Talisman Energy USA Inc. Shale Wells Water Analysis Tracking		
Constituent	**Units**	**UCL (95%)**
Acidity as CACO3	mg/L $CACO_3$	207.277
Alkalinity as CACO#	mg/L $CACO_3$	**253.911**
Bromide	mg/L	**901.930**
Chloride	mg/L	105338.661
Hardness as CACO3	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 cmf to PA DEP - Amy Hackman
2. ______

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

TABLE OF CONTENTS

SECTION B – 2d

Hazardous Waste Determination

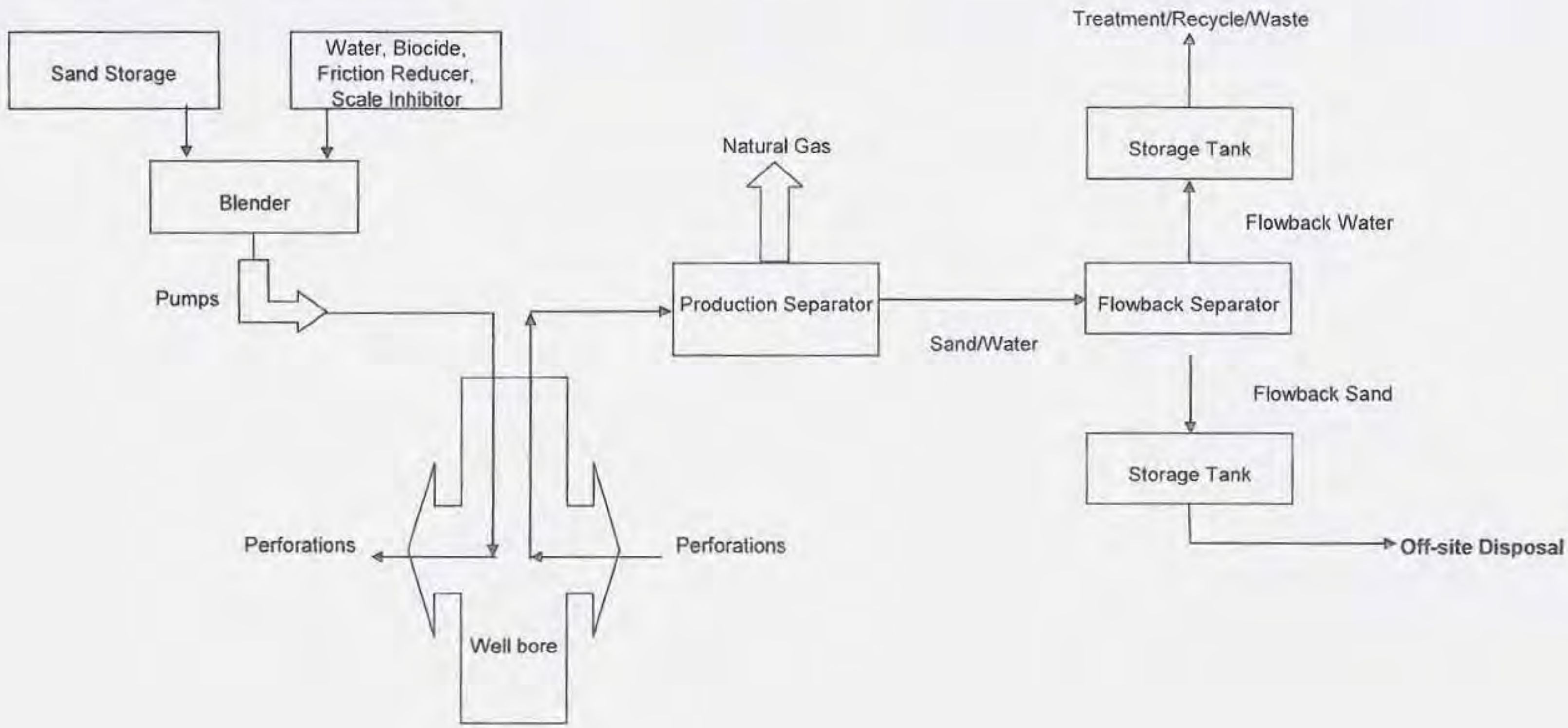
In accordance with Federal Code 40 CFR 261.4 (b)(5) and as incorporated by reference at 25 PA Code 261A.1 drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy are exempt from being classified as hazardous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

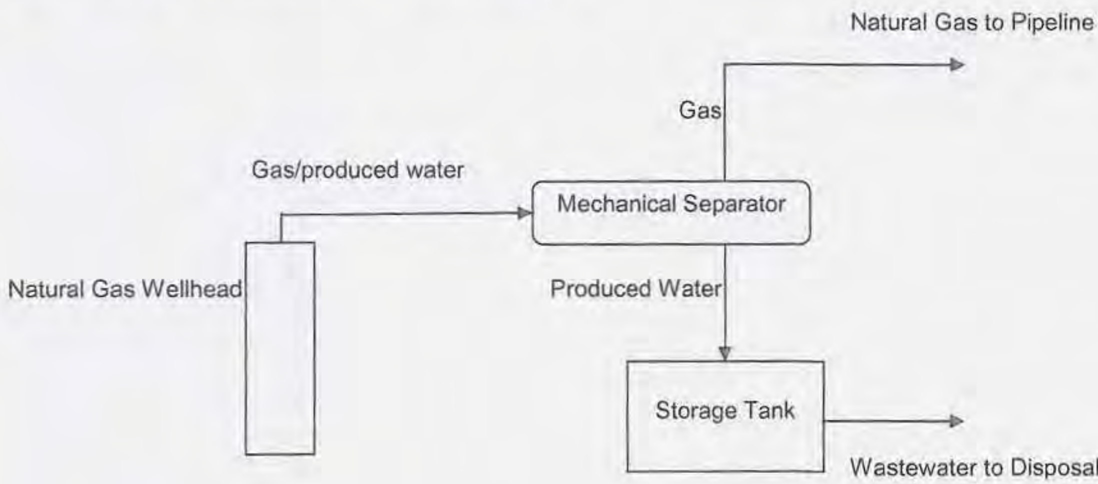


SECTION B - 3a and 3b

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 consistant quality. It is an oil/water emulsion and is specially handled by a separate waste transport company for solidication 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 dehdration 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