



Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-9-QWP) Incident Related to the Medium Pressure System (Excluding Dig-in) Workpapers

May 17, 2021

Overall Workpaper Description	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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"Master Inputs" Tab	This sheet contains the major MAVF inputs for risk scoring
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"RSE Summary" Tab	This sheet presents a summarized view of RSE scoring
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RSE Equation	$\text{Risk Reduction} = (\text{Pre - Mitigated LoRE} * \text{Pre - Mitigated CoRE}) - (\text{Post - Mitigated LoRE} * \text{Post - Mitigated CoRE})$ $\text{Discounted Time} = 1 - \left(\frac{1}{\frac{(1 + \text{Benefit Discount Rate})^{\text{Benefits Lifetime}}}{\text{Benefit Discount Rate}}} \right)$ $\text{RSE per \$M} = \frac{\text{Risk Reduction} * \text{Discounted Time}}{\text{Total Cost (\$M)}}$
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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-9-QWP
RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE
SDG&E-RISK-9-A01	ALTERNATIVE - Post Training Follow-Up	5	\$45	0.00%
SDG&E-RISK-9-A02	ALTERNATIVE - Soil Sampling Program	1	\$12,300	0.04%
SDG&E-RISK-9-C02	Cathodic Protection Program - Capital	15	\$18,732	6.38%
SDG&E-RISK-9-C01	Cathodic Protection Program - O&M	4.1	\$5,853	3.39%
SDG&E-RISK-9-C12	Cathodic Protection System Enhancements - Base	10	\$4,938	0.42%
SDG&E-RISK-9-M02	Cathodic Protection System Enhancements – Real Time Monitoring	68	\$3,000	1.18%
SDG&E-RISK-9-C10	Code Compliance Mitigation	40	\$6,210	0.45%
SDG&E-RISK-9-C21	CSF Quality Assurance (QA) Program	5	\$973	0.22%
SDG&E-RISK-9-C16-T01	DIMP – DREAMS – Vintage Integrity Plastic Plan (VI PP)	68	\$174,900	3.36%
SDG&E-RISK-9-C09-T02	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	68	\$9,291	0.03%
SDG&E-RISK-9-C09-T01	Early Vintage Program (Components) - Oil Drip Piping Removal	68	\$7,159	0.55%
SDG&E-RISK-9-C09-T03	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones	68	\$774	0.03%
SDG&E-RISK-9-C19	Field and Public Safety	1	\$30,789	1.09%

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RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE
SDG&E-RISK-9-C11	Gas Distribution Emergency Department	68	\$27,290	22.49%
SDG&E-RISK-9-C14	Human Factors Mitigations - Operator Qualification Training and Certification	3	\$12,010	0.27%
SDG&E-RISK-9-C06/C07	Leak Repair & Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)	1.497987631	\$41,187	70.40%
SDG&E-RISK-9-C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	1	\$333	0.03%
SDG&E-RISK-9-C03	Piping in Vaults Replacement Program	40	\$9,060	0.41%
SDG&E-RISK-9-C05	Regulator Station Replacement	47	\$6,000	0.11%
SDG&E-RISK-9-C04	Regulator Station, Valve, and Large Meter Set Inspection	1	\$4,463	43.12%
SDG&E-RISK-9-M03	Replace Curb Valves with EFVs	68	\$7,605	2.64%
SDG&E-RISK-9-M01	Safety Control Valves	68	\$7,605	0.21%
SDG&E-RISK-9-C08-T03	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage)	68	\$10,701	0.52%
SDG&E-RISK-9-C08-T01	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage)	68	\$27,654	0.91%
SDG&E-RISK-9-C08-T02	Underperforming Steel Replacement Program (1934-1965 vintage)	68	\$21,900	0.79%

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RSE Summary

ID	Mitigation Name	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial	CoRE Reliability
SDG&E-RISK-9-A01	ALTERNATIVE - Post Training Follow-Up	101.42	4.37	0.33	0.43
SDG&E-RISK-9-A02	ALTERNATIVE - Soil Sampling Program	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C02	Cathodic Protection Program - Capital	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C01	Cathodic Protection Program - O&M	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C12	Cathodic Protection System Enhancements - Base	101.42	4.37	0.33	0.43
SDG&E-RISK-9-M02	Cathodic Protection System Enhancements – Real Time Monitoring	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C10	Code Compliance Mitigation	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C21	CSF Quality Assurance (QA) Program	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C16-T01	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C09-T02	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C09-T01	Early Vintage Program (Components) - Oil Drip Piping Removal	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C09-T03	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C19	Field and Public Safety	101.42	4.37	0.33	0.43

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RSE Summary

ID	Mitigation Name	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial	CoRE Reliability
SDG&E-RISK-9-C11	Gas Distribution Emergency Department	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C14	Human Factors Mitigations - Operator Qualification Training and Certification	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C06/C07	Leak Repair & Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C03	Piping in Vaults Replacement Program	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C05	Regulator Station Replacement	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C04	Regulator Station, Valve, and Large Meter Set Inspection	101.42	4.37	0.33	0.43
SDG&E-RISK-9-M03	Replace Curb Valves with EFVs	101.42	4.37	0.33	0.43
SDG&E-RISK-9-M01	Safety Control Valves	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C08-T03	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage)	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C08-T01	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage)	101.42	4.37	0.33	0.43
SDG&E-RISK-9-C08-T02	Underperforming Steel Replacement Program (1934-1965 vintage)	101.42	4.37	0.33	0.43

