



Underground Natural Gas Storage Integrity Management Plan Summary

East Cheyenne Gas Storage (ECGS) has developed this Underground Gas Storage Management Plan for the purpose of protecting the public, our personnel and contractors and the environment through the establishment of programs, policies, processes and procedures designed to ensure the safe and reliable operation of the East Cheyenne Gas Storage Field (ECGS). ECGS relies on this plan for the expressed purpose of defining how it will develop and implement the necessary geological, reservoir, engineering, operating and maintenance policies, programs and procedures necessary to comply with the Pipeline and Hazardous Materials Safety Administration (PHMSA) pipeline safety regulations that were adopted on December 19, 2016 (Federal Register/Vol. 81, No. 243 / Monday, December 19, 2016) and listed in 49 CFR 192.12, Underground Natural Gas Storage Facilities.

ECGS does incorporate principles of process safety (as appropriate) into its underground natural gas storage program.

This plan includes the requirements specified in 49 CFR 192.12, 49 CFR 192.605 and API RP 1171 for written operations, maintenance, and emergency procedures.

The Table of Contents below outlines the program in its entirety.

Table of Contents

1.	Introduction	12	
1.1	Purpose	12	
1.2	New Storage Field Design, Construction and Commissioning		13
1.3	Expansion of Existing Storage Capacity	13	
1.4	Facility Description	13	
1.5	Background	14	
2.	Commitments	14	
2.1	Management Commitment	14	
2.2	Environmental, Safety and Health Commitment		15
3.	Compliance Requirements	15	
3.1	Regulatory Applicability	15	
3.2	Pipeline and Hazardous Materials Safety Administration		16
3.2.1	UNGS Program Effective Dates	16	
3.2.2	Compliance Implementation, Risk Assessments, Analysis and Assessments		18
3.2.3	Maintenance Activities	19	
3.2.4	UNGS Notification and Reporting Requirements		19
3.2.5	PHMSA Regulatory Requirements Summary	19	
3.2.6	UNGS PHMSA Exclusions	20	
3.2.7	Non-mandatory Provisions and Deviations	20	

3.3	Federal Energy Regulatory Commission (FERC)	21
3.4	Colorado Oil and Gas Conservation Commission (COGCC)	21
3.5	Colorado Department of Public Health and Environment Air Pollutions Control Division (CDPHE)	21
3.6	Colorado Public Utility Commission	21
4.	Compliance Implementation Schedule	22
5.	UNGS Personnel Roles and Responsibilities	23
6.	UNGS Integrity Management Process	24
7.	Data management and Validation	25
8.	Procedure Development	25
9.	Underground Natural Gas Storage Program Workflow	27
9.1	Summary of Program Development	27
9.2	How we plan, execute, document and comply?	28
10.	Work Flow Process	29
10.1	UNGS Planned Well Work.	29
10.2	Well and Well Pad Work Site Requirements.	29
10.3	Site Access Control Plan [API RP 1171, Section 10].	30
10.4	Work Related Environmental Monitoring [API RP 1171, Section 10].	30
10.5	Well Work Procedures and Best Practices [API RP 1171, Section 6, and 11.5].	30
10.6	Well Control Equipment Requirements [API RP 1171, Section 11.5.2].	31
10.7	Controllers, Company Representatives and Contractors [API RP 1171, Section 11].	31
10.8	Work Related Cyber Security [API RP 1171, Section 10.7].	31
10.9	Emergency Response/Well Control Plan Requirements [API RP 1171, Section 10.6.1 and 11].	31
10.10	Personnel Qualification Requirements [API RP 1171, Section 6.10.3, 11.12.3, and 11.12.4].	32
10.11	PHMSA Advanced Notification of Certain Work [§191.22].	32
10.12	Regulatory Agency Notification of Certain Work	32
10.13	Functional Integrity in the Design of Natural Gas Storage Reservoirs [API RP 1171, Section 5].	32
10.14	Functional Integrity in the Design and Construction of Natural Gas Storage Wells [API RP 1171, Section 6].	33
10.15	Functional Integrity of the Natural Gas Storage Reservoir and Wells Established and Demonstrated Through Initial Attainment of Maximum Reservoir Pressure and Total Inventory [API RP 1171, Section 7].	33
10.16	Integrity Demonstration, Verification, and Monitoring Practices [API RP 1171, Section 9].	33
10.17	Appendix A – API RP 1171 Requirements Detail.	33
10.18	Appendix B - Applicable Incorporated by Reference / Recommended Practices.	33
10.19	API RP 1171 Flow Chart of Documented Sections	34
11.	Functional Integrity in the Design of Natural Gas Storage Reservoirs [API RP 1171, Section 5]	35

