WESTERN REFINING

Jal, NM Storage Facility

LPG Cavern #3

Mechanical Integrity Test Report

JA3301/12 002/O/J/O

us geostock

Number of pages: 12	Revision: O	Status: FINAL	Date of distribution: December 27, 2012

B.BATSON/M.COPPERSMITH	*C. BREHERET*	*C. BREHERET*
Issued (name, signature)	Checked (name, signature)	Approved (name, date, signature)
		K.27.2012

CONTENTS

MAIN PURPOSE OF THE REVISION AND TYPE OF MODIFICATIONS

1. INTRODUCTION

Geostock US has performed a mechanical integrity test on Western Refining Jal, NM LPG Storage well #3 using brine as a test medium. The testing procedures were designed to meet the requirements set forth in the OCD regulations for liquid-filled caverns.

Cavern Well #3 and Cavern Well #4 are used for LPG storage in salt caverns. The production casings were successfully pressure tested with a packer; multi-finger calipers and cement bond logs have been performed to verify the integrity of the wells.

The subject wells and salt formation will be tested at maximum operating pressure at the casing, i.e. 1250 psig which corresponds to a pressure gradient of 0.75 psi/ft.

2. TEST METHODOLOGY

Wellhead pressure and temperature were recorded, however to eliminate any error on the density of the fluid column in the wellbore a surface read-out (SRO) pressure gauge was set at the casing depth (~1666 ft) to measure directly the pressure in the cavern.

The test was conducted by injection of brine to increase the cavern pressure at the casing shoe to test pressure. By this method, both well and salt formation were tested for potential leak.

The first phase of the MIT test consisted of daily brine injection to maintain test pressure at the casing shoe based on the SRO gauge readings. The volume of brine per day required to return the well to test pressure was measured until stabilized conditions were reached.

In the second phase of the MIT test, after a final brine injection to test pressure, the well was isolated with double valve combinations and the downhole and surface pressures and temperature were recorded for a test period of 4 hours. Pressures on the 7" x 4 ½" annulus and on the 4 ½" tubing were recorded by the use of calibrated chart recorders, with one hour clock setting, for a period of 4 hours (Appendix 3).

3. TEST CHRONOLOGY

Daily brine injection began on 12/17/12. The Surface read out gague was installed on 12/20/12. The MIT began on 12/22/12 at 12:10 and ended on 12/22/12 at 16:10.

	Start Pressure	End Pressure	Start Pressure	End Pressure	Volume Injected
	WHP, psi	WHP, psi	SRO, psi	SRO, psi	bbl
12/17/12	15.9	370			220
12/18/12	352	376			15
12/19/12	371	378			3.5
12/20/12	371	385	1172	1186	5.6
12/21/12	380	384	1179	1186	2.5

4. RESULTS

4.1. Data Collected

During the pre-test period, the amount of daily brine injection required to return the cavern to test pressure was recorded. (see Appendix 1) The cavern quickly stabilized to the point that the daily brine injection required was less than 2.64 bbl/day, which corresponds to the acceptable leak rate of 963.6 bbl/yr

The wellhead pressures, downhole pressure, and ambient temperature were recorded during the MIT. (see Appendix 2). The wellhead pressure loss recorded by the digital gauges on the 4 ½" tubing during the MIT was:

Initial pressure:	381.19 psig
Final pressure:	380.64 psig
Pressure loss:	0.55 psi (0.14%)

The cavern pressure loss recorded with the SRO gauge during the MIT was:

Initial Pressure:	1180.72 psi
Final Pressure:	1180.10 psi
Pressure loss:	0.62 psi (0.05%)

4.2. Apparent leak rate

Using the pressure increase and daily brine injection from the pre-test period, a stabilized seepage rate can be calculated that relates the amount of pressure change in the cavern to the apparent leak rate.

	ΔP	Volume Injected	Seepage
	psi	bbl	bbl/psi
12/17/12	354.1	220	0.62
12/18/12	24	15	0.63
12/19/12	7	3.5	0.50
12/20/12	14*	5.6	0.40
12/21/12	7*	2.5	0.36

*From SRO tool

Using the stabilized observed seepage rate of 0.36 bbl/psi and recorded pressure loss of 0.62 psi during the 4 hour MIT period, the apparent leak rate during the MIT can be calculated:

0.62 psi x 0.36 bbl/psi = 0.223 bbl apparent leak during 4 hours

= 1.34 bbl/day apparent leak rate

= 489 bbl/yr apparent leak rate

4.3. Pass/fail criteria

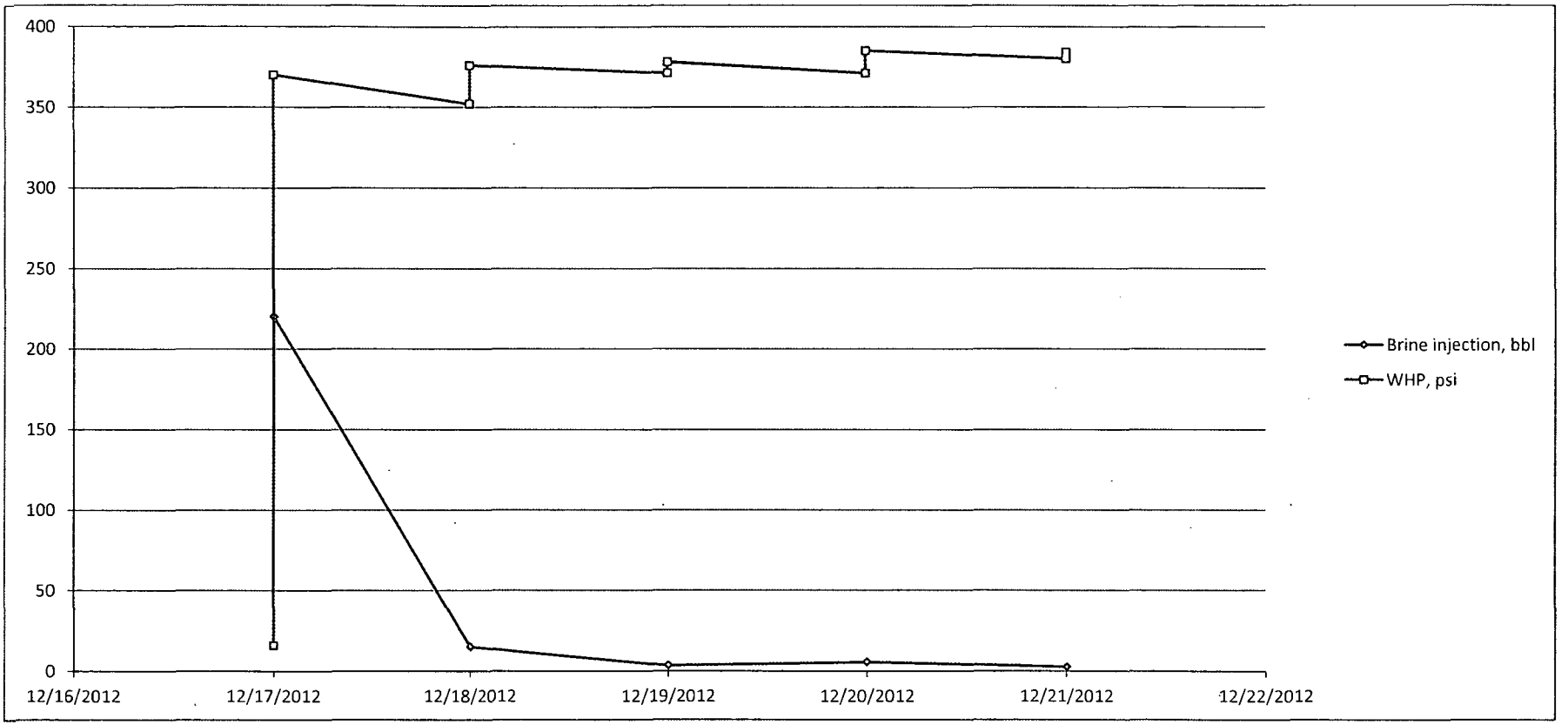
Apparent leak rate, 489 bbl/yr < 963.6 bbl/yr (2.64 bbl/day)

Pressure loss at casing shoe over 4 hour MIT period, 0.05% < 10%

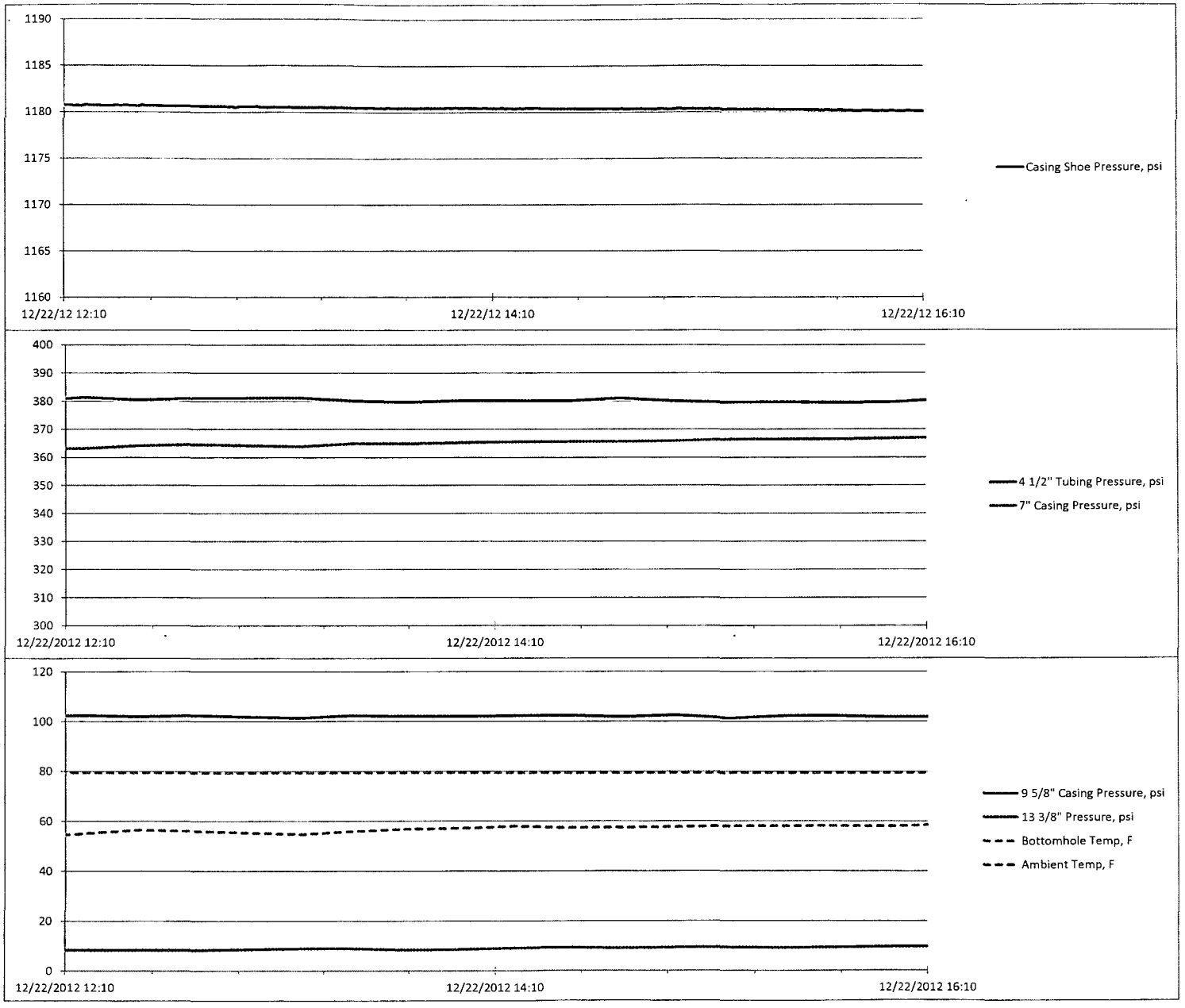
4.4. Test Result

Based on the data collected during the test and the definition of the pass/fail criteria, Well #3 has passed the mechanical integrity test.

APPENDIX 1 – PRE-TEST BEHAVIOR


400
350
300
250
200
150
100
50
0
12/16/2012
12/17/2012
12/18/2012
12/19/2012
12/20/2012
12/21/2012
12/22/2012
Brine injection, bbl
WHP, psi

APPENDIX 2 – MIT TEST PERIOD

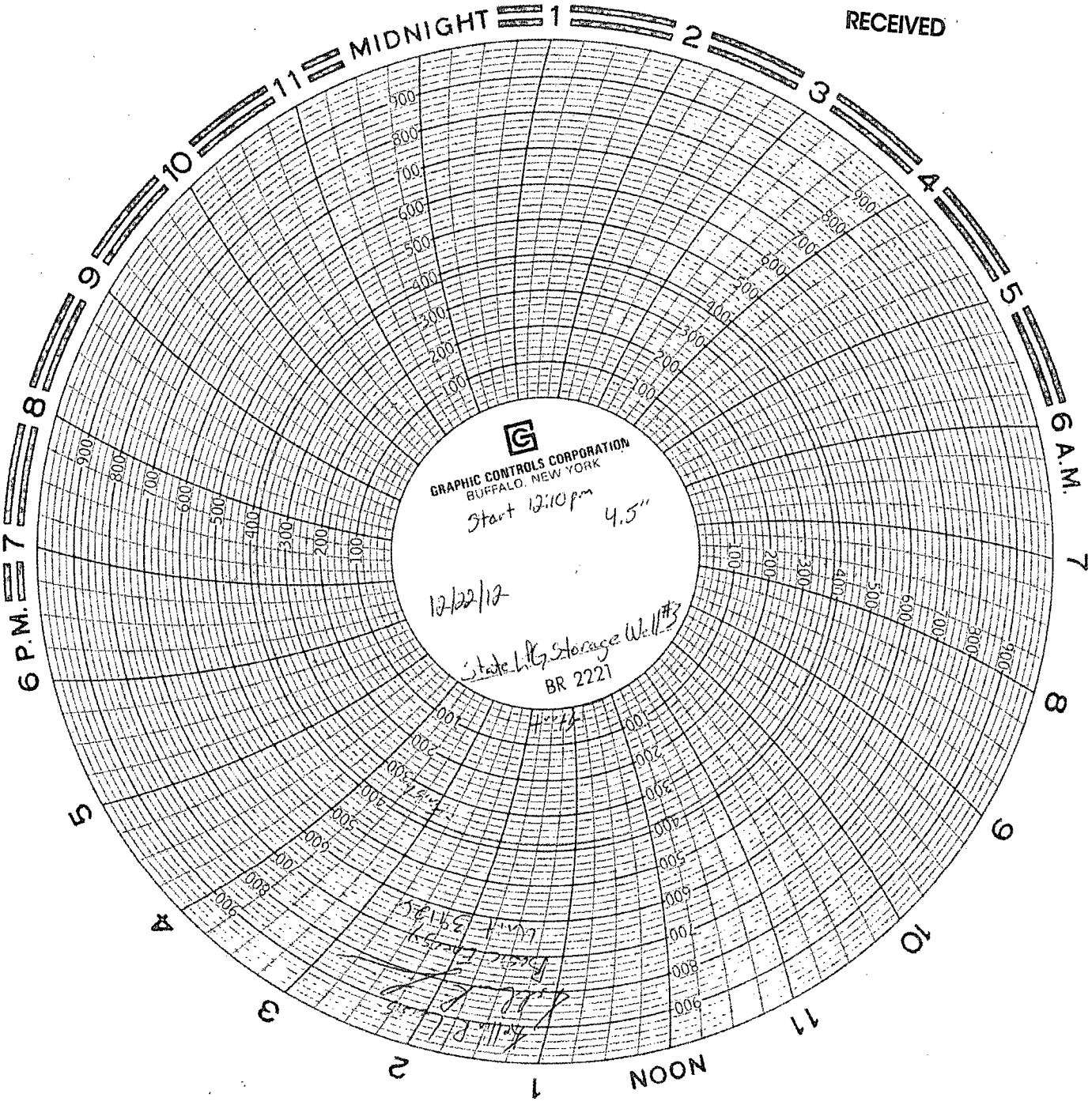

1190
1185
1180
1175
1170
1165
1160
12/22/12 12:10
12/22/12 14:10
12/22/12 16:10
Casing Shoe Pressure, psi
400
390
380
370
360
350
340
330
320
310
300
12/22/2012 12:10
12/22/2012 14:10
12/22/2012 16:10
4 1/2" Tubing Pressure, psi
7" Casing Pressure, psi
120
100
80
60
40
20
0
12/22/2012 12:10
12/22/2012 14:10
12/22/2012 16:10
9 5/8" Casing Pressure, psi
13 3/8" Pressure, psi
Bottomhole Temp, F
Ambient Temp, F

APPENDIX 3 – PRESSURE CHARTS (SCANS)

HOBBS OCD

JAN 28 2013

RECEIVED



HOBBS OCD

JAN 28 2013

RECEIVED