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RSE Summary

ID	Mitigation Name	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE	Risk Reduction
SDG&E-RISK-9-A01	ALTERNATIVE - Post Training Follow-Up	0.84	5.97	101.42	0.01
SDG&E-RISK-9-A02	ALTERNATIVE - Soil Sampling Program	0.84	5.97	101.38	0.24
SDG&E-RISK-9-C02	Cathodic Protection Program - Capital	0.84	5.97	94.95	38.66
SDG&E-RISK-9-C01	Cathodic Protection Program - O&M	0.84	5.97	97.98	20.56
SDG&E-RISK-9-C12	Cathodic Protection System Enhancements - Base	0.84	5.97	101.00	2.53
SDG&E-RISK-9-M02	Cathodic Protection System Enhancements – Real Time Monitoring	0.84	5.97	100.22	7.17
SDG&E-RISK-9-C10	Code Compliance Mitigation	0.84	5.97	100.97	2.73
SDG&E-RISK-9-C21	CSF Quality Assurance (QA) Program	0.84	5.97	101.20	1.33
SDG&E-RISK-9-C16-T01	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	0.84	5.97	98.02	20.34
SDG&E-RISK-9-C09-T02	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	0.84	5.97	101.39	0.20
SDG&E-RISK-9-C09-T01	Early Vintage Program (Components) - Oil Drip Piping Removal	0.84	5.97	100.86	3.35
SDG&E-RISK-9-C09-T03	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones	0.84	5.97	101.40	0.17
SDG&E-RISK-9-C19	Field and Public Safety	0.84	5.97	100.31	6.63

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RSE Summary

ID	Mitigation Name	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE	Risk Reduction
SDG&E-RISK-9-C11	Gas Distribution Emergency Department	0.84	5.97	78.62	136.18
SDG&E-RISK-9-C14	Human Factors Mitigations - Operator Qualification Training and Certification	0.84	5.97	101.15	1.61
SDG&E-RISK-9-C06/C07	Leak Repair & Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)	0.84	5.97	30.03	426.33
SDG&E-RISK-9-C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	0.84	5.97	101.39	0.18
SDG&E-RISK-9-C03	Piping in Vaults Replacement Program	0.84	5.97	101.01	2.48
SDG&E-RISK-9-C05	Regulator Station Replacement	0.84	5.97	101.32	0.64
SDG&E-RISK-9-C04	Regulator Station, Valve, and Large Meter Set Inspection	0.84	5.97	57.69	261.16
SDG&E-RISK-9-M03	Replace Curb Valves with EFVs	0.84	5.97	98.75	15.97
SDG&E-RISK-9-M01	Safety Control Valves	0.84	5.97	101.21	1.28
SDG&E-RISK-9-C08-T03	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage)	0.84	5.97	100.89	3.17
SDG&E-RISK-9-C08-T01	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage)	0.84	5.97	100.51	5.48
SDG&E-RISK-9-C08-T02	Underperforming Steel Replacement Program (1934-1965 vintage)	0.84	5.97	100.62	4.78

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RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-9-A01	ALTERNATIVE - Post Training Follow-Up	4.58	1.07	> Ten years of historical PHMSA incidents > Company training forecast data > SME input
SDG&E-RISK-9-A02	ALTERNATIVE - Soil Sampling Program	0.97	0.02	> Ten years of historical PHMSA incidents > Company training forecast data > SME input
SDG&E-RISK-9-C02	Cathodic Protection Program - Capital	11.94	24.64	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-9-C01	Cathodic Protection Program - O&M	3.80	13.36	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-9-C12	Cathodic Protection System Enhancements - Base	8.53	4.37	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-9-M02	Cathodic Protection System Enhancements – Real Time Monitoring	28.87	69.03	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C10	Code Compliance Mitigation	23.11	10.17	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C21	CSF Quality Assurance (QA) Program	4.58	6.28	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Company historical QA training data
SDG&E-RISK-9-C16-T01	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIIP)	28.87	3.36	> Ten years of historical PHMSA incidents > Company operational forecast data > Company historical leak data > SME input > Accounting average service life figures
SDG&E-RISK-9-C09-T02	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	28.87	0.63	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C09-T01	Early Vintage Program (Components) - Oil Drip Piping Removal	28.87	13.50	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C09-T03	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones	28.87	6.24	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C19	Field and Public Safety	0.97	0.21	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input

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RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-9-C11	Gas Distribution Emergency Department	28.87	144.05	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C14	Human Factors Mitigations - Operator Qualification Training and Certification	2.83	0.38	> Ten years of historical PHMSA incidents > Company training forecast data > SME input
SDG&E-RISK-9-C06/C07	Leak Repair & Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)	1.44	14.94	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-9-C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	0.97	0.53	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-9-C03	Piping in Vaults Replacement Program	23.11	6.33	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C05	Regulator Station Replacement	25.02	2.67	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C04	Regulator Station, Valve, and Large Meter Set Inspection	0.97	56.81	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SDG&E-RISK-9-M03	Replace Curb Valves with EFVs	28.87	60.62	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-M01	Safety Control Valves	28.87	4.87	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C08-T03	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage)	28.87	8.56	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C08-T01	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage)	28.87	5.72	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SDG&E-RISK-9-C08-T02	Underperforming Steel Replacement Program (1934-1965 vintage)	28.87	6.30	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures