



Risk Assessment and Mitigation Phase

(Chapter SCG-Risk-1-QWP) Incident Related to the High 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	$\text{Risk Reduction} = (\text{Pre} - \text{Mitigated LoRE} * \text{Pre} - \text{Mitigated CoRE}) - (\text{Post} - \text{Mitigated LoRE} * \text{Post} - \text{Mitigated CoRE})$ $\text{Discounted Time} = 1 - \left(\frac{1}{\frac{(1 + \text{Benefit Discount Rate})^{\text{Benefits Lifetime}}}{\text{Benefit Discount Rate}}} \right)$ $\text{RSE per \$M} = \frac{\text{Risk Reduction} * \text{Discounted Time}}{\text{Total Cost (\$M)}}$
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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%

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 SCG-RISK-1-QWP
 RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial
SCG-RISK-1-A02	ALTERNATIVE - Expanding Geotechnical Analysis	1.0	\$1,395	0%	8.64	49.08	10.78
SCG-RISK-1-A01	ALTERNATIVE - Proactive Soil Sampling	1.0	\$5,634	0%	8.64	49.08	10.78
SCG-RISK-1-C01-T01	Cathodic Protection - Capital	64.0	\$15,211	1%	8.64	49.08	10.78
SCG-RISK-1-C01-T02	Cathodic Protection - Capital	64.0	\$30,883	1%	8.64	49.08	10.78
SCG-RISK-1-C02-T01	Cathodic Protection - Maintenance	1.0	\$379	2%	8.64	49.08	10.78
SCG-RISK-1-C02-T02	Cathodic Protection - Maintenance	1.0	\$770	3%	8.64	49.08	10.78
SCG-RISK-1-C09-T01	Class Location (Hydrotest) - Maintenance	7.0	\$7,366	0%	8.64	49.08	10.78
SCG-RISK-1-C09-T02	Class Location (Hydrotest) - Maintenance	7.0	\$14,954	0%	8.64	49.08	10.78
SCG-RISK-1-C11	Compressor Station - Maintenance	1.0	\$8,237	48%	8.64	49.08	10.78
SCG-RISK-1-C23-T02	Compressor Station Modernization Projects	50.0	\$178,855	52%	8.64	49.08	10.78
SCG-RISK-1-C10	Compressor Stations - Capital	50.0	\$61,072	3%	8.64	49.08	10.78
SCG-RISK-1-M01-T01	Gas Transmission Safety Rule - MAOP Reconfirmation	24.4	\$170,755	1%	8.64	49.08	10.78
SCG-RISK-1-M01-T02	Gas Transmission Safety Rule - MAOP Reconfirmation	24.4	\$69,745	0%	8.64	49.08	10.78
SCG-RISK-1-M02-T01	Gas Transmission Safety Rule – Material Verification	10.0	\$539	0%	8.64	49.08	10.78
SCG-RISK-1-M02-T02	Gas Transmission Safety Rule – Material Verification	10.0	\$1,103	0%	8.64	49.08	10.78
SCG-RISK-1-C21-T01	Integrity Assessments & Remediation	7.0	\$246,865	71%	8.64	49.08	10.78
SCG-RISK-1-C21-T02	Integrity Assessments & Remediation	10.0	\$427,659	92%	8.64	49.08	10.78

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 RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial
SCG-RISK-1-C03-T01	Leak Repair	64.0	\$11,524	0%	8.64	49.08	10.78
SCG-RISK-1-C03-T02	Leak Repair	64.0	\$23,398	0%	8.64	49.08	10.78
SCG-RISK-1-C04-T01	Leak Survey & Patrol	0.5	\$141	6%	8.64	49.08	10.78
SCG-RISK-1-C04-T02	Leak Survey & Patrol	0.5	\$286	7%	8.64	49.08	10.78
SCG-RISK-1-C12-T01	Measurement & Regulation - Capital	46.0	\$27,811	0%	8.64	49.08	10.78
SCG-RISK-1-C12-T02	Measurement & Regulation - Capital	46.0	\$56,467	0%	8.64	49.08	10.78
SCG-RISK-1-C13-T01	Measurement & Regulation Station - Maintenance	46.0	\$3,425	0%	8.64	49.08	10.78
SCG-RISK-1-C13-T02	Measurement & Regulation Station - Maintenance	46.0	\$6,957	0%	8.64	49.08	10.78
SCG-RISK-1-C14	Odorization	1.0	\$691	0%	8.64	49.08	10.78
SCG-RISK-1-C07-T01	Pipeline Maintenance	1.0	\$222	7%	8.64	49.08	10.78
SCG-RISK-1-C07-T02	Pipeline Maintenance	1.0	\$451	9%	8.64	49.08	10.78
SCG-RISK-1-C05-T01	Pipeline Relocation/Replacement - Capital	64.0	\$21,881	1%	8.64	49.08	10.78
SCG-RISK-1-C05-T02	Pipeline Relocation/Replacement - Capital	64.0	\$44,426	1%	8.64	49.08	10.78
SCG-RISK-1-C22-T03.4	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2A, GRC base)	7.0	\$269,705	22%	8.64	49.08	10.78
SCG-RISK-1-C22-T02.4	Pipeline Safety Enhancement Plan - Pipeline Replacement (Phase 1B, GRC base)	64.0	\$69,247	0%	8.64	49.08	10.78

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 SCG-RISK-1-QWP
 RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial
SCG-RISK-1-C22-T03.2	Pipeline Safety Enhancement Plan - Pipeline Replacement (Phase 2A, GRC base)	64.0	\$93,713	16%	8.64	49.08	10.78
SCG-RISK-1-C22-T04.3	Pipeline Safety Enhancement Plan - Valve Enhancement (GRC base)	46.0	\$28,688	7%	8.64	49.08	10.78
SCG-RISK-1-C22-T04.4	Pipeline Safety Enhancement Plan - Valve Enhancement (GRC base)	46.0	\$5,438	4%	8.64	49.08	10.78
SCG-RISK-1-C08-T01	Right of Way	1.0	\$786	0%	8.64	49.08	10.78
SCG-RISK-1-C08-T02	Right of Way	1.0	\$1,595	0%	8.64	49.08	10.78
SCG-RISK-1-C15	Security and Auxiliary Equipment	10.0	\$13,566	0%	8.64	49.08	10.78
SCG-RISK-1-C06-T01	Shallow/Exposed Pipe Remediations	64.0	\$4,398	0%	8.64	49.08	10.78
SCG-RISK-1-C06-T02	Shallow/Exposed Pipe Remediations	64.0	\$8,929	0%	8.64	49.08	10.78

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 SCG-RISK-1-QWP
 RSE Summary

ID	Mitigation Name	CoRE Reliability	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE	Risk Reduction
SCG-RISK-1-A02	ALTERNATIVE - Expanding Geotechnical Analysis	378.46	99.27	537.59	8.64	0.22
SCG-RISK-1-A01	ALTERNATIVE - Proactive Soil Sampling	378.46	99.27	537.59	8.63	4.83
SCG-RISK-1-C01-T01	Cathodic Protection - Capital	378.46	99.27	537.59	8.56	41.34
SCG-RISK-1-C01-T02	Cathodic Protection - Capital	378.46	99.27	537.59	8.54	55.35
SCG-RISK-1-C02-T01	Cathodic Protection - Maintenance	378.46	99.27	537.59	8.44	108.00
SCG-RISK-1-C02-T02	Cathodic Protection - Maintenance	378.46	99.27	537.59	8.38	140.50
SCG-RISK-1-C09-T01	Class Location (Hydrotest) - Maintenance	378.46	99.27	537.59	8.64	0.33
SCG-RISK-1-C09-T02	Class Location (Hydrotest) - Maintenance	378.46	99.27	537.59	8.64	0.84
SCG-RISK-1-C11	Compressor Station - Maintenance	378.46	99.27	537.59	4.51	2218.04
SCG-RISK-1-C23-T02	Compressor Station Modernization Projects	378.46	99.27	537.59	4.18	2395.48
SCG-RISK-1-C10	Compressor Stations - Capital	378.46	99.27	537.59	8.34	159.39
SCG-RISK-1-M01-T01	Gas Transmission Safety Rule - MAOP Reconfirmation	378.46	99.27	537.59	8.59	27.18
SCG-RISK-1-M01-T02	Gas Transmission Safety Rule - MAOP Reconfirmation	378.46	99.27	537.59	8.62	7.25
SCG-RISK-1-M02-T01	Gas Transmission Safety Rule – Material Verification	378.46	99.27	537.59	8.64	0.05
SCG-RISK-1-M02-T02	Gas Transmission Safety Rule – Material Verification	378.46	99.27	537.59	8.64	0.05
SCG-RISK-1-C21-T01	Integrity Assessments & Remediation	378.46	99.27	537.59	2.51	3292.62
SCG-RISK-1-C21-T02	Integrity Assessments & Remediation	378.46	99.27	537.59	0.67	4284.61

