Chapter 9 – Air Quality

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Chapter 9 Air Quality

This chapter is based on the background information and technical analysis documented in Appendix L, *Air Quality Technical Appendix*, which includes additional information on air quality conditions and technical analysis of the effects of each alternative.

9.1 Affected Environment

The U.S. Environmental Protection Agency (USEPA) has set National Ambient Air Quality Standards (NAAQS) for seven common pollutants, known as criteria pollutants, according to health-based criteria. The criteria pollutants are carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, particulate matter of 10 microns diameter and smaller (PM_{10},), particulate matter of 2.5 microns diameter and smaller ($PM_{2.5}$), and sulfur dioxide (SO_2). The California Air Resources Board (CARB) has set state ambient air quality standards that are similar or stricter than the NAAQS. Lead is not a component of the fuels used in power plants and consequently is not assessed. Reactive organic gases (ROG), though not a criteria pollutant, are evaluated because they contribute to ozone formation. Ozone is not emitted directly from sources but is formed in the atmosphere from chemical reactions of the ozone precursor chemicals nitrogen oxides (NO_x) and ROG. Therefore, potential ozone impacts are assessed based on emissions of NO_x and ROG.

USEPA and CARB have designated many of the counties in the action area as nonattainment (not meeting the NAAQS) for one or more pollutants, based on ambient concentrations measured by a network of monitors. Appendix L provides information on the attainment status of each county in the action area.

9.2 Effects of the Alternatives

The impact analysis considers changes in air quality related to changes in CVP and SWP operation under the alternatives as compared with the No Action Alternative.

The No Action Alternative is based on 2040 conditions. The changes to emissions that are assumed to occur by 2040 under the No Action Alternative conditions would be different from existing conditions because of the following factors:

- Climate change and sea-level rise
- General plan development throughout California, including increased water demands in portions of the Sacramento Valley

Under the No Action Alternative, Reclamation would continue with the current operation of the CVP, as described in the 2020 Record of Decision and subject to the 2019 Biological Opinions. The 2020 Record of Decision for the CVP and the 2020 Incidental Take Permit for the SWP represent current management direction or intensity pursuant to 43 CFR Section 46.30.

Although the No Action Alternative included habitat restoration projects at a programmatic level, the 2020 ROD did not provide environmental coverage for these projects, and all of the habitat projects considered under the No Action required or will require additional environmental documentation. Thus, ground disturbance for habitat restoration projects did not materialize as a result of implementing the No Action Alternative. For the purpose of the analysis, these habitat restoration projects are considered independent projects that will be considered under cumulative effects.

For the purposes of this analysis, the changes in operations and flows are linked to changes in air pollutant emissions because changes in operations and flows affect the amount of power the hydroelectric facilities in the system can generate. Where flows increase on rivers that have hydroelectric facilities then hydropower generation could increase. The additional hydroelectric power is expected to displace power that must be purchased from suppliers connected to the regional electric system (grid). To the extent that the displaced power would have been generated by fossil-fueled power plants, emissions of criteria pollutants from these plants would decrease. Conversely, if hydropower generation decreases, the decrease must be offset by purchased power from the grid to meet demand for power. To the extent that the additional purchased power would have been generated by fossil-fueled power plants, emissions from these plants would increase.

Changes in river flows and reservoir levels also can affect the amount of water available for agricultural irrigation. If surface water availability decreases, farmers could make up the difference in water supply by increasing groundwater pumping, which could lead to an increase in emissions. Conversely, if surface water availability increases, farmers could decrease the amount of groundwater they pump, which could lead to a decrease in emissions.

The No Action Alternative, thus, is expected to result in potential changes to air quality from potential changes in emissions from fossil-fueled power plants, hydropower generation, and groundwater pumping. These changes were described and considered in the 2020 Long-term Operation of the CVP and SWP record of decision and associated documents.

9.2.1 Air quality impacts from potential changes in emissions from fossil-fueled power plants (hydropower generation)

The action alternatives would change operations of the CVP and SWP, which change river flows and reservoir levels. These changes could affect the amount of hydroelectric energy generated, as well as the amount of energy used for operations and pumping, at CVP and SWP facilities. Net energy is the difference between energy generated and energy used. When net energy is positive the CVP and SWP sell the excess to the grid, and GHG emissions from power plants decrease. When net energy is negative the CVP and SWP purchase power from the grid, and GHG emissions from power plants (to the extent fossil-fueled) supplying that power increase.

