



A  Sempra Energy utility®

Order Instituting Investigation into the November ) Investigation 19-11-010  
2019 Submission of Southern California Gas )  
Company's Risk Assessment and Mitigation Phase. )

**RISK ASSESSMENT MITGATION PHASE**  
**WORKPAPERS TO**  
**CHAPTER SCG-5**  
**HIGH PRESSURE PIPELINE INCIDENT**

**November 27, 2019**

<b>Chapter</b>	<b>SCG-5</b>
<b>Risk</b>	<b>High Pressure Gas Pipeline Incident (Excluding Dig-in)</b>

PHMSA Incident Rate

Number of Incidents\_National

Type	Number of Incidents_Excl. 3rd party dig-in			
	Transmission	Distribution_Main	Distribution_Service	Distribution Meters
MAOP > 60 psig	450	71	13	31

SCG

Type	Miles			
	Transmission	Distribution_Main	Distribution_Service	Total
MAOP > 60 psig	3448	3269	125	6842

National				
Type	Miles			Meter
	Transmission	Distribution_Main	Distribution_Service	
MAOP > 60 psig	297553	83618	2288	120300

SCG

Type	Meters		
	Residential	Industrial	Total
SCG	5656526	273290	5929816

SCG\_excl

Type	Incident Rate			
	Transmission	Distribution_Main	Distribution_Service	Meters
MAOP > 60 psig	0.61	0.39		0.83

Chapter	SCG-5
Risk	High Pressure Gas Pipeline Incident (Excluding Dig-in)

Single Point

ID	Activity	Project Life In Years	Cost Forecast (O&M, \$M) 2022	Cost Forecast (Capital, \$M)			Pre-Mitigation Single Point		% risk reduction (use if % risk addressed not available) (%)	% Risk Reduction			RSE	Post-Mitigation Single Point	
				2020	2021	2022	LORE	CORE		Safety	Reliability	Financial (\$M)	Single Point	LORE	CORE
				SCG-5-C2	Cathodic Protection	64	0.00	4.37		4.37	4.37	4	76	9.8%	9.8%
SCG-5-C6	TIMP	7	48.26	57.71	57.71	57.71	4	76	337.3%	337.3%	337.3%	20.64	18.59	75.65	
SCG-5-C3-T2	Pipe Replacement - Tranche 2: Phase 1B (PSEP)	64	0.00	82.25	121.51	20.05	4	76	2.5%	2.5%	7.6%	1.14	4.36	75.89	
SCG-5-C3-T3	Pipe Replacement - Tranche 3: Phase 2A (PSEP)	64	0.00	6.76	14.06	33.68	4	76	17.2%	17.2%	51.7%	31.17	4.98	77.10	
SCG-5-C4-T3	Pressure Testing - Tranche 3: Phase 2A (PSEP)	7	79.68	11.98	27.18	34.60	4	76	140.1%	140.1%	420.2%	10.22	10.20	81.42	
SCG-5-C5	Valve automation	45	0.00	53.96	36.63	6.08	4	76	0.8%	0.8%	8.2%	1.04	4.28	76.01	
SCG-5-A1	Alternative: Proactive Soil Sampling Collection	1	5.60	0.00	0.00	0.00	4	76	0.1%	0.1%	0.1%	0.08	4.24	75.65	
SCG-5-A2	Alternative: Expanding Geotechnical Analysis	1	1.35	0.80	0.20	0.59	4	76	0.2%	0.2%	0.2%	0.12	4.24	75.65	
SCG-5-C1	GIPP	40	0.69	1.00	1.00	1.00	4	76	3.8%	3.8%	3.8%	54.46	4.41	75.65	

Low Alternative

ID	Activity	Project Life In Years	Cost Forecast (O&M, \$M) 2022	Cost Forecast (Capital, \$M)			Pre-Mitigation Low Alternative		% risk reduction (use if % risk addressed not available) (%)	% Risk Reduction			RSE	Post-Mitigation Low Alternative	
				2020	2021	2022	LORE	CORE		Safety	Reliability	Financial (\$M)	Low Alternative	LORE	CORE
				SCG-5-C2	Cathodic Protection	64	0.00	4.37		4.37	4.37	4	12	9.8%	9.8%
SCG-5-C6	TIMP	7	48.26	57.71	57.71	57.71	4	12	337.3%	337.3%	337.3%	3.29	18.59	12.07	
SCG-5-C3-T2	Pipe Replacement - Tranche 2: Phase 1B (PSEP)	64	0.00	82.25	121.51	20.05	4	12	2.5%	2.5%	7.6%	0.29	4.36	12.31	
SCG-5-C3-T3	Pipe Replacement - Tranche 3: Phase 2A (PSEP)	64	0.00	6.76	14.06	33.68	4	12	17.2%	17.2%	51.7%	8.00	4.98	13.52	
SCG-5-C4-T3	Pressure Testing - Tranche 3: Phase 2A (PSEP)	7	79.68	11.98	27.18	34.60	4	12	140.1%	140.1%	420.2%	2.62	10.20	17.84	
SCG-5-C5	Valve automation	45	0.00	53.96	36.63	6.08	4	12	0.8%	0.8%	8.2%	0.49	4.28	12.43	
SCG-5-A1	Alternative: Proactive Soil Sampling Collection	1	5.60	0.00	0.00	0.00	4	12	0.1%	0.1%	0.1%	0.01	4.24	12.07	
SCG-5-A2	Alternative: Expanding Geotechnical Analysis	1	1.35	0.80	0.20	0.59	4	12	0.2%	0.2%	0.2%	0.02	4.24	12.07	
SCG-5-C1	GIPP	40	0.69	1.00	1.00	1.00	4	12	3.8%	3.8%	3.8%	8.69	4.41	12.07	

High Alternative

ID	Activity	Project Life In Years	Cost Forecast (O&M, \$M) 2022	Cost Forecast (Capital, \$M)			Pre-Mitigation High Alternative		% risk reduction (use if % risk addressed not available) (%)	% Risk Reduction			RSE	Post-Mitigation High Alternative	
				2020	2021	2022	LORE	CORE		Safety	Reliability	Financial (\$M)	High Alternative	LORE	CORE
				SCG-5-C2	Cathodic Protection	64	0.00	4.37		4.37	4.37	4	182	9.8%	9.8%
SCG-5-C6	TIMP	7	48.26	57.71	57.71	57.71	4	182	337.3%	337.3%	337.3%	49.56	18.59	181.61	
SCG-5-C3-T2	Pipe Replacement - Tranche 2: Phase 1B (PSEP)	64	0.00	82.25	121.51	20.05	4	182	2.5%	2.5%	7.6%	2.54	4.36	181.85	
SCG-5-C3-T3	Pipe Replacement - Tranche 3: Phase 2A (PSEP)	64	0.00	6.76	14.06	33.68	4	182	17.2%	17.2%	51.7%	69.77	4.98	183.07	
SCG-5-C4-T3	Pressure Testing - Tranche 3: Phase 2A (PSEP)	7	79.68	11.98	27.18	34.60	4	182	140.1%	140.1%	420.2%	22.87	10.20	187.39	
SCG-5-C5	Valve automation	45	0.00	53.96	36.63	6.08	4	182	0.8%	0.8%	8.2%	1.96	4.28	181.97	
SCG-5-A1	Alternative: Proactive Soil Sampling Collection	1	5.60	0.00	0.00	0.00	4	182	0.1%	0.1%	0.1%	0.19	4.24	181.61	
SCG-5-A2	Alternative: Expanding Geotechnical Analysis	1	1.35	0.80	0.20	0.59	4	182	0.2%	0.2%	0.2%	0.29	4.24	181.61	
SCG-5-C1	GIPP	40	0.69	1.00	1.00	1.00	4	182	3.8%	3.8%	3.8%	130.74	4.41	181.61	

SCG-5-C1: Gas Infrastructure Protection Project (GIPP)									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	86%	3.8%	<i>Selected locations/total locations</i>	Scheduled inspections and remediations	SME Estimate	Based on PHMSA data assessment		40
	% Effectiveness	95%		<i>High effectiveness</i>					
	% Risk Addressed	5%		<i>Outside force damage/total incidents from sample</i>					
Reliability	% Scope	86%	3.8%	<i>Selected locations/total locations</i>					
	% Effectiveness	95%		<i>High effectiveness</i>					
	% Risk Addressed	5%		<i>Outside force damage/total incidents from sample</i>					
Financial	% Scope	86%	3.8%	<i>Selected locations/total locations</i>					
	% Effectiveness	95%		<i>High effectiveness</i>					
	% Risk Addressed	5%		<i>Outside force damage/total incidents from sample</i>					

SCG-5-C2: Cathodic Protection									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	72%	10%	<i>Evaluated CP protection areas/total protection areas</i>	SCG designated areas	SME Estimate	Based on PHMSA data assessment		64
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	14%		<i>Corrosion-related incidents in sample</i>					
Reliability	% Scope	72%	10%	<i>Evaluated CP protection areas/total protection areas</i>	SCG designated areas	SME Estimate	Based on PHMSA data assessment		64
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	14%		<i>Corrosion-related incidents in sample</i>					
Financial	% Scope	72%	10%	<i>Evaluated CP protection areas/total protection areas</i>	SCG designated areas	SME Estimate	Based on PHMSA data assessment	PHMSA data	64
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	14%		<i>Corrosion-related incidents in sample</i>					

SCG-5-C3-T2: Pipe Replacement - Tranche 2: Phase 1B (PSEP)									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	15%	3%	<i>Fraction of pipeline in scope</i>	SCG designated areas for Phase 1B	SME Estimate	Based on PHMSA data assessment, vintage analysis, and the application of the non-HCA fraction. Significant property damage assumed (financial only).		64
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	17%		<i>Corrosion and natural force-related incidents in sample</i>					
Reliability	% Scope	15%	3%	<i>Fraction of pipeline in scope</i>					
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	17%		<i>Corrosion and natural force-related incidents in sample</i>					
Financial	% Scope	15%	8%	<i>Fraction of pipeline in scope</i>					
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	50%		<i>Corrosion and natural force-related incidents in sample</i>					

