Appendix B: Air Pollutant Emissions Estimates

RTI-I Transpacific Fiber-Optic Cables Project

RTI-I Transpacific Fiber-Optic Cables Project

Emissions Summary

		Daily Emissions lbs/day					
Work Phase	Emissions Type	NOx	PM10	PM2.5	ROG	CO	SOx
Terrestrial Conduit Installation	Terrestrial	13.40	1.11	0.79	1.17	10.15	0.03
Manhole Installation	Terrestrial	5.59	0.51	0.38	0.52	5.53	0.01
Directional Bores – Marine	Terrestrial	35.38	2.08	1.66	2.98	28.86	0.11
	Marine	14.36	0.98	0.98	2.93	7.26	0.01
	Total	49.74	3.05	2.64	5.90	36.12	0.12
OGB and LMH	Terrestrial	6.66	0.52	0.34	0.54	5.47	0.02
Terrestrial Cable Pulling	Terrestrial	2.96	0.37	0.25	0.32	2.93	0.00
PFE Facility (construction and testing)	Terrestrial	1.74	0.30	0.13	0.18	2.18	0.01
Pre-lay grapnel run	Marine	1,543.26	37.41	33.90	58.46	128.60	46.77
Marine cable landing/Installation	Terrestrial	12.84	1.24	0.98	1.27	9.05	0.02
	Marine	1,565.42	38.72	35.21	62.08	137.80	46.78
	Total	1,578.26	39.96	36.19	63.36	146.85	46.80
Marine cable lay	Marine	1,543.26	37.41	33.90	58.46	128.60	46.77
Marine cable burial (Diver assisted)	Terrestrial	0.07	0.18	0.05	0.08	0.70	0.00
	Marine	95.36	3.75	3.75	7.61	21.50	0.05
	Total	95.44	3.93	3.80	7.69	22.21	0.05
Marine cable burial (ROV assisted)	Marine	1,543.26	37.41	33.90	58.46	128.60	46.77
Cable Laying Vessel Arrival/Departure	Marine	206.19	5.00	4.53	7.81	17.18	6.25

RTI-I Transpacific Fiber-Optic Cables Project

Emissions Summary

Maximum Overlap Day

		Daily Emissions lbs/day					
	Emissions Type	NOx	PM10	PM2.5	ROG	CO	SOx
Terr. Conduit + Manhole + Directional Bores	Terrestrial Only	55.43	3.71	2.80	4.69	44.48	0.15
Marine Cable Landing + Terrestrial Cable + Manholes + PFE	All	1,598.98	41.88	37.49	65.23	164.71	46.84

Total Emissions

	Tons					
Emissions Type	NOx	PM10	PM2.5	ROG	CO	SOx
Terrestrial	0.74	0.06	0.04	0.07	0.64	0.00
Marine	42.91	1.05	0.95	1.64	3.64	1.29
Total	43.64	1.11	0.99	1.71	4.28	1.29

	Days/Week Construction																
Phase 1 Schedule	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Terrestrial Conduit Installation	6	6	6	6	6	6	6	6									
Manhole Installation		2		2		2	2	2									
Directional Bores – Marine	6	6	6	6	6												
OGB and LMH					5												
Terrestrial Cable Pulling						6											
PFE Facility (construction and testing)						6	6	6	6	6	6	6	6	6	6	6	6
Pre-lay grapnel run							3										
Marine cable landing/Installation							3										
Marine cable lay								7	7	7	7						
Marine cable burial (ROV assisted)												7	7	7			
Marine cable burial (Diver assisted)															7		

X - days of construction per week

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Terrestrial Construction Off-Road Equipment Emissions

