

Appendix B

Emission Inventory

2013 Plan for the Revoked 1-Hour Ozone Standard
SJVUAPCD

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APPENDIX B: EMISSIONS INVENTORY

An emissions inventory is a critical air pollution evaluation tool. In simple terms, an emissions inventory is a systematic listing of air pollution sources along with the amount of pollution emitted from each source or category over a given time period. Emissions inventories represent estimates of the air pollution emissions from given sources; they are not measurements of ambient concentrations. Emissions inventory data are used as primary input for air quality modeling, are used for developing control strategies, and provide a means to track progress in meeting emissions reduction commitments. More specifically, the inventories in this appendix were used to evaluate and propose control measures, to track emissions for Rate of Progress (ROP), to track Emissions Reduction Credits (ERCs), to establish motor vehicle conformity budgets for transportation planning, and to assist in demonstrating attainment of the NAAQS.

Pollution sources are grouped by major industry sectors. The following are examples of pollution sources by key sectors:

- Industrial or stationary point sources—power plants and oil refineries;
- Area-wide sources—consumer products and residential fuel combustion;
- On-road sources—passenger vehicles and heavy-duty trucks;
- Off-road mobile sources—aircraft, trains, ships, recreational boats, construction equipment, and farm equipment; and
- Non-anthropogenic (natural) sources—biogenic (or vegetation), geogenic (petroleum seeps), and wildfires.

Tables B-1 and B-2 reflect anthropogenic emissions (i.e., emissions generated by human activity). Only anthropogenic emissions are subject to regulatory requirements. However, biogenic volatile organic compounds emissions (BVOC) from vegetation are evaluated and estimated for photochemical modeling. Total volatile organic compound (VOC) emissions from biogenic sources can overwhelm anthropogenic VOC emissions, particularly during the Valley's ozone season (Table B-3). Appendix E, California Air Resources Board (ARB) Photochemical Modeling Protocol, contains a more thorough discussion of BVOCs.

The U.S. Environmental Protection Agency (EPA) establishes requirements pertaining to emissions information that must be included as part of the SIP submittal package. Plans for 1-hour ozone are to include emissions inventories for oxides of nitrogen (NOx) and VOCs.

As discussed in Appendix A and throughout the *2013 Plan for the Revoked 1-Hour Ozone Standard*, the Valley's attainment challenges under the national 1-hour ozone standard occur in the summer months. For this reason, this plan focuses on summer (May through October) average daily emissions inventories, with emissions presented as tons per day (tpd).

Emissions inventories are usually developed at various geographical resolutions encompassing district, air basin, and county levels. The inventories presented in this appendix are the total emissions for the San Joaquin Valley Air Basin.

This appendix includes emissions for the San Joaquin Valley Air Basin for the years 2007 and 2013 through 2022. The base year (the year from which the inventory is projected forward and backward) for these inventories is 2007. The year 2013 has been included as a reference point for the current year. Years 2014 through 2022 have been included, as 2022 is the latest possible attainment deadline for the federal 1-hour ozone standard.

The tables in this appendix include:

- Table B-1 NO_x Emissions (Summer Daily Averages in Tons per Day)
- Table B-2 VOC Emissions (Summer Daily Averages in Tons per Day)
- Table B-3 Valley-Wide Biogenic Emissions for 2007 in Tons per Day

These tables are followed by an overview of emissions inventory calculations and revisions.

B.1 Emissions Inventory Tables

Table B-1 NOx Emissions (Summer Daily Averages in Tons per Day)

