



Risk Management Plan Summary

This Risk Management Plan (RMP) is intended to identify the unique characteristics of the East Cheyenne Gas Storage (ECGS) Facility, assess the risks associated with those characteristics and determine preventative and mitigative measures to limit the potential consequences from those risks in compliance with PHMSA regulations. The plan starts off with an overview of the location, geography, and other characteristics of the ECGS reservoirs, wells, and facilities. Current safety features, programs, and well barriers are also discussed. In Section 4, the Plan address the development of the risk assessment itself, including data types and sources, well and reservoir information, the development of the risk model, and determination of consequence of failure and likelihood of occurrence. The risk analysis process and rankings are also included in this section as well as the process for the analyzing the results of the risk rankings. Section 5 addresses threat identification, exclusion of threats, interactive threats, and identification of the highest relative risk threats. Section 6 breaks down the risk assessment results, evaluation of the need for Emergency Shutdown Valves, and Analysis of Findings. Section 7 covers preventative and mitigative measures, Section 8 covers Recordkeeping and Documentation Requirements, and Section 9 discusses the Risk Assessment review process. The Table of Contents below gives a further outline of the ECGS RMP.

TABLE OF CONTENTS

1.	INTRODUCTION	8
1.1	Purpose of the Risk Management Plan	8
1.2	Corporate Commitment to Safety	10
1.3	Identification of Multi-Disciplinary Team, Roles in Plan Development	10
2.	BACKGROUND & DESCRIPTION OF STORAGE FACILITY	10
2.1	Location & Geography	10
2.2	Geology of the Storage Reservoirs	11
2.2.1	Caprock Description:	11
2.3	Storage Development History	11
2.4	ECGS – Control Facility	11
2.5	Existing Safety Features & Programs	11
3.	Well Barriers	12
3.1	Primary and Secondary Barriers	12
3.2	Operational Barriers	14
3.3	Human Barriers	17
4.	RISK ASSESSMENT MODEL DEVELOPMENT & EVALUATION	17
4.1	Overview	17
4.2	Scope of Review	19
4.2.1	Wells	19
4.2.2	Reservoirs	20



4.2.3	Surface Equipment	21
4.3	Threats and Hazards	22
4.4	Risk and Impact Rating Scale (Risk Matrix Measurement Scale)	23
4.5	Collection and Integration of Data	24
4.5.1	Types of Data Collected	24
4.5.2	Assignment of Metadata Keywords to Well Records	25
4.5.3	Data Storage & Accessibility	26
4.5.4	Data Review & Integration of New Data	26
4.6	Determination of Consequence of Failure and Likelihood of Occurrence	27
4.7	Risk Analysis and Ranking	30
4.8	Analysis of Results	30
5.	THREAT IDENTIFICATION	31
5.1	Introduction	31
5.2	Additional Threats to ECGS Wells and Facilities	31
5.3	Consideration of Interactive Threats	31
5.4	Exclusion of Threats	32
5.5	Identification of Highest Relative Risk Threats	32
6.	RISK ASSESSMENT RESULTS	33
6.1	Introduction	33
6.2	Risk Assessment Results	34
6.3	Evaluation of the Need for Emergency Shutdown Valves (API RP 1171, Section 6.2.5)	35
6.4	Analysis of Findings	36
7.	PREVENTATIVE & MITIGATION MEASURES	37
7.1	Prioritization of Risk Mitigation	37
7.1.1	Preventative & Mitigative Programs (API RP 1171, Chapter 8, Table 2)	37
7.1.1.1	I/W Wells	37
7.1.1.2	Reservoir	39
7.1.1.3	Surface Equipment	39
7.2	Ongoing Verification and Demonstration of Reservoir Integrity	39
7.2.1	Baseline Conditions	40
7.2.2	Inventory Verification	41
7.2.2.1	Internal/Informal	41
7.2.2.2	Formal/Independent	42
7.2.2.3	Schedule	43
7.3	Mechanical Integrity Monitoring	43
7.3.1	Well Barrier Verification	43
7.3.1.1	Function testing of valves	44
7.3.1.2	Annular pressure monitoring	44
7.3.1.3	Barrier mechanical integrity pressure testing	44
7.3.1.4	Corrosion logging	45
7.3.2	Leakage Monitoring & Detection	45
7.3.2.1	Surface gas detection	46



7.3.2.2	Temperature/Acoustic logging	46
7.3.3	SCADA	46
7.3.4	Data Analysis & Corrective Measures	47
7.4	Assessment and Monitoring of Surface Encroachment/ Third Party Damage/ Outside Natural Causes	47
7.5	Evaluation of New Mitigation Measures	48
7.5.1	Continuous downhole temperature monitoring in place of annual temperature logs	48
7.5.2	Installation of Subsurface Safety Valves in wells located in landslide zones	48
7.5.3	Security cameras at remote sites where third party impacts could occur and not be discovered until the next routine wellsite inspection	48
7.5.4	Installation of cathodic protection on well casings	48
8.	RECORDKEEPING/DOCUMENTATION REQUIREMENTS	49
9.	PLANS FOR RISK ASSESSMENT REVIEWS	49
9.1	Regular Periodic Review	50
9.2	New Threats and Hazards	50
9.3	Changes in Regulation	51
9.4	Other Changes Potentially Affecting Risk	51
9.5	Revisions to the Plan, Review & Approval	51