2020 OFFROAD Fleet Average Emissions Factors

		Emissions Factors lbs/hour					
Item	Hp	NOx	PM	ROG	CO	SOx	
Concrete/Asphalt Saw	81	5.34E-01	3.72E-02	4.73E-02	3.11E-01	6.53E-04	CalEEMod Default Hp
Trencher	78	4.90E-01	3.68E-02	4.49E-02	2.89E-01	4.34E-04	CalEEMod Default Hp
Backhoe/Loader	98	2.87E-01	1.91E-02	2.44E-02	2.78E-01	4.00E-04	CalEEMod Default Hp
Jumping Jack Compactor	4	2.15E-02	1.23E-03	2.66E-03	7.02E-03	2.75E-05	CalEEMod Default Hp
Rough Terrain Forklift	84	1.90E-01	8.28E-03	1.24E-02	2.90E-01	3.73E-04	CalEEMod Default Hp
Marine HDD Machine	600	7.86E-01	2.62E-02	5.90E-02	8.71E-01	3.33E-03	Applicant (American Auger DD440T)
Cleaning/Mixing Machine	355	6.69E-01	2.18E-02	4.71E-02	3.91E-01	1.94E-03	Applicant (American Auger MCD 1000)
Mud Pump	617	8.08E-01	2.69E-02	6.07E-02	8.96E-01	3.43E-03	Applicant (American Auger P-157)
Loader	203	5.99E-01	2.06E-02	4.20E-02	2.57E-01	8.04E-04	CalEEMod Default Hp
Terrestrial Bore Machine	260	5.33E-01	1.66E-02	3.60E-02	3.56E-01	1.42E-03	Applicant (American Auger DD-110)
Excavator	158	3.47E-01	1.70E-02	2.88E-02	5.99E-01	6.65E-04	CalEEMod Default Hp
Cable Puller	70	3.37E-01	2.55E-02	3.10E-02	2.96E-01	3.20E-04	Aspen (Hogg Davis HP6500)
Generator	84	7.21E-01	5.46E-02	6.62E-02	3.25E-01	6.85E-04	CalEEMod Default Hp
Well Drilling Machine	221	4.53E-01	1.41E-02	3.06E-02	3.03E-01	1.21E-03	CalEEMod Default Hp
Manlift	63	7.87E-02	1.63E-03	3.94E-03	1.20E-01	2.14E-04	CalEEMod Default Hp
Crane	231	9.64E-01	4.45E-02	6.97E-02	2.25E-01	7.34E-04	CalEEMod Default Hp
Welder	46	2.16E-01	1.79E-02	3.94E-02	2.04E-01	2.35E-04	CalEEMod Default Hp
Roller	80	2.88E-01	1.93E-02	2.46E-02	2.58E-01	3.32E-04	CalEEMod Default Hp

Note: PM=PM10/PM2.5

					Daily Emissions lbs							Total Emissions lbs					
Phase Name	Offroad Equipment	HP	Number	Hours/day	NOx	PM10	PM2.5	ROG	CO	SOx	Days	NOx	PM10	PM2.5	ROG	CO	SOx
Terrestrial Conduit Installation	Trencher	78	1	6	2.94	0.22	0.22	0.27	1.73	0.00	48	141.06	10.61	10.61	12.94	83.18	0.13
	Terrestrial Bore Machine	260	1	10	5.33	0.17	0.17	0.36	3.56	0.01	48	256.06	7.97	7.97	17.28	171.04	0.68
	Concrete/Asphalt Saw	81	1	2	1.07	0.07	0.07	0.09	0.62	0.00	48	51.28	3.57	3.57	4.54	29.89	0.06
	Backhoe/Loader	98	1	2	0.57	0.04	0.04	0.05	0.56	0.00	48	27.55	1.83	1.83	2.34	26.67	0.04
	Roller	80	1	8	2.30	0.15	0.15	0.20	2.07	0.00	8	18.42	1.24	1.24	1.57	16.53	0.02
	Jumping Jack Compactor	4	1	1	0.02	0.00	0.00	0.00	0.01	0.00	48	1.03	0.06	0.06	0.13	0.34	0.00
				Totals	12.24	0.66	0.66	0.97	8.55	0.02	Totals	495.40	25.28	25.28	38.80	327.64	0.93

					Daily Emissions lbs							Total Emissions lbs					
Phase Name	Offroad Equipment	HP	Number	Hours/day	NOx	PM10	PM2.5	ROG	CO	SOx	Days	NOx	PM10	PM2.5	ROG	CO	SOx
Manhole Installation	Excavator	158	1	6	2.08	0.10	0.10	0.17	3.60	0.00	10	20.80	1.02	1.02	1.73	35.96	0.04
	Generator	84	1	4	2.88	0.22	0.22	0.26	1.30	0.00	10	28.83	2.18	2.18	2.65	12.99	0.03
	Jumping Jack Compactor	4	1	0.5	0.01	0.00	0.00	0.00	0.00	0.00	10	0.11	0.01	0.01	0.01	0.04	0.00
				Totals	4.97	0.32	0.32	0.44	4.90	0.01	Totals	49.74	3.21	3.21	4.39	48.98	0.07

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Construction - Terrestrial Construction Off-Road Equipment Emissions