SUMMARY CATEGORY NAME	NOx (tpd)										
	SUMMER AVERAGE										
	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
STATIONARY SOURCES											
FUEL COMBUSTION											
ELECTRIC UTILITIES	7.1	5.5	5.2	5.2	5.4	5.5	5.6	5.6	5.6	5.6	5.7
COGENERATION	3.0	1.6	1.7	1.8	1.8	1.9	2.0	2.0	2.1	2.1	2.1
OIL AND GAS PRODUCTION (COMBUSTION)	3.5	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3
PETROLEUM REFINING (COMBUSTION)	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MANUFACTURING AND INDUSTRIAL	5.1	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
FOOD AND AGRICULTURAL PROCESSING	25.1	14.5	14.1	9.9	7.2	6.7	6.4	6.1	5.9	5.6	5.3
SERVICE AND COMMERCIAL	3.2	3.0	2.9	2.8	2.8	2.9	2.9	2.9	2.9	2.9	2.8
OTHER (FUEL COMBUSTION)	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
* TOTAL FUEL COMBUSTION	48.4	32.4	31.6	27.1	24.7	24.2	24.0	23.8	23.4	23.2	22.8
WASTE DISPOSAL											
SEWAGE TREATMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LANDFILLS	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
INCINERATORS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SOIL REMEDIATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (WASTE DISPOSAL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL WASTE DISPOSAL	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
CLEANING AND SURFACE COATINGS											
LAUNDERING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEGREASING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COATINGS AND RELATED PROCESS SOLVENTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ADHESIVES AND SEALANTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (CLEANING AND SURFACE COATINGS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL CLEANING AND SURFACE COATINGS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PETROLEUM PRODUCTION AND MARKETING											
OIL AND GAS PRODUCTION	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
PETROLEUM REFINING	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PETROLEUM MARKETING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NOx (tpd)												
SUMMARY CATEGORY NAME	SUMMER AVERAGE											
	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
* TOTAL PETROLEUM PRODUCTION AND MARKETING	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
INDUSTRIAL PROCESSES												
CHEMICAL	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5
FOOD AND AGRICULTURE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MINERAL PROCESSES	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
METAL PROCESSES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD AND PAPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GLASS AND RELATED PRODUCTS	7.8	6.3	4.0	4.1	4.2	4.3	4.3	4.4	4.4	4.6	4.7	4.7
ELECTRONICS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (INDUSTRIAL PROCESSES)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL INDUSTRIAL PROCESSES	8.5	6.9	4.7	4.8	4.9	5.0	5.0	5.1	5.1	5.3	5.5	5.5
** TOTAL STATIONARY SOURCES	57.4	39.8	36.8	32.4	30.1	29.8	29.6	29.4	29.1	29.1	28.9	28.9
AREA-WIDE SOURCES												
SOLVENT EVAPORATION												
CONSUMER PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PESTICIDES/FERTILIZERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ASPHALT PAVING / ROOFING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL SOLVENT EVAPORATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MISCELLANEOUS PROCESSES												
RESIDENTIAL FUEL COMBUSTION	3.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
FARMING OPERATIONS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CONSTRUCTION AND DEMOLITION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNPAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FUGITIVE WINDBLOWN DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIRES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MANAGED BURNING AND DISPOSAL	8.1	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
COOKING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (MISCELLANEOUS PROCESSES)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL MISCELLANEOUS PROCESSES	11.1	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	10.9
** TOTAL AREA-WIDE SOURCES	11.1	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	10.9
MOBILE SOURCES												
ON-ROAD MOTOR VEHICLES												
LIGHT DUTY PASSENGER (LDA)	15.8	8.4	7.2	6.4	5.8	5.2	4.7	4.4	4.1	3.8	3.6	3.6
LIGHT DUTY TRUCKS - 1 (LDT1)	5.2	2.9	2.6	2.4	2.3	2.1	1.9	1.8	1.7	1.6	1.5	1.5
LIGHT DUTY TRUCKS - 2 (LDT2)	10.9	6.2	5.3	4.7	4.2	3.7	3.3	3.0	2.8	2.6	2.4	2.4
MEDIUM DUTY TRUCKS (MDV)	14.2	10.4	9.6	9.0	8.4	7.8	7.3	6.9	6.5	6.0	5.6	5.6

