,504	7%
Industrial	0.97	3,104	2%
Dust	0.45	1,440	1%
Fires	0.27	864	1%
Other	0.11	352	<1%
Energy/utilities	0.04	128	<1%
Total (MT per year)	**42**	**134,400**	**100%**
Wildfires[1]	26[2]	83,200	NA

Note: CEPAM: California Emissions Projection Analysis Model; CO_2e= carbon dioxide equivalent; MT = metric tons; NA = not applicable.

[1] Emissions from wildfires are added for informational purposes only and are not included in the total BC emissions estimates.

[2] Wildfire emissions estimates for 2017 available from CEPAM were adjusted to reflect emissions in 2019. This was done because 2017 was an anomaly year in terms of wildfires in Napa and a vast discrepancy was identified in acres burned due to wildfires between 2017 and 2019 in the region.

Source: Data compiled by Ascent in 2023.

According to CEPAM's 2017 estimates, wildfires generated 2,396 $MTCO_2e$ in BC emissions. However, 2017 was an anomalous year in terms of wildfires in Napa. In 2017, 60,000 acres were reported burned (Kirk 2022). While in 2019, a total of 640 acres were reported burned (CAL FIRE 2019). Therefore, 2017 wildfire emissions estimates were scaled by the burned acreage to reflect 2019 conditions. As a result, it is estimated that wildfires generated 26 $MTCO_2e$ in BC emissions, which are more than half of the region's anthropogenic BC emissions.

8 FUGITIVE METHANE

Based on modeling conducted, fugitive methane emissions in 2019 were 13,424 MT CH_4 or 1,090,020 $MTCO_2e$. This only accounts for one percent of total SLCP emissions in the region. Primary sources of fugitive methane emissions are oil and gas refineries and natural gas pipelines. The methodology for estimating fugitive methane for the state inventory is provided in the California 2000-2020 GHG Inventory (CARB 2022b). For this inventory, fugitive methane from oil and gas sources is excluded because according to the State's annual Oil and Gas reports, this industry is not known to operate in the region (Department of Conservation 2024). Fugitive emissions from pipelines are generated from transmission pipeline leaks, distribution main & service pipeline leaks, and transmission pipeline blowdowns. Pipeline blowdowns are routine natural gas transmission and distribution systems operations to allow operators to safely perform maintenance, inspections, construction, and emergency response. This practice involves isolating and depressurizing a section of the pipeline and typically venting the natural gas into the atmosphere, which can result in methane emissions. Pacific Gas and Electric (PG&E) provided data for fugitive methane emissions from pipelines (Melendez, pers. comm., 2023). Fugitive methane has a 20-year GWP factor of 81. GWP factors are presented in Table 3. Table 7 presents fugitive methane emissions from the region's pipeline sources.

Table 7 2019 Napa County Regional Fugitive Methane Emissions

Emission Sources	Fugitive Methane Emissions (MT)	Fugitive Methane Emissions ($MTCO_2e$)	Share of Fugitive Methane Emissions by Emission Sources (%)
Pipeline	196	15,953	100%

Notes: CO_2e= carbon dioxide equivalent; MT = metric tons.

Source: Modelling by Ascent in 2024.

9 SULFUR HEXAFLUORIDE

Based on modeling conducted, SF_6 in the region accounted for 0.034 MT SF_6 or 615 $MTCO_2e$ in 2019 which is less than one percent of total SLCP emissions in the region. SF_6 is a gas used in electrical insulation with applications in both semiconductor manufacturing and transmission of electricity. SF_6 from semiconductor manufacturing are excluded because this industry is not known to operate in the region. For SF_6 emissions from electrical transmission, CARB's inventory methodology uses a 0.00003625 gram-per-kWh emissions factor to calculate SF_6 emissions from the total electricity generation in the state (CARB 2022b). The regional inventory uses the same emissions factor and applies it to the estimated 926,660,844 kWh of electricity used in Napa County in 2019. The 20-year GWP factor used for SF_6 is 18,300. GWP factors are presented in Table 3. Table 8 presents SF_6 emissions in the region.

Table 8 2019 Napa County Regional Sulfur Hexafluoride Emissions

Emission Sources	Sulfur Hexafluoride Emissions (MT)	Sulfur Hexafluoride Emissions ($MTCO_2e$)	Share of Sulfur Hexafluoride Emissions by Emission Sources (%)
Electrical Transmission	0.03	615	100%

Notes: CO_2e= carbon dioxide equivalent; MT = metric tons; SF_6 = sulfur hexafluoride

Source: Modelling by Ascent in 2024.