					Daily Emissions lbs							Total Emissions lbs					
Phase Name	Offroad Equipment	HP	Number	Hours/day	NOx	PM10	PM2.5	ROG	CO	SOx	Days	NOx	PM10	PM2.5	ROG	CO	SOx
Directional Bores – Marine	Marine HDD Machine	600	1	10	7.86	0.26	0.26	0.59	8.71	0.03	20	157.14	5.23	5.23	11.80	174.26	0.67
	Cleaning/Mixing Machine	355	1	10	6.69	0.22	0.22	0.47	3.91	0.02	20	133.74	4.36	4.36	9.41	78.27	0.39
	Mud Pump	617	1	10	8.08	0.27	0.27	0.61	8.96	0.03	20	161.59	5.38	5.38	12.14	179.20	0.69
	Loader	203	1	2	1.20	0.04	0.04	0.08	0.51	0.00	30	35.92	1.23	1.23	2.52	15.39	0.05
	Welder	46	1	8	1.73	0.14	0.14	0.32	1.63	0.00	20	34.63	2.86	2.86	6.31	32.67	0.04
	Roller (1)	80	1	8	2.30	0.15	0.15	0.20	2.07	0.00	2	4.61	0.31	0.31	0.39	4.13	0.01
	Excavator (1)	158	1	8	2.77	0.14	0.14	0.23	4.79	0.01	2	5.55	0.27	0.27	0.46	9.59	0.01
	Backhoe/Loader (1)	98	1	8	2.30	0.15	0.15	0.19	2.22	0.00	2	4.59	0.31	0.31	0.39	4.45	0.01
	Generator	84	1	10	7.21	0.55	0.55	0.66	3.25	0.01	25	180.22	13.65	13.65	16.56	81.22	0.17
	(1) hese items do not operate on maximum day			Totals	32.76	1.48	1.48	2.73	26.98	0.10	Totals	717.98	33.61	33.61	59.99	579.17	2.02

					Daily Emissions lbs							Total Emissions lbs					
Phase Name	Offroad Equipment	HP	Number	Hours/day	NOx	PM10	PM2.5	ROG	CO	SOx	Days	NOx	PM10	PM2.5	ROG	CO	SOx
OGB and LMH	Well Drilling Machine	221	1	8	3.63	0.11	0.11	0.24	2.42	0.01	3	10.88	0.34	0.34	0.73	7.27	0.03
	Backhoe/Loader	98	1	8	2.30	0.15	0.15	0.19	2.22	0.00	5	11.48	0.76	0.76	0.97	11.11	0.02
				Totals	5.92	0.27	0.27	0.44	4.65	0.01	Totals	22.36	1.10	1.10	1.71	18.38	0.05

					Daily Emissions lbs							Total Emissions lbs					
Phase Name	Offroad Equipment	HP	Number	Hours/day	NOx	PM10	PM2.5	ROG	CO	SOx	Days	NOx	PM10	PM2.5	ROG	CO	SOx
Terrestrial Cable Pulling	Cable Puller	70	1	8	2.70	0.20	0.20	0.25	2.37	0.00	6	16.19	1.23	1.23	1.49	14.22	0.02
				Totals	2.70	0.20	0.20	0.25	2.37	0.00	Totals	16.19	1.23	1.23	1.49	14.22	0.02

					Daily Emissions lbs							Total Emissions lbs					
Phase Name	Offroad Equipment	HP	Number	Hours/day	NOx	PM10	PM2.5	ROG	CO	SOx	Days	NOx	PM10	PM2.5	ROG	CO	SOx
PFE Facility (construction and testing)	Rough Terrain Forklift	84	1	2	0.38	0.02	0.02	0.02	0.58	0.00	49	18.58	0.81	0.81	1.22	28.42	0.04
	Manlift	63	1	2	0.16	0.00	0.00	0.01	0.24	0.00	49	7.71	0.16	0.16	0.39	11.79	0.02
	Backhoe/Loader	98	1	2	0.57	0.04	0.04	0.05	0.56	0.00	72	41.33	2.75	2.75	3.51	40.01	0.06
				Totals	1.11	0.06	0.06	0.08	1.38	0.00	Totals	67.62	3.72	3.72	5.11	80.22	0.12

					Daily Emissions lbs							Total Emissions lbs					
Phase Name	Offroad Equipment	HP	Number	Hours/day	NOx	PM10	PM2.5	ROG	CO	SOx	Days	NOx	PM10	PM2.5	ROG	CO	SOx
Marine cable landing/Installation	Cable Puller	70	1	8	2.70	0.20	0.20	0.25	2.37	0.00	1	2.70	0.20	0.20	0.25	2.37	0.00
	Crane	231	1	2	1.93	0.09	0.09	0.14	0.45	0.00	3	5.78	0.27	0.27	0.42	1.35	0.00
	Generator	84	1	8	5.77	0.44	0.44	0.53	2.60	0.01	3	17.30	1.31	1.31	1.59	7.80	0.02
	Backhoe/Loader	98	1	8	2.30	0.15	0.15	0.19	2.22	0.00	3	6.89	0.46	0.46	0.58	6.67	0.01
				Totals	12.69	0.88	0.88	1.11	7.64	0.01	Totals	32.67	2.24	2.24	2.84	18.19	0.03

	Daily Emissions lbs							Total Emissions lbs					
	NOx	PM10	PM2.5	ROG	CO	SOx		NOx	PM10	PM2.5	ROG	CO	SOx
Peak Onshore Day	50.92	2.40	2.40	4.14	40.17	0.13		1,401.95	70.39	70.39	114.33	1,086.81	3.23
Peak Day	31.01	1.92	1.92	2.61	22.47	0.04							

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Construction - Trips Estimate

Assumption:
1) Round trip distances are the default values for Los Angeles County in CalEEMod.

	Daily Round Trips			Total trips	P & V Trip	RT Distance		
Construction Task	Passenger	Vendor	HHDT	HHDT	Days	Passenger	Vendor	HHDT
Terrestrial Conduit Installation	16	1	2	10	48	29.4	13.8	40
Manhole Installation	6	1	1	5	10	29.4	13.8	40
Directional Bores – Marine	16	2	5	40	30	29.4	13.8	40
OGB and LMH	8	2	1	0	5	29.4	13.8	40
Terrestrial Cable Pulling	6	2	0	0	6	29.4	13.8	40
PFE Facility (construction and testing)	8	1	1	5	72	29.4	13.8	40
Pre-lay grapnel run	0	0	0	0	3	29.4	13.8	40
Marine cable landing	16	0	0	0	3	29.4	13.8	40
Marine cable lay	0	0	0	0	28	29.4	13.8	40
Marine cable burial (diver-assisted)	8	0	0	0	7	29.4	13.8	40
Marine cable burial (ROV-assisted)	8	0	0	0	21	29.4	13.8	40

	Daily Miles			Total Miles		
Construction Task	Passenger	Vendor	HHDT	Passenger	Vendor	HHDT
Terrestrial Conduit Installation	470	14	80	22,579	662	400
Manhole Installation	176	14	40	1,764	138	200
Directional Bores – Marine	470	28	200	14,112	828	1,600
OGB and LMH	235	28	40	1,176	138	0
Terrestrial Cable Pulling	176	28	0	1,058	166	0
PFE Facility (construction and testing)	235	14	40	16,934	994	200
Pre-lay grapnel run	0	0	0	0	0	0
Marine cable landing	470	0	0	1,411	0	0
Marine cable lay	0	0	0	0	0	0
Marine cable burial (diver-assisted)	235	0	0	1,646	0	0
Marine cable burial (ROV-assisted)	235	0	0	4,939	0	0
			Total	65,621	2,926	2,400

	Passenger	Vendor	HHDT
Maximum Day VMT	1,117	55	320
Average Day VMT (105 days)	625	28	23

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Construction - Terrestrial Construction On-Road Vehicle Emissions

Assumptions

1) Emissions factors developed from EMFAC2017 web version for three vehicle classes. Paved road dust included using AP-42 and CalEEMod input defaults.

2) Passenger vehicle class is a miles weighted average of the EMFAC LDA, LDT1, LDHT1, LDHT2, and MCY vehicle types, all fuel types.

3) Vendor vehicle class is the diesel fueled MHDT vehicle type.

3) Heavy Duty Truck is the diesel fueled HHDT vehicle type.

	Emissions Factors lbs/mile					
	NOx	PM10	PM2.5	ROG	CO	SOx
Passenger Vehicle	3.18E-04	7.68E-04	2.08E-04	3.41E-04	2.98E-03	7.06E-06
Delivery Vehicle	7.42E-03	1.17E-03	4.80E-04	3.30E-04	1.21E-03	2.09E-05
Heavy Duty Truck	1.13E-02	1.01E-03	3.74E-04	3.93E-04	2.22E-03	3.32E-05

			Daily Emissions - Lbs							Total Emissions - Lbs					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
Terrestrial Conduit Installation	Passenger	470	0.150	0.361	0.098	0.160	1.404	0.003	22,579	7.19	17.35	4.69	7.70	67.40	0.16
	Delivery	14	0.102	0.016	0.007	0.005	0.017	0.000	662	4.91	0.78	0.32	0.22	0.80	0.01
	Heavy Truck	80	0.906	0.081	0.030	0.031	0.178	0.003	400	4.53	0.41	0.15	0.16	0.89	0.01
		Total	1.158	0.459	0.134	0.196	1.599	0.006	Total	16.63	18.53	5.16	8.07	69.09	0.19

			Daily Emissions							Total Emissions					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
Manhole Installation	Passenger	176	0.056	0.136	0.037	0.060	0.527	0.001	1,764	0.56	1.36	0.37	0.60	5.27	0.01
	Delivery	14	0.102	0.016	0.007	0.005	0.017	0.000	138	1.02	0.16	0.07	0.05	0.17	0.00
	Heavy Truck	40	0.453	0.041	0.015	0.016	0.089	0.001	200	2.26	0.20	0.07	0.08	0.44	0.01
		Total	0.611	0.192	0.058	0.080	0.632	0.003	Total	3.85	1.72	0.51	0.73	5.88	0.02

