

# Appendix G

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## Air Quality Emission Calculations

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This appendix contains the California Emissions Estimator Model (CALEEMOD) input and output files used to estimate construction and operational emissions for the Salmon Conservation and Research Facility (SCARF).

Criteria air pollutant and greenhouse gas (GHG) emission calculations were calculated using the CALEEMOD. Construction-related emissions generated by the SCARF project component are summarized as annual emissions over the SCARF construction period in Table G-1. Table G-2 lists the CALEEMOD input assumptions used to estimate the construction emissions.

Operational emissions that would be generated by the SCARF and Related Management Actions project components are summarized in Table G-3. The operational emissions associated with vehicles are summarized in Table G-4. This includes the annual trips and mileage. The operational emissions associated with boat usage are summarized in Table G-5. The boat emissions factors are summarized in Table G-6. Other operational emissions associated with SCARF activities estimated in CALEEMOD are summarized in Table G-7. Table G-8 lists the CALEEMOD input assumptions used to estimate SCARF and Related Management Actions operational emissions.

**Table G-1. SCARF Construction Emissions**

Construction Activity	ROG	NO <sub>x</sub>	CO	SO <sub>x</sub>	PM10 fugitive	PM10 exhaust	PM10 total	PM2.5 fugitive	PM2.5 exhaust	PM2.5 total	Bio-CO <sub>2</sub>	NBio-CO <sub>2</sub> <sup>a</sup>	Total CO <sub>2</sub> <sup>a</sup>	CH4	N <sub>2</sub> O	CO <sub>2</sub> e <sup>a</sup>
	(tons/year)										(metric tons per year)					
2015 emissions	1.13	8.03	5.43	0.01	1.58	0.44	2.02	0.34	0.44	0.78	0	1,018	1,018	0.09	0	1020
2016 emissions	0.02	0.02	0.02	0	0	0	0	0	0	0	0	2.80	2.80	0	0	2.81
Total emissions	1.15	8.05	5.45	0.01	1.58	0.44	2.02	0.34	0.44	0.78	0	1,021	1,021	0.09	0	1023
Amortized total emissions <sup>b</sup>	N/A															114

Notes: Bio-CO<sub>2</sub> = biological sources of carbon dioxide, CH4 = methane, CO = carbon monoxide, CO<sub>2</sub> = carbon dioxide, CO<sub>2</sub>e= carbon dioxide equivalent, NBio-CO<sub>2</sub> = non-biological sources of carbon dioxide, NO<sub>x</sub> = nitrogen oxides, N<sub>2</sub>O = nitrous oxide, PM2.5 = fine particulate matter 2.5 micrometers in diameter or smaller, PM10 = inhalable particulate matter 10 micrometers in diameter or smaller, ROG = reactive organic gas, SO<sub>x</sub>= sulfur oxides

<sup>a</sup> decimal values are not shown for the larger numbers.

<sup>b</sup> Amortization was only performed for the greenhouse gas (GHG) calculations (i.e., CO<sub>2</sub>e) per the San Joaquin Valley Air Pollution Control District’s recommendation to amortize GHG emissions by the operational life of a project. Nine-year amortization was based on the Proposed Project facility’s operation, which is currently scheduled to begin production in 2016 and end in 2025. The amortization calculation averaged the CO<sub>2</sub>e emissions over 9 years as follows: 1023 CO<sub>2</sub>e emissions/9 years = approximately 114 CO<sub>2</sub>e emissions/year.

**Table G-2. Assumptions and CALEEMOD Inputs Used for SCARF Construction Emission Estimates**

Input Type	Input Information
Operational Year	2016
County	Fresno
Urbanization	Rural
Land Use Type	General Light Industrial
Land Use Square Footage	8,200 square feet <sup>1</sup>
<b>Construction Phasing:<sup>2</sup></b>	
Site Preparation (CALEEMOD phase)	The construction periods for the Mobilization and Clearing and Grubbing phases were combined for the CALEEMOD Site Preparation phase. Thus, the total construction period was assumed to be from 2/1/2015 to 4/30/2015. Construction Equipment assumed is as follows: 1 Excavator, 1 Grader, 1 Off-Highway Truck, 1 Roller, 2 Rubber-Tired Dozers, 4 Tractors/Loaders/Backhoes. Assumed number of worker trips is 25.
Grading (CALEEMOD phase)	The Site Preparation Phase's construction period, except for one month for the paving of the Access Road, was used for this CALEEMOD phase. Thus, the construction period was assumed to be from 3/1/2015 to 5/31/2015. The Access Road paving was included in the CALEEMOD Paving phase below. Construction Equipment assumed is as follows: 1 Excavator, 1 Grader, 1 Off-Highway Truck, 1 Roller, 2 Rubber-Tired Dozers (though one would only operate for one hour per day), and 2 Tractors/Loaders/Backhoes (operating for six hours per day). Assumed number of worker trips is 20. The CALEEMOD estimated number of hauling trips is 1,438 based on an imported fill quantity of 23,600 cubic yards. This hauling trip value was consistent with the Project Description's assumed haul truck capacity of 15 to 20 cubic yards per load.
Paving (CALEEMOD phase)	The Access Road paving was used for this construction period of 6/1/2015 to 6/30/2015. Construction Equipment assumed is as follows: 4 Cement and Mortar Mixers (six hours per day), 1 Off-Highway Truck, 1 Paver (seven hours per day), 1 Paving Equipment, 1 Roller (seven hours per day), and 1 Tractor/Loader/Backhoe (seven hours per day). Assumed number of worker trips is 23.
Trenching (CALEEMOD phase)	The Underground Infrastructure's construction period was used for this phase and had a construction period of 7/1/2015 to 9/30/2015. Construction Equipment assumed is as follows: 2 Excavators, 1 Other General Industrial Equipment, 1 Tractors/Loaders/Backhoes. Assumed number of worker trips is 10.