NOx (tpd)											
SUMMARY CATEGORY NAME	SUMMER AVERAGE										
	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1)	4.4	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2)	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
MEDIUM HEAVY DUTY GAS TRUCKS (MHDV)	1.0	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3
HEAVY HEAVY DUTY GAS TRUCKS (HHDV)	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1)	14.3	10.6	9.8	9.2	8.7	8.1	7.6	7.2	6.7	6.3	5.9
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2)	3.5	2.5	2.4	2.2	2.1	2.0	1.9	1.8	1.7	1.5	1.4
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	18.5	11.7	11.1	9.9	9.1	8.3	7.6	6.9	5.5	3.9	3.4
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	177.1	93.6	85.8	76.2	68.3	62.9	58.6	55.5	49.9	43.7	39.8
MOTORCYCLES (MCY)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0
HEAVY DUTY DIESEL URBAN BUSES (UB)	2.0	1.9	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7
HEAVY DUTY GAS URBAN BUSES (UB)	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
SCHOOL BUSES (SB)	1.4	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.8
OTHER BUSES (OB)	2.1	1.4	1.3	1.1	1.0	0.9	0.8	0.8	0.7	0.5	0.4
MOTOR HOMES (MH)	0.8	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4
* TOTAL ON-ROAD MOTOR VEHICLES	272.9	157.6	144.6	130.6	118.8	109.8	102.5	96.7	87.9	78.2	72.1
OTHER MOBILE SOURCES											
AIRCRAFT	2.6	2.7	2.7	2.7	2.7	2.7	2.7	5.0	5.0	5.0	5.1
TRAINS	21.7	16.6	17.0	17.1	17.0	16.9	16.7	16.5	16.3	16.1	15.8
SHIPS AND COMMERCIAL BOATS	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
RECREATIONAL BOATS	2.6	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
OFF-ROAD RECREATIONAL VEHICLES	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
OFF-ROAD EQUIPMENT	40.3	26.7	26.0	25.5	24.6	23.8	22.4	21.4	20.8	20.1	18.9
FARM EQUIPMENT	75.1	58.2	56.0	53.8	51.8	49.9	48.2	46.4	43.7	41.0	38.5
FUEL STORAGE AND HANDLING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL OTHER MOBILE SOURCES	143.5	107.6	104.9	102.3	99.4	96.6	93.1	92.4	88.9	85.3	81.4
** TOTAL MOBILE SOURCES	416.4	265.2	249.5	232.9	218.2	206.4	195.6	189.2	176.8	163.5	153.5
GRAND TOTAL FOR SAN JOAQUIN VALLEY	484.9	316.0	297.2	276.3	259.2	247.1	236.1	229.5	217.0	203.5	193.3

Table B-2 VOC Emissions (Summer Daily Averages in Tons per Day)

VOC (tpd)											
SUMMARY CATEGORY NAME	SUMMER AVERAGE										
	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
STATIONARY SOURCES											
FUEL COMBUSTION											
ELECTRIC UTILITIES	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
COGENERATION	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
OIL AND GAS PRODUCTION (COMBUSTION)	1.5	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0
PETROLEUM REFINING (COMBUSTION)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MANUFACTURING AND INDUSTRIAL	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
FOOD AND AGRICULTURAL PROCESSING	2.2	1.2	1.2	1.0	0.8	0.8	0.7	0.7	0.7	0.7	0.6
SERVICE AND COMMERCIAL	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
OTHER (FUEL COMBUSTION)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
* TOTAL FUEL COMBUSTION	5.1	3.9	3.8	3.6	3.3	3.3	3.2	3.2	3.1	3.1	3.0
WASTE DISPOSAL											
SEWAGE TREATMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LANDFILLS	1.3	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6
INCINERATORS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOIL REMEDIATION	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
OTHER (WASTE DISPOSAL)	23.1	19.7	20.1	20.5	20.9	20.6	21.0	21.4	21.8	22.2	22.6
* TOTAL WASTE DISPOSAL	24.6	21.4	21.8	22.3	22.7	22.3	22.8	23.2	23.6	24.0	24.5
CLEANING AND SURFACE COATINGS											
LAUNDERING	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DEGREASING	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
COATINGS AND RELATED PROCESS SOLVENTS	7.3	8.0	8.2	8.4	8.5	8.7	8.9	9.1	9.1	9.3	9.4
PRINTING	4.4	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.7	5.8
ADHESIVES AND SEALANTS	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5
OTHER (CLEANING AND SURFACE COATINGS)	3.6	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2
* TOTAL CLEANING AND SURFACE COATINGS	17.6	19.6	20.0	20.3	20.7	21.0	21.4	21.8	22.1	22.4	22.7
PETROLEUM PRODUCTION AND MARKETING											
OIL AND GAS PRODUCTION	28.5	24.6	24.1	23.5	23.0	22.5	22.0	21.5	21.1	20.6	20.2
PETROLEUM REFINING	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
PETROLEUM MARKETING	6.7	7.4	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL PETROLEUM PRODUCTION AND MARKETING	36.3	33.2	32.7	32.4	32.0	31.6	31.3	31.0	30.6	30.3	30.0
INDUSTRIAL PROCESSES											