			Daily Emissions							Total Emissions					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
Directional Bores – Marine	Passenger	470	0.150	0.361	0.098	0.160	1.404	0.003	14,112	4.49	10.84	2.93	4.81	42.12	0.10
	Delivery	28	0.205	0.032	0.013	0.009	0.033	0.001	828	6.14	0.97	0.40	0.27	1.00	0.02
	Heavy Truck	200	2.264	0.203	0.075	0.079	0.445	0.007	1,600	18.11	1.62	0.60	0.63	3.56	0.05
		Total	2.618	0.596	0.186	0.248	1.882	0.011	Total	28.75	13.43	3.93	5.71	46.68	0.17

			Daily Emissions							Total Emissions					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
OGB and LMH	Passenger	235	0.075	0.181	0.049	0.080	0.702	0.002	1,176	0.37	0.90	0.24	0.40	3.51	0.01
	Delivery	28	0.205	0.032	0.013	0.009	0.033	0.001	138	1.02	0.16	0.07	0.05	0.17	0.00
	Heavy Truck	40	0.453	0.041	0.015	0.016	0.089	0.001	0	0.00	0.00	0.00	0.00	0.00	0.00
		Total	0.732	0.254	0.077	0.105	0.824	0.004	Total	1.40	1.07	0.31	0.45	3.68	0.01

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Construction - Terrestrial Construction On-Road Vehicle Emissions

			Daily Emissions							Total Emissions					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
Terrestrial Cable Pulling	Passenger	176	0.056	0.136	0.037	0.060	0.527	0.001	1,058	0.34	0.81	0.22	0.36	3.16	0.01
	Delivery	28	0.205	0.032	0.013	0.009	0.033	0.001	166	1.23	0.19	0.08	0.05	0.20	0.00
	Heavy Truck	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0.00	0.00	0.00	0.00	0.00	0.00
		Total	0.261	0.168	0.050	0.069	0.560	0.002	Total	1.57	1.01	0.30	0.42	3.36	0.01

			Daily Emissions							Total Emissions					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
PFE Facility (construction and testing)	Passenger	235	0.075	0.181	0.049	0.080	0.702	0.002	16,934	5.39	13.01	3.52	5.77	50.55	0.12
	Delivery	14	0.102	0.016	0.007	0.005	0.017	0.000	994	7.37	1.16	0.48	0.33	1.20	0.02
	Heavy Truck	40	0.453	0.041	0.015	0.016	0.089	0.001	200	2.26	0.20	0.07	0.08	0.44	0.01
		Total	0.630	0.237	0.070	0.100	0.808	0.003	Total	15.03	14.38	4.07	6.18	52.19	0.15

			Daily Emissions							Total Emissions					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
Marine cable landing/Installation	Passenger	470	0.150	0.361	0.098	0.160	1.404	0.003	1,411	0.45	1.08	0.29	0.48	4.21	0.01
	Delivery	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0.00	0.00	0.00	0.00	0.00	0.00
	Heavy Truck	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0.00	0.00	0.00	0.00	0.00	0.00
		Total	0.150	0.361	0.098	0.160	1.404	0.003	Total	0.45	1.08	0.29	0.48	4.21	0.01

			Daily Emissions							Total Emissions					
Construction Task	Vehicle Type	Daily VMT	NOx	PM10	PM2.5	ROG	CO	SOx	VMT Total	NOx	PM10	PM2.5	ROG	CO	SOx
Marine cable burial (Diver assisted)	Passenger	235	0.075	0.181	0.049	0.080	0.702	0.002	1,646	0.52	1.26	0.34	0.56	4.91	0.01
	Delivery	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0.00	0.00	0.00	0.00	0.00	0.00
	Heavy Truck	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0.00	0.00	0.00	0.00	0.00	0.00
		Total	0.075	0.181	0.049	0.080	0.702	0.002	Total	0.52	1.26	0.34	0.56	4.91	0.01

	NOx	PM10	PM2.5	ROG	CO	SOx		NOx	PM10	PM2.5	ROG	CO	SOx
Peak Onshore Day	4.509	1.309	0.397	0.549	4.306	0.020	Total	68.20	52.48	14.91	22.59	190.00	0.57
Peak Day	2.549	1.250	0.361	0.537	4.443	0.016							