10 PERFLUORINATED COMPOUNDS

Based on modeling conducted, PFCs in the region accounted for 0.0004 MT PFCs or 2 $MTCO_2e$ in 2019 which is less than one percent of the total SLCP emissions. In the region, semiconductor manufacturing-related PFC emissions are not assumed to be present given the absence of semiconductor manufacturing industry. PFC emissions from other

sources (e.g., solvents, and fire protection) emit minimal emissions. Estimations using data from California's 2000-2020 GHG Inventory show that these emissions account for only 0.015 percent of statewide SLCP emissions (CARB 2022b). To calculate PFC emissions in the region, this percentage was applied to the total SLCP emissions originating from the region. The 20-year GWP factor used for PFCs is 5,868. GWP factors are presented in Table 3. Table 9 presents PFC compounds and their sources listed in the California 2000-2020 GHG Inventory applicable to the region and Table 10 presents PFC emissions in the region (CARB 2022b).

Table 9 PFC compounds and their sources listed in the California 2000-2020 GHG Inventory that apply to Napa County Region

Sources	Compounds
Solvents	Other PFC and PFE
Commercial Fire Protection	CF_4
Industrial Fire Protection	CF_4
Solvents	CF_4

Notes: CF_4= perfluorocarbon; PFC= perfluorinated compounds; PFE= perfluoropolyethers.

Source: Modelling by Ascent in 2024.

Table 10 2019 Napa County Regional PFC Emissions

Emission Sources	PFC emissions (MT)	PFC Emissions ($MTCO_2e$)	Share of PFC Emissions by Emission Sources (%)
Ozone-depleting substitutes and fire suppressants	0.0032	2	100%

Notes: CO_2e = carbon dioxide equivalent; MT= metric tons; PFC= perfluorinated compounds.

Source: Modelling by Ascent in 2024.

11 SUMMARY

Although not included in the region's GHG inventory, SLCPs still contribute to increased concentrations of GHGs in the atmosphere and, thereby, climate change. In 2019, SLCPs accounted for 1.1 million $MTCO_2e$, based on a 20-year GWP factor, and over 396,000 $MTCO_2e$ if using a 100-year GWP factor. Accounting for the methane already included in the regional GHG inventory and using the same 100-year GWP factors, this could increase the region's emissions by 32 percent. However, reducing SLCPs in the near term can have immediate effects on the contribution of these gases to climate change.

The strategy for reducing SLCPs begins with identifying the largest sources. Actions to reduce these emissions are already underway, but there are opportunities to support these and further reductions. With nearly 70 percent of SLCPs coming from other methane sources, the region is already committed to reducing these emissions through the forthcoming Regional Climate Action and Adaptation Plan (RCAAP). Following other methane sources, HFCs and black carbon sources account for nearly 30 percent of emissions. In terms of reducing HFC emissions, the state is currently implementing a maximum GWP limit for refrigerants, the main source of HFCs. According to the Refrigerant Management Program, CARB began prohibiting refrigerants with GWPs greater than 750 in most new applications starting in January 2023 (CARB 2020). This GWP limit is almost 80 percent lower than the current GWP level assumed for HFCs, meaning that, once fully implemented, HFC emissions could be reduced by 80 percent in the future from 2019 levels.

Anthropogenic black carbon emissions come from a variety of sources, but most are from fuel combustion in buildings, transportation, and off-road equipment. Energy efficiency measures, building electrification, vehicle electrification, and strategies to reduce VMT are all existing and planned measures to reduce emissions from fuel

combustion in buildings and mobile sources. The reduction in PM emissions from these measures will also have a proportional reduction in black carbon emissions.

With the existing legislative reductions and planned measures under the RCAAP addressing most of the SLCP emissions sources, further reductions in the impact of SLCPs could be gained through the immediate implementation of these measures. The sooner SLCP emissions are reduced, the greater the reductions can be on climate change impacts due to these pollutants' high GWP, especially in the short term. Similarly, gains in wildfire management and the prevention of significant BC emissions from wildfires can also reduce impacts associated with climate change.

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Attachment A

Sources of SLCP Emissions in the Napa County Region

SOURCES OF SLCP EMISSIONS IN THE NAPA COUNTY REGION

Table A-1 presents the SLCPs and their emission sources as included in the region's 2019 SLCP inventory. The list of emissions sources is analogous to the list used by the State in its SLCP inventory. Table A-1 also identifies whether a particular SLCP emissions source, included in the State's inventory, applies to the region and explains the rationale behind its applicability. Table A-2 shows the detailed emissions sources accounted for in the BC inventory. Table A-3 details the HFC emissions estimated for 2019 by HFC pollutant as listed in California's 2000-2020 GHG SLCP Inventory.