SCG-5-C3-T3: Pipe Replacement - Tranche 3: Phase 2A (PSEP)									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	21%	17%	<i>Fraction of in-scope pipeline</i>	SCG designated areas for Phase 2A	SME Estimate	Based on PHMSA data assessment, vintage analysis, and the application of the HCA fraction. Significant property damage assumed (financial only).		64
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	81%		<i>Corrosion and natural force-related incidents in sample</i>					
Reliability	% Scope	21%	17%	<i>Fraction of in-scope pipeline</i>					
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	81%		<i>Corrosion and natural force-related incidents in sample</i>					
Financial	% Scope	21%	52%	<i>Fraction of in-scope pipeline</i>					
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	242%		<i>Corrosion and natural force-related incidents in sample</i>					

**SCG-5-C4-T3: Pressure Testing - Tranche 3: Phase 2A (PSEP)**

Attribute	Risk Reduction		Total	Formula	Basis			Reference	Project Life
	% Scope	% Effectiveness			Scope	Effectiveness	Risk Addressed		
Safety	% Scope	32%	140%	<i>Fraction of in-scope pipeline</i>	SCG designated pressure testing miles	SME Estimate	Based on PHMSA data assessment, vintage analysis, and the application of the HCA fraction. Significant property damage assumed (financial only).	PHMSA data	7
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	457%		<i>Corrosion and natural force-related incidents in sample</i>					
Reliability	% Scope	32%	140%	<i>Fraction of in-scope pipeline</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	457%		<i>Corrosion and natural force-related incidents in sample</i>					
Financial	% Scope	32%	420%	<i>Fraction of in-scope pipeline</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	1370%		<i>Corrosion and natural force-related incidents in sample</i>					



SCG-5-C5: Valve Automation									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	82%	0.8%	Targeted valves	SCG targeted valves	SME Estimate	SME Estimate		45
	% Effectiveness	100%		High					
	% Risk Addressed	1%		Minimal					
Reliability	% Scope	82%	0.8%	Targeted valves	SCG targeted valves	SME Estimate	SME Estimate		45
	% Effectiveness	100%		High					
	% Risk Addressed	1%		Minimal					
Financial	% Scope	82%	8%	Targeted valves	SCG targeted valves	SME Estimate	SME Estimate		45
	% Effectiveness	100%		High					
	% Risk Addressed	10%		Larger than minimal due to heat flux reduction					

**SCG-5-C6: Transmission Integrity Management Program (TIMP)**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	43%	337%	<i>Transmission system fraction to be assessed</i>	SCG targeted % of system	SME Estimate	Based on PHMSA data assessment. Residual risk multiplier based on estimate of significant failure risk stemming from the interruption of pipeline condition assessments	PHMSA data	7
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	829%		<i>In-scope incidents from sample</i>					
Reliability	% Scope	43%	337%	<i>Transmission system fraction to be assessed</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	829%		<i>In-scope incidents from sample</i>					
Financial	% Scope	43%	337%	<i>Transmission system fraction to be assessed</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	829%		<i>In-scope incidents from sample</i>					

SCG-5-A1: Proactive Soil Sampling Collection									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	100%	0.14%	100% of soil to be sampled as a one-time effort	Proposed sampling at a fixed rate per mile	SME Estimate	Based on PHMSA data assessment		1
	% Effectiveness	1%		Minimal					
	% Risk Addressed	14%		Corrosion-related significant events in company history					
Reliability	% Scope	100%	0.14%	100% of soil to be sampled as a one-time effort					
	% Effectiveness	1%		Minimal effectiveness					
	% Risk Addressed	14%		Corrosion-related events/significant events in company history					
Financial	% Scope	100%	0.14%	100% of soil to be sampled as a one-time effort					
	% Effectiveness	1%		Minimal effectiveness					
	% Risk Addressed	14%		Corrosion-related events/significant events in company history					

SCG-5-A2: Expanding Geotechnical Analysis									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	5%	0.2%	<i>% of problematic areas where most impactful work can be done</i>	SME Estimate	SME Estimate	Based on PHMSA data assessment		1
	% Effectiveness	50%		<i>Not fully effective</i>					
	% Risk Addressed	9%		<i>Fraction of historical experience</i>					
Reliability	% Scope	5%	0.2%	<i>% of half the problematic areas where more impactful spots can be targeted</i>					
	% Effectiveness	50%		<i>Half effective</i>					
	% Risk Addressed	9%		<i>Fraction of historical experience</i>					
Financial	% Scope	5%	0.2%	<i>% of half the problematic areas where more impactful spots can be targeted</i>			PHMSA data		
	% Effectiveness	50%		<i>Half effective</i>					
	% Risk Addressed	9%		<i>Fraction of historical experience</i>					