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Marine Emissions Summary

		Daily Emissions lbs/day					
Work Phase	**Source**	**NOx**	**PM10**	**PM2.5**	**ROG**	**CO**	**SOx**
Directional Bores – Marine	Support Vessel	4.21	0.19	0.19	0.45	1.20	0.00
	Work Boat	10.15	0.79	0.79	2.48	6.06	0.01
	Total	14.36	0.98	0.98	2.93	7.26	0.01
Pre-lay grapnel run	Cable Vessel	1,543.26	37.41	33.90	58.46	128.60	46.77
Marine cable landing/Installation	Cable Vessel	1,543.26	37.41	33.90	58.46	128.60	46.77
	Support Vessel	12.01	0.52	0.52	1.15	3.13	0.01
	Work Boat	10.15	0.79	0.79	2.48	6.06	0.01
	Total	1,565.42	38.72	35.21	62.08	137.80	46.78
Marine cable lay	Cable Vessel	1,543.26	37.41	33.90	58.46	128.60	46.77
Marine cable burial (Diver assisted)	Support Vessel	7.22	0.27	0.27	0.52	1.50	0.00
	Work Boat	88.14	3.48	3.48	7.09	20.00	0.05
	Total	95.36	3.75	3.75	7.61	21.50	0.05
Marine cable burial (ROV assisted)	Cable Vessel	1,543.26	37.41	33.90	58.46	128.60	46.77
Cable Laying Vessel Arrival/Departure	Cable Vessel	206.19	5.00	4.53	7.81	17.18	6.25

	Total Emissions tons					
Source	**NOx**	**PM10**	**PM2.5**	**ROG**	**CO**	**SOx**
Cable Vessel	42.54	1.03	0.93	1.61	3.55	1.29
Support Vessel	0.04	0.00	0.00	0.00	0.01	0.00
Work Boat	0.33	0.01	0.01	0.03	0.08	0.00
Total	42.91	1.05	0.95	1.64	3.63	1.29

LST Emissions Maximum

	Total Emissions tons					
Source	**NOx**	**PM10**	**PM2.5**	**ROG**	**CO**	**SOx**
Cable Vessel	1543.26	37.41	33.90	58.46	128.60	46.77
Support Vessel	1.25	0.12	0.12	0.39	0.93	0.00
Work Boat	7.36	0.68	0.68	2.28	5.49	0.01
Total	1,551.87	38.21	34.71	61.13	135.03	46.77

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Marine Construction Emissions

Main Cable Lay Vessel

Vessel Engine Assumptions:

Surrogate Vessel: CS Responder
Diesel-Electric vessel with 4 non-emergency engines:

Engine Type	ngine Make/Model		Number	kW/Eng.
Main Engines	Man L32/40 720 RPM		2	3840
Auxiliary Engines	Unknown Mfg.		2	700
Total Power	9080	kW		
Max Speed	14.0	knots		

Emissions Factor Assumptions

1) Main propulsion engines are Tier 0 medium speed engines that will be required to use 0.1 percent sulfur MGO/MDO fuel.

2) Auxiliary Engines will also be required to use 0.1% sulfur MGO/MDO fuel.

3) Emissions factors from Port of Long Beach 2013 Emissions Inventory.

	Emissions Factors g/kW-hr					
	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	13.20	0.32	0.29	0.50	1.10	0.40
Auxiliary Engine	13.80	0.32	0.29	0.40	1.10	0.40

Load Factor Assumptions:

1) 6,000 kW is used for propulsion when at max speed meaning the auxiarly engine load is 410 kW (27 percent) at cruise.

2) Auxiliary engine load is 45 percent during dynamic positioning, per previous estimate.

3) Cruise kW-hr is based on propeller law which gives 9 knots as 26.6 percent of full load at 14 knots plus aux engine 410 kW.

Fuel Use	Total	Main	Auxiliary	
	Tons/day	kW/hr	kW/hr	kW/hr	
Fuel use at full speed (14 knots)	40	6,410	6,000	410	@0.52 lb/kW-hr
Fuel use with dynamic positioning operation	18	2,885	2,210	675	
Cruise at 9 knots	12.5	2,004	1,594	410	

Fuel use estimate based on CS specifications for the Responder cabling vessel

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Marine Construction Emissions

Main Cable Lay Vessel

Emissions:

			Daily Emissions, lbs					
Activity	Hour/Day	kW	NOx	PM10	PM2.5	ROG	CO	SOx
Pre-Lay Grapnel Run	24	2,210	1,543.26	37.41	33.90	58.46	128.60	46.77
Marine Cable Landing	24	2,210	1,543.26	37.41	33.90	58.46	128.60	46.77
Marine Cable Lay	24	2,210	1,543.26	37.41	33.90	58.46	128.60	46.77
Marine Cable Burial (diver)	0	2,210	0.00	0.00	0.00	0.00	0.00	0.00
Marine Cable Burial (ROV)	24	2,210	1,543.26	37.41	33.90	58.46	128.60	46.77
Cruise out of work area	4.4	1,594	206.19	5.00	4.53	7.81	17.18	6.25

Total Emissions

		Total Emissions, tons					
Activity	Days	NOx	PM10	PM2.5	ROG	CO	SOx
Pre-Lay Grapnel Run	3	2.31	0.06	0.05	0.09	0.19	0.07
Marine Cable Landing	3	2.31	0.06	0.05	0.09	0.19	0.07
Marine Cable Lay	28	21.61	0.52	0.47	0.82	1.80	0.65
Marine Cable Burial (ROV)	21	16.20	0.39	0.36	0.61	1.35	0.49
Marine Cable Burial (diver)	0	0.00	0.00	0.00	0.00	0.00	0.00
Cruise out of work area	1	0.10	0.00	0.00	0.00	0.01	0.00
	Totals	42.54	1.03	0.93	1.61	3.55	1.29

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Marine Construction Emissions

Support Vessel

Vessel Engine Assumptions:

Surrogate Vessel: Theory Marine JAB (2010 build year)

Main Propulsion: 2 Cummins QSC engines (1000 hp total/746 kW total)
Auxiliary: 8 kW (10.7 hp)

Uses: Dive Platform during directional bore support and diver assisted post lay burial
Home Port: Kings Harbor during project

Daily activity: Travel to and from work site at 9 knots, and full day of auxiliary engine use.

Top Speed: 34 Knots

Emissions Factor Assumptions

1) The JAB is used for engine size not Tier rating as the JAB may not be used.
2) Engines are Tier 0, 1995 to 2000 model year that will be required to use ULSD diesel fuel.
3) Emissions factors from Port of Long Beach 2013 Emissions Inventory Table C.1. Given conservative age of engines assumed no additional engine degradation assumed.
4) Minimum engine load during transit is assumed to be 38 percent using the average load factor in the Port of Long Beach emissions inventory.

	Emissions Factors g/kW-hr					
	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	12.92	0.48	0.48	0.91	2.64	0.01
Auxiliary Engine	9.25	0.86	0.86	2.87	6.90	0.01

Daily Emissions

Directional Bore Support

Assumption:
1) The support boat provides workers and supplies for two days

Each Day			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	38%	0.44	3.59	0.13	0.13	0.25	0.73	0.00
Auxiliary Engine	32%	12	0.63	0.06	0.06	0.19	0.47	0.00
		Totals	4.21	0.19	0.19	0.45	1.20	0.00

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Marine Construction Emissions

Support Vessel

Cable Pulling Support

Assumption:

1) The support boat provides one crew/supply trip the first day and three trips the second day, stays on station when not in transit.

Day 1			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	38%	0.44	3.59	0.13	0.13	0.25	0.73	0.00
Auxiliary Engine	32%	12	0.63	0.06	0.06	0.19	0.47	0.00
		Totals	4.21	0.19	0.19	0.45	1.20	0.00

Day 2			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	38%	1.33	10.76	0.40	0.40	0.76	2.20	0.01
Auxiliary Engine	32%	24	1.25	0.12	0.12	0.39	0.93	0.00
		Totals	12.01	0.52	0.52	1.15	3.13	0.01

Dive Assisted Post Lay Burial

Assumption:

1) The support boat provides two crew/supply round trips per day, docks at port rest of day.

			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	38%	0.89	7.17	0.27	0.27	0.51	1.47	0.00
Auxiliary Engine	32%	0.89	0.05	0.00	0.00	0.01	0.03	0.00
		Totals	7.22	0.27	0.27	0.52	1.50	0.00

Emissions Totals

	Emissions tons					
	NOx	PM10	PM2.5	ROG	CO	SOx
Bore Support	0.00	0.00	0.00	0.00	0.00	0.00
Cable Pulling	0.01	0.00	0.00	0.00	0.00	0.00
Post Lay Burial	0.03	0.00	0.00	0.00	0.01	0.00
	0.04	0.00	0.00	0.00	0.01	0.00

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Marine Construction Emissions

Work Boat

Vessel Engine Assumptions:

Surrogate Vessel: M/V Danny C

Main Propulsion: Twin Cummins QSM11 Tier 3 (810 bhp/604 kW total)
Auxiliary: Two with total 47 kW (63 hp)

Uses: Dive Platform during directional bore support and diver assisted post lay burial
Home Port: Kings Harbor during project

Daily activity: Travel to and from work site at 9 knots, and full day of auxiliary engine use.

Top Speed: 10 Knots

Emissions Factor Assumptions

1) The Danny C is used for engine size not Tier rating as the Danny C, and it's Tier 3 engines may not be used.
2) Engines are Tier 0, 1995 to 2000 model year that will be required to use ULSD diesel fuel.
3) Emissions factors from Port of Long Beach 2013 Emissions Inventory Table C.1. Given conservative age of engines assumed no additional engine degradation assumed.
4) Minimum engine load during transit is assumed to be 38 percent using the average load factor in the Port of Long Beach emissions inventory.