**Table G-2. Assumptions and CALEEMOD Inputs Used for SCARF Construction Emission Estimates**

Input Type	Input Information
Building Construction (CALEEMOD phase)	The Building Slabs, Facilities Construction, and Utilities, Electrical, and Plumbing phases of the SCARF component were assumed to occur during this CALEEMOD phase. The construction period was assumed to be from 7/1/2015 to 12/31/2015. Construction Equipment assumed is as follows: 2 Air Compressors, 1 Crane (4 hours per day), 2 Forklifts (6 hours per day), 2 Generator Sets, and 2 Tractors/Loaders/Backhoes. Assumed number of worker trips is 3.
Architectural Coating (CALEEMOD phase)	The Ancillary Improvements/Finishing phase of the SCARF component was used for this construction period of 11/1/2015 to 1/31/2016. Construction Equipment assumed is as follows: 1 Air Compressor (6 hours per day). Assumed number of worker trips is 1.

Notes: Unless specified in this table, CALEEMOD's default values were used.

<sup>1</sup> Square footage used is the square footage of the hatchery building.

<sup>2</sup> Construction duration periods and project component names are based on the Estimated Construction Schedule in Chapter 2, Project Description. Other construction phases indicated are the CALEEMOD construction phase categories.

**Table G-3: Overall Operation Emissions for SCARF and Related Management Actions Project**

2016										
Project Activity Category	Emissions (tons/year)						Emissions (metric tons/year)			
	ROG	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e
SCARF Operations	0.06	0.22	0.11	< 0.01	0.04	0.01	232.81	0.03	6.95	388.93
Fish Reintroduction	0.02	0.17	0.029	< 0.01	0.05	0.01	96.52	< 0.01	< 0.01	93.54
Fisheries Management	0.04	0.14	0.15	< 0.01	0.04	< 0.01	54.64	< 0.01	< 0.01	54.66
Fisheries Research & Monitoring	2.02	4.32	0.37	< 0.01	0.40	0.37	76.30	0.01	0.11	82.58
Recreational Management	< 0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	3.76	< 0.01	< 0.01	3.76
Total Operation Emissions	2.14	4.86	0.66	< 0.01	0.53	0.39	464.03	0.04	7.06	623.47
SJVAPCD Threshold	10	100	10	27	15	15	1,100	1,100	1,100	1,100
Exceed Threshold?	No	No	No	No	No	No	No	No	No	No

2020										
Project Activity Category	Emissions (tons/year)						Emissions (metric tons/year)			
	ROG	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e
SCARF Operations	--	--	--	--	--	--	228.44	0.03	6.95	384.55
Fish Reintroduction	--	--	--	--	--	--	86.8	< 0.01	< 0.01	86.81
Fisheries Management	--	--	--	--	--	--	51.51	< 0.01	< 0.01	51.52
Fisheries Research & Monitoring	--	--	--	--	--	--	73.94	0.01	0.08	79.49
Recreational Management	--	--	--	--	--	--	3.49	< 0.01	< 0.01	3.49
Total Operation Emissions	--	--	--	--	--	--	444.18	0.04	7.03	605.86
SJVAPCD Threshold	10	100	10	27	15	15	1,100	1,100	1,100	1,100
Exceed Threshold?	No	No	No	No	No	No	No	No	No	No

**Table G-4: Vehicle Operation Emissions for SCARF and Related Management Actions Project**

2016													
Project Activity Category	Number of Trips	Total Annual Vehicle Miles Travelled (VMT)	Vehicle Class	Emissions (tons/year)						Emissions (metric tons/year)			
				ROG	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e
SCARF Operations	6365	75702	Default	0.02	0.21	0.1	< 0.01	0.04	0.01	39.48	< 0.01	< 0.01	39.51
Fish Reintroduction	352	71178	MHDT	0.02	0.17	0.029	< 0.01	0.05	0.01	96.52	< 0.01	< 0.01	93.54
Fisheries Management	540	74980	MHDT	0.04	0.14	0.15	< 0.01	0.04	< 0.01	54.64	< 0.01	< 0.01	54.66
Fisheries Research & Monitoring	1200	56500	LHD2	0.03	0.11	0.11	< 0.01	0.03	< 0.01	41.17	< 0.01	< 0.01	41.18
Recreational Management	94	2820	MHDT	< 0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	3.76	< 0.01	< 0.01	3.76
Total Operation Emissions				0.11	0.64	0.399	< 0.01	0.16	0.02	235.57	< 0.01	< 0.01	232.65