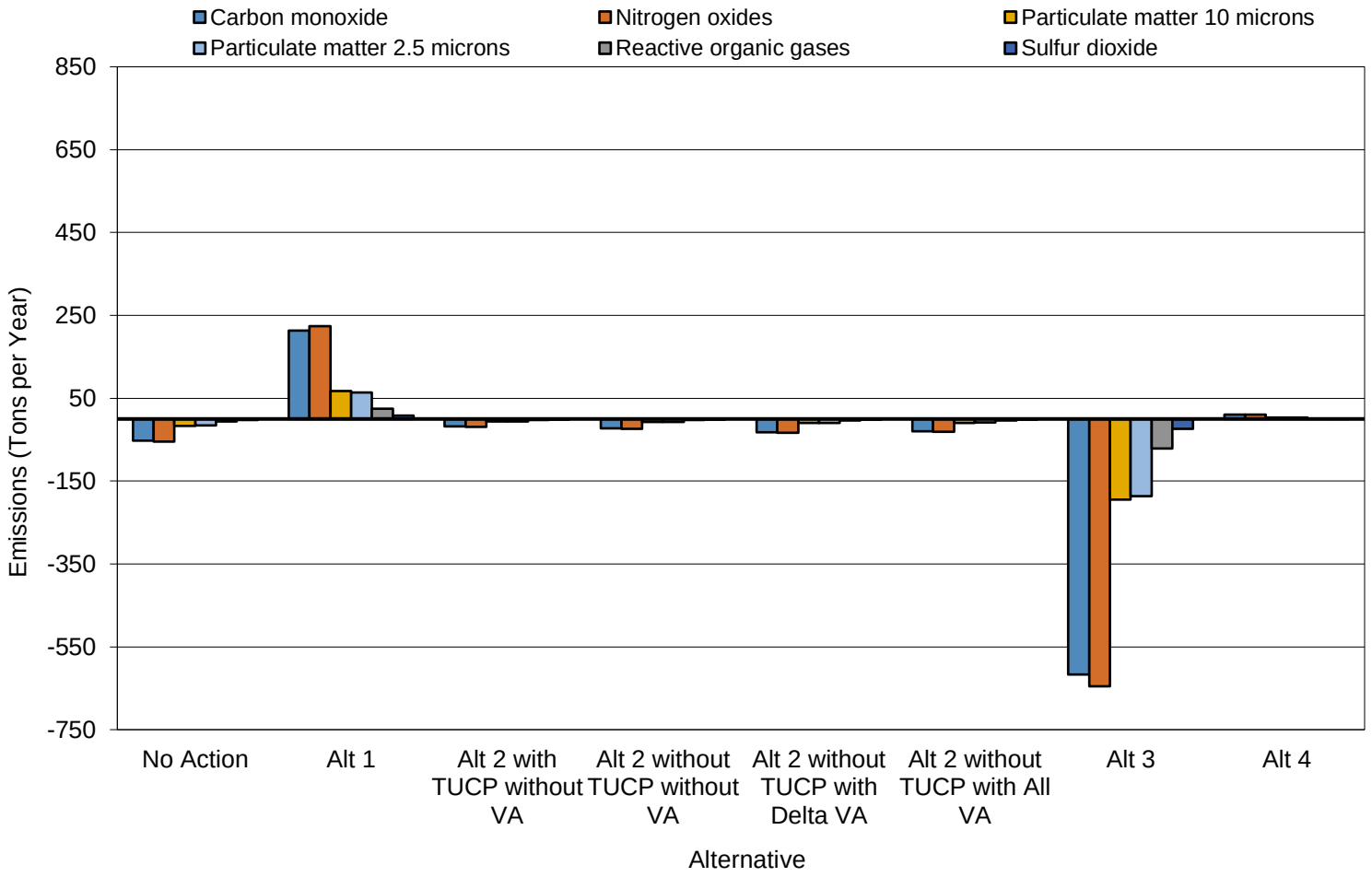
With alternatives 1, 2 (all four phases), and 4, net energy would decrease compared to the No Action Alternative (decreases of long-term averages from 6% to 47% for SWP and increases of 2% to decreases of 4% for CVP), and as a result emissions would increase. The increases would be largest with Alternative 1, less with Alternative 4, and least with Alternative 2 (all four phases). With Alternative 3 net energy would increase compared to the No Action Alternative (increases of long-term averages of 86% for SWP and 21% for CVP), and as a result emissions would decrease.

Table 9-1 shows the estimated emissions from fossil-fueled grid power plants associated with net generation. Figure 9-1 and Figure 9-2 show the emissions of each pollutant for grid power generation and the changes compared to the No Action Alternative, respectively.

Table 9-1. Emissions from Net Generation.

