

Talisman Energy USA Inc. Shale Wells Water Analysis Tracking		
Constituent	Units	UCL (95%)
Acidity as CaCO ₃	mg/L CaCO ₃	207.277
Alkalinity as CaCO ₃	mg/L CaCO ₃	253.911
Bromide	mg/L	901.930
Chloride	mg/L	105338.661
Hardness as CaCO ₃	mg/L CaCO ₃	48092.186
Ammonia Nitrogen	mg/L	89.939
Total Kjeldahl Nitrogen	mg/L	169.483
Nitrate-Nitrite as N	mg/L	0.305
Oil & Grease	mg/L	46.771
BOD 5 Day	mg/L	1106.739
Chemical Oxygen Demand	mg/L	67382.920
PH	STD Units	6.395
Phenolics	mg/L	0.193
TDS @ 180 C	mg/L	193105.999
Total Suspended Solids	mg/L	1822.447
Specific Conductance	UMHOS/CM	176368.905
Sulfate	mg/L	50.000
Surfactants MBAS	mg/L	29.186
Aluminum, Total	mg/L	13.018
Arsenic, Total	mg/L	0.047
Barium, Total	mg/L	9082.730
Beryllium, Total	mg/L	0.001
Boron, Total	mg/L	0.921
Cadmium, Total	mg/L	0.004
Calcium, Total	mg/L	12632.703
Chromium, Total	mg/L	0.050
Cobalt, Total	mg/L	1.588
Copper, Total	mg/L	0.324
Iron, Total	mg/L	185.031
Iron, Dissolved	mg/L	186.278
Lead, Total	mg/L	0.051
Lithium, Total	mg/L	633.925
Magnesium, Total	mg/L	1185.032
Manganese, Total	mg/L	3.485
Mercury, Total	mg/L	0.000426
Molybdenum, Total	mg/L	0.576
Nickel, Total	mg/L	0.112
Selenium, Total	mg/L	0.052
Silver, Total	mg/L	0.016
Sodium, Total	mg/L	39080.870
Strontium, Total	mg/L	3715.607
Zinc, Total	mg/L	0.665
Benzene	ug/L	2.500
Toluene	ug/L	2.500
Gross Alpha	pCi/L	458.565
Gross Beta	pCi/L	216740.951
Radium-226	pCi/L	242.283
Radium-228	pCi/L	91.182

Notes:

1. mg/L = milligrams per liter
2. µg/L = micrograms per liter
3. pCi/L = picocuries per liter
4. umhos/cm = micromhos per centimeter
5. **BOLD VALUES** indicate log normal UCL. UCL calculations were modified for data sets that were not normally distributed, based on Lilliefors Test for Normality.

SECTION B – 2b

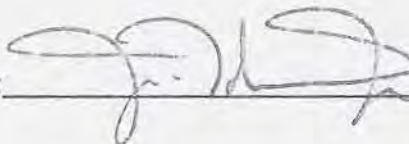
Waste Sampling Method – Brine and Wastewater

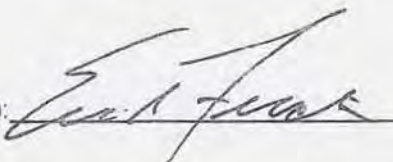
Wastewater samples are collected from the access hatch in the top of the closed tanks. This is accomplished by repeatedly filling a bailer with sample. The sample is then decanted into prepared sample bottles, creating the appropriate sample aliquots for specific analyses. One bailer full is used to collect a sample for volatile aromatics. The sample is measured for temperature and pH in the field using a calibrated pH meter and temperature sensor.

QUALITY ASSURANCE MANUAL

SEEWALD LABORATORIES, INC.
1403 WEST FOURTH STREET
WILLIAMSPORT, PENNSYLVANIA 17701
570-326-4001

Approved By (Owner):  Date: 1-11-10

Approved By (Laboratory Director):  Date: 1/11/10

Approved By (Microbiology Director):  Date: 1/11/10

Approved By (Quality Assurance Director):  Date: 1/11/10

Preface 1:

Preparations & Revisions History

Effective Date: June 3, 1998

Revision 1: February 1, 2002

Revision 2: January 06, 2003

Revision 3: March 11, 2004

Revision 4: March 22, 2004

Revision 5: June 10, 2005

Revision 6: April 28, 2006

Revision 7: September 22, 2008

- Revisions include Section 18: Appendices, including Appendix A - Distribution list; Appendix B – List of Employee signatures/initials; Appendix C – revision History

Revision 8: October 17, 2008

- Revisions include Section 2.1 – another point added under Laboratory Director responsibilities to state his/her authorization to approve and release analytical reports; same point added under Technical Director responsibilities (currently Lab. Director); Manager of Quality Assurance revised from "currently Laboratory Director" to "currently Quality Assurance Officer;" another point added under Manager, Microbiology to state his/her authorization to approve and release analytical reports. Added Section 8.7 Ownership Transfer Responsibilities.