2020													
Project Activity Category	Number of Trips	Total Annual VMT	Vehicle Class	Emissions (tons/year)						Emissions (metric tons/year)			
				ROG	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e
SCARF Operations	6365	75702	Default	--	--	--	--	--	--	35.11	< 0.01	< 0.01	35.13
Fish Reintroduction	352	71178	MHDT	--	--	--	--	--	--	86.8	< 0.01	< 0.01	86.81
Fisheries Management	540	74980	MHDT	--	--	--	--	--	--	51.51	< 0.01	< 0.01	51.52
Fisheries Research & Monitoring	1200	56500	LHD2	--	--	--	--	--	--	38.81	< 0.01	< 0.01	38.82
Recreational Management	94	2820	MHDT	--	--	--	--	--	--	3.49	< 0.01	< 0.01	3.49
Total Operation Emissions				--	--	--	--	--	--	215.72	< 0.01	< 0.01	215.77

Notes:

1. Calculations are based on CalEEMod version 2011.1.1 results.
2. The total number of trips and VMT are based on information provided by CDFW; there may be some differences due to rounding in CalEEMod.

**Table G-5: Boat Operation Emissions for SCARF and Related Management Actions Project**

Project Activity Category	Quantity of Boats	Total Annual Operation Activity (hours)	Calendar Year	Emissions (tons/year)						Emissions (metric tons/year)			
				ROG	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e
Fisheries Research & Monitoring	3	4752	2016	1.99	4.21	0.26	0.00066	0.37	0.37	35.13	0.01	0.11	41.40
	3	4752	2020	--	--	--	--	--	--	35.13	0.01	0.08	40.67

Notes:

1. Annual operation activity is based on information provided by DFW. This assumes 3 boats are used for 6 hours a day for 22 days per month.
2. Emission factors are based on OFFROAD2007 emission rates for calendar 2016 and 2020 for vessels with outboards. These represent the weighted value between all horsepower categories.
3. PM<sub>10</sub> and PM<sub>2.5</sub> emissions were assumed to be equal.
4. CO<sub>2</sub>e was estimated by multiplying CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub> with their global warming potentials (GWP) of 1, 310, and 21 respectively.

Sources:

CDFW. 2013. Anticipated Annual Travel for SCARF and Studies 06052013. Excel spreadsheet.

**Table G-6: Boat Emission Factors for SCARF and Related Management Actions Project**

Calendar Year	Exhaust Emission Factor (pounds/hour)										Evaporative Emission Factor (pounds/boat)
	ROG	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e	ROG
2016	8.38E-01	1.77E+00	1.08E-01	2.79E-04	1.56E-01	1.56E-01	1.63E+01	5.86E-03	5.20E-02	1.92E+01	0.054326565
2020	6.23E-01	1.38E+00	1.02E-01	2.79E-04	1.56E-01	1.56E-01	1.63E+01	5.67E-03	3.87E-02	1.89E+01	0.054665908

Notes:

1. Emissions factors are based on OFFROAD 2007 for vessels with outboard motors. A weighted average of all 2 stroke and 4 stroke engines based on activity and number of vessels was utilized since the specific engines are not known.
2. Exhaust emissions are weighted by the number of hours of activity. Evaporative emissions are weighted by the number of vessels in OFFROAD 2007.

**Table G-7: Other SCARF Operation Emissions for SCARF and Related Management Actions Project**

Project Activity Category	Calendar Year	Emissions (tons/year)						Emissions (metric tons/year)			
		ROG	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e
SCARF Operations	2016	0.04	0.01	0.01	< 0.01	< 0.01	< 0.01	193.33	0.03	6.95	349.42
SCARF Operations	2020	--	--	--	--	--	--	193.33	0.03	6.95	349.42

Notes:

1. Emissions are based on CalEEMod Version 2011.1.1 for area sources, energy use, water and wastewater use, and solid waste disposal associated with the SCARF facility.

**Table G-8. Assumptions and CALEEMOD Inputs Used for SCARF Operational Emission Estimates**

<b>Input Type</b>	<b>Input Information</b>
Operational Year	2016 & 2020 (GHG)
SCARF Land Use Type	General Light Industrial
SCARF Land Use Square Footage	8,200 square feet <sup>1</sup>
All Other Related Activities Land Use Type	User Defined Industrial
All Other Related Activities Size Metric	1 User Defined

Notes: Number of vehicle trips, mileage, and vehicle class was based on the values in Table G-4 based on guidance from DFW and the number of workers described in Chapter 2, Project Description. All other inputs used CalEEMod defaults.

<sup>1</sup> Square footage used is the square footage of the hatchery building.