	Emissions Factors g/kW-hr					
	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	12.92	0.48	0.48	0.91	2.64	0.01
Auxiliary Engine	9.25	0.86	0.86	2.87	6.90	0.01

Daily Emissions

Directional Bore Support

Assumption:
1) The work boat/dive platform goes on station the morning of the first day and anchors until completion of the work when it returns to port.

Day 1			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	73%	0.22	2.79	0.10	0.10	0.20	0.57	0.00
Auxiliary Engine	32%	12	3.68	0.34	0.34	1.14	2.75	0.00
		Totals	6.47	0.45	0.45	1.34	3.31	0.00

Day 2			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	73%	0.22	2.79	0.10	0.10	0.20	0.57	0.00
Auxiliary Engine	32%	24	7.36	0.68	0.68	2.28	5.49	0.01
		Totals	10.15	0.79	0.79	2.48	6.06	0.01

RTI-I Transpacific Fiber-Optic Cables Project

Construction - Marine Construction Emissions

Work Boat

Cable Pulling Support

Assumption:

1) The work boat/dive platform arrives on station the first day, anchors and works the first day during daylight. Second day is 24 hour operation.

Day 1

			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	73%	0.22	2.79	0.10	0.10	0.20	0.57	0.00
Auxiliary Engine	32%	18	5.52	0.51	0.51	1.71	4.12	0.00
		Totals	8.31	0.62	0.62	1.91	4.69	0.01

Day 2

			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	73%	0.22	2.79	0.10	0.10	0.20	0.57	0.00
Auxiliary Engine	32%	24	7.36	0.68	0.68	2.28	5.49	0.01
		Totals	10.15	0.79	0.79	2.48	6.06	0.01

Dive Assisted Post Lay Burial

Assumption:

Daytime only activity in near shore shallow water, total duration 7 days.

			Daily Emissions lbs/day					
	Load	Hours	NOx	PM10	PM2.5	ROG	CO	SOx
Main engine	73%	1	12.54	0.47	0.47	0.88	2.56	0.01
Main engine	38%	11	71.92	2.67	2.67	5.07	14.70	0.04
Auxiliary Engine	32%	12	3.68	0.34	0.34	1.14	2.75	0.00
		Totals	88.14	3.48	3.48	7.09	20.00	0.05

Emissions Totals

	Emissions tons					
	NOx	PM10	PM2.5	ROG	CO	SOx
Bore Support	0.01	0.00	0.00	0.00	0.00	0.00
Cable Pulling	0.01	0.00	0.00	0.00	0.01	0.00
Post Lay Burial	0.31	0.01	0.01	0.02	0.07	0.00
	0.33	0.01	0.01	0.03	0.08	0.00

RTI-I Transpacific Fiber-Optic Cables Project

Operations - Emergency Engines

Assumptions:

1) Per SCAQMD Rule 1470 engines will be U.S. EPA/ARB Tier 3 Emissions Standards Compliant, and will be required to meet a PM emissions limit of 0.01 g/bhp-hr due to being located within 500 feet of a school.

2) Two 670 hp/500 kW diesel-fired engine generators.

3) Engine testing will be limited to no more than one hour per day and permit will be limited to 50 hours/year each for testing/maintenance operation (full load operation assumed). Actual testing is forecast as one hour per month per engine (12 hours/year/engine).

4) Per the CARB ATCM, given the engine is located adjacent to a school, so engine testing will not occur between 7:30 am and 3:30 pm on school days.

5) Emissions factors for SOx based on ultra low sulfur diesel (15 ppm sulfur) and fuel consumption of 0.36 lb/hp-hr, other emissions factors based on the Tier 3 emissions limits

Emissions

			Emissions Factors (g/hp-hr)					
			NOx	PM10	PM2.5	ROG	CO	SOx
			3.0	0.01	0.01	1.00	2.6	4.9E-03

			Emissions (lbs)					
Period	Hours	Engine Hp	NOx	PM10	PM2.5	ROG	CO	SOx
Daily	2	670	8.86	0.03	0.03	2.95	7.68	0.01
Annual	100	670	443.13	1.48	1.48	147.71	384.05	0.72

RTI-l Transpacific Fiber-Optic Cables Project

Operations - Screening Level Heath Risk Assessment Assumptions:

1) The engines will not be tested when school is normally in session.

2) The nearest sensitive receptors are located in apartment complex adjacent to the east and north sides of the building where the PFE is located.

3) The initial screening level risk assessment X/Q value is based on SCAQMD Rule 1401 Package "N" Version 8.1 Table 10.5A.

4) Risk value is calculated using the ARB/OEHHA AB2588 Risk Assessment Standalone Tool (RAST).

Screening Level Risk Calculation

X/Q 8.04 LAX with 25 meters to receptor distance

Concetration in ug/m3 = X/Q x ton/year

Annual concentration = 0.00593796

Using RAST for 30 year exposure the Cancer Risk = 5.14E-06