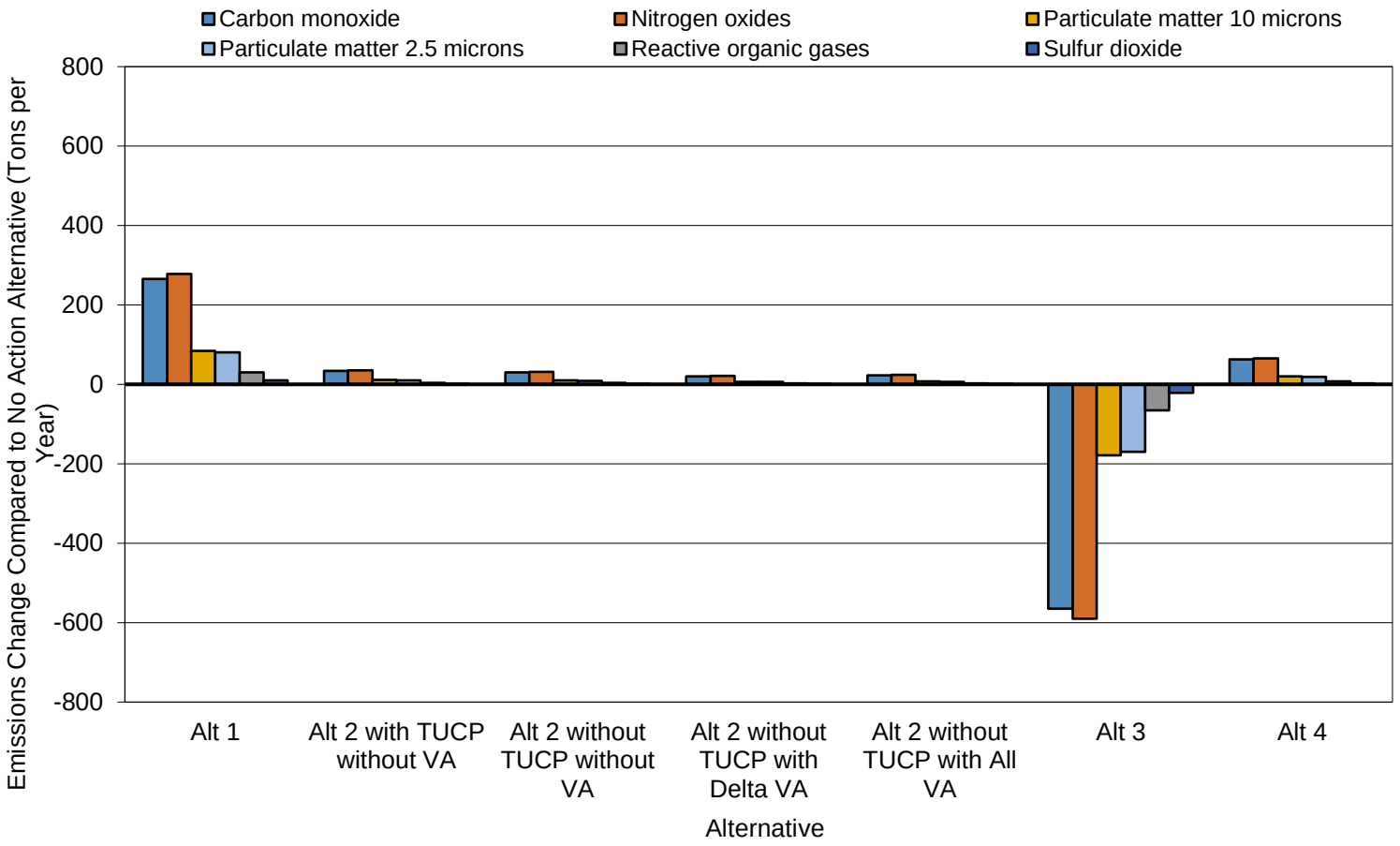
Pollutant	Emissions (U.S. tons per average year)							
	No Action	Alt 1	Alt 2 with TUCP without VA	Alt 2 without TUCP without VA	Alt 2 without TUCP with Delta VA	Alt 2 without TUCP with All VA	Alt 3	Alt 4
CO	-52	214	-18	-22	-32	-30	-617	10
NO_x	-55	223	-19	-23	-34	-31	-645	10
PM_{10}	-17	68	-6	-7	-10	-9	-195	3
$PM_{2.5}$	-16	64	-6	-7	-10	-9	-186	3
ROG	-6	25	-2	-3	-4	-3	-71	1
SO_2	-2	8	-1	-1	-1	-1	-24	0

Notes:
Values represent the emissions effects of net generation, i.e., CVP/SWP hydropower generation minus CVP/SVP energy use. Emissions of zero would indicate that CVP/SWP hydropower generation exactly equals CVP/SWP energy use. Negative emission values indicate decreases in emissions because net generation is positive and displaces grid power; positive emission values indicate increases in emissions because net generation is negative and CVP/SWP purchases the needed power from the grid.
CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = particulate matter of 10 microns diameter and smaller; $PM_{2.5}$ = particulate matter of 2.5 microns diameter and smaller; ROG = reactive organic gases; SO_2 = sulfur dioxide; Alt = Alternative; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements



Notes: Alt = Alternative; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements

Figure 9-1. Emissions from Grid Power Generation.



