



# **Risk Assessment and Mitigation Phase**

## **(Chapter SDG&E-Risk-3-QWP) Incident Related to the High Pressure System (Excluding Dig-in) Workpapers**

**May 17, 2021**

<b>Overall Workpaper Description</b>	This workpaper file explains the risk scoring and Risk Spend Efficiency (RSE) quantification. It contains necessary information and sources for calculating the risk score and RSE for respective mitigations and controls filed in the 2021 RAMP.
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<b>"Master Inputs" Tab</b>	This sheet contains the major MAVF inputs for risk scoring
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<b>"RSE Summary" Tab</b>	This sheet presents a summarized view of RSE scoring
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<b>RSE Equation</b>	$\text{Risk Reduction} = (\text{Pre - Mitigated LoRE} * \text{Pre - Mitigated CoRE}) - (\text{Post - Mitigated LoRE} * \text{Post - Mitigated CoRE})$ $\text{Discounted Time} = 1 - \left( \frac{1}{\frac{(1 + \text{Benefit Discount Rate})^{\text{Benefits Lifetime}}}{\text{Benefit Discount Rate}}} \right)$ $\text{RSE per \$M} = \frac{\text{Risk Reduction} * \text{Discounted Time}}{\text{Total Cost (\$M)}}$
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***Master Inputs***

**Discount Factors**

Benefit Discount Factor                      3.00%

**MAVF Framework**

	Range	Weight
Safety Index	20	60%
Reliability Index	1	23%
Financial Cost	500	15%
Stakeholder Satisfaction Index	100	2%

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE
SDG&E-RISK-3-M04	Adobe Falls Relocation Project	64.0	\$2,000	1%
SDG&E-RISK-3-A01	ALTERNATIVE - Expanding Geotechnical Analysis	1.0	\$180	0%
SDG&E-RISK-3-A02	ALTERNATIVE - Proactive Soil Sampling	1.0	\$359	0%
SDG&E-RISK-3-C01-T01	Cathodic Protection - Capital	64.0	\$204	0%
SDG&E-RISK-3-C01-T02	Cathodic Protection - Capital	64.0	\$412	0%
SDG&E-RISK-3-C02-T01	Cathodic Protection - Maintenance	1.0	\$26	1%
SDG&E-RISK-3-C02-T02	Cathodic Protection - Maintenance	1.0	\$52	0%
SDG&E-RISK-3-C09	Compressor Station - Maintenance	1.0	\$2,333	48%
SDG&E-RISK-3-C08	Compressor Stations - Capital	50.0	\$31,717	6%
SDG&E-RISK-3-M02-T01	Gas Transmission Safety Rule - MAOP Reconfirmation	24.4	\$37,440	1%
SDG&E-RISK-3-M02-T02	Gas Transmission Safety Rule - MAOP Reconfirmation	24.4	\$1,560	0%
SDG&E-RISK-3-M03-T02	Gas Transmission Safety Rule – Material Verification	10.0	\$135	0%
SDG&E-RISK-3-M03-T01	Gas Transmission Safety Rule – Material Verification	10.0	\$26	0%

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE
SDG&E-RISK-3-C15-T01	Integrity Assessments & Remediation	7.0	\$33,687	95%
SDG&E-RISK-3-C15-T02	Integrity Assessments & Remediation	10.0	\$7,902	14%
SDG&E-RISK-3-C03-T01	Leak Repair	64.0	\$2,046	0%
SDG&E-RISK-3-C03-T02	Leak Repair	64.0	\$4,154	0%
SDG&E-RISK-3-C10-T01	Measurement & Regulation Station – Capital	46.0	\$668	0%
SDG&E-RISK-3-C10-T02	Measurement & Regulation Station – Capital	46.0	\$1,355	0%
SDG&E-RISK-3-C11-T01	Measurement & Regulation Station – Maintenance	46.0	\$585	1%
SDG&E-RISK-3-C11-T02	Measurement & Regulation Station – Maintenance	46.0	\$1,185	0%
SDG&E-RISK-3-C12	Odorization	1.0	\$9	0%
SDG&E-RISK-3-C06-T01	Pipeline Maintenance	0.5	\$101	11%

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE
SDG&E-RISK-3-C06-T02	Pipeline Maintenance	0.5	\$205	1%

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE
SDG&E-RISK-3-C04-T01	Pipeline Relocation/Replacement	64.0	\$1,909	0%
SDG&E-RISK-3-C04-T02	Pipeline Relocation/Replacement	64.0	\$3,878	0%
SDG&E-RISK-3-M01-T01.3	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, HCA)	7.0	\$10,000	13%
SDG&E-RISK-3-M01-T01.2	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, Non-HCA)	7.0	\$10,000	8%
SDG&E-RISK-3-M01-T01.1	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, HCA)	64.0	\$10,000	13%
SDG&E-RISK-3-M01-T01.4	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, Non-HCA)	64.0	\$10,000	8%
SDG&E-RISK-3-C13	Security and Auxiliary Equipment	10.0	\$2,205	0%
SDG&E-RISK-3-C05-T01	Shallow/Exposed Pipe Remediations	64.0	\$2,943	0%
SDG&E-RISK-3-C05-T02	Shallow/Exposed Pipe Remediations	64.0	\$5,978	0%