VOC (tpd)											
SUMMARY CATEGORY NAME	SUMMER AVERAGE										
	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
CHEMICAL	3.6	2.9	2.9	2.9	3.0	3.0	3.0	3.1	3.2	3.3	3.3
FOOD AND AGRICULTURE	12.4	13.9	14.2	14.4	14.7	14.9	15.2	15.5	15.7	16.0	16.2
MINERAL PROCESSES	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
METAL PROCESSES	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
WOOD AND PAPER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GLASS AND RELATED PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ELECTRONICS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (INDUSTRIAL PROCESSES)	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
* TOTAL INDUSTRIAL PROCESSES	16.9	17.6	18.0	18.3	18.6	18.9	19.2	19.6	20.0	20.3	20.6
** TOTAL STATIONARY SOURCES	100.4	95.7	96.3	96.8	97.3	97.2	98.0	98.7	99.4	100.1	100.9
AREA-WIDE SOURCES											
SOLVENT EVAPORATION											
CONSUMER PRODUCTS	22.8	20.3	20.6	20.8	21.2	21.5	21.9	22.2	22.5	22.9	23.3
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	13.2	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.9	11.1	11.2
PESTICIDES/FERTILIZERS	17.3	17.0	16.9	16.8	16.7	16.6	16.6	16.5	16.4	16.3	16.2
ASPHALT PAVING / ROOFING	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
* TOTAL SOLVENT EVAPORATION	54.1	48.4	48.7	48.9	49.3	49.7	50.0	50.4	50.7	51.1	51.5
MISCELLANEOUS PROCESSES											
RESIDENTIAL FUEL COMBUSTION	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
FARMING OPERATIONS	148.6	119.7	121.2	122.5	123.9	125.3	126.7	128.1	129.5	130.9	132.3
CONSTRUCTION AND DEMOLITION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNPAVED ROAD DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FUGITIVE WINDBLOWN DUST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIRES	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MANAGED BURNING AND DISPOSAL	16.7	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8
COOKING	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7
OTHER (MISCELLANEOUS PROCESSES)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL MISCELLANEOUS PROCESSES	166.7	137.7	139.1	140.5	141.9	143.3	144.7	146.1	147.5	148.9	150.3
** TOTAL AREA-WIDE SOURCES	220.9	186.1	187.8	189.4	191.2	193.0	194.7	196.5	198.3	200.1	201.9
MOBILE SOURCES											
ON-ROAD MOTOR VEHICLES											
LIGHT DUTY PASSENGER (LDA)	23.0	13.3	10.2	9.0	7.9	7.0	6.2	5.6	5.2	4.8	4.5
LIGHT DUTY TRUCKS - 1 (LDT1)	7.6	5.1	4.1	3.8	3.5	3.2	3.0	2.8	2.7	2.6	2.5
LIGHT DUTY TRUCKS - 2 (LDT2)	9.5	6.8	5.4	4.9	4.4	4.0	3.7	3.4	3.3	3.1	3.0
MEDIUM DUTY TRUCKS (MDV)	8.8	8.6	7.5	7.3	7.1	6.9	6.7	6.5	6.4	6.3	6.1
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDV1)	3.5	2.9	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8

VOC (tpd)											
SUMMARY CATEGORY NAME	SUMMER AVERAGE										
	2007	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDV2)	0.4	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
MEDIUM HEAVY DUTY GAS TRUCKS (MHDV)	1.1	0.7	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2
HEAVY HEAVY DUTY GAS TRUCKS (HHDV)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDV1)	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDV2)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDV)	1.1	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDV)	9.6	5.7	4.4	4.1	4.0	4.0	4.1	4.2	4.3	4.5	4.6
MOTORCYCLES (MCY)	4.3	3.9	3.4	3.3	3.3	3.4	3.4	3.4	3.5	3.6	3.7
HEAVY DUTY DIESEL URBAN BUSES (UB)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
HEAVY DUTY GAS URBAN BUSES (UB)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SCHOOL BUSES (SB)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
OTHER BUSES (OB)	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MOTOR HOMES (MH)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
* TOTAL ON-ROAD MOTOR VEHICLES	70.8	49.4	40.1	37.2	34.8	32.7	31.1	29.9	29.0	28.4	27.9
OTHER MOBILE SOURCES											
AIRCRAFT	4.2	4.2	4.2	4.2	4.3	4.3	4.3	6.0	6.1	6.1	6.1
TRAINS	1.6	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.7
SHIPS AND COMMERCIAL BOATS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
RECREATIONAL BOATS	17.9	14.0	13.5	13.0	12.5	12.1	11.6	11.2	10.8	10.4	10.0
OFF-ROAD RECREATIONAL VEHICLES	5.2	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5
OFF-ROAD EQUIPMENT	16.8	11.8	11.4	11.1	10.7	10.4	10.1	9.9	9.8	9.9	9.8
FARM EQUIPMENT	14.8	11.2	10.6	10.0	9.5	9.1	8.7	8.3	7.9	7.6	7.3
FUEL STORAGE AND HANDLING	4.6	2.7	2.5	2.4	2.3	2.3	2.2	2.2	2.1	2.1	2.0
* TOTAL OTHER MOBILE SOURCES	65.1	49.3	47.6	46.2	44.7	43.4	42.2	42.8	41.9	41.3	40.5
** TOTAL MOBILE SOURCES	136.0	98.8	87.7	83.3	79.5	76.2	73.3	72.7	71.0	69.7	68.4
GRAND TOTAL FOR SAN JOAQUIN VALLEY	457.3	380.6	371.8	369.6	368.0	366.3	366.0	367.9	368.6	369.9	371.1

Table B-3 Valley-Wide Biogenic Emissions for 2007 in Tons per Day

	Isoprene	Methylbutenol	Terpenes	Other VOC	Total VOC
January	4	14	13	24	55
February	6	18	24	58	106
March	117	78	70	142	407
April	163	111	92	161	526
May	436	251	159	276	1121
June	734	400	261	427	1821
July	941	495	341	522	2300
August	771	394	303	440	1908
September	336	182	160	220	899
October	43	63	60	88	255
November	11	29	28	45	113
December	2	8	9	19	39

B.2 Emissions Inventory Calculations and Revisions

ARB and the District continually collect information and conduct research to improve the emissions estimates. During development of the *2013 Plan for the Revoked 1-Hour Ozone Standard*, both agencies allocated substantial resources to a thorough review of the inventory to ensure that the emissions estimates reflected accurate emissions reports for point sources, and that estimates for mobile and area-wide sources were based on the most recent methodologies.

ARB also conducts periodic evaluations and updates of the growth profiles to ensure that emission forecasts are based on data that reflect historical trends, current conditions, and recent forecasts. The most significant challenge for the *2013 Plan for the Revoked 1-Hour Ozone Standard* was to ensure that the growth projections reflected the economic recession. ARB staff conducted a category-by-category review and update of the growth profile data for all the categories that, in aggregate, comprise more than 95% of the NO_x or VOC emissions. To capture the effects of the recession, ARB staff ensured that the growth profiles included historical data through at least 2008 (data through 2009 or 2010 were included when available). Growth forecasts for the years 2009 and beyond were obtained primarily from government entities with expertise in developing forecasts for specific sectors, or in some cases, from econometric models.

In addition, this comprehensive emissions inventory update process required detailed information on the timing and locations of emissions sources on the most severe air quality days. This posed a unique challenge to translate regional, annual emission estimates into the temporal and spatial resolution needed for modeling. An iterative

process was used as a means to refine the modeling emission inputs to better reflect observed conditions expected at a local, 1-hour scale. Model-simulated concentrations were compared with chemical species present in the ambient monitoring data, maps of emission sources known to surround the monitoring stations, and temporal trends in the monitoring data. This led to further updates in the spatial and temporal emissions data used in the modeling.

ARB and District staff worked jointly to develop a comprehensive emissions inventory for the *2013 Plan for the Revoked 1-Hour Ozone Standard*. The District worked closely with operators of major stationary facilities to develop the point-source emissions estimates. The District also developed emissions estimates for approximately one-third of the non-point (or area-wide) sources, such as commercial cooking and agricultural burning.

ARB staff developed the emissions inventory for mobile sources (both on-road and off-road) and the remaining two-thirds of the area-wide sources. ARB worked with several state and local agencies such as the Department of Transportation (Caltrans), the Department of Motor Vehicles (DMV), the Department of Pesticide Regulation (DPR), the California Energy Commission (CEC), and local councils of government (COGs) to assemble activity information necessary to develop the mobile and area-wide source emissions estimates.

B.2.1 Base-Year Inventory

The base-year inventory is an essential element of the plan that forms the basis for all future-year projections and also establishes the emissions levels against which progress in emissions reductions will be measured. EPA regulations establish general guidelines for selecting an inventory base year. Based on those guidelines, ARB and the District selected 2007 as the base year for this plan.