11.1	Geological Reservoir Characterization [API RP 1171, Section 5.2]	37
11.1.1	FAQ's which may apply to API 1171 Section 5.2	38
11.1.2	UNGS Work Plan Check sheet, Geological Characterization [API 1171, Section 5.2]	39
11.2	Engineering Reservoir Characterization [API RP 1171, Section 5.3]	40
11.2.1	FAQ's which may apply to API 1171, Section 5.3	41
11.2.2	UNGS Work Plan Check sheet, Engineering Reservoir Characterization [API 1171, Section 5.3]	41
11.3	Containment Assurance of Reservoir Design [API RP 1171, Section 5.4]	42
11.3.1	UNGS Work Plan Check sheet, Containment Assurance of Reservoir Design [API 1171, Section 5.4.1]	42
11.3.2	Reservoir Connectivity [API RP 1171, Section 5.4.2]	43
11.3.3	Maximum and Minimum Pressure [API RP 1171, Section 5.4.3]	45
11.3.4	Well Penetrations [API RP 1171, Section 5.4.4]	46
11.3.5	Supplemental Evaluation [API 1171, Section 5.4.5]	47
11.3.6	Other Design Factors [API 1171, Section 5.4.6]	47
11.3.7	Facility Integrity Plan [API RP 1171, Section 5.4.7]	48
11.4	Environmental, Safety, and Health Considerations in Design [API RP 1171, Section 5.5]	49
11.4.1	UNGS Work Plan Check sheet, Environmental, Safety and Health Considerations in Design [API 1171, Section 5.5]	49
11.5	Recordkeeping [API RP 1171, Section 5.6]	49
11.5.1	UNGS Work Plan Check sheet, Recordkeeping [API 1171, Section 5.6]	49
12.	Functional Integrity in the Design and Construction of Natural Gas Storage Wells [API RP 1171, Section 6]	51
12.1	Wellhead Equipment and Valves [API RP 1171, Section 6.2]	52
12.1.1	UNGS Work Plan Check sheet, Wellhead Equipment, Valves and Design [API 1171, Section 6.2.1 and 6.2.2]	53
12.1.2	UNGS Work Plan Check sheet, Wellhead Pressure Rating [API 1171, Section 6.2.3 and 6.2.4]	53
12.1.3	UNGS Work Plan Check sheet, Emergency Shutdown Valves [API 1171, Section 6.2.5]	54
12.2	Well Casing [API RP 1171, Section 6.3]	55
12.2.1	UNGS Work Plan Check sheet, Well Casing [API 1171, Section 6.3.1 – 6.3.5]	56
12.2.2	UNGS Work Plan Check sheet, Casing Handling [API 1171, Section 6.3.6]	57
12.2.3	UNGS Work Plan Check sheet, Casing Connections [API 1171, Section 6.3.7]	57
12.3	Casing Cementing Practices [API RP 1171, Section 6.4]	58
12.3.1	UNGS Work Plan Check sheet, Cement in Well Construction and Remedial Work [API 1171, Section 6.4.1, 6.4.2, 6.4.3]	58
12.3.2	UNGS Work Plan Check sheet, Cement Slurry Design & Controls [API 1171, Section 6.4.4]	59
12.3.3	UNGS Work Plan Check sheet, Cement Pumping Design [API 1171, Section 6.4.5]	60
12.3.4	UNGS Work Plan Check sheet, Cement Evaluation & Location [API 1171, Section 6.4.6]	61