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 RSE Summary

ID	Mitigation Name	CoRE Reliability	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE	Risk Reduction
SCG-RISK-1-C03-T01	Leak Repair	378.46	99.27	537.59	8.63	4.09
SCG-RISK-1-C03-T02	Leak Repair	378.46	99.27	537.59	8.63	5.62
SCG-RISK-1-C04-T01	Leak Survey & Patrol	378.46	99.27	537.59	8.15	259.86
SCG-RISK-1-C04-T02	Leak Survey & Patrol	378.46	99.27	537.59	8.01	337.69
SCG-RISK-1-C12-T01	Measurement & Regulation - Capital	378.46	99.27	537.59	8.63	5.29
SCG-RISK-1-C12-T02	Measurement & Regulation - Capital	378.46	99.27	537.59	8.62	7.18
SCG-RISK-1-C13-T01	Measurement & Regulation Station - Maintenance	378.46	99.27	537.59	8.61	17.87
SCG-RISK-1-C13-T02	Measurement & Regulation Station - Maintenance	378.46	99.27	537.59	8.60	23.20
SCG-RISK-1-C14	Odorization	378.46	99.27	537.59	8.63	1.85
SCG-RISK-1-C07-T01	Pipeline Maintenance	378.46	99.27	537.59	8.07	305.56
SCG-RISK-1-C07-T02	Pipeline Maintenance	378.46	99.27	537.59	7.90	397.80
SCG-RISK-1-C05-T01	Pipeline Relocation/Replacement - Capital	378.46	99.27	537.59	8.59	28.09
SCG-RISK-1-C05-T02	Pipeline Relocation/Replacement - Capital	378.46	99.27	537.59	8.57	36.44
SCG-RISK-1-C22-T03.4	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2A, GRC base)	378.46	99.27	537.59	6.73	1023.53
SCG-RISK-1-C22-T02.4	Pipeline Safety Enhancement Plan - Pipeline Replacement (Phase 1B, GRC base)	378.46	99.27	537.59	8.61	14.03

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 RSE Summary

ID	Mitigation Name	CoRE Reliability	CoRE Stakeholder Satisfaction	CoRE	Post-Mitigated LoRE	Risk Reduction
SCG-RISK-1-C22-T03.2	Pipeline Safety Enhancement Plan - Pipeline Replacement (Phase 2A, GRC base)	378.46	99.27	537.59	7.28	729.24
SCG-RISK-1-C22-T04.3	Pipeline Safety Enhancement Plan - Valve Enhancement (GRC base)	378.46	99.27	537.59	8.04	320.06
SCG-RISK-1-C22-T04.4	Pipeline Safety Enhancement Plan - Valve Enhancement (GRC base)	378.46	99.27	537.59	8.33	163.13
SCG-RISK-1-C08-T01	Right of Way	378.46	99.27	537.59	8.64	1.38
SCG-RISK-1-C08-T02	Right of Way	378.46	99.27	537.59	8.63	2.73
SCG-RISK-1-C15	Security and Auxiliary Equipment	378.46	99.27	537.59	8.64	1.55
SCG-RISK-1-C06-T01	Shallow/Exposed Pipe Remediations	378.46	99.27	537.59	8.63	4.96
SCG-RISK-1-C06-T02	Shallow/Exposed Pipe Remediations	378.46	99.27	537.59	8.63	6.35