B.2.2 Emissions Forecasts

In addition to a base-year inventory, EPA regulations require future-year inventories for specific milestone years. ARB develops emission forecasts for point and area-wide sources by applying growth and control factors to the base-year inventory to account for year-to-year changes resulting from anticipated trends in economic conditions and population growth, as well as the effects of adopted emission control rules.

Growth factors are expressed as a ratio of the expected activity level in a future year relative to the base year. For point and area-wide sources, growth factors are derived from surrogates such as economic activity, fuel usage, population, and dwelling unit data that best reflect the expected growth or decline rates for each specific source category.

Control factors are percentages representing the extent to which a source category is controlled. These factors are derived from data provided by the regulatory agencies responsible for the affected emission categories. Developing control factors enables

agencies to take appropriate credit for adopted rules and regulations that reduce emissions, remove exemptions, or improve compliance.

Mobile source projections are generated by emission models that use sophisticated modeling routines that predict vehicle fleet turnover by vehicle model year. As with stationary sources, the mobile source models include control algorithms that account for all adopted regulatory actions.

B.2.3 Annual, Seasonal, and Modeling Inventories

Annual and seasonal emissions inventories, often referred to as planning inventories, are typically produced at a county or air basin level of resolution. Annual emissions inventories represent the total emissions over an entire year (tons per year), or a simple average of annual emissions divided by 365 days (tons per day).

Seasonal inventories (summer and winter) account for temporal activity variations throughout the year as determined by actual data from point source facilities or by temporal profiles developed for area and mobile sources. Summer inventories include emissions from May through October, and winter inventories include November through April. Because ozone concentrations in the Valley are at their highest during the summer, the plan's attainment demonstration is based on the summer inventory.

Modeling inventories (also referred to as gridded inventories) are estimated at finer spatial and temporal scales than planning inventories. Modeling inventories are used to support hour-by-hour, grid-based calculations of ambient pollutant concentrations. As a result, these inventories must characterize hourly emissions from all sources (stationary point, area-wide, mobile, and biogenic) located within each grid cell for the region and time being simulated. Modeling inventories account for day-specific variations within grid cells (such as actual plant shut-downs or wildfires) and the effects of meteorological conditions on emission rates (*e.g.*, the hour-specific ambient temperature effects on biogenic or evaporative emission releases). A more in-depth discussion of the temporal and spatial adjustments made to the Valley's modeling inventory is presented in Appendix E, ARB Photochemical Modeling Protocol.

B.2.4 Quality Assurance and Quality Control

ARB has established a quality assurance and quality control (QA/QC) process to ensure the integrity and accuracy of the emissions inventories used in the development of air quality plans. ARB staff performs comprehensive QA/QC checks to confirm that inventory inputs have been reliably prepared and approved for use in photochemical modeling. This process involves collaboration among ARB and air district staff to develop base- and future-year emissions estimates.

QA/QC occurs at the various stages of SIP emissions inventory development. Base-year emissions are assembled and maintained in the California Emission Inventory Development and Reporting System (CEIDARS). ARB staff works with the District, who is responsible for developing and reporting point-source emission estimates, to verify

these data are accurate. The locations of point sources, including stacks, are checked to ensure they are valid. Area-wide source emissions estimates are developed by ARB staff as well as the District. The methodologies for estimating these are reviewed by ARB and District staff before their inclusion in the emissions inventory. Additionally, CEIDARS is designed with automatic system checks to prevent errors such as double counting of emissions sources. The system also makes various reports available to assist ARB staff in their efforts to identify and reconcile anomalous emissions.

Future-year emissions are estimated using the California Emission Forecasting and Planning Inventory System (CEFS). Growth and control factors are reviewed for each category and year along with the resulting emissions projections. Year-to-year trends are compared to similar and past datasets to ensure general consistency. Emissions for specific categories are checked to confirm they reflect the anticipated effects of applicable control measures. Mobile categories are verified with mobile source staff for consistency with the on- and off-road emission models (EMFAC and OFFROAD).

Prior to input into the air quality model, the spatial and temporal parameters applied to the emissions are checked. Monthly, weekly, and diurnal emission profiles are examined to ensure they appear reasonable for the category. Emissions are again summarized by region (county, air basin, and district), category, and pollutant to confirm their consistency with the overall inventory.

As modeling results become available, the results are used to further validate the inventory. The modeled concentrations in a particular grid cell are reviewed for consistency with the types of sources present nearby in the emission inventory. Additionally, the inclusion of air quality monitor data, when available, is used to re-affirm that the types and magnitude of upwind sources are accounted for in the inventory.