12.4	Completion and Stimulation [API RP 1171, Section 6.5]	62
12.4.1	UNGS Work Plan Check sheet, Completion and Stimulation [API 1171, Section 6.5.1]	63
12.4.2	UNGS Work Plan Check sheet, Baseline Logging [API 1171, Section 6.5.2]	63
12.4.3	UNGS Work Plan Check sheet, Fracture Stimulation [API 1171, Section 6.5.3]	63
12.5	Well Remediation [API RP 1171, Section 6.6]	64
12.5.1	UNGS Work Plan Check sheet, Well Remediation Evaluation and Responsive Action [API 1171, Section 6.6.1 and 6.6.2]	65
12.6	Well Closure (Plugging and Abandonment) [API RP 1171, Section 6.7]	65
12.6.1	UNGS Work Plan Check sheet, Well Closure (Plugging and Abandonment) [API 1171, Section 6.7.1]	65
12.6.2	UNGS Work Plan Check sheet, Storage Zone Isolation [API 1171, Section 6.7.2]	66
12.6.3	UNGS Work Plan Check sheet, Abandoned Well Maintenance [API 1171, Section 6.7.3]	67
12.7	Environmental, Safety and Health [API RP 1171, Section 6.8]	67
12.7.1	UNGS Work Plan Check sheet, Design & Construction Safeguards [API 1171, Section 6.8.1]	67
12.7.2	UNGS Work Plan Check sheet, Operation & Maintenance Safeguards [API 1171, Section 6.8.2]	67
12.8	Testing and Commissioning [API RP 1171, Section 6.9]	68
12.8.1	UNGS Work Plan Check sheet, Well Mechanical Integrity and Suitability Testing [API 1171, Section 6.9.1]	68
12.8.2	UNGS Work Plan Check sheet, Casing Inspection Logging [API 1171, Section 6.9.2]	68
12.9	Monitoring of Construction Activities [API RP 1171, Section 6.10]	68
12.9.1	UNGS Work Plan Check sheet, Monitoring of Construction Activities [API 1171, Section 6.10.1]	68
12.9.2	Procedures and Documentation [API RP 1171, Section 6.10.2]	69
12.9.3	UNGS Work Plan Check sheet, Work Supervision [API 1171, Section 6.10.3]	70
12.9.4	Resolution of Issues [API RP 1171, Section 6.10.4]	70
12.10	Recordkeeping [API RP 1171, Section 6.11]	71
12.10.1	UNGS Work Plan Check sheet, Well Work Records [API 1171, Section 6.11.1]	71
12.10.2	UNGS Work Plan Check sheet, Permitting, Procedures, Personnel, and Equipment Records [API 1171, Section 6.11.2]	73
13.	Functional Integrity of the Natural Gas Storage Reservoir and Wells Established and Demonstrated Through Initial Attainment of Maximum Reservoir Pressure and Total Inventory [API RP 1171, Section 7]	73
13.1	Testing and Commissioning [API RP 1171, Section 7.2]	73
13.1.1	FAQ's which may apply to API 1171, Section 7.2	73
13.1.2	UNGS Work Plan Check sheet, Testing and Commissioning [API 1171, Section 7.2]	75
13.2	Reservoir Integrity Monitoring [API RP 1171, Section 7.3]	75
13.2.1	UNGS Work Plan Check sheet, Reservoir Integrity Monitoring [API 1171, Section 7.3]	77

13.3	Mechanical Integrity Monitoring [API RP 1171, Section 7.4]	78
13.3.1	UNGS Work Plan Check sheet, Mechanical Integrity Monitoring [API 1171, Section 7.4]	79
13.4	Recordkeeping [API RP 1171, Section 7.5]	79
13.4.1	UNGS Work Plan Check sheet, Recordkeeping [API 1171, Section 7.5]	79
14.	Risk Management for Gas Storage Operations [API RP 1171, Section 8]	80
15.	Integrity Demonstration, Verification, and Monitoring Practices [API RP 1171, Section 9]	80
15.1	Integrity Maintenance and Risk-based Evaluation [API RP 1171, Section 9.2.1 and 9.2.2]	80
15.1.1	UNGS Work Plan Check sheet, Overview of Integrity Maintenance and Risk based Evaluation [API 1171, Section 9.1 and 9.2]	80
15.2	Well Integrity Demonstration, Verification, and Monitoring [API RP 1171, Section 9.3]	82
15.2.1	UNGS Work Plan Check sheet, Well Integrity Evaluation [API 1171, Section 9.3.1]	83
15.2.2	UNGS Work Plan Check sheet, Well Integrity Monitoring [API 1171, Section 9.3.2]	83
15.3	Reservoir Integrity [API RP 1171, Section 9.4]	85
15.3.1	UNGS Work Plan Check sheet, Reservoir Integrity [API 1171, Section 9.4.1 – 9.4.5]	87
15.4	Gas Inventory Assessment [API RP 1171, Section 9.5]	88
15.4.1	UNGS Work Plan Check sheet, Gas Inventory Assessment [API 1171, Section 9.5.1 and 9.5.2]	89
15.4.2	UNGS Work Plan Check sheet, Hydrocarbon Reservoir Methodology [API 1171, Section 9.5.3]	89
15.4.3	UNGS Work Plan Check sheet, Aquifer Reservoir Methodology [API 1171, Section 9.5.4]	90
15.4.4	UNGS Work Plan Check sheet, Additional Actions [API 1171, Section 9.5.5]	90
15.5	Flow and Pressure Monitoring [API RP 1171, Section 9.6]	91
15.5.1	UNGS Work Plan Check sheet, Flow and Pressure Monitoring [API 1171, Section 9.6.1 – 9.6.3]	92
15.5.2	UNGS Work Plan Check sheet, Integrity Nonconformance and Response [API 1171, Section 9.7]	92
15.5.3	UNGS Work Plan Check sheet, Recordkeeping [API 1171, Section 9.8]	92
16.	Site Security and Safety, Site Inspections, and Emergency Preparedness and Response [API RP 1171, Section 10]	93
16.1	Site Security and Safety [API RP 1171, Section 10.2]	93
16.1.1	ECGS Work Plan – Site Access Control Plan (Exhibit)	94
16.1.2	Flammables [API RP 1171, Section 10.2.3]	95
16.2	Ingress and Egress [API RP 1171, Section 10.3]	95
16.2.1	Roads [API RP 1171, Section 10.3.1]	95
16.2.2	Fences and Enclosures [API RP 1171, Section 10.3.2]	95
16.3	Signage [API RP 1171, Section 10.4]	96
16.3.1	Minimum Signage Information [API RP 1171, Section 10.4.1]	96