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 SCG-RISK-1-QWP
 RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SCG-RISK-1-A02	ALTERNATIVE - Expanding Geotechnical Analysis	0.97	0.15	> Ten years of historical PHMSA incidents > Company operational forecast data > Historical company patrol data > SME input
SCG-RISK-1-A01	ALTERNATIVE - Proactive Soil Sampling	0.97	0.83	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C01-T01	Cathodic Protection - Capital	28.31	76.93	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C01-T02	Cathodic Protection - Capital	28.31	50.74	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C02-T01	Cathodic Protection - Maintenance	0.97	276.65	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C02-T02	Cathodic Protection - Maintenance	0.97	177.15	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C09-T01	Class Location (Hydrotest) - Maintenance	6.23	0.28	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C09-T02	Class Location (Hydrotest) - Maintenance	6.23	0.35	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C11	Compressor Station - Maintenance	0.97	261.43	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C23-T02	Compressor Station Modernization Projects	25.73	344.61	> Ten years of historical PHMSA incidents > Company operational forecast data > Company compressor capacity data > SME input > Accounting average service life figures
SCG-RISK-1-C10	Compressor Stations - Capital	25.73	67.15	> Ten years of historical PHMSA incidents > Company operational forecast data > Company compressor capacity data > SME input > Accounting average service life figures
SCG-RISK-1-M01-T01	Gas Transmission Safety Rule - MAOP Reconfirmation	17.13	2.73	> Company operational forecast data > SME input
SCG-RISK-1-M01-T02	Gas Transmission Safety Rule - MAOP Reconfirmation	17.13	1.78	> Company operational forecast data > SME input
SCG-RISK-1-M02-T01	Gas Transmission Safety Rule – Material Verification	8.53	0.72	> Company operational forecast data > SME input
SCG-RISK-1-M02-T02	Gas Transmission Safety Rule – Material Verification	8.53	0.35	> Company operational forecast data > SME input
SCG-RISK-1-C21-T01	Integrity Assessments & Remediation	6.23	83.10	> Ten years of historical PHMSA incidents > Company operational forecast data > Historical company in-line-inspection (IU) data and probability of exceedence standards > SME input
SCG-RISK-1-C21-T02	Integrity Assessments & Remediation	8.53	85.46	> Ten years of historical PHMSA incidents > Company operational forecast data > Historical company in-line-inspection (IU) data and probability of exceedence standards > SME input

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 SCG-RISK-1-QWP
 RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SCG-RISK-1-C03-T01	Leak Repair	28.31	10.05	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C03-T02	Leak Repair	28.31	6.80	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C04-T01	Leak Survey & Patrol	0.49	901.27	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C04-T02	Leak Survey & Patrol	0.49	577.40	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C12-T01	Measurement & Regulation - Capital	24.78	4.71	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C12-T02	Measurement & Regulation - Capital	24.78	3.15	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C13-T01	Measurement & Regulation Station - Maintenance	24.78	129.25	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C13-T02	Measurement & Regulation Station - Maintenance	24.78	82.64	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C14	Odorization	0.97	2.59	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C07-T01	Pipeline Maintenance	0.97	1336.30	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C07-T02	Pipeline Maintenance	0.97	856.34	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C05-T01	Pipeline Relocation/Replacement - Capital	28.31	36.34	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C05-T02	Pipeline Relocation/Replacement - Capital	28.31	23.22	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C22-T03.4	Pipeline Safety Enhancement Plan - Hydrotesting (Phase 2A, GRC base)	6.23	23.64	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C22-T02.4	Pipeline Safety Enhancement Plan - Pipeline Replacement (Phase 1B, GRC base)	28.31	5.73	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures

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 SCG-RISK-1-QWP
 RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SCG-RISK-1-C22-T03.2	Pipeline Safety Enhancement Plan - Pipeline Replacement (Phase 2A, GRC base)	28.31	220.27	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C22-T04.3	Pipeline Safety Enhancement Plan - Valve Enhancement (GRC base)	24.78	276.41	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C22-T04.4	Pipeline Safety Enhancement Plan - Valve Enhancement (GRC base)	24.78	743.20	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C08-T01	Right of Way	0.97	1.70	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C08-T02	Right of Way	0.97	1.66	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C15	Security and Auxiliary Equipment	8.53	0.97	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input
SCG-RISK-1-C06-T01	Shallow/Exposed Pipe Remediations	28.31	31.95	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures
SCG-RISK-1-C06-T02	Shallow/Exposed Pipe Remediations	28.31	20.15	> Ten years of historical PHMSA incidents > Company operational forecast data > SME input > Accounting average service life figures