Table A-1 Summary of Sources for the 2019 Napa County Regional GHG SLCP Inventory

Pollutant/ Sources	Applicability in Napa County Region (Yes/No)	Rationale
Black Carbon		
Manufacturing and Industrial	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Service and Commercial	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Incinerators	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Soil Remediation[2]	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Chemical	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Mineral Processes	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Other (Industrial Processes)	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Residential Fuel Combustion	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Agriculture[3]	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Construction and Demolition	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Paved Road Dust	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Unpaved Road Dust	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Fugitive Windblown Dust	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Managed Burning and Disposal	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Cooking	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Other (Miscellaneous Processes)	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]

Pollutant/ Sources	Applicability in Napa County Region (Yes/No)	Rationale
Transportation [4]	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Wildfires	Yes	Listed as a source of BC in Napa County Region in CEPAM 2019v1.03 Emission Projection Data[1]
Fugitive Methane		
Pipeline Methane Fugitives	Yes	Emissions arising from intentional and unintentional leakage of natural gas in pipelines
Oil & Gas CH_4 Fugitives	No	No oil and gas refineries in Napa County
Methane (non-fugitive)		
Energy consumption	Yes	Emissions from electricity demand, natural gas, biomass (wood), diesel, propane, and gasoline in residential, commercial, and industrial developments
On-road sector	Yes	Emissions from fuel combustion from on-road vehicles
Off-road sector	Yes	Emissions from fuel combustion from off-road equipment
Landfills	Yes	Emissions from waste generation and waste in place
Wastewater	Yes	Emissions from wastewater treatment
Agriculture (livestock)	Yes	Emissions from enteric fermentation and manure management in livestock
Agriculture (farming practices)	Yes	Emissions from crop growing & harvesting and fuel use in equipment
Hydrofluorocarbon (HFCs)		
From semiconductors	No	No semiconductor manufacturing companies in the region
From ODS substitutes	Yes	Emissions occur when they are released into the atmosphere or when they leak out of equipment such as refrigerators and air conditioning units
Perfluorinated compounds (PFCs)		
From semiconductors	No	No semiconductor manufacturing companies in Napa County
From ODS substitutes	Yes	Emissions occur when they are released into the atmosphere or when they leak out of equipment such as refrigerators and air conditioning units
Fire suppressants	Yes	Emissions occur from fire suppressants
Sulfur hexafluoride (SF_6)		
From electricity transmission	Yes	Emissions occur by use of SF_6 by the electric power industry in gas-insulated substations, circuit breakers, and other switchgear
From semiconductors	No	No semiconductor manufacturing companies in Napa County

Notes: BC= black carbon; CARB = California Air Resources Board; CEPAM = California Emissions Projection Analysis Model; CH_4 = methane; GHG= greenhouse gas; HFCs = hydrofluorocarbons; ODS= ozone-depleting substances; PFC= perfluorinated compound; SLCP= short-lived climate pollutant; SF_6 = sulfur hexafluoride.

[1] Source: CARB 2017.
[2] Soil remediation is a term that refers to various processes designed to remove contaminants such as hydrocarbons (petroleum and fuel residues), heavy metals, pesticides, cyanides, volatiles, creosote, and semi-volatiles from soil.
[3] Agriculture includes emissions from farming operations and farm equipment
[4] Transportation includes emissions from off-road Equipment, recreational boats, aircraft, Medium Heavy Duty Diesel Trucks (MHDDT), Heavy Heavy Duty Diesel Trucks (HHDDT), Light Heavy Duty Diesel Trucks - 1 (LHDDT1), Medium Duty Trucks (MDV), Light Duty Trucks - 2 (LDT2)

Source: Compiled by Ascent in 2024. CARB 2017.

Table A-2 2019 Napa County Regional Black Carbon Emissions by Process

Emissions Sector	CEPAM 2019v1.03 Combustion Processes Categories	Black Carbon Emissions (MT per year)	Share of Black Carbon Emissions by Combustion Processes Categories (%)
Industrial	Coatings and related process solvents	0	0.00%
Transportation	Heavy-heavy duty gas trucks (HHDGT)	0.00018	0.0004%
Transportation	School buses - gas (SBG)	0.00387	0.01%
Transportation	Heavy duty gas urban buses (UBG)	0.00626	0.02%
Dust	Unpaved road dust	0.00649	0.02%
Offroad	Commercial harbor craft	0.00783	0.02%
Transportation	Motorcycles (MCY)	0.009	0.02%
Other	Other (fuel combustion)	0.0102	0.02%
Energy/Utilities	Electric utilities	0.01068	0.03%
Industrial	Wood and paper	0.01185	0.03%
Transportation	Heavy duty diesel urban buses (UBD)	0.01307	0.03%
Transportation	Other buses - gas (OBG)	0.01521	0.04%
Industrial	Manufacturing and industrial	0.0164	0.04%
Agricultural	Farming operations	0.01712	0.04%
Transportation	Light heavy duty gas trucks - 2 (LHDGT2)	0.01722	0.04%
Transportation	Motor homes (MH)	0.01886	0.05%
Transportation	Medium heavy duty gas trucks (MHDGT)	0.01971	0.05%
Agricultural	Soil remediation	0.02757	0.07%
Transportation	Other buses - motor coach - diesel (OBC)	0.03241	0.08%
Energy/Utilities	Cogeneration	0.03392	0.08%
Industrial	Other (industrial processes)	0.04578	0.11%
Agricultural	Food and agriculture	0.05034	0.12%
Dust	Fugitive windblown dust	0.05475	0.13%
Offroad	Trains	0.06333	0.15%
Agricultural	Food and agricultural processing	0.07058	0.17%
Offroad	Construction and demolition	0.09455	0.23%
Other	Other (miscellaneous processes)	0.10175	0.25%
Transportation	All other buses - diesel (OBD)	0.10432	0.25%

Emissions Sector	CEPAM 2019v1.03 Combustion Processes Categories	Black Carbon Emissions (MT per year)	Share of Black Carbon Emissions by Combustion Processes Categories (%)
Industrial	Service and commercial	0.11599	0.28%
Transportation	Light heavy-duty gas trucks - 1 (LHDGT1)	0.12346	0.30%
Transportation	Light heavy-duty diesel trucks - 2 (LHDDT2)	0.15517	0.37%
Transportation	School buses - diesel (SBD)	0.15963	0.38%
Transportation	Light duty trucks - 1 (LDT1)	0.19822	0.48%
Industrial	Mineral processes	0.20095	0.48%
Industrial	Chemical	0.20752	0.50%
Fires	Fires	0.26984	0.65%
Offroad	Off-road recreational vehicles	0.3688	0.89%
Industrial	Incinerators	0.37145	0.90%
Dust	Paved road dust	0.39001	0.94%
Offroad	Aircraft	0.43989	1.06%
Transportation	Medium-duty trucks (MDV)	0.48498	1.17%
Transportation	Light heavy-duty diesel trucks - 1 (LHDDT1)	0.48562	1.17%
Transportation	Light duty trucks - 2 (LDT2)	0.60726	1.46%
Residential Fuel Combustion	Cooking	0.89901	2.17%
Offroad	Recreational boats	0.93546	2.25%
Offroad	Off-road equipment (perp)	0.94874	2.29%
Transportation	Heavy heavy-duty diesel trucks (HHDDT)	1.35201	3.26%
Transportation	Medium heavy-duty diesel trucks (MHDDT)	1.60775	3.87%
Transportation	Light duty passenger (LDA)	1.62773	3.92%
Prescribed Fires	Managed burning and disposal	2.97384	7.17%
Residential Fuel Combustion	Residential fuel combustion	5.38202	12.97%
Offroad	Off-road equipment	6.67398	16.08%
Agricultural	Farm equipment	13.65876	33%
	Total (MT per year)	**42**	**100%**
	Wildfires[1]	26[2]	NA

Note: CEPAM = California Emissions Projection Analysis Model; HHDDT = heavy heavy-duty diesel trucks; HHDGT= heavy-heavy duty gas trucks; LDA= light duty passenger; LHDGT= light heavy-duty gas trucks; LDT= light duty trucks; LHDDT= light heavy-duty diesel trucks; LHDGT = light heavy-duty gas trucks; MHDDT= medium heavy duty diesel trucks; MHDGT= medium heavy duty gas trucks; MDV= medium duty trucks; OBC= other buses - motor coach; OBD= all other buses – diesel; OBG= other buses-gas; SBG= school buses – gas; MCY= motorcycles; NA = not applicable; MT = metric ton; UBD = diesel urban buses.

[1] Emissions from wildfires are added for informational purposes only and are not included in the total BC emissions estimates.

[2] Wildfire emissions estimates for 2017 available from CEPAM were adjusted to reflect emissions in 2019. This was done because 2017 was an anomaly year in terms of wildfires in Napa and a vast discrepancy was identified in acres burned due to wildfires between 2017 and 2019 in the region.

Source: Data compiled by Ascent in 2023.

Table A-3 HFC Compounds and Sources Listed in the California 2000-2020 GHG SLCP Inventory that apply to the Napa County Region

HFC Compound	HFC Source
HFC-125	ODS Substitutes
HFC-134a	ODS Substitutes
HFC-143a	ODS Substitutes
HFC-152a	ODS Substitutes
HFC-227ea	ODS Substitutes
HFC-236fa	ODS Substitutes
HFC-245fa	ODS Substitutes
HFC-32	ODS Substitutes
HFC-365mfc	ODS Substitutes
HFC-43-10mee	ODS Substitutes

Notes: HFC = hydrofluorocarbon, ODS = ozone depleting substance, GHG = greenhouse gas, SLCP = slow lived climate pollutant

Source: CARB 2022b. Modeling conducted by Ascent in 2024.

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