Notes: Alt = Alternative; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements
Emissions for the No Action Alternative are not shown because they are the baseline to which changes under the action alternatives are compared. These baseline emissions are indicated by the No Action bar in Figure 9-1.

Figure 9-2. Changes in Emissions from Grid Power Generation Compared to the No Action Alternative.

9.2.2 Air quality impacts from potential changes in emissions from fossil-fueled power plants (groundwater pumping)

The action alternatives would change operation of the CVP and SWP, which could change river flows and reservoir levels. These changes could affect the amount of water available for agricultural irrigation. If surface water availability decreases, farmers could make up the difference in water supply by increasing groundwater pumping. To the extent that the additional purchased power would be generated by fossil-fueled power plants, emissions from these plants could increase. Conversely, if surface water availability increases, farmers could decrease the amount of groundwater they pump, which could lead to a decrease in emissions.

Changes in surface water availability also can affect the amount of land fallowed by agricultural water users. If an increase in fallowing were to occur under dry-weather conditions the potential for fugitive dust emissions could increase. Conversely, a decrease in fallowing could decrease the potential for fugitive dust emissions.

Air quality effects resulting from changes in groundwater pumping were evaluated on a project-wide basis in terms of air pollutant emissions from the fossil-fueled power plants (for electrically-powered pumps) and from engines (for engine-powered pumps). For the details of the groundwater modeling on which the air quality analysis was based and the project-wide quantities of water pumped, see Appendix I, *Groundwater Technical Appendix*. Table 9-2 shows the estimated emissions from groundwater pumping. Figure 9-3 and Figure 9-4 show the emissions of each pollutant and the changes compared to the No Action Alternative for groundwater pumping, respectively.

Table 9-2. Emissions from Groundwater Pumping.

	Emissions (U.S. tons per average year)							
Pollutant	No Action	Alt 1	Alt 2 with TUCP without VA	Alt 2 without TUCP without VA	Alt 2 without TUCP with Delta VA	Alt 2 without TUCP with All VA	Alt 3	Alt 4
ELECTRIC PUMPS								
CO	1,853	1,835	1,856	1,856	1,861	1,859	1,939	1,851
NO_x	1,939	1,921	1,942	1,942	1,948	1,945	2,029	1,937
PM_{10}	586	581	587	587	589	588	613	585
$PM_{2.5}$	559	554	560	560	562	561	585	558
ROG	214	212	214	214	215	214	224	214
SO_2	72	71	72	72	72	72	76	72
DIESEL PUMPS								
CO	9,492	9,402	9,507	9,505	9,533	9,520	9,933	9,481
NO_x	8,670	8,588	8,684	8,682	8,708	8,696	9,073	8,661

Pollutant	Emissions (U.S. tons per average year)							
	No Action	Alt 1	Alt 2 with TUCP without VA	Alt 2 without TUCP without VA	Alt 2 without TUCP with Delta VA	Alt 2 without TUCP with All VA	Alt 3	Alt 4
PM_{10}	275	272	275	275	276	275	287	274
$PM_{2.5}$	251	248	251	251	252	252	262	251
ROG	1,034	1,024	1,036	1,036	1,039	1,037	1,082	1,033
SO_2	17	17	17	17	17	17	17	17
TOTAL PUMPING EMISSIONS [1]								
CO	11,345	11,237	11,363	11,361	11,395	11,379	11,872	11,332
NO_x	10,609	10,508	10,627	10,624	10,656	10,641	11,103	10,597
PM_{10}	861	853	862	862	865	863	901	860
$PM_{2.5}$	810	802	811	811	813	812	848	809
ROG	1,248	1,236	1,250	1,250	1,253	1,252	1,306	1,247
SO_2	89	88	89	89	89	89	93	89