16.3.2	Additional Information [API RP 1171, Section 10.4.2]	96
16.4	Site Inspections [API RP 1171, Section 10.5]	96
16.4.1	Procedures [API RP 1171, Section 10.5.2]	98
16.4.2	Risk Mitigation [API RP 1171, Section 10.5.3]	98
16.5	Emergency Preparedness/Emergency Response [API RP 1171, Section 10.6]	98
16.5.1	Emergency Preparedness/Emergency Response Plan [API RP 1171, Section 10.6.1]	98
16.5.2	Training [API RP 1171, Section 10.6.2]	100
16.5.3	Blowout Contingency Plan [API RP 1171, Section 10.6.3]	100
16.6	Cyber Security [API RP 1171, Section 10.7]	100
16.6.1	ECGS Work Plan – Work Related Cyber Security (Exhibit)	101
17.	Procedures and Training [API RP 1171, Section 11]	101
17.1	Procedures [API RP 1171, Section 11.2]	101
17.1.1	Construction, Operation, and Maintenance Procedures [API RP 1171, Section 11.2.1]	101
17.1.2	Review of Procedure Content and Adequacy [API RP 1171, Section 11.2.2 and 11.2.3]	102
17.1.3	Records Retention [API RP 1171, Section 11.2.4]	103
17.2	Operations and Maintenance [API RP 1171, Section 11.3]	103
17.2.1	Development and Implementation of Storage Well and Reservoir O&M Procedures	103
17.2.2	Scope of Procedures [API RP 1171, Section 11.3.2]	103
17.3	Emergency Plans [API RP 1171, Section 11.4]	104
17.3.1	Plan Effectiveness [API RP 1171, Section 11.4.2]	104
17.4	Well Work [API RP 1171, Section 11.5]	104
17.4.1	Scope of Procedures [API RP 1171, Section 11.5.2]	104
17.4.2	MOC During Drilling, Completion, and Servicing [API RP 1171, Section 11.5.3]	105
17.5	Other Well Entry and Well Operation Procedures [API RP 1171, Section 11.6]	106
17.5.1	Scope of Procedures [API RP 1171, Section 11.6.2]	106
17.6	Interaction with Control Room [API RP 1171, Section 11.7]	107
17.6.1	Scope of Procedures [API RP 1171, Section 11.7.2]	107
17.6.2	ECGS Work Plan – Controllers, Company Representatives and Contractors Checklist (Exhibit)	108
17.7	Integrity and Risk Management [API RP 1171, Section 11.8]	108
17.7.1	Scope of Procedures [API RP 1171, Section 11.8.2]	109
17.7.2	Review of Procedures [API RP 1171, Section 11.8.3]	109
17.8	Safety and Environmental Programs [API RP 1171, Section 11.9]	109
17.8.1	Scope of Procedures [API RP 1171, Section 11.9.2]	109
17.9	Public Awareness and Damage Prevention [API RP 1171, Section 11.10]	110
17.9.1	Scope and Coordination of Programs [API RP 1171, Section 11.10.1 and 11.10.2]	110
17.10	Management of Change [API RP 1171, Section 11.11]	110
17.10.1	Scope [API RP 1171, Section 11.11.2]	110
17.11	Training [API RP 1171, Section 11.12]	111

17.11.1	Training Requirements [API RP 1171, Section 11.12.1]	111
17.11.2	O&M Personnel [API RP 1171, Section 11.12.2]	112
17.11.3	Supervisory Personnel [API RP 1171, Section 11.12.3]	112
17.11.4	Contractor Personnel [API RP 1171, Section 11.12.4]	113
17.12	Records [API RP 1171, Section 11.13]	113
17.12.1	Documentation [API RP 1171, Section 11.13.1]	113
17.12.2	Training Records [API RP 1171, Section 11.13.2]	117
17.12.3	Retention [API RP 1171, Section 11.13.3]	117
18.	Applicable Incorporated by Reference/ Recommended Practices	118