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial	CoRE Reliability
SDG&E-RISK-3-M04	Adobe Falls Relocation Project	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-A01	ALTERNATIVE - Expanding Geotechnical Analysis	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-A02	ALTERNATIVE - Proactive Soil Sampling	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C01-T01	Cathodic Protection - Capital	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C01-T02	Cathodic Protection - Capital	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C02-T01	Cathodic Protection - Maintenance	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C02-T02	Cathodic Protection - Maintenance	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C09	Compressor Station - Maintenance	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C08	Compressor Stations - Capital	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M02-T01	Gas Transmission Safety Rule - MAOP Reconfirmation	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M02-T02	Gas Transmission Safety Rule - MAOP Reconfirmation	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M03-T02	Gas Transmission Safety Rule – Material Verification	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M03-T01	Gas Transmission Safety Rule – Material Verification	0.88	916.52	194.49	1,040.52



2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial	CoRE Reliability
SDG&E-RISK-3-C15-T01	Integrity Assessments & Remediation	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C15-T02	Integrity Assessments & Remediation	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C03-T01	Leak Repair	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C03-T02	Leak Repair	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C10-T01	Measurement & Regulation Station – Capital	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C10-T02	Measurement & Regulation Station – Capital	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C11-T01	Measurement & Regulation Station – Maintenance	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C11-T02	Measurement & Regulation Station – Maintenance	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C12	Odorization	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C06-T01	Pipeline Maintenance	0.88	916.52	194.49	1,040.52

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial	CoRE Reliability
SDG&E-RISK-3-C06-T02	Pipeline Maintenance	0.88	916.52	194.49	1,040.52

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial	CoRE Reliability
SDG&E-RISK-3-C04-T01	Pipeline Relocation/Replacement	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C04-T02	Pipeline Relocation/Replacement	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M01-T01.3	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, HCA)	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M01-T01.2	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, Non-HCA)	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M01-T01.1	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, HCA)	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-M01-T01.4	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, Non-HCA)	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C13	Security and Auxiliary Equipment	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C05-T01	Shallow/Exposed Pipe Remediations	0.88	916.52	194.49	1,040.52
SDG&E-RISK-3-C05-T02	Shallow/Exposed Pipe Remediations	0.88	916.52	194.49	1,040.52

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE
SDG&E-RISK-3-M04	Adobe Falls Relocation Project	150.10	2301.63	0.88
SDG&E-RISK-3-A01	ALTERNATIVE - Expanding Geotechnical Analysis	150.10	2301.63	0.88
SDG&E-RISK-3-A02	ALTERNATIVE - Proactive Soil Sampling	150.10	2301.63	0.88
SDG&E-RISK-3-C01-T01	Cathodic Protection - Capital	150.10	2301.63	0.88
SDG&E-RISK-3-C01-T02	Cathodic Protection - Capital	150.10	2301.63	0.88
SDG&E-RISK-3-C02-T01	Cathodic Protection - Maintenance	150.10	2301.63	0.87
SDG&E-RISK-3-C02-T02	Cathodic Protection - Maintenance	150.10	2301.63	0.88
SDG&E-RISK-3-C09	Compressor Station - Maintenance	150.10	2301.63	0.46
SDG&E-RISK-3-C08	Compressor Stations - Capital	150.10	2301.63	0.83
SDG&E-RISK-3-M02-T01	Gas Transmission Safety Rule - MAOP Reconfirmation	150.10	2301.63	0.88
SDG&E-RISK-3-M02-T02	Gas Transmission Safety Rule - MAOP Reconfirmation	150.10	2301.63	0.88
SDG&E-RISK-3-M03-T02	Gas Transmission Safety Rule – Material Verification	150.10	2301.63	0.88
SDG&E-RISK-3-M03-T01	Gas Transmission Safety Rule – Material Verification	150.10	2301.63	0.88

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE
SDG&E-RISK-3-C15-T01	Integrity Assessments & Remediation	150.10	2301.63	0.05
SDG&E-RISK-3-C15-T02	Integrity Assessments & Remediation	150.10	2301.63	0.76
SDG&E-RISK-3-C03-T01	Leak Repair	150.10	2301.63	0.88
SDG&E-RISK-3-C03-T02	Leak Repair	150.10	2301.63	0.88
SDG&E-RISK-3-C10-T01	Measurement & Regulation Station – Capital	150.10	2301.63	0.88
SDG&E-RISK-3-C10-T02	Measurement & Regulation Station – Capital	150.10	2301.63	0.88
SDG&E-RISK-3-C11-T01	Measurement & Regulation Station – Maintenance	150.10	2301.63	0.87
SDG&E-RISK-3-C11-T02	Measurement & Regulation Station – Maintenance	150.10	2301.63	0.88
SDG&E-RISK-3-C12	Odorization	150.10	2301.63	0.88
SDG&E-RISK-3-C06-T01	Pipeline Maintenance	150.10	2301.63	0.79