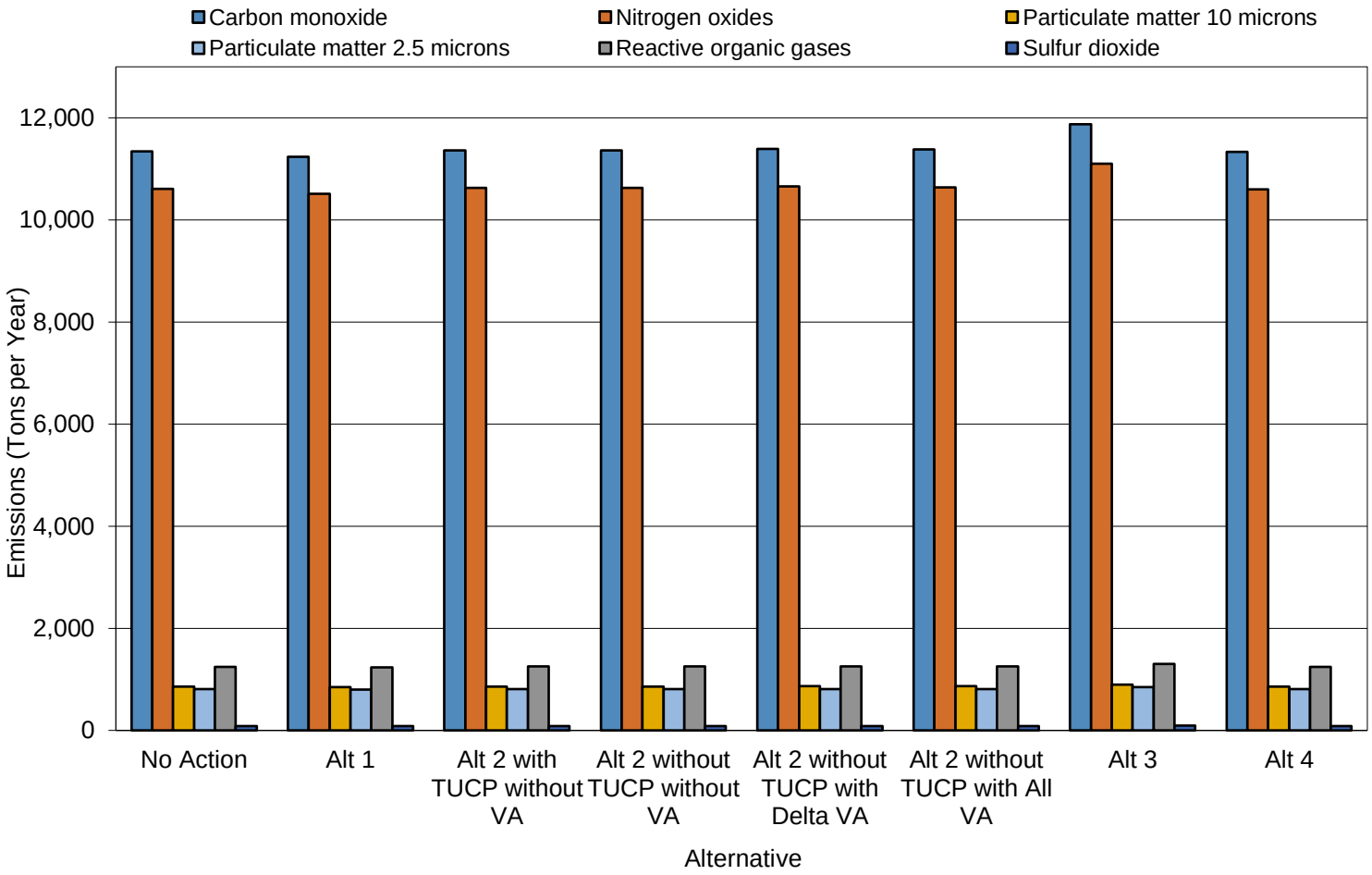
Notes: Alt = Alternative; CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter of 10 microns diameter and smaller; $PM_{2.5}$ = particulate matter of 2.5 microns diameter and smaller; ROG = reactive organic gases; SO_2 = sulfur dioxide; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements

[1] Sum of individual values may not equal total due to rounding.

9.2.3 Air quality impacts from combined potential changes in emissions

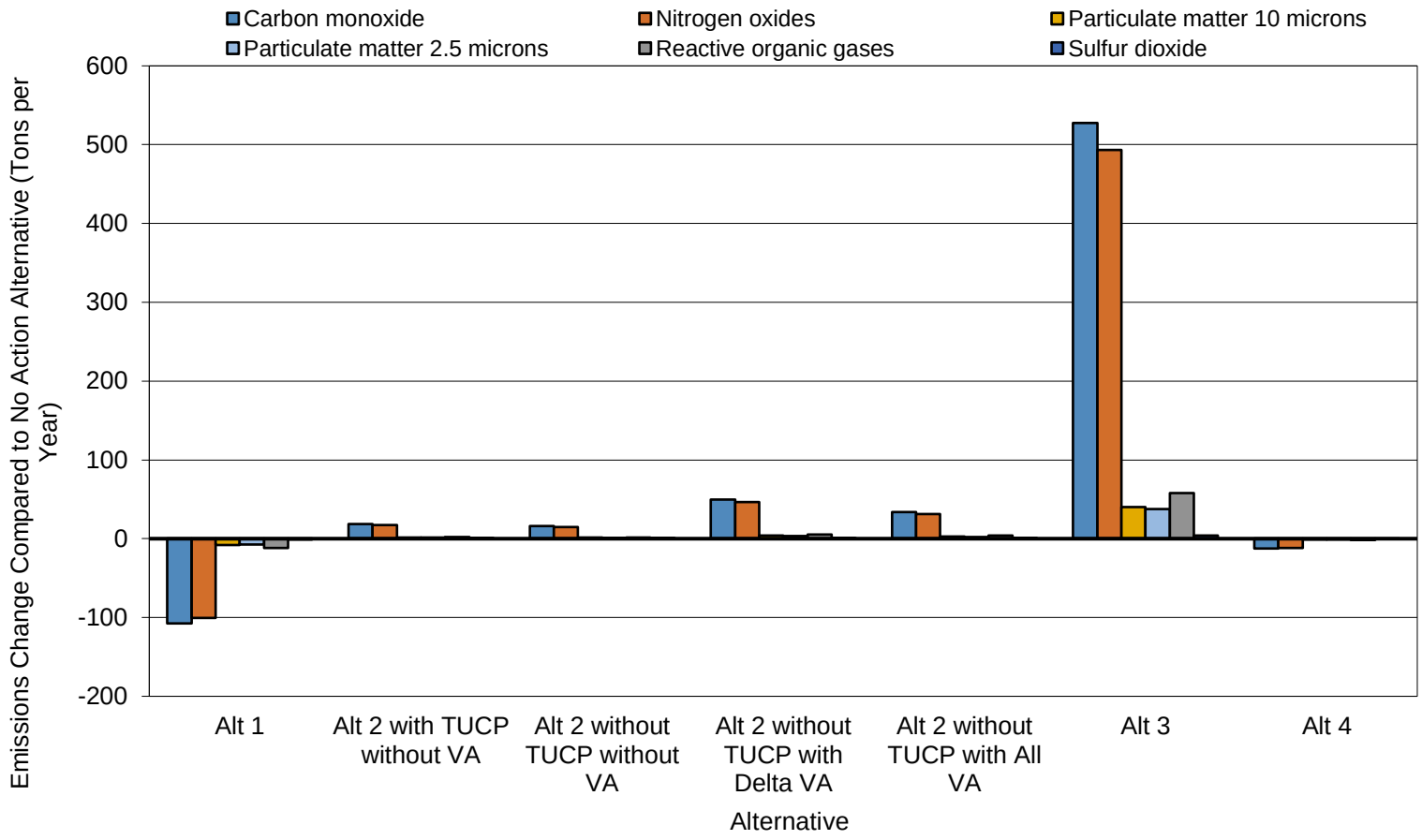
The total emissions associated with the alternatives are the sum of the emissions from net generation (Table 9-1) and groundwater pumping (Table 9-2). Table 9-3 shows the estimated total project emissions for a long-term average year. Figure 9-5 and Figure 9-6 show the overall emissions of each pollutant for all emission sources, and the changes in emissions compared to the No Action Alternative, respectively.

Alternative 1 would lead to increases in regional emissions of CO, NO_X, PM_{10}, $PM_{2.5}$, ROG, and SO_2 compared to the No Action Alternative by 1.4% to 11% depending on the pollutant. Alternative 2, including all four phases, would lead to increases in regional emissions of CO, NO_X, PM_{10}, $PM_{2.5}$, ROG, and SO_2 compared to the No Action Alternative by 0.4% to 1.7% depending on the pollutant. Alternative 3 would lead to decreases in regional emissions of CO, NO_X, PM_{10}, $PM_{2.5}$, ROG, and SO_2 compared to the No Action Alternative by 0.3% to 20.6% depending on the pollutant. Alternative 4 would lead to increases in regional emissions of CO, NO_X, PM_{10}, $PM_{2.5}$, ROG, and SO_2 compared to the No Action Alternative by 0.4% to 2.3% depending on the pollutant.



Notes: Alt = Alternative; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements

Figure 9-3. Emissions from Groundwater Pumping.



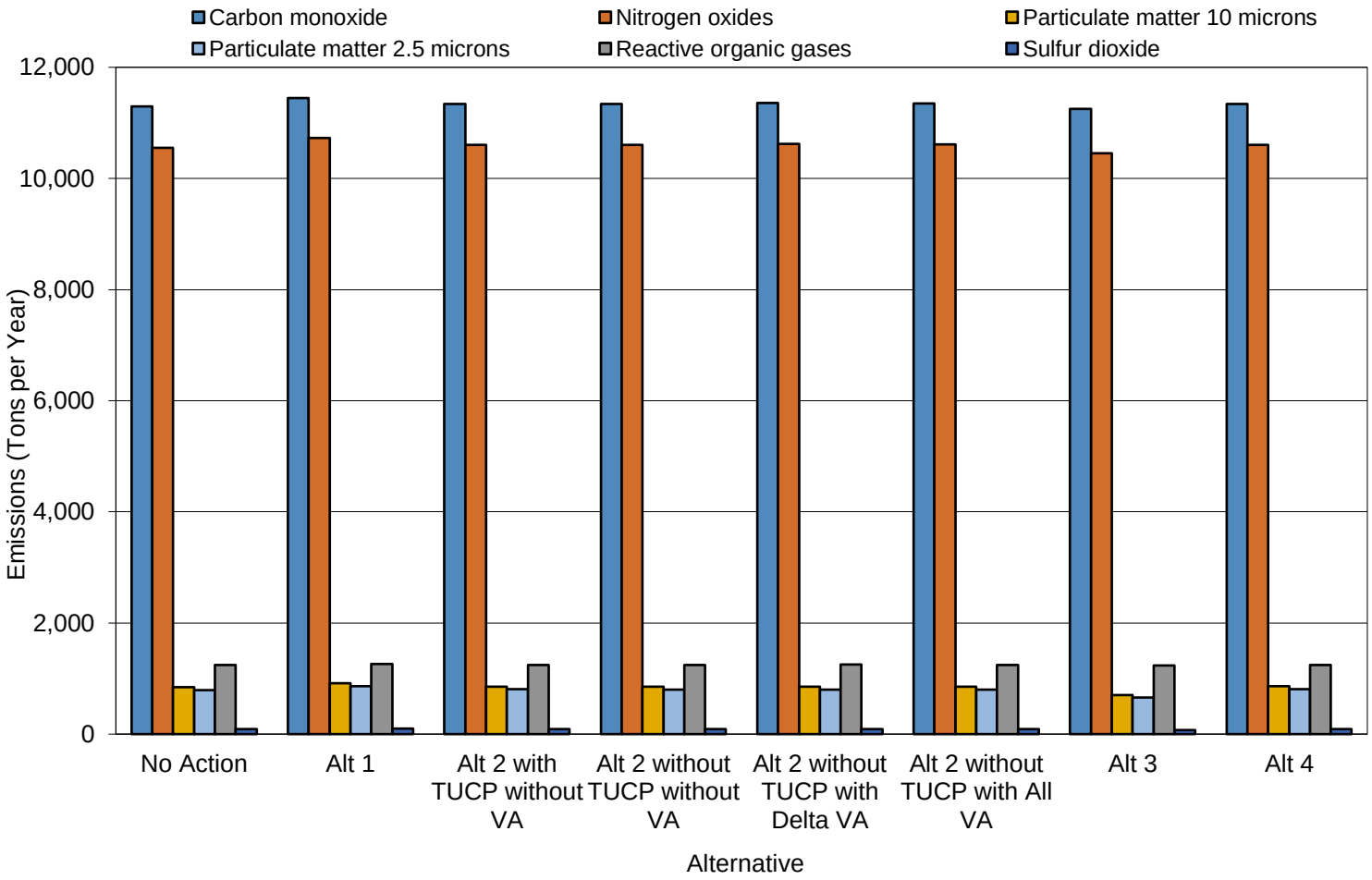
Notes: Alt = Alternative; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements
Emissions for the No Action Alternative are not shown because they are the baseline to which changes under the action alternatives are compared. These baseline emissions are indicated by the No Action bar in Figure 9-3.

Figure 9-4. Changes in Emissions from Groundwater Pumping Compared to the No Action Alternative.

Table 9-3. Total Project Emissions.

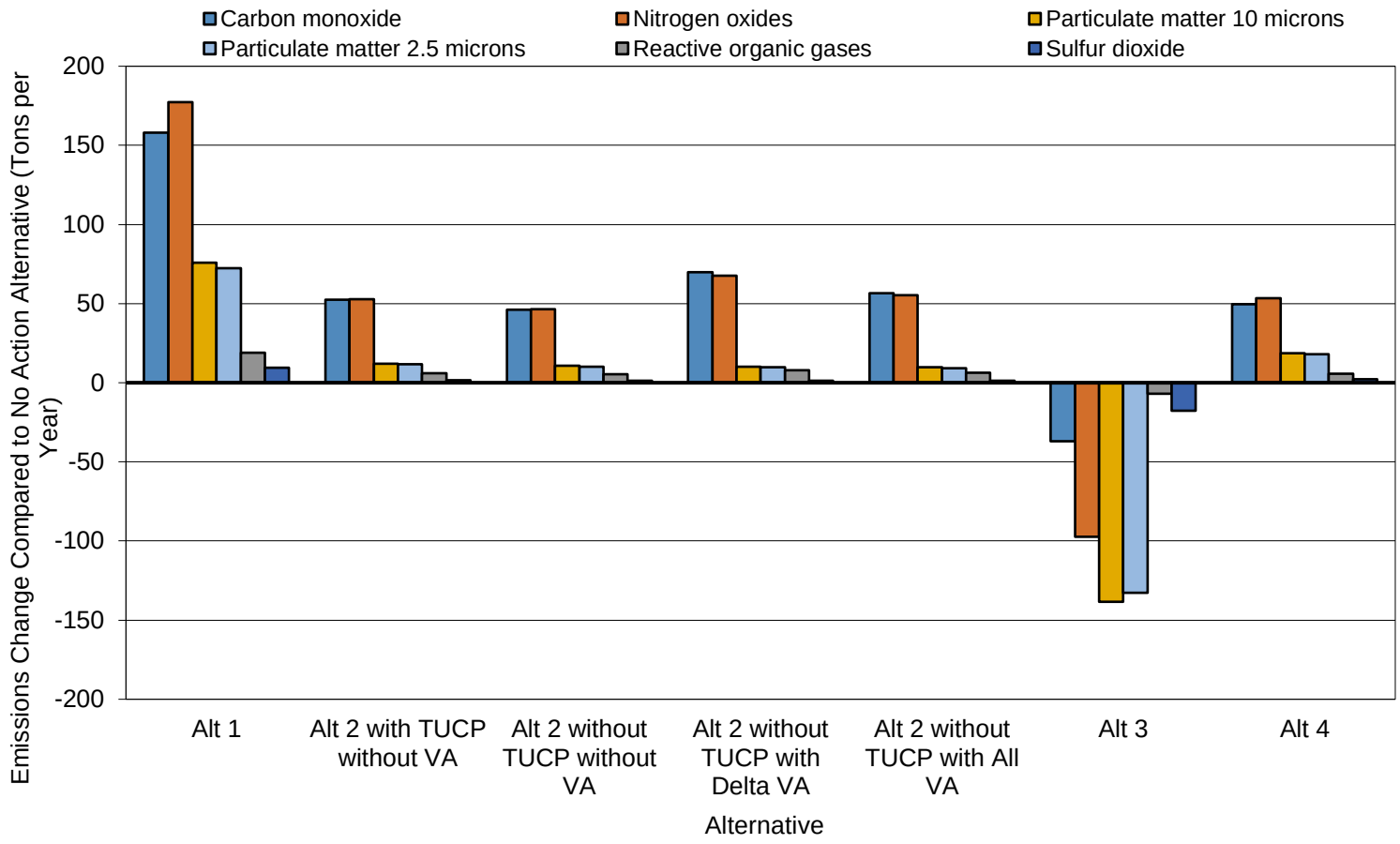
Pollutant	Emissions (U.S. tons per average year)							
	No Action	Alt 1	Alt 2 with TUCP without VA	Alt 2 without TUCP without VA	Alt 2 without TUCP with Delta VA	Alt 2 without TUCP with All VA	Alt 3	Alt 4
CO	11,293	11,451	11,345	11,339	11,362	11,349	11,256	11,342
NO_x	10,554	10,732	10,607	10,601	10,622	10,610	10,457	10,608
PM_{10}	844	920	856	855	854	854	706	863
$PM_{2.5}$	794	867	806	804	804	803	661	812
ROG	1,242	1,261	1,248	1,247	1,250	1,248	1,235	1,248
SO_2	87	96	88	88	88	88	69	89

Notes: Values represent the sum of emissions from fossil-fueled power plants (for CVP/SWP purchases of grid power and for electrically-powered groundwater pumps) and emissions from diesel engines (for engine-powered groundwater pumps).
CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter of 10 microns diameter and smaller; $PM_{2.5}$ = particulate matter of 2.5 microns diameter and smaller; ROG = reactive organic gases; SO_2 = sulfur dioxide; Alt = Alternative; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements



Notes: Alt = Alternative; TUCP = Temporary Urgency Change Petition; VA = Voluntary Agreements

Figure 9-5. Emissions from All Sources.



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Emissions for the No Action Alternative are not shown because they are the baseline to which changes under the action alternatives are compared. These baseline emissions are indicated by the No Action bar in Figure 9-5.

Figure 9-6. Changes in Emissions from All Sources Compared to the No Action Alternative.

9.3 Mitigation Measures

No avoidance and minimization measures or mitigation measures have been identified for air quality.

9.4 Cumulative Impacts

The No Action Alternative would continue with the current operation of the CVP and may result in potential changes to air quality from fossil-fueled powerplant emissions from hydropower generation and groundwater pumping. The action alternatives will result in changes to air quality from fossil-fueled powerplant emissions from hydropower generation and groundwater pumping. The magnitude of the changes is dependent on alternative and water year type. Therefore, the No Action Alternative and action alternatives may contribute to cumulative changes to air quality as described in Appendix L, *Air Quality* and Appendix Y, *Cumulative Impacts Technical Appendix*.