Revision 9: January 11, 2010

- Revisions include every section combined into one document with one revision number. Each section updated to reflect current Laboratory practices and to meet Chapter 252 requirements.

Prepared By (Christopher M. Fuller):



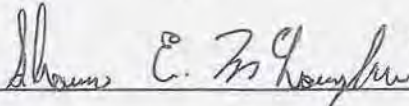
Date: 1/11/10

Reviewed By (Jessica Gehr):



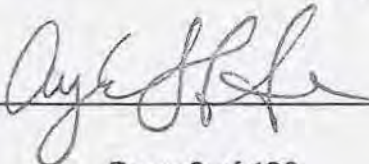
Date: 11 Jan 10

Reviewed By (Shawn McLaughlin):



Date: 01/11/10

Reviewed By (Angela Shaffer):



Date: 01/11/10

Preface 2:

2.1 Distribution List:

There are two master Quality Assurance Manuals (QAM) located in the Laboratory (Lab), one is stored in electronic format under the Quality Assurance/Quality Control Director's (QA/QC) secure network folder, and the other is located in the secure Quality Control (QC) cabinet. The only document that contains all the appropriate signatures is the one in the QC cabinet. The following is a list of locations/departments where the QAM is located through out the Lab for easy reference. These locations have a copy of the master document stamped "COPY" in blue. These documents are all controlled by the QA/QC Director and the Laboratory Director.

- Office/Packing Room – 1 copy
- Wet Chemistry – 1 copy
- Metals – 1 copy
- Organics – 1 copy
- Microbiology – 1 copy

The following is a list of all copies made that are not listed above.

1. 1 copy 1/12/10 WAF to PA DEP - Arny Handman
2. _____

3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

TABLE OF CONTENTS

OVERVIEW	SECTION 1
1.1 Purpose	
1.2 Objectives	
1.3 Major Components of the QA Process	
STAFF ORGANIZATION AND RESPONSIBILITIES	SECTION 2
2.1 Laboratory Director	
2.2 Microbiology Director	
2.3 Technical Director	
2.4 Quality Assurance/Quality Control Director	
2.5 Sample Control Manager	
2.6 Client Services Manager	
2.7 Organics Department Manager	
2.8 Metals Department Manager	
2.9 Wet Chemistry Department Manager	
HEALTH AND SAFETY POLICY	SECTION 3
3.1 Fume Hoods	
QUALITY CONTROL	SECTION 4
4.1 Notebooks	
4.2 Automated Data acquisition	

- 4.3 Standard Preparation
- 4.4 Quality Control and Blind Samples
- 4.5 Analytical Balances
- 4.6 Thermometers
- 4.7 Spectrophotometers
- 4.8 Temperature Controlled Devices
- 4.9 Laboratory Water System
- 4.10 Control Charting
- 4.11 pH Meters
- 4.12 Conductivity Meters
- 4.13 Dispensing Devices

TRAINING AND STANDARDIZATION

SECTION 5

- 5.1 Documentation of Training File
- 5.2 Work Cells

QUALITY ASSURANCE AUDITS

SECTION 6

- 6.1 Introduction
- 6.2 Purpose
- 6.3 Quality Assurance Auditors
- 6.4 Post Audit Debriefing

STANDARD OPERATING PROCEDURES

SECTION 7

7.1 Purpose

7.2 SOP Contents

7.3 SOP Generation

7.4 SOP Necessity

7.5 SOP Modification

DOCUMENT CONTROL & RECORDKEEPING

SECTION 8

8.1 Introduction

8.2 Standard Operating Procedures

8.3 Computer Generated Data and Instrument Printouts

8.4 Data Packages

8.5 Client Reports/Invoices

8.6 Ownership Transfer and Ownership Termination Responsibilities

8.7 Record Keeping

SAMPLE HANDLING

SECTION 9

9.1 Sample Acceptance and Custody

9.2 Sampling

9.3 Laboratory Sample Control and Sample Tracking

9.4 Sample Storage and Sample Check Out

USING QUALITY CONTROL IN THE LABORATORY

SECTION 10

10.1 The Purpose of Quality Control

10.2 Definitions

10.3 Applying Quality Control

DATA QUALITY CALCULATIONS

SECTION 11

11.1 Significant Figures

11.2 Rounding

11.3 Precision

11.4 Accuracy

DATA REDUCTION & REPORTING

SECTION 12

12.1 Precision and Accuracy Reporting

12.2 Method Detection Limits

12.3 Maximum Concatenation Levels

EQUIPMENT LISTING & PREVENTIVE MAINTENANCE

SECTION 13

13.1 Major Equipment Listings

13.2 Preventative Maintenance

13.3 Maintenance Responsibilities

13.4 Maintenance Schedules

13.5 Spare Parts

CORRECTIVE ACTION

SECTION 14

14.1 QA/QC Corrective Actions

14.2 Failed QC Criteria

SOP REFERENCES LISTING	SECTION 15
LABORATORY ETHICS POLICY	SECTION 16
16.1 Code of Conduct	
16.2 Examples of Improper Laboratory Practices	
16.3 Personnel Education and Training	
16.4 Violations	
PREVENTING IMPROPER & UNETHICAL ACTIONS	SECTION 17
17.1 Ethics Policy	
17.2 Internal QC/PT studies	
17.3 Data Review	
17.4 External Audits	
17.5 Correction Action Plan	
17.6 Document Control	
REFERENCES	SECTION 18
PERSONNEL FILES	SECTION 19
19.1 Personnel Records	
19.2 Dates of Employment and Laboratory Responsibilities	
19.3 QAM Signatures	
19.4 Ethics Training Signatures	

SECTION B – 2d

Hazardous Waste Determination

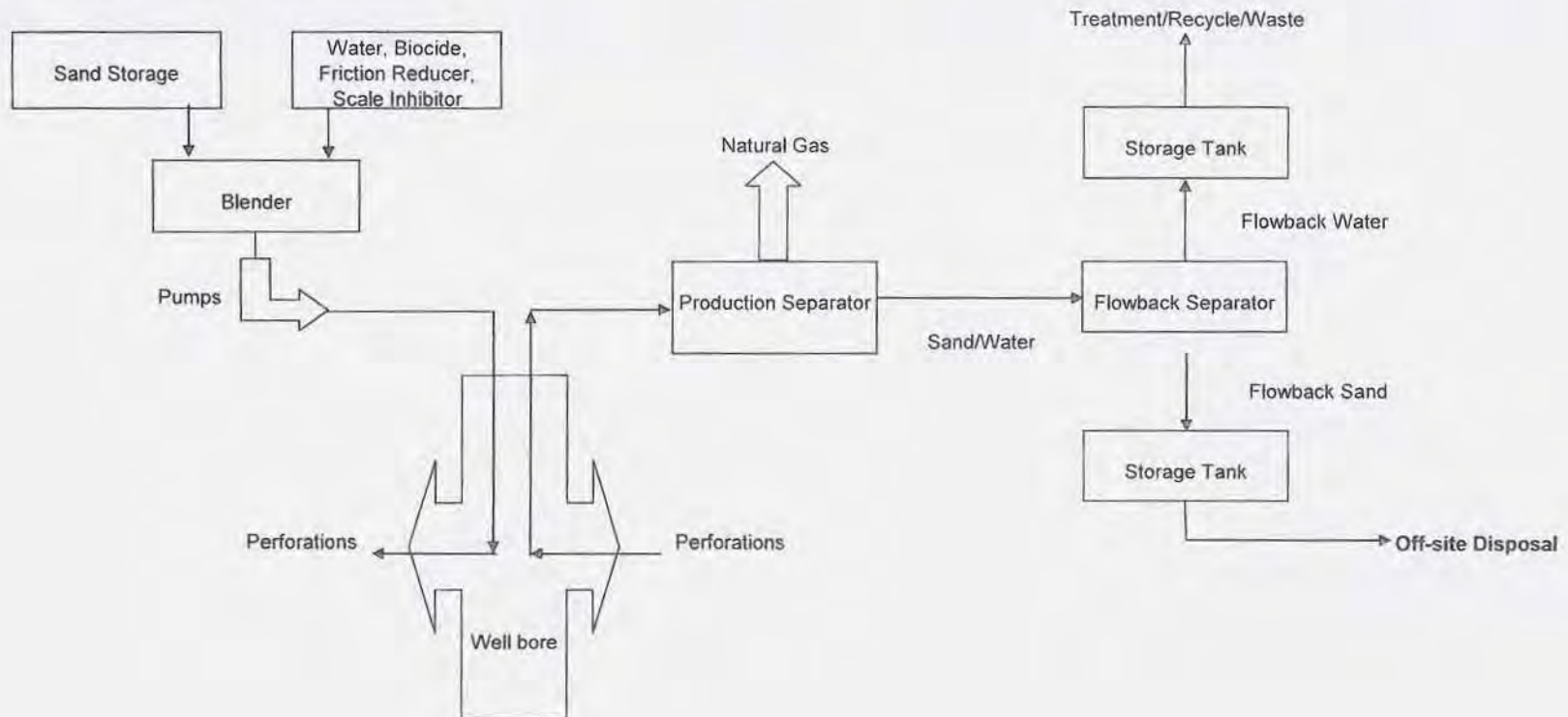
In accordance with Federal Code 40 CFR 261.4 (b)(5) and as incorporated by reference at 25 PA Code 261A.1 drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy are exempt from being classified as hazardous waste.

SECTION B - 3a and 3b

Process Description for Generation of Flowback Water

Flowback water is generated during the completion/hydraulic fracturing of a natural gas well. Sand and water is injected into the well bore to fracture the shale and hold open the fractures. The water is returned to the surface and either treated, recycled, or wasted.

Schematic of Flowback Water Generation

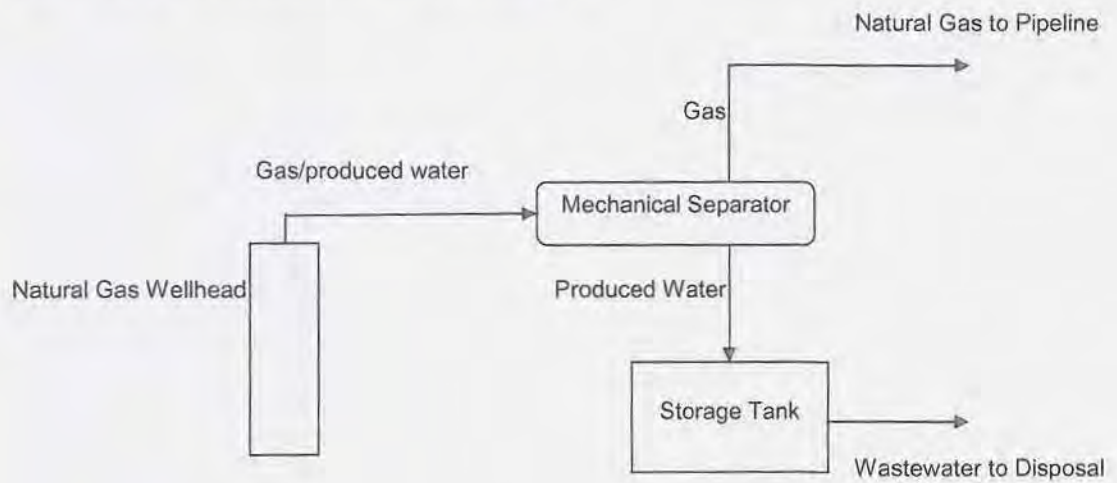


SECTION B - 3a and 3b

Process Description for Generation of Produced Water

A natural gas well produces a combination of gas and produced water. The gas and water come out of the ground at the well head and flow through a short flowline to a mechanical separator. The mechanical separator separates the two fluid streams, allowing the gas to flow out the top into a pipeline while collecting the produced water in a storage tank. The produced water is then trucked to disposal.

Schematic of Produced Water Generation



2.e. Explanation Supporting Use of Generator Knowledge

The oily water waste generated at the natural gas compressor stations is of a known and constant quality. It is an oil/water emulsion and is specially handled by a separate waste transport company for solidification and/or recycling.

3.a. Process Description for Generation of Oily Water Waste at Natural Gas Compressor Stations

Compression of natural gas is required periodically along the collection pipelines to ensure that the gas remains pressurized. Compression occurs at a compressor station. Within the compressor station, scrubbers and dehydration towers capture any liquids or other unwanted particles from the natural gas in the pipeline. Although natural gas in pipelines is considered 'dry' gas, it is not uncommon for a certain amount of water and hydrocarbons to condense out of the gas stream while in transit.

3.b. Schematic for Generation of Oily Water Waste at Natural Gas Compressor Stations