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE
SDG&E-RISK-3-C06-T02	Pipeline Maintenance	150.10	2301.63	0.87

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE
SDG&E-RISK-3-C04-T01	Pipeline Relocation/Replacement	150.10	2301.63	0.88
SDG&E-RISK-3-C04-T02	Pipeline Relocation/Replacement	150.10	2301.63	0.88
SDG&E-RISK-3-M01-T01.3	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, HCA)	150.10	2301.63	0.77
SDG&E-RISK-3-M01-T01.2	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, Non-HCA)	150.10	2301.63	0.81
SDG&E-RISK-3-M01-T01.1	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, HCA)	150.10	2301.63	0.77
SDG&E-RISK-3-M01-T01.4	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, Non-HCA)	150.10	2301.63	0.81
SDG&E-RISK-3-C13	Security and Auxiliary Equipment	150.10	2301.63	0.88
SDG&E-RISK-3-C05-T01	Shallow/Exposed Pipe Remediations	150.10	2301.63	0.88
SDG&E-RISK-3-C05-T02	Shallow/Exposed Pipe Remediations	150.10	2301.63	0.88

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Risk Reduction	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-3-M04	Adobe Falls Relocation Project	11.81	28.31	167.10	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-3-A01	ALTERNATIVE - Expanding Geotechnical Analysis	0.16	0.97	0.86	> Ten years of historical PHMSA incidents > Company operational forecast data > Historical company patrol data > SME input
SDG&E-RISK-3-A02	ALTERNATIVE - Proactive Soil Sampling	2.11	0.97	5.70	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-3-C01-T01	Cathodic Protection - Capital	3.53	28.31	489.25	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C01-T02	Cathodic Protection - Capital	5.64	28.31	387.60	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C02-T01	Cathodic Protection - Maintenance	28.78	0.97	1074.64	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-3-C02-T02	Cathodic Protection - Maintenance	3.51	0.97	65.50	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-3-C09	Compressor Station - Maintenance	969.32	0.97	403.38	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-3-C08	Compressor Stations - Capital	112.38	25.73	91.16	> Ten years of historical PHMSA incidents > Company operational forecast data > Company compressor capacity data > SME input > Accounting average service life figures
SDG&E-RISK-3-M02-T01	Gas Transmission Safety Rule - MAOP Reconfirmation	15.08	17.13	6.90	> Company operational forecast data > SME input
SDG&E-RISK-3-M02-T02	Gas Transmission Safety Rule - MAOP Reconfirmation	0.38	17.13	4.12	> Company operational forecast data > SME input
SDG&E-RISK-3-M03-T02	Gas Transmission Safety Rule – Material Verification	0.02	8.53	1.20	> Company operational forecast data > SME input
SDG&E-RISK-3-M03-T01	Gas Transmission Safety Rule – Material Verification	0.02	8.53	6.26	> Company operational forecast data > SME input



2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Risk Reduction	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-3-C15-T01	Integrity Assessments & Remediation	1921.38	6.23	355.35	> Ten years of historical PHMSA incidents > Company operational forecast data > Historical company in-line-inspection (ILI) data and probability of exceedence standards > SME input
SDG&E-RISK-3-C15-T02	Integrity Assessments & Remediation	277.89	8.53	299.99	> Ten years of historical PHMSA incidents > Company operational forecast data > Historical company in-line-inspection (ILI) data and probability of exceedence standards > SME input
SDG&E-RISK-3-C03-T01	Leak Repair	0.41	28.31	5.64	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C03-T02	Leak Repair	0.78	28.31	5.34	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C10-T01	Measurement & Regulation Station – Capital	2.32	24.78	86.01	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C10-T02	Measurement & Regulation Station – Capital	3.12	24.78	56.99	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C11-T01	Measurement & Regulation Station – Maintenance	19.87	24.78	841.47	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C11-T02	Measurement & Regulation Station – Maintenance	2.42	24.78	50.64	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C12	Odorization	0.21	0.97	22.38	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-3-C06-T01	Pipeline Maintenance	214.38	0.49	1037.98	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Risk Reduction	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-3-C06-T02	Pipeline Maintenance	26.13	0.49	62.34	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input

2021 RAMP  
SDG&E-RISK-3-QWP  
RSE Summary

ID	Mitigation Name	Risk Reduction	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-3-C04-T01	Pipeline Relocation/Replacement	8.85	28.31	131.30	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C04-T02	Pipeline Relocation/Replacement	8.50	28.31	62.05	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-M01-T01.3	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, HCA)	258.07	6.23	160.78	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-M01-T01.2	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2B, Non-HCA)	165.16	6.23	102.90	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-M01-T01.1	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, HCA)	258.07	28.31	730.50	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-M01-T01.4	Pipeline Safety Enhancement Plan - Pipeline Replacement and Hydrotesting (Phase 2B, Non-HCA)	165.16	28.31	467.52	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C13	Security and Auxiliary Equipment	0.21	8.53	0.82	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-3-C05-T01	Shallow/Exposed Pipe Remediations	0.89	28.31	8.60	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-3-C05-T02	Shallow/Exposed Pipe Remediations	1.24	